THE HEALTH STATUS OF CHILDREN AND YOUNG PEOPLE

IN THE MIDLAND REGION

The Health Status of Children and Young People in the Midland Region

This report was prepared for the Midland Region District Health Boards (DHBs) by Elizabeth Craig, Judith Adams, Glenda Oben, Anne Reddington, Andrew Wicken and Jean Simpson on behalf of the NZ Child and Youth Epidemiology Service

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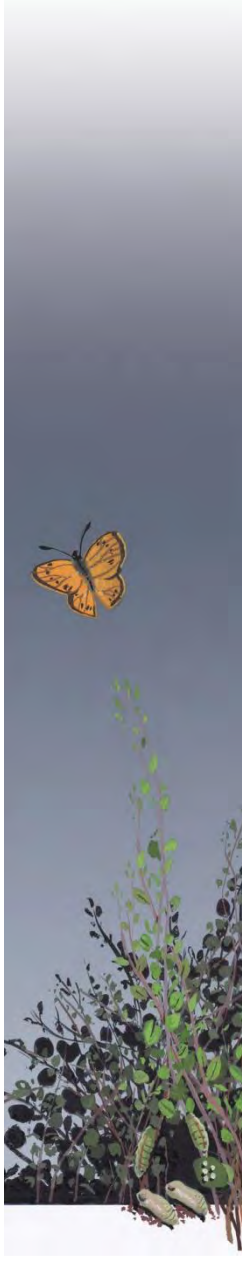

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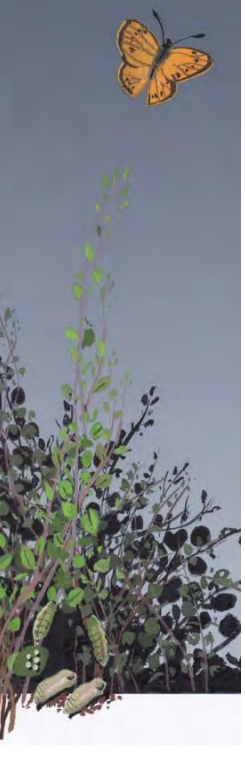

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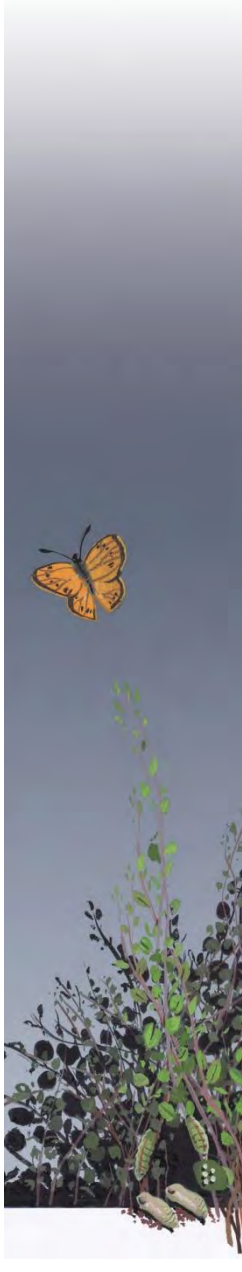

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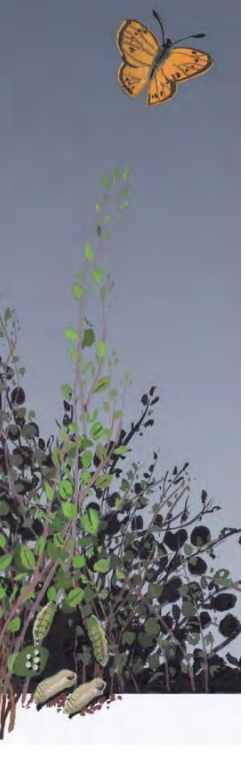

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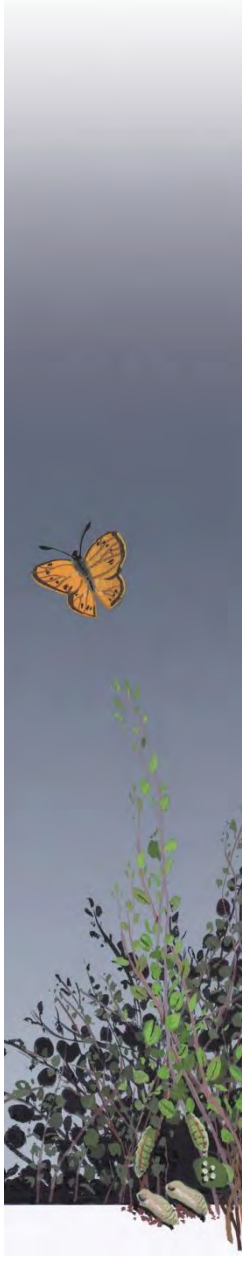

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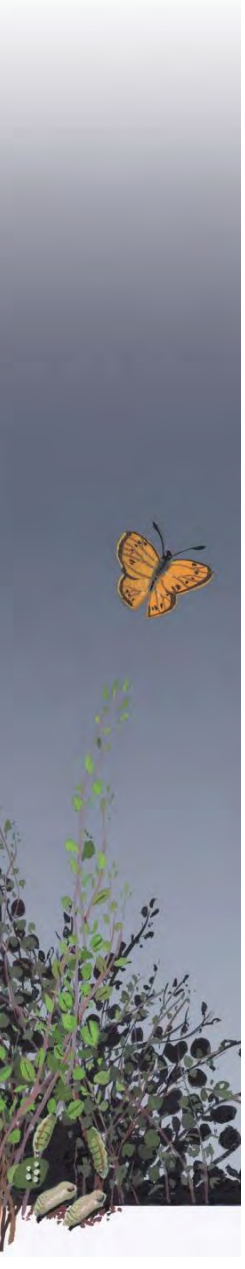

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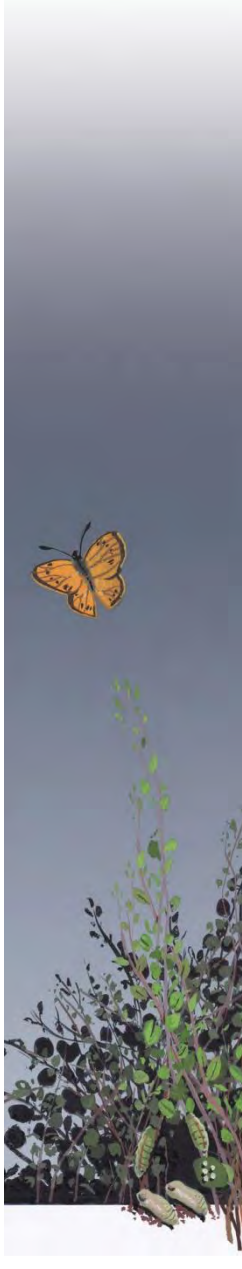

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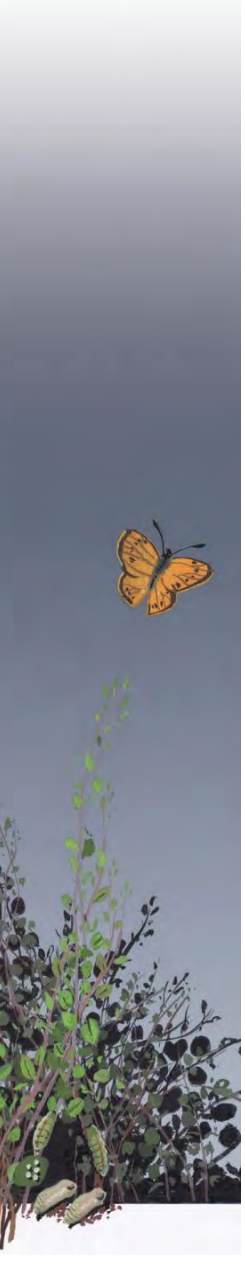

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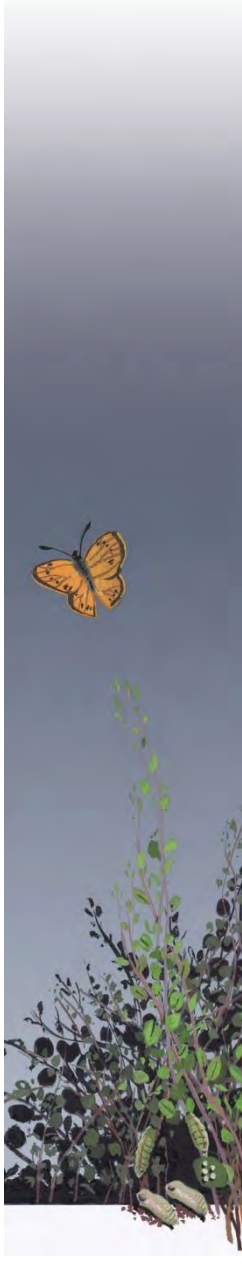

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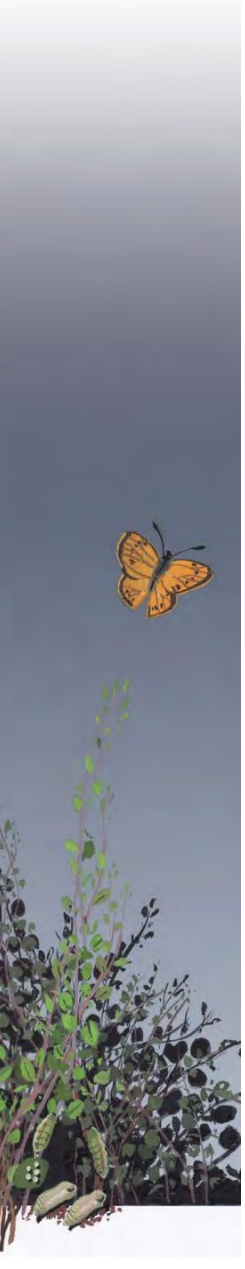

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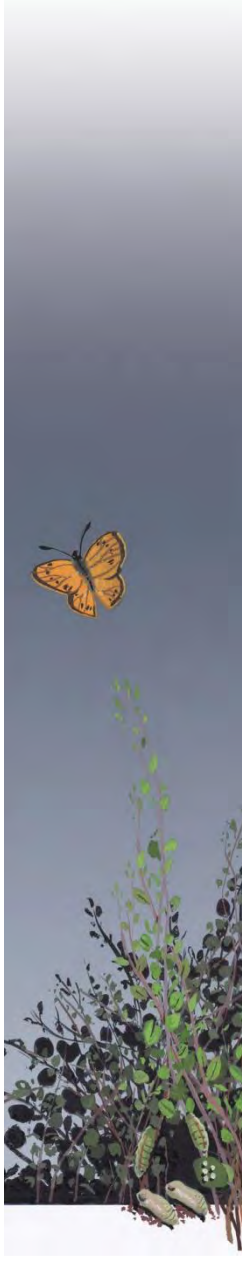

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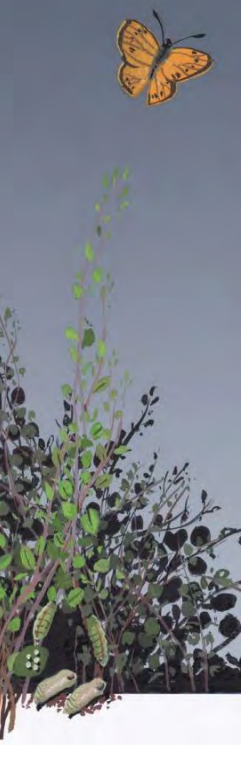

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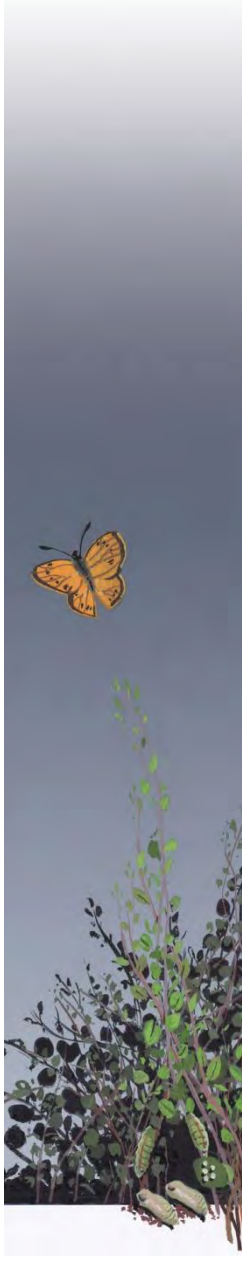

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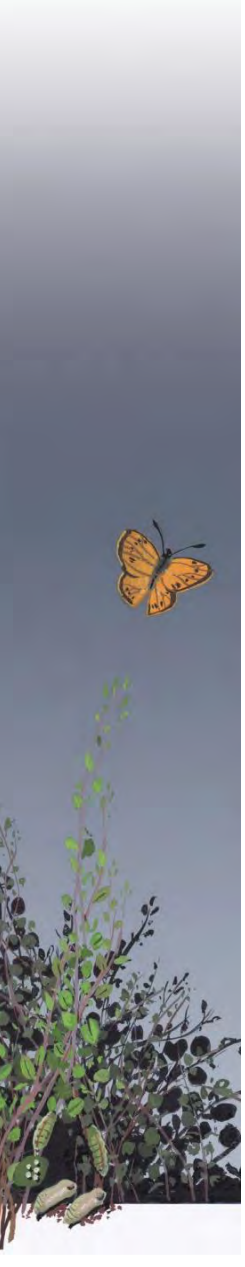

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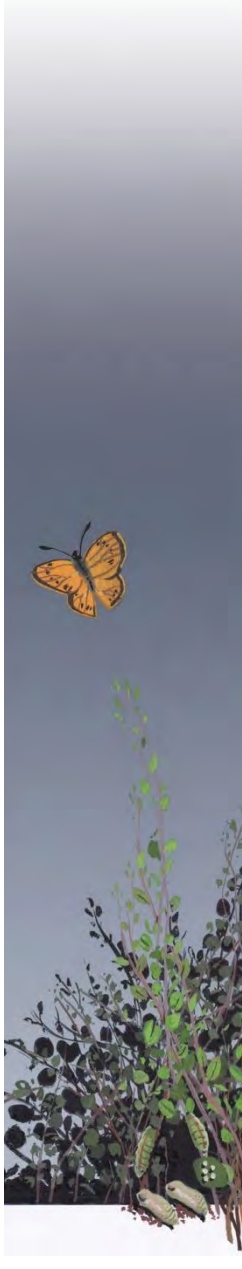

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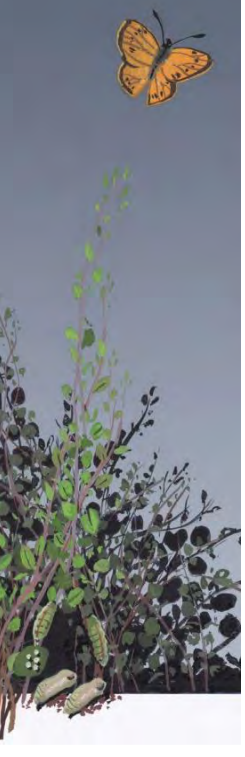

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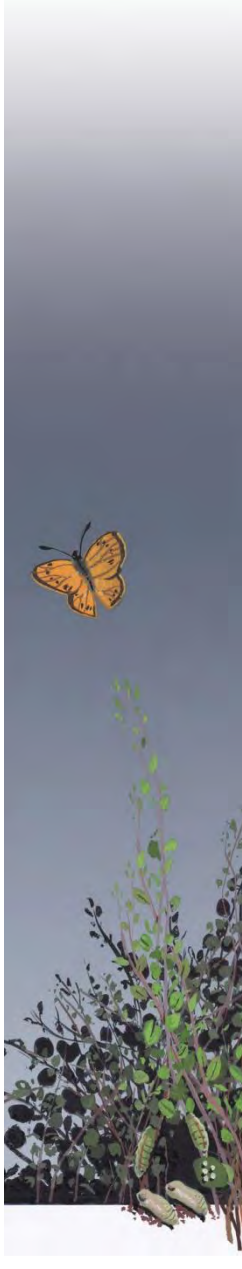

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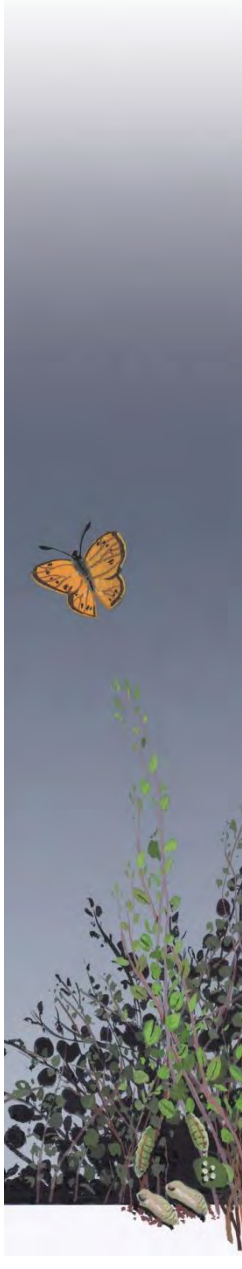

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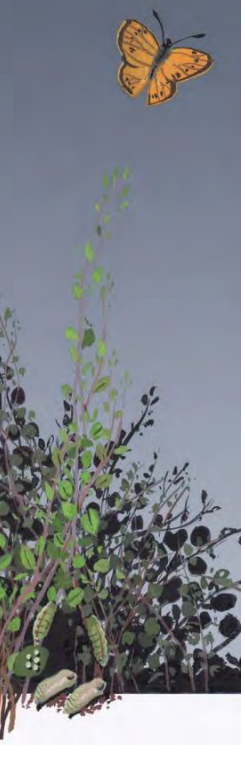


INTRODUCTION AND OVERVIEW

INTRODUCTION AND OVERVIEW

Introduction

This report is the first of three reports, in the third series on the health of children and young people in the Midland Region's District Health Boards (DHBs), and fits into the reporting cycle as follows:

Year 1 (2011) Health Outcomes

Year 2 (2012) Health Determinants

Year 3 (2013) Disability and Chronic Conditions

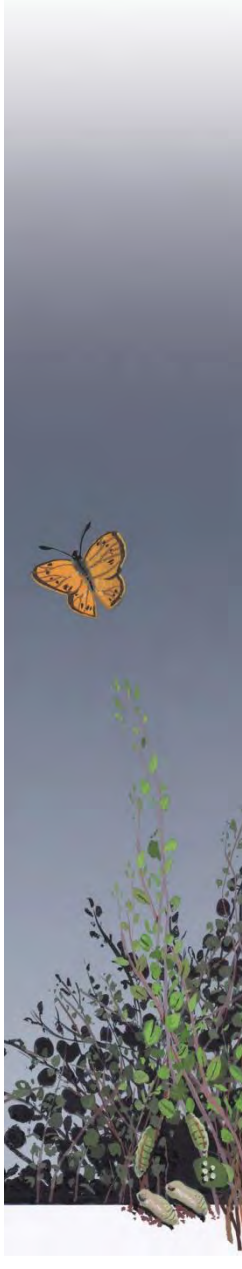
While the aim of the first two reporting cycles was to present an overview of the major issues affecting the health of children and young people in Midland's DHBs individually, this third series, while building on the frameworks developed in the previous two, aims to take a more regional approach to child and youth health needs assessment.

Report Aims and In-Depth Topics

The aim of the current report is to provide an overview of the health status of children and young people in the Midland Region, and to assist those working to improve child and youth health regionally, to utilise all of the available evidence when developing programmes and interventions to address child and youth health need.

In this context, the role primary care plays in preventing a range of avoidable hospital admissions and mortality is crucial, with this year's in depth topics focusing on the role of primary care in achieving health gains for children and young people. Specifically, the issues considered in this year's in-depth topics are:

1. **Models of Primary Care for Children**: This in-depth topic focuses on ambulatory sensitive hospitalisations (ASH) in children, particularly those under 5 years of age. A factor common to many of these admissions is the abrupt nature of their onset. The reasons why primary care may not be addressing these acute conditions and the role of primary care in the management of chronic conditions are examined. The international literature also identifies a number of barriers to optimal service delivery that may impact at the personal or organisational level. Models that attempt to reduce such barriers by improving access, ensuring cultural and language appropriateness, and providing adequate out-of-hours services have been effective in improving services or reducing avoidable hospitalisations. Other models have focused on developing nurse-led services, or better information sharing systems within and between sectors of the health system. The literature also includes funding models that have achieved health gains. How these models could assist with the delivery of more effective primary health care to New Zealand children is discussed.
2. **Models of Primary Care for Young People**: This in-depth topic begins with a brief overview of the health issues most commonly encountered by New Zealand young people, before exploring the normal developmental milestones which occur during adolescence, and the implications these have for the delivery of primary healthcare. The three most frequent models of primary healthcare available to young people are then reviewed, namely: General Practitioners / Primary Health Organisations, School-Based Health Services and Youth One Stop Shops. For each model of care, a brief description of the degree to which it has been implemented in the New Zealand context is provided, before the findings of any local evaluations are reviewed. Each section concludes with a brief review of the overseas literature, which seeks to identify evidence of effective service delivery, or guidance as to how optimal services might be developed. The review concludes with a brief discussion of the implications of these findings for the delivery of primary healthcare to young people in New Zealand.



Report Sections and Indicators

As previously, this report is based on the *Indicator Framework* developed during the first cycle of DHB reporting, with the majority of indicators in the *Individual and Whanau Health and Wellbeing* stream being updated in this year's edition. Within this stream, each of the indicators in this year's report has been assigned to one of three main sections as follows:

Issues More Common in Infancy: This section considers issues more common during the first year of life, and includes indicators such as *Fetal Deaths*, *Preterm Birth*, *Infant Mortality and Sudden Unexpected Death in Infancy (SUDI*), and *Breastfeeding.*

Issues More Common in Children, or Common in both Children and Young People: This section, which focuses on issues more common to children or to both children and young people, is further subdivided into three sub-sections: Total and Avoidable Morbidity and Mortality, Infectious and Respiratory Diseases (including Upper and Lower Respiratory Tract Conditions and Infectious Diseases) and Other Issues (including Injuries in Children, Oral Health and Permanent Hearing Loss).

Issues More Common in Young People: This stream reviews a number of conditions more common in young people including *The Most Frequent Causes of Hospital Admissions and Mortality, Injuries, Teenage Births* and *Terminations of Pregnancy*.

The Children's Social Health Monitor

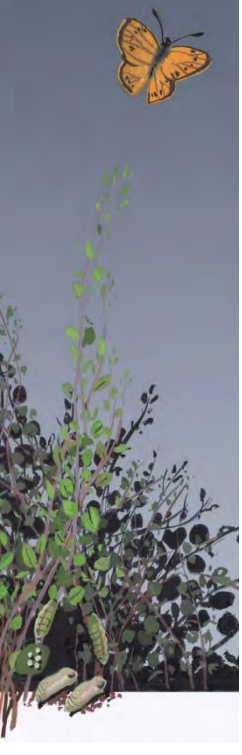
The *Children's Social Health Monitor* is updated again in this year's report, with a view to determining how children are faring in the current economic climate. Issues reviewed include: Economic Indicators: *GDP*, *Income Inequality*, *Child Poverty*, *Unemployment Rates* and *Number of Children Reliant on Benefit Recipients*; and Child Wellbeing Indicators: *Hospital Admissions and Mortality with a Social Gradient*, *Infant Mortality*, and *Hospital Admissions for Injuries Arising from Assault in Children*.

Evidence Based Approaches to Intervention

As previously, each of the sections in this year's report concludes with a brief overview of local policy documents and evidence-based reviews which consider population level approaches to the prevention or management of the issue under review. **Appendix 1** provides an overview of the methodology used to develop these reviews. As previously, the quality and depth of evidence available varies considerably from indicator to indicator.

Data Quality Issues and the Signalling of Statistical Significance

As previously **Appendix 2** outlines the rationale for the use of statistical significance testing in this report and **Appendix 4 to Appendix 9** contain information on the data sources used to develop each indicator. Readers are urged to be aware of the contents of these Appendices when interpreting any information in this report. (Note: As outlined in **Appendix 2**, in order to assist the reader to determine whether tests of statistical significance have been used in a particular section, the significance of the associations presented has been signalled in the text with the words *significant*, or not *significant* in italics. Where the words *significant* or not *significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance).



Overview of the Health Status of Children and Young People in the Midland Region

While it is hoped that a regional approach will serve to enhance the utility of this report for regional planning purposes, the need for a consistent approach to monitoring over time means that the way the data are presented is very similar to previous years. Thus the table which follows provides a brief overview of each of the indicators in this year's report, including their distribution nationally and within Midland's DHBs.

While it is possible to consider each of these issues individually, when considering which should be awarded the highest priority in future regional planning, a number of the approaches to prioritising health need outlined below may provide useful starting points:

Regional Comparative Approach: One possible approach to prioritising health need is to consider those areas where Midland's DHBs differ from the New Zealand average. In this context, a brief perusal of the tables which follow suggests that teenage births and hospital admissions for land transport injuries in young people were higher than the New Zealand rate in all five DHBs, while land transport admissions in children were higher in all DHBs except Taranaki. For a number of infectious and respiratory diseases (e.g. bronchiolitis, asthma, skin infections) hospital admissions in Lakes, Bay of Plenty and Tairawhiti children were higher than the New Zealand rate, while in the Waikato and Taranaki rates were either similar or lower.

An Inequalities Approach: An alternative approach to prioritisation would be to consider issues for which ethnic or socioeconomic disparities were most marked. A brief review of the tables which follow suggests that the Midland Region's DHBs experienced large ethnic disparities across a range of conditions including hospital admissions for infectious and respiratory diseases, teenage births and dental caries. In addition, while numbers were too small to permit a valid regional analysis, at the national level large disparities were also evident for issues such as sudden unexpected death in infancy (SUDI), hospital admissions for assault in children, and injury mortality.

An Absolute Approach: Another approach to prioritisation is to consider those issues which, irrespective of regional, socioeconomic or ethnic inequalities, made the greatest contributions to hospital admissions and mortality in the region. A brief perusal of the tables which follow suggests that in the Midland DHBs during the past 5 years, injuries (particularly land transport injuries) were important causes of mortality for children and young people. Suicide, however, also claimed the lives of a large number of young people. In terms of hospital admissions, injuries again made a significant contribution to morbidity for both children and young people, although infectious and respiratory conditions were prominent for children, and reproductive health issues (particularly admissions for labour and delivery) were important for young people.

Consideration of Areas of Unmet Need: Finally, it is important to remember that hospital admission and mortality data does not fully capture all of the issues experienced by children and young people. In particular, there is a paucity of information on children and young people with disabilities and mental health issues, with the 2009 and 2010 reports suggesting that there may be considerable unmet need in these areas. Thus, in addition to the approaches outlined above, it is also necessary to consider whether similar areas of unmet need exist in the Midland Region, and if so, to consider the needs of these children and young people when allocating resources for future service development.

Conclusions

In addition to providing an overview of the health status of children and young people in the Midland Region, this report aims to provide an entry point into the policy and evidence-based review literatures, so that child and youth health needs can be addressed in a systematic and evidence-based manner. In undertaking this task, it is suggested that DHBs combine the epidemiological data in this report, with knowledge of existing services and local stakeholders' views. In addition, any approaches developed need to be congruent with current Ministry of Health policy, and the evidence contained in the current literature. Finally, for DHBs developing new approaches in areas where there is currently no sound evidence base, the plea is that they build into their programmes an evaluation arm, so that learnings gained can be used by others to enhance the wellbeing of children and young people and to ensure the best use of available resources.

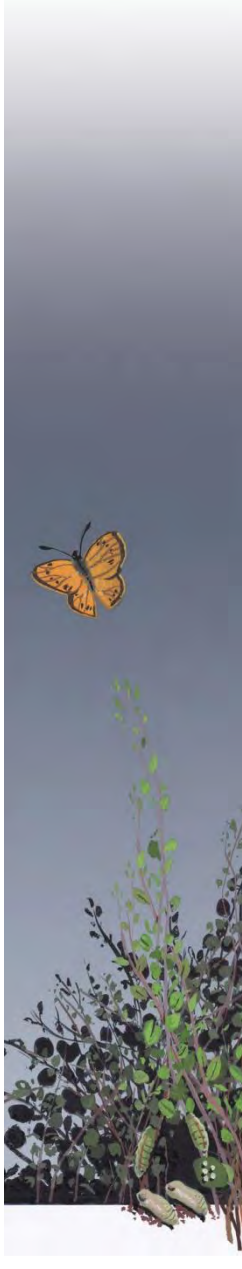


Table 1. Overview of the Health Status of Children and Young People in the Midland Region's DHBs

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Issues More Common in Infancy		
Regional Births	In New Zealand, 46.4% of newborn babies registered during 2010 were European, 29.2% were Māori, 11.5% were Asian/Indian, and 11.2% were Pacific. While 7.01% were born to mothers aged <20 years, 29.1% were born to mothers aged 35+ years. In addition, 15.0% were born into the least deprived (NZDep decile 1–2) areas, while 27.1% were born into the most deprived (NZDep decile 9–10) areas.	In the Midland Region during 2000–2010, Waikato DHB had the largest number of birth registrations annually, followed by the Bay of Plenty, then Lakes and Taranaki, and then Tairawhiti. The number of births registered in 2010 was higher than in 2000 in all DHBs, although the magnitude of the difference varied considerably from DHB to DHB. In the Midland Region during 2010, Tairawhiti and Lakes DHBs had the highest proportion of Māori babies registered, while Taranaki DHB had the highest proportion of European babies and Waikato DHB had the highest proportion of Asian and Pacific babies. Tairawhiti had the highest proportion of babies born into the most deprived (NZDep decile 10) areas, followed by Lakes DHB, while Taranaki and Waikato DHBs had the lowest proportion of babies born into the most deprived areas.
Fetal Deaths	In New Zealand during 2004–2008, unspecified cause was the most frequently listed fetal cause of intermediate fetal deaths (IFD), followed by extreme immaturity/low birth weight. Congenital and chromosomal anomalies also made a significant contribution. Of IFDs with a maternal cause listed, the most frequent causes were placenta praevia/separation/haemorrhage and chorioamnionitis. Unspecified cause was also the most frequently listed fetal cause of late fetal deaths (LFD), followed by malnutrition/slow fetal growth. Congenital and chromosomal anomalies again made a significant contribution. Of LFDs with a maternal cause listed, the most frequent causes were placenta praevia/separation/ haemorrhage/other anomaly, and compression of the umbilical cord.	During 2004–2008, while there was considerable variation, intermediate and late fetal death rates in each of the Midland Region's DHBs were not significantly different from the New Zealand rate. Within the region, unspecified causes, congenital and chromosomal anomalies and extreme immaturity / low birth weight were common fetal causes of intermediate fetal deaths. Of intermediate fetal deaths with a maternal cause listed, placenta praevia / other placental causes, chorioamnionitis, incompetent cervix / premature rupture membranes, and oligohydramnios were frequently listed causes. Similarly, unspecified causes, malnutrition / slow fetal growth, congenital and chromosomal anomalies and intrauterine hypoxia were common fetal causes of late fetal deaths. Of late fetal deaths with a maternal cause listed, placenta praevia / other placental causes, compression of the umbilical cord and chorioamnionitis were frequently listed causes.
Preterm Birth	In New Zealand during 2000–2010, preterm birth rates were relatively static. During 2006–2010, preterm birth rates were significantly higher for males, Māori > Asian/Indian, European and Pacific babies, those born into more deprived (NZDep decile 6–10) areas, and babies born to younger (<25 years) or older (35+ years) mothers.	In the Midland Region during 2006–2010, preterm birth rates in Waikato babies were significantly (albeit marginally) higher than the New Zealand rate, while rates in Lakes were significantly lower. Rates in Bay of Plenty, Tairawhiti and Taranaki babies were not significantly different from the New Zealand rate. Preterm births in the Waikato increased between 2000 and 2009, while rates in Taranaki declined, and rates in the Bay of Plenty, Tairawhiti and Lakes fluctuated from year to year. During the mid-late 2000s preterm birth rates were generally higher for Māori than for European babies, although ethnic differences were less consistent during the early 2000s in some DHBs.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Infant Mortality and Sudden Unexpected Death in Infancy (SUDI)	*Neonatal and Post Neonatal Mortality:* In New Zealand during 1990–2008, neonatal and post neonatal mortality both declined. Neonatal mortality was higher for Pacific and Māori > European > Asian/Indian infants during the late 1990s, although ethnic differences were less consistent during the 2000s. Post neonatal mortality was higher for Māori > Pacific > European and Asian/Indian infants throughout 1996–2008. During 2004–2008, both outcomes were also significantly higher for males, those in average-to-more deprived areas, preterm infants and those with younger mothers. *SUDI:* In New Zealand, SUDI declined during the late 1990s–early 2000s, but became more static after 2002–03. When broken down by sub-type, SIDS deaths declined during 1996–2008, while those due to suffocation or strangulation in bed became more prominent as the period progressed. During 2004–2008, SUDI was highest in infants 4–7 weeks of age. Suffocation/strangulation in bed accounted for 57.1% of all SUDI deaths in those aged 0–3 weeks and 36.8% of SUDI deaths in those aged 4–7 weeks. SUDI was also significantly higher for Māori > Pacific > European > Asian/Indian infants, those from average-to-more deprived (NZDep decile 3–10) areas, preterm infants, and those whose mothers were <30 years of age.	*Neonatal and Post Neonatal Mortality:* In the Midland Region during 2004–2008, congenital anomalies and extreme prematurity were the most frequent causes of neonatal mortality in all five DHBs, while SUDI was the most frequent cause of post neonatal mortality. While neonatal mortality was higher than the New Zealand rate in the Waikato, Lakes and Bay of Plenty, only in the case of the Bay of Plenty did these differences reach statistical significance. Neonatal mortality in Tairawhiti and Taranaki was similar to the New Zealand rate. Similarly, while post neonatal mortality in the Waikato, Lakes and Tairawhiti was higher than the New Zealand rate, none of these differences reached statistical significance. *SUDI*: In the Bay of Plenty, Lakes and Tairawhiti during 1996–2008, SUDI rates declined, although an upswing in rates was evident in Lakes after 2004–05. SUDI rates in the Waikato and Taranaki were more variable during this period. During 2004–2008, while SUDI rates were higher than the New Zealand rate in the Waikato, Lakes and Tairawhiti, in none of these cases did these differences reach statistical significance.
Breastfeeding	In New Zealand during June 2004–2011, the proportion of babies exclusively or fully breastfed remained fairly static, with rates in the year ending June 2011 being 66.3% at <6 weeks, 54.9% at 3 months and 25.2% at 6 months. Exclusive/full breastfeeding rates at <6 weeks were consistently higher for European/Other babies than for babies of other ethnic groups. At 3 and 6 months however, rates were generally higher European/Other > Asian/Indian > Māori and Pacific babies, with differences between Asian/Indian and Māori and Pacific babies increasing as the period progressed.	During June 2004–2011, exclusive/full breastfeeding rates at <6 weeks were higher than the New Zealand rate in all Midland DHBs. By 3 months, rates in most DHBs were closer to the New Zealand rate, with the exception of Tairawhiti, where rates remained consistently higher, as they did at 6 months. During the late 2000s, breastfeeding rates in Lakes and Taranaki were lower than the New Zealand rate, while rates in the Bay of Plenty were higher. During 2011, breastfeeding rates at all three ages were lower for babies living in the most deprived (NZDep decile 10 vs. decile 1) areas. During 2004–2011, rates at all three ages were also higher for European / Other babies than for Māori babies.
Issues More Common in Children or in Children and Young People		
Total and Avoidable Morbidity and Mortality		
Most Frequent Causes of Hospital Admission and Mortality in Children	In New Zealand during 2006–2010, injury/poisoning and gastroenteritis were the most frequent reasons for acute hospital admissions in children, while neoplasms/chemotherapy/radiotherapy and injury/poisoning were the most frequent reasons for arranged admissions. Dental procedures and grommets were the most frequent reasons for a waiting list admission. During 2004–2008, neoplasms were the most frequent cause of mortality in children aged 1–14 years, followed by congenital anomalies and vehicle occupant transport injuries.	Amongst DHBs in the Midland Region during 2006–2010, injury/poisoning was the leading reason for acute hospital admissions in children aged 0–14 years, followed by a range of infectious and respiratory diseases (e.g. bronchiolitis, asthma, gastroenteritis, acute upper respiratory infections). Neoplasms/chemotherapy/radiotherapy, injury/poisoning and dental conditions were the most frequent reasons for arranged admissions, while dental procedures and grommets were the most frequent reasons for a waiting list admission. During 2004–2008, transport injuries, congenital anomalies, neoplasms and drowning / submersion were common causes of mortality in children aged 1–14 years.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Ambulatory Sensitive Hospitalisations (ASH)	In New Zealand during 2006–2010, gastroenteritis, acute upper respiratory infections and asthma were the most frequent causes of ASH in children 0–4 years when emergency department (ED) cases were included, while gastroenteritis, dental conditions and asthma were the most frequent causes when ED cases were excluded. When broken down by age, ASH rates were highest in infants and one year olds, with rates then tapering off rapidly between one and two years, and then again between four and seven years of age. ASH rates were also significantly higher for males, Pacific > Māori > Asian/Indian > European children and those from average-to-more deprived (NZDep decile 3–10) areas. Similar patterns were seen when ED cases were excluded, although admission rates for Asian/Indian were significantly lower than for European children.	In the Waikato, ASH rates in children 0–4 years declined during the early-2000s, reached their lowest point in 2006–07 and then increased again, while rates in the Bay of Plenty increased throughout 2000–2010. ASH also increased in Lakes and Tairawhiti during the early-mid 2000s, with rates reaching their highest point in Tairawhiti in 2004–05 and in Lakes in 2008–09, before declining again. In contrast, in Taranaki, ASH rates declined during the early-mid 2000s, reached their lowest point in 2006–07 and then increased again. During 2006–2010, ASH in Waikato and Taranaki children were significantly lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti, ASH were significantly higher. ASH were also higher for Māori children than for European children in all five DHBs, with the number of admissions also being higher in winter and spring.
Upper Respiratory Tract Conditions		
Acute Upper Respiratory Tract Infections and Tonsillectomy	*Acute Upper Respiratory Infections*: In New Zealand during 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an URTI admission in children, followed by croup/acute laryngitis/tracheitis. URTI admissions were most common in infants and one year olds, with rates tapering off rapidly thereafter. Rates were also significantly higher for males, Pacific > Māori > European > Asian/Indian children and those in average-to-more deprived (NZDep decile 4–10) areas. *Tonsillectomy*: In New Zealand during 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in children admitted to hospital for tonsillectomy +/− adenoidectomy, accounting for 60.1% of all admissions. Hypertrophy of the tonsils/adenoids was the second leading diagnosis, followed by sleep apnoea. Admissions increased during the pre-school years, to reach their highest point at four years of age in European and Asian/Indian children, at five years of age in Māori children, and at six years of age in Pacific children. Overall, admissions were significantly higher for European > Māori > Asian/Indian and Pacific children, and significantly lower for those living in the least deprived (NZDep decile 1) areas.	*Acute Upper Respiratory Infections*: During 2006–2010, acute upper respiratory infections of multiple / unspecified sites were the most frequent reasons for an URTI admission in all five Midland DHBs, followed by croup/ acute laryngitis/tracheitis. During 2000–2010, there were no consistent trends in URTI admissions, with rates in most DHBs fluctuating during this period. However, in the Waikato and Taranaki during 2006–2010, admissions were significantly lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti admissions were significantly higher. URTI admissions were also generally higher for Māori children than for European children, although this was not consistent across all DHBs, or in some years. Admissions however were consistently higher in winter and early spring in all five DHBs. *Tonsillectomy*: In the Waikato and Bay of Plenty during 2006–2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children were significantly higher than the New Zealand rate, while in Tairawhiti, rates were significantly lower. Rates in Lakes and Taranaki however, were not significantly different from the New Zealand rate. Admissions were consistently higher for European children than for Māori children in all five Midland DHBs, with admissions for Waikato European children also being higher than for Waikato Asian/Indian and Pacific children during this period.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Middle Ear Conditions: Otitis Media and Grommets	In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, as well as for those admitted semi-acutely/from the waiting list for the insertion of grommets. Acute admissions for otitis media were highest in infants and one year olds, with rates declining rapidly thereafter. Rates were higher for Māori and Pacific > European > Asian/Indian children during the first four years, although ethnic differences were less consistent thereafter. In contrast, arranged/waiting list admissions for the insertion of grommets were relatively infrequent during the first year of life, but increased rapidly thereafter. Rates reached their highest point in European children at one year, in Māori children at two years, in Asian / Indian children at four years and in Pacific children at six years of age. Overall, during the first four years admissions were higher for European and Māori > Pacific > Asian/Indian children, while after six years, admissions were higher for Pacific > Māori > European > Asian/Indian children.	In the Midland Region during 2006–2010, otitis media was also the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, as well as for those admitted semi-acutely/from the waiting list for the insertion of grommets. Acute admissions for otitis media were significantly higher than the New Zealand rate in the Bay of Plenty, Lakes, Tairawhiti and the Waikato, but significantly lower in Taranaki. In contrast, arranged/waiting list admissions for grommets were significantly higher than the New Zealand rate in Taranaki and the Waikato, but significantly lower in the Bay of Plenty, and not significantly different in Lakes and Tairawhiti. Arranged/waiting list admissions for grommets were generally higher for Māori than for European children in the Bay of Plenty, Lakes and Taranaki, although differences between Māori and European children in the Waikato and Tairawhiti were less consistent. Admissions in Waikato European children however were consistently higher than for Waikato Asian/Indian children.
Lower Respiratory Tract Conditions		
Bronchiolitis	In New Zealand during 2000–2010, bronchiolitis admissions remained static during the early-mid 2000s, but then increased between 2006–07 and 2008–09. On average during 2000–2008, one infant each year died from bronchiolitis. During 2006–2010, bronchiolitis admissions were significantly higher for males, Pacific > Māori > European > Asian/Indian infants and those from average-to-more deprived (NZDep decile 3–10) areas.	In Lakes, Tairawhiti and the Bay of Plenty during 2006–2010, bronchiolitis admissions in infants were significantly higher than the New Zealand rate, while in Taranaki admissions were significantly lower. In contrast, admissions in the Waikato were similar to the New Zealand rate. In the Waikato, bronchiolitis admissions were higher for Pacific and Māori > European > Asian/Indian infants, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European infants. Admissions were higher during winter and early spring in all five DHBs.
Pneumonia	In New Zealand, bacterial / non-viral / unspecified pneumonia admissions in children declined during 2000–2007. A small upswing in rates was evident in 2008–09, before rates declined again in 2010. Similar patterns were seen for young people. In contrast, viral pneumonia admissions increased in both children and young people, with the most rapid increases in children occurring between 2004–05 and 2008–09. Pneumonia admissions (both types) were highest in one year olds, with the next highest rates being in infants <1 year. Mortality was highest in infants < 1 year. Admissions for bacterial / non-viral / unspecified pneumonia in children were also significantly higher for males, Pacific > Māori > Asian/Indian > European children and those in average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were significantly higher for Pacific > Māori > European >Asian/Indian young people, and those in average-to-more deprived (NZDep decile 5–10) areas. Admissions for viral pneumonia were higher for Pacific > Māori > European and Asian/Indian children and those in average-to-more deprived (NZDep decile 6–10) areas.	In the Waikato, Bay of Plenty and Lakes during 2000–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children declined, while in Tairawhiti and Taranaki rates increased during the mid-late 2000s. Admissions for young people were more static, with the exceptions of the Bay of Plenty where admissions declined during the mid-late 2000s, and Taranaki, where admission rates increased. There were however, no consistent trends in hospital admissions for viral pneumonia in children, with large year to year variations in rates being seen in a number of DHBs. In the Waikato, hospital admissions for bacterial/non-viral/unspecified pneumonia were higher for Pacific and Māori > European and Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were generally higher for Māori than for European children and young people. Admissions for viral and bacterial/non-viral/unspecified pneumonia were also higher in winter and early spring in all five DHBs.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Asthma	In New Zealand during 2000–2010, asthma admissions in children gradually increased, while admissions in young people were more static after 2004–2005. On average during 2000–2008, five children or young people each year, died from asthma. During 2006–2010, admissions were relatively infrequent during infancy but increased rapidly thereafter, reaching a peak at 2 years of age. In contrast, asthma deaths were most frequent amongst those in their late teens and early twenties. Asthma admissions in children were also significantly higher for males, Pacific > Māori > Asian/Indian > European children and those living in average-to-more deprived (NZDep decile 3–10) areas. In contrast, asthma admissions in young people were significantly higher for females, Pacific and Māori > European > Asian/Indian young people, and those in average-to-more deprived (NZDep decile 4–10) areas.	In the Bay of Plenty and Lakes during 2000–2010, asthma admissions in children increased. In the Waikato, Taranaki and Tairawhiti rates were more variable, although rates in the Waikato and Taranaki increased after 2006–07. In contrast, asthma admissions in young people were more static in most DHBs. In the Waikato, asthma admissions were higher for Pacific and Māori > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki asthma admissions were higher for Māori than for European children and young people. While no consistent seasonal patterns were evident, admissions in children and young people were generally lower in January.
Bronchiectasis	In New Zealand, hospital admissions for children and young people with bronchiectasis increased during the early 2000s, reached a peak in 2004–05 and then declined, with six children or young people having bronchiectasis listed as their main underlying cause of death during 2000–2008. During 2006–2010, admissions increased rapidly after the first year of life, with rates remaining elevated during childhood, but dropping away amongst those in their teens and early twenties. Admissions were also significantly higher for Pacific > Māori > Asian/Indian > European children and young people and those in average-to-more deprived (NZDep decile 3–10) areas.	In the Waikato during 2000–2010, hospital admissions for children and young people with bronchiectasis were static during the early-mid 2000s, but increased after 2006–07. Large year to year variations in the other Midland DHBs (possibly as a result of small numbers) made trends more difficult to interpret, although rates in Lakes increased and rates in Tairawhiti decreased during the mid-2000s. In Lakes during 2006–2010, admission rates were significantly higher than the New Zealand rate, while in Taranaki and the Bay of Plenty admissions were significantly lower. Admission rates in the Waikato and Tairawhiti were not significantly different from the New Zealand rate.
Infectious Diseases		
Pertussis	In New Zealand during 2000–2010, hospital admissions for pertussis in infants fluctuated, with peaks occurring in 2000 and 2004. Admissions reached their lowest point in 2007, with rates increasing gradually thereafter. During the early-mid 2000s one infant each year died from pertussis, although no deaths occurred during 2006–2008. During 2006–2010, pertussis admissions were highest in infants <1 year, with rates declining rapidly thereafter. Similarly, during 2004–2008, all pertussis deaths occurred in infants <1 year. Admission rates were also significantly higher for Pacific and Māori > European > Asian/Indian infants and those from more deprived (NZDep decile 5–10) areas.	In the Midland Region during 2000–2010, there were large year to year fluctuations in hospital admissions for pertussis in infants aged <1 year in all five DHBs. In Lakes during 2006–2010, admissions were significantly higher than the New Zealand rate. While admissions in the Bay of Plenty and Tairawhiti were also higher and admissions in Taranaki were lower than the New Zealand rate, in none of these DHBs did these differences reach statistical significance.
Meningococcal Disease	In New Zealand, hospital admissions for meningococcal disease in children and young people declined rapidly during the early-mid 2000s, but became more static after 2006–07. Similar patterns were seen for mortality during 2000–2008, although the number of deaths in 2008 was higher than in the previous four years. Admissions and mortality were both highest for infants <1 year. During 2006–2010, admissions were also significantly higher for males, Pacific and Māori>European >Asian/Indian children and young people and those from more deprived (NZDep decile 5–10) areas.	In the Midland Region during 2000–2010, hospital admissions for meningococcal disease in children and young people declined in all five Midland DHBs. During 2006–2010, hospital admissions for meningococcal disease were significantly higher than the New Zealand rate in Tairawhiti, but not significantly different from the New Zealand rate in the remaining four Midland DHBs were.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Tuberculosis	In New Zealand, hospital admissions for tuberculosis in children and young people declined after 2002–03, although a small upswing in rates was evident in 2010. During 2006–2010, admissions were highest amongst those in their late teens and early twenties. Rates were also significantly higher for Asian/Indian, Pacific and Māori children and young people than for European children and young people and for those from more deprived (NZDep decile 5–10) areas.	In the Midland Region during 2000–2010, large year to year variations (as the result of small numbers) made trends in hospital admissions for tuberculosis in individual DHBs difficult to interpret. During 2006–2010, TB admissions were significantly lower than the New Zealand rate in the Waikato and Bay of Plenty, while in Lakes, while rates were also lower, they were not significantly different from the New Zealand rate. In Tairawhiti small numbers precluded a valid analysis, while in Taranaki no admissions occurred during this period.
Acute Rheumatic Fever and Rheumatic Heart Disease	In New Zealand, hospital admissions for children and young people with acute rheumatic fever declined gradually during the early-mid 2000s, but increased again after 2006–07. In contrast, admissions for those with rheumatic heart disease were relatively static during the mid 2000s, although a downswing in rates was evident in 2010. During 2006–2010, acute rheumatic fever and heart disease admissions were infrequent during infancy, but increased rapidly during childhood, to reach a peak at 11-12 years. Acute rheumatic fever admissions were significantly higher for males, Pacific > Māori > European and Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas. Rheumatic heart disease admissions were significantly higher for females, Pacific>Māori >European>Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas.	In the Midland Region during 2000–2010, large year to year variations in rates (likely as the result of small numbers) made trends in hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease difficult to interpret. During 2006–2010, hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease in the Bay of Plenty and Tairawhiti were significantly higher than the New Zealand rate, while in Lakes rates were not significantly different from the New Zealand rate. In the Waikato, admissions for acute rheumatic fever were similar to the New Zealand rate, while admissions for rheumatic heart disease were significantly lower. In Taranaki, while admissions for both outcomes were lower than the New Zealand rate, only in the case of acute rheumatic fever did these differences reach statistical significance.
Serious Skin Infections	In New Zealand during 2000–2010, hospital admissions for serious skin infections increased in both children and young people. During 2006–2010, cellulitis and cutaneous abscesses/furuncles/carbuncles were the most frequent primary diagnoses in children admitted with serious skin infections, while in young people, cutaneous abscesses / furuncles/carbuncles and cellulitis were the main reasons for admission. Admissions were highest in infants <1 year, with a second, smaller peak evident amongst those in their late teens and early twenties. Admissions in children were significantly higher for males, Pacific > Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were significantly higher for Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas.	In the Midland Region during 2000–2010, hospital admissions for serious skin infections in children and young people increased in all five DHBs, with the most rapid increases in most DHBs occurring during the mid-late 2000s. During 2006–2010, admissions in children and young people were significantly higher than the New Zealand rate in Lakes, the Bay of Plenty and Tairawhiti, while admissions in Waikato were significantly lower. In Taranaki, admissions in children were significantly lower than the New Zealand rate, while admissions in young people were similar. In the Waikato, admissions were higher for Māori > Pacific > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki rates were higher for Māori children and young people than for European children and young people.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Gastroenteritis	In New Zealand, gastroenteritis admissions increased gradually during the early-mid 2000s but became static after 2006-07 in both children and young people. During 2002–2008, on average one child or young person per year died from gastroenteritis. During 2006–2010, admissions were highest in infants <1 year, with rates tapering off rapidly during the preschool years. Mortality was also highest in infants <1 year. Admissions in children were significantly higher for males, Pacific > Asian/Indian and European > Māori children and those from average-to-more deprived (NZDep decile 4–10) areas. In contrast, admissions in young people were significantly higher for females, European > Pacific and Māori > Asian/Indian young people, and those from average-to-more deprived (NZDep decile 4–10) areas.	In the Midland Region during 2000–2010, there were no consistent trends in gastroenteritis admissions in children and young people. During 2006–2010, admissions in children and young people were significantly higher than the New Zealand rate in the Bay of Plenty and Tairawhiti, but significantly lower in the Waikato. In Lakes, admissions in children were similar to the New Zealand rate, while admissions in young people were significantly higher. In Taranaki, rates in children were significantly lower than the New Zealand rate while rates in young people were similar. In the Waikato, Bay of Plenty and Taranaki, rates were higher for European than for Māori children and young people. In Lakes and Tairawhiti ethnic differences were less consistent.
Other Issues		
Injuries in Children	In New Zealand during 2006–2010 falls, followed by inanimate mechanical forces were the leading causes of injury admissions in children, although transport injuries as a group also made a significant contribution. In contrast, accidental threats to breathing, followed by vehicle occupant injuries were the leading causes of childhood injury mortality during 2004–2008. During 2000–2008, mortality from land transport injuries and unintentional non-transport injuries in children both declined, while mortality from accidental threats to breathing increased. The majority of accidental threats to breathing deaths however, occurred in infants <1 year, who were coded as dying as a result of suffocation/strangulation in bed, and thus the potential exists for some the increases seen to have arisen from a diagnostic shift in the coding of SUDI.	In the Midland Region during 2006–2010, falls followed by inanimate mechanical forces were the leading causes of injury admissions in children in all five DHBs, although transport injuries as a group also made a significant contribution. During 2004–2008, accidental threats to breathing, vehicle occupant, pedestrian and other transport injuries, and drowning / submersion were the most frequent causes of injury mortality in children in most DHBs.
Oral Health	*School Dental Service Data:* In New Zealand during 2000–2010, the % of children caries-free at 5 years was higher in areas with fluoridated school water supplies, while mean DMFT scores at 12 years were lower. During 2003–2010, a higher % of European/Other children, than Māori or Pacific children were caries-free at 5 years, while mean DMFT scores at 12 years were higher for Māori and Pacific children than for European/Other children. *Dental Caries Admissions*: In New Zealand during 2006–2010, dental caries were the leading reasons for dental admissions in children 0–4 and 5–14 years. In contrast, embedded / impacted teeth were the leading reasons in young people 15–24 years. Dental caries admissions in children 0–4 years were significantly higher for males, Pacific > Māori > Asian/Indian > European children and those from average-to-more deprived (NZDep decile 2–10) areas, while admissions for children 5–14 years were significantly higher for males, Māori and Pacific > Asian/Indian and European children and those from average-to-more deprived (NZDep decile 3–10) areas. For young people 15–24 years, admissions were significantly higher for European and Māori > Pacific > Asian/Indian young people and those from more deprived (NZDep decile 5–10) areas.	*School Dental Service Data:* In the Waikato during 2010, 44.8% of 5 year olds examined by the School Dental Service had access to fluoridated school water, as compared to 10.3% in Bay of Plenty, 18.4% in Lakes, 62.4% in Tairawhiti, and 69.0% in Taranaki. During 2003–2010, a higher proportion of European/Other children than Māori children were caries-free at 5 years, while mean DMFT scores at 12 years were higher for Māori, than for European/Other children in all five Midland DHBs. In the Waikato during 2009, 66.4% of eligible adolescents (aged ≈13–18 years) were reported as accessing publicly funded dental services, as compared to 63.0% in the Bay of Plenty, 55.2% in Lakes, 67.0% in Tairawhiti, and 72.5% in Taranaki. *Dental Caries Admissions*: In the Midland Region, hospital admissions for dental caries in children aged 0–4 and 5–14 years increased in all five DHBs during the early-mid 2000s although, with the exception of Waikato, rates tapered off again during the late 2000s. Trends for young people were more variable. During 2006–2010, admissions in children 0–4 and 5–14 years and young people 15–24 years were either similar to, or significantly higher than the New Zealand rate in all five DHBs. The only exception was in Taranaki, where rates in children 5–14 years were significantly lower. During 2000–2010, admissions were generally higher for Māori than for European children.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Permanent Hearing Loss	*Deafness Notification Database:* In New Zealand during 2010, 120 notifications were received by the Deafness Notification Database for children with bilateral hearing losses of >26dB in the better ear and 60 notifications were received for children with unilateral losses. During 2010, 15% of children notified to the DND had profound losses, 6% had severe losses, 37% had moderate losses and 42% had mild losses. When unilateral, acquired and overseas born cases were excluded, the average age at confirmation of a hearing loss in 2010 was 51 months, although the average age of suspicion was much earlier (31 months). *Newborn Hearing Screening:* In New Zealand during 1 April 2010–30 September 2010, the caregivers of 77.8% of eligible babies consented to newborn hearing screening, although this proportion varied by DHB. Of those completing screening 94.0% did so within one month, with 2.4% of babies completing screening receiving an audiology referral. Of those babies who passed screening, a further 7.4% were deemed to have risk factors for delayed onset/progressive hearing loss which warranted follow up over time.	*Deafness Notification Database:* In the Midland Region during 2010, a total of 38 children were notified to the Deafness Notification Database. *Newborn Hearing Screening:* In the Midland Region, the proportion of babies consenting to screening was ≥99% in all 5 DHBs, with the proportion being referred for audiology assessment ranging from 0.9% to 2.3%. In addition the proportion being targeted for follow up ranged from 5.4% to 11.1%.
Issues More Common in Young People		
Total and Avoidable Morbidity and Mortality		
Most Frequent Causes of Hospital Admissions and Mortality	In New Zealand during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people. In terms of other admission types, injury/poisoning and abdominal/pelvic pain were the leading reasons for acute admissions, injury/poisoning and neoplasms/chemotherapy/radiotherapy the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures the leading reasons for waiting list admissions. During 2004–2008, intentional self-harm, vehicle occupant transport injuries and neoplasms were the leading causes of mortality in young people aged 15–24 years.	In the Midland Region during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people in all five DHBs. In terms of other admission types, injury/poisoning, abdominal/pelvic pain and mental health issues were the leading reasons for acute admissions, while dialysis, neoplasm / chemotherapy / radiotherapy, injury / poisoning and mental health issues the leading reasons for arranged admissions. Gastrointestinal and musculoskeletal procedures, dental procedures and tonsillectomy +/− adenoidectomy were the leading reasons for waiting list admissions in Midland DHBs. During 2004–2008, vehicle occupant transport injuries, intentional self-harm and neoplasms were the leading causes of mortality in young people aged 15–24 years in all five DHBs.
Other Issues		
Injuries in Young People	In New Zealand during 2006–2010, inanimate mechanical forces and falls were the leading causes of injury admissions in young people, although as a group transport injuries also made a significant contribution. In contrast, during 2004–2008, intentional self-harm and vehicle occupant injuries were the leading causes of injury related mortality.	In the Midland Region during 2006–2010, inanimate mechanical forces and falls were also the leading causes of injury admissions in young people in all five DHBs, although as a group transport injuries again made a significant contribution. In contrast, during 2004–2008 vehicle occupant injuries and intentional self-harm were the leading causes of injury related mortality in all five DHBs.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Teenage Pregnancy	In New Zealand, teenage live births declined during the late 1990s and early 2000s, to reach their lowest point in 2002. Birth rates then gradually increased again, reaching a peak of 32.4 per 1,000 in 2008. In contrast, teenage terminations increased during the late 1990s and early 2000s, reached a plateau during 2002–2007, and then declined, with teenage live birth and termination rates being roughly equivalent during 2002–2004. During 2006–2010, teenage live birth rates were significantly higher for Māori > Pacific > European >Asian/Indian women and those from average-to-more deprived (NZDep decile 2–10) areas. Higher teenage live birth rates for Māori and Pacific women however, must be seen in the context of higher overall fertility rates (at all ages) for Māori and Pacific women.	In the Midland Region during 2006–2010, teenage birth rates were significantly higher than the New Zealand rate in all five DHBs. In the Waikato, rates were higher for Māori > Pacific > European > Asian/Indian women, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki rates were higher for Māori than for European.
Terminations of Pregnancy	In New Zealand during 1980–2010, terminations of pregnancy were highest in women aged 20-24 years, followed by those 25-29 years and 15-19 years. Termination rates increased during the 1980s and 1990s, with rates reaching a peak for most age groups in the early 2000s and then beginning to gradually decline. During 2006–2010, terminations were higher for Pacific and Māori > European > Asian teenagers, while amongst those 20–24 years, terminations were higher for Pacific > Māori > European and Asian women.	During 2009, 1,445 terminations of pregnancy were recorded as occurring in women living in the Waikato Regional Council catchment, while 905 occurred in women resident in the Bay of Plenty, 122 in women resident in Gisborne, and 350 in women resident in Taranaki.
The Children's Social Health Monitor		
Economic Indicators		
Gross Domestic Product (GDP)	In New Zealand, GDP decreased for five consecutive quarters from March 2008–March 2009, before increasing again, for five consecutive quarters, from June 2009–June 2010. GDP then briefly declined by 0.1% in the September quarter of 2010, before increasing again, by 0.6% in the December 2010 quarter, by 0.9% in the March 2011 quarter and by 0.1% in the June 2011 quarter. Economic activity for the year ending June 2011 increased by 1.5%.	
Income Inequality	In New Zealand during 1984–2010 income inequality, as measured by the P80/P20 ratio and Gini coefficient, was higher after adjusting for housing costs than prior to this adjustment. The most rapid rises in income inequality occurred between the late 1980s and early 1990s. During the early–mid 2000s however, income inequality declined, a change Perry attributes largely to the Working for Families package. Additional falls in income inequality were seen in 2010, with Perry attributing this to a fall in higher incomes, coupled with small gains for lower income households.	

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Child Poverty and Living Standards	In New Zealand during 1988–1992, child poverty rates increased markedly, as a result of rising unemployment and the 1991 Benefit cuts. During 1994–1998 however, rates declined, as economic conditions improved and unemployment fell. During 1998–2004, child poverty trends varied, depending on the measure used, but between 2004 and 2007 they again declined, following the roll out of the Working for Families package. For the majority of this period, child poverty rates were higher for younger children (0–11 vs. 12–17 years), larger households (3or more children vs. 1–2 children), sole parent households and households where the adults were either workless, or where none worked full time.	
Unemployment Rates	In the quarter ending September 2011, seasonally adjusted unemployment rates rose to 6.6%, while seasonally adjusted unemployment numbers increased from 154,000 to 157,000. During September 1987–2011, unemployment rates were higher for younger people (15–19 years > 20–24 years > 25–29 years > 35–39 years and 45–49 years) and those with no qualifications > school qualifications, or post school but no school qualifications > both post school and school qualifications, although there were no consistent gender differences for young people 15–24 years. During 2007(Q4)–2011(Q3) unemployment rates were higher for Māori and Pacific >Asian/Indian > European people. Unemployment rates increased for all ethnic groups during 2008 and 2009, but became more static during 2010–2011(Q3) for Māori, Pacific and European people. Rates for Asian/Indian people declined between 2010(Q2) and 2011(Q2).	In the Waikato, Bay of Plenty, Gisborne / Hawke's Bay and Taranaki regional council catchments during 2005(Q1)–2011(Q3) unemployment trends were similar to those occurring nationally. While rates were similar to the New Zealand rate in the Waikato, rates in Gisborne / Hawke's Bay were higher for the majority of 2005(Q1)–2011(Q3). In the Bay of Plenty rates were similar to the New Zealand rate during 2005-2008, but higher during 2009–2011(Q3), while in Taranaki rates were lower than the New Zealand rate during 2008–2011(Q3).
Children Reliant on Benefit Recipients	In New Zealand, the proportion of children aged 0–18 years who were reliant on a benefit, or benefit recipient, fell from 24.9% in April 2000 to 17.5% in April 2008, before increasing again to 20.4% in April 2011. A large proportion of the initial decline was due to a fall in the number of children reliant on unemployment benefit recipients (from 4.5% of children in 2000 to 0.5% in April 2008, before increasing to 1.4% in April 2011). The proportion of children reliant on DPB recipients also fell, from 17.2% of children in April 2000, to 13.8% in April 2008, before increasing to 15.8% in April 2011.	At the end of April 2011, there were 55,199 children aged 0–18 years who were reliant on a benefit or benefit recipient and who received their benefits from Service Centres in the Waikato (n=23,768), Bay of Plenty (n=12,734), Lakes (n=8,775), Taranaki (5,350) and Tairawhiti (4,572) DHB catchments. While the majority of these children were reliant on DPB recipients, increases in the number reliant on unemployment benefit recipients were evident between April 2008 and April 2011.

Indicator	New Zealand Distribution and Trends	Midland Region Distribution and Trends
Health and Wellbeing Indicators		
Hospital Admissions and Mortality with a Social Gradient	In New Zealand during 2006–2010, gastroenteritis, bronchiolitis, and asthma were the leading causes of hospitalisations for medical conditions with a social gradient, while falls, followed by inanimate mechanical forces were the leading causes of injury admissions. During 2004–2008 SUDI was the leading cause of mortality with a social gradient. Vehicle occupant deaths, followed by pedestrian injuries and drowning, made the largest contribution to injury related deaths, while bacterial/non-viral pneumonia was the leading cause from medical conditions. Medical admissions with a social gradient increased during the early 2000s, reached peak in 2002 and then declined, with an upswing in rates again being evident during 2007–2009. In contrast, injury admissions declined throughout 2000–2010. During this period, hospitalisations for medical conditions were higher for Pacific > Māori > European and Asian/Indian children. For Pacific children, rates increased during the early 2000s, reached a peak in 2003 and then declined. An upswing in rates was again evident during 2007–2009, with rates then declining during 2010. For Māori children, rates were static during the mid 2000s, but then increased during 2007–2009, while for Asian/Indian and European children rates were static during the mid-2000s but increased after 2007. Injury admissions with a social gradient were also higher for Pacific and Māori > European >Asian/Indian children. Admission rates for European and Māori children declined during 2000–2010, while rates for Pacific and Asian/Indian children were more static.	In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for medical conditions with a social gradient increased, while in the Waikato and Taranaki, admissions declined during the mid-2000s, reached a nadir and then increased again. Rates in Tairawhiti fluctuated from year to year. In contrast, injury admissions with a social gradient exhibited a general downward trend in all five DHB. In the Waikato, hospital admissions for medical conditions were generally higher for Pacific and Māori > European and Asian/Indian children, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European children. In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for injuries were generally higher Māori than for European children. In the Waikato, Tairawhiti and Taranaki ethnic differences were less evident, although rates were lower for Waikato Asian/Indian children than for other ethnic groups.
Injuries Arising from the Assault, Neglect and Maltreatment of Children	In New Zealand during 2006–2010, hospital admissions for injuries sustained as the result of the assault, neglect or maltreatment of children exhibited a U-shaped distribution with age, with rates being highest for infants < 1 year, and those > 11 years of age. In contrast, mortality was highest for infants < 1 year. While the gender balance for admissions was relatively even during infancy and early childhood, hospital admissions for males became more predominant as adolescence approached. In addition, admissions were also significantly higher for males, Māori > Pacific > European >Asian/Indian children, and those in average-to-more deprived (NZDep decile 2–10) areas.	In the Midland Region during 2000–2010, large year to year variations made trends in hospital admissions for injuries arising from the assault, neglect or maltreatment of children in individual DHBs difficult to interpret. During 2006–2010 however, admissions were significantly higher than the New Zealand rate in Lakes, the Bay of Plenty and Tairawhiti. In the Waikato, rates were significantly lower than the New Zealand rate, while in Taranaki rates were similar. During 2000–2008, four Waikato, three Bay of Plenty and three Taranaki children died as the result of injuries arising from assault, neglect or maltreatment.

THE HEALTH STATUS OF CHILDREN AND YOUNG PEOPLE

ISSUES MORE COMMON IN INFANCY

REGIONAL BIRTHS

Introduction

While often not explicitly stated, much of the interest in monitoring health status in recent years has been around benchmarking and the desire to assess a DHB's performance based on a basket of key indicators. The ability to undertake such analyses in a robust manner, however, requires differences in the age structure, and ethnic, rural/urban and socioeconomic composition of the region's population to be taken into account.

Further, at the regional level what is often needed for planning purposes is not an adjusted analysis where the effects of each of these factors have been discounted, but rather an overview of a region's crude rates with consideration then being given to why these rates might differ from the national average. As a consequence, the report which follows uses unadjusted/crude rates to provide an overview of morbidity and mortality for children and young people in the region. In interpreting these crude rates, however, knowledge of regional demography is essential, as well as an understanding of the ways in which the underlying determinants of health (e.g. socioeconomic deprivation) influence health outcomes at the population level. It is thus suggested that when reading each of the sections in this report, the reader considers the answers to the following questions:

1. What are the characteristics of the region's child and youth population in terms of age structure, ethnicity, rural / urban profile and exposure to socioeconomic disadvantage?
2. For each health issue under review, how might this demographic profile influence the distribution of health outcomes at the population level? (*This information is provided by the rate ratio tables and graphs (ethnicity, gender, and NZDep Index decile) which appear in the national level analysis for most indicators*).
3. What are the region's actual rates for the health issue in question and do they differ in any way from those that might be predicted based on an understanding of the region's demographic profile? (*This information is provided in the DHB level analysis for each indicator*).

In assisting the reader with the first of these tasks, the following section provides an overview of births in the region's DHBs by ethnicity, NZ Deprivation Index decile and maternal age using information from the Birth Registration Dataset. Due to the postponement of the 2011 Census, Census data for the region will not be provided this year, but will be updated as soon as they become available.

Data Sources and Methods

Indicator

1. Distribution of Live Births by Ethnicity, NZ Deprivation Index Decile and Maternal Age

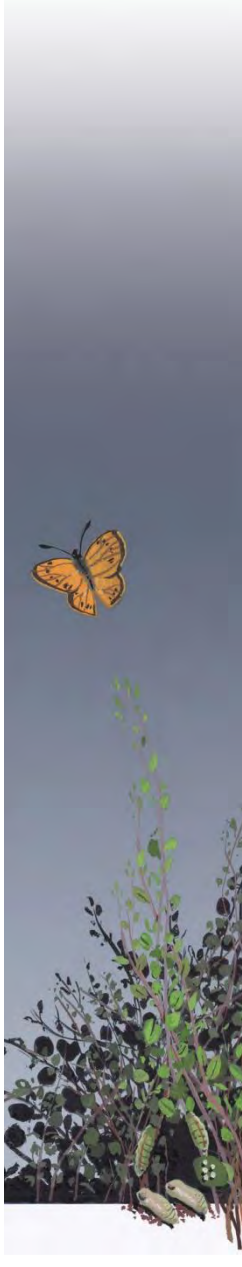
Numerator: Birth Registration Dataset

Notes on Interpretation

Note 1: In this analysis, NZDep2006 decile has been assigned on the basis of Domicile Code / Census Area Unit (CAU ≈1,000–2,000 people). In regions where there are no births in e.g. decile 10 areas, there still may be babies born into e.g. decile 10 meshblocks (smaller areas of ≈100 people). When these smaller meshblocks are aggregated into larger CAUs however, they may collectively fail to achieve an overall decile 10 ranking.

Note 2: The number of births presented here may vary slightly from previous years, as the Ministry of Health no longer provides information on stillbirths in the Birth Registration Dataset due to concerns about data quality. Thus the current analysis is restricted to live births (as compared to total births (including stillbirths) which were presented in previous years).

Note 3: Year is year of birth registration rather than year of birth.



New Zealand vs. Midland Region Distribution

Regional Trends

In the Midland Region during 2000–2010, Waikato DHB had the largest number of birth registrations annually, followed by the Bay of Plenty, then Lakes and Taranaki, and then Tairawhiti. The number of births registered in 2010 was higher than in 2000 in all DHBs, although the magnitude of the difference varied considerably from DHB to DHB (**Table 2**, **Table 3**).

Table 2. Distribution of Live Births by Ethnicity, Waikato, Bay of Plenty and Lakes DHBs 2000–2010

Year	Asian/Indian	European	Māori	Other	Pacific	Not Stated	Total
Waikato							
2000	201	2,549	1,855	42	139	6	4,792
2001	179	2,622	1,884	51	159	<3	4,897
2002	194	2,467	1,742	51	150	4	4,608
2003	242	2,443	1,886	64	157	8	4,800
2004	226	2,549	1,977	45	157	<3	4,956
2005	290	2,585	1,999	89	139	8	5,110
2006	249	2,540	2,026	53	180	10	5,058
2007	305	2,764	2,298	73	180	10	5,630
2008	354	2,799	2,386	78	217	9	5,843
2009	359	2,691	2,222	60	210	6	5,548
2010	400	2,712	2,258	107	215	5	5,697
Bay of Plenty							
2000	88	1,320	1,168	7	43	<3	2,628
2001	76	1,279	1,191	10	47	<3	2,604
2002	96	1,210	1,188	9	55	<3	2,560
2003	111	1,223	1,200	11	55	<3	2,602
2004	104	1,330	1,251	11	65	<3	2,763
2005	108	1,295	1,310	14	61	6	2,794
2006	125	1,329	1,293	21	53	3	2,824
2007	134	1,426	1,403	8	73	6	3,050
2008	140	1,414	1,403	20	68	<3	3,047
2009	134	1,349	1,329	17	70	<3	2,900
2010	175	1,318	1,398	20	76	<3	2,988
Lakes DHB							
2000	20	609	896	7	43	<3	1,576
2001	30	600	852	3	37	<3	1,523
2002	32	615	803	4	45	<3	1,500
2003	46	580	875	5	46	<3	1,553
2004	35	646	928	6	44	0	1,659
2005	41	547	928	8	48	5	1,577
2006	46	613	922	5	45	<3	1,632
2007	45	629	954	5	56	3	1,692
2008	75	613	984	7	46	<3	1,726
2009	58	614	937	17	58	<3	1,685
2010	58	575	923	13	55	0	1,624

Source: Birth Registration Dataset; Note: Year is year of birth registration

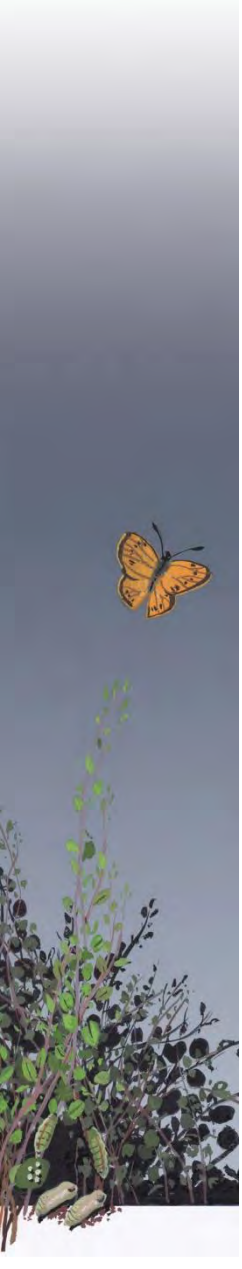


Table 3. Distribution of Live Births by Ethnicity, Tairawhiti and Taranaki DHBs 2000−2010

Year	Asian/Indian	European	Māori	Other	Pacific	Not Stated	Total
Tairawhiti							
2000	6	251	494	3	19	0	773
2001	4	225	519	<3	16	0	766
2002	15	224	501	<3	17	0	759
2003	14	191	484	<3	12	<3	703
2004	18	214	498	5	24	<3	760
2005	15	216	545	<3	21	<3	800
2006	7	186	536	<3	16	<3	747
2007	16	204	596	<3	19	0	836
2008	12	200	627	<3	20	<3	862
2009	18	171	543	<3	12	0	746
2010	16	205	559	6	19	0	805
Taranaki							
2000	23	982	403	<3	17	0	1,427
2001	21	897	434	<3	15	0	1,368
2002	34	891	359	5	20	<3	1,310
2003	23	883	440	4	28	0	1,378
2004	27	836	449	<3	22	0	1,336
2005	21	911	481	8	17	0	1,438
2006	32	925	485	7	28	<3	1,479
2007	41	970	572	15	26	<3	1,626
2008	40	972	577	9	24	<3	1,623
2009	47	957	560	7	28	<3	1,601
2010	50	984	535	6	32	0	1,607

Source: Birth Registration Dataset; Note: Year is year of birth registration

Distribution by Ethnicity, NZDep Index Decile and Maternal Age

In the Midland Region during 2010, Tairawhiti and Lakes DHBs had the highest proportion of Māori babies registered, while Taranaki DHB had the highest proportion of European babies and Waikato DHB had the highest proportion of Asian and Pacific babies. Tairawhiti had the highest proportion of babies born into the most deprived (NZDep decile 10) areas, followed by Lakes DHB, while Taranaki and Waikato DHBs had the lowest proportion of babies born into the most deprived areas (**Table 4**).

Summary

In the Midland Region during 2000–2010, Waikato DHB had the largest number of birth registrations annually, followed by the Bay of Plenty, then Lakes and Taranaki, and then Tairawhiti. The number of births registered in 2010 was higher than in 2000 in all DHBs, although the magnitude of the difference varied considerably from DHB to DHB.

In the Midland Region during 2010, Tairawhiti and Lakes DHBs had the highest proportion of Māori babies registered, while Taranaki DHB had the highest proportion of European babies and Waikato DHB had the highest proportion of Asian and Pacific babies. Tairawhiti had the highest proportion of babies born into the most deprived (NZDep decile 10) areas, followed by Lakes DHB, while Taranaki and Waikato DHBs had the lowest proportion of babies born into the most deprived areas.

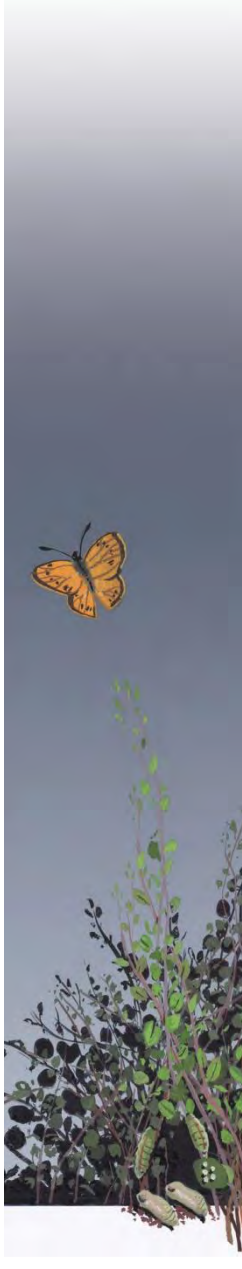


Table 4. Distribution of Live Births by Ethnicity, Maternal Age and NZ Deprivation Index Decile, Midland DHBs vs. New Zealand 2010

Variable	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births
	Waikato		Bay of Plenty		Lakes DHB		Tairawhiti		Taranaki		New Zealand	
Ethnicity												
Asian/Indian	400	7.0	175	5.9	58	3.6	16	2.0	50	3.1	7,451	11.5
European	2,712	47.6	1,318	44.1	575	35.4	205	25.5	984	61.2	30,016	46.4
Māori	2,258	39.7	1,398	46.8	923	56.8	559	69.4	535	33.3	18,893	29.2
Other	107	1.9	20	0.7	13	0.8	6	0.7	6	0.4	1,045	1.6
Pacific	215	3.8	76	2.5	55	3.4	19	2.4	32	2.0	7,261	11.2
*Total	5,692	100.0	2,987	100.0	1,624	100.0	805	100.0	1,607	100.0	64,666	100.0
Maternal Age												
<20 Years	519	9.1	261	8.7	172	10.6	88	10.9	131	8.2	4,533	7.0
20–24 Years	1,187	20.8	661	22.1	413	25.4	213	26.5	361	22.5	11,994	18.5
25–29 Years	1,562	27.4	732	24.5	369	22.7	193	24.0	407	25.3	16,087	24.9
30–34 Years	1,475	25.9	748	25.0	375	23.1	179	22.2	416	25.9	17,898	27.7
35+ Years	954	16.7	586	19.6	295	18.2	132	16.4	292	18.2	14,187	21.9
*Total	5,697	100.0	2,988	100.0	1,624	100.0	805	100.0	1,607	100.0	64,699	100.0
NZ Deprivation Index Decile												
Decile 1	356	6.2	38	1.3	39	2.40	0	0.0	54	3.4	4,304	6.7
Decile 2	258	4.5	30	1.00	167	10.3	15	1.9	90	5.6	5,341	8.3
Decile 3	250	4.4	374	12.5	103	6.3	0	0.0	147	9.1	4,962	7.7
Decile 4	377	6.6	192	6.4	62	3.8	68	8.4	37	2.3	5,232	8.1
Decile 5	871	15.3	141	4.7	91	5.6	78	9.7	96	6.0	6,333	9.8
Decile 6	434	7.6	447	15.0	195	12.0	34	4.2	367	22.8	5,957	9.3
Decile 7	863	15.1	460	15.4	45	2.8	8	1.0	356	22.2	6,793	10.5
Decile 8	695	12.2	394	13.2	249	15.3	39	4.8	268	16.7	8,042	12.5
Decile 9	779	13.7	389	13.0	328	20.2	227	28.2	81	5.0	8,436	13.1
Decile 10	814	14.3	523	17.5	345	21.2	336	41.7	111	6.9	8,991	14.0
*Total	5,697	100.0	2,988	100.0	1,624	100.0	805	100.0	1,607	100.0	64,391	100.0

Source: Birth Registration Dataset. Note: *Total: Some totals may differ due to a small number of births with missing information; Decile is NZDep2006.

FETAL DEATHS

Introduction

Stillbirths are often defined as the *"Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles" (WHO 1977).*

While internationally, controversy still exists regarding the exact gestation at which a death becomes a fetal death rather than a spontaneous abortion (some countries use 22 weeks [1] and others 24 weeks [2]), in New Zealand the Perinatal and Maternal Mortality Review Committee defines a fetal death as "*the death of a fetus born at 20 weeks gestation or beyond, or weighing at least 400g if gestation is unknown. Fetal death includes stillbirth and termination of pregnancy*" [3].

In addition to varying gestational age criteria, there are also a number of classification systems used internationally to assign a single underlying cause to deaths occurring in utero [1]. While a comprehensive review is beyond the scope of this section, in essence each takes into consideration a variety of maternal, placental, cord and fetal factors when trying to determine the precise cause of a fetal death. Using one such system (the ONS Classification System), a New Zealand study noted that during 1995–99, 43.9% of late fetal deaths were attributed to antepartum asphyxia, 14.8% to congenital anomalies, and 22.8% to unspecified causes (although only 24.2% of unspecified deaths underwent a post-mortem, making it difficult to determine whether these deaths were unexplained or merely un-nvestigated [4]). In another New Zealand study, which used the Perinatal Society of Australia and New Zealand Perinatal Death Classification System, only 14.1% of stillbirths in an Auckland cohort (20+ weeks gestation n=306) were deemed to be unexplained, with the authors concluding that the proportion of unexplained fetal deaths was likely to vary with the classification system used [5].

In terms of risk factors, in New Zealand fetal deaths have been shown to be higher for Indian and Pacific women, older women (35+ years), smokers, those from more deprived areas (NZDep decile 9-10), and for growth restricted babies [6] [7]. In one recent local case control study (155 late fetal deaths vs. 310 controls), risk of late fetal death was also significantly associated with maternal overweight and obesity, nulliparity, grandmultiparity, not being married, and not being in paid work. The excess risk for Pacific women disappeared once these other risk factors were taken into account [8]. Additional risk factors from the international literature include intrauterine infections, gestational diabetes, pregnancy induced hypertension, antepartum haemorrhage, and low maternal education [1,2,9,10,11].

The following section reviews intermediate and late fetal deaths using information from the National Mortality Collection. The section concludes with a brief review of policy documents and evidence-based reviews which consider how fetal deaths might be prevented at the population level.

Data Sources and Methods

Indicator

1. *Intermediate Fetal Deaths*

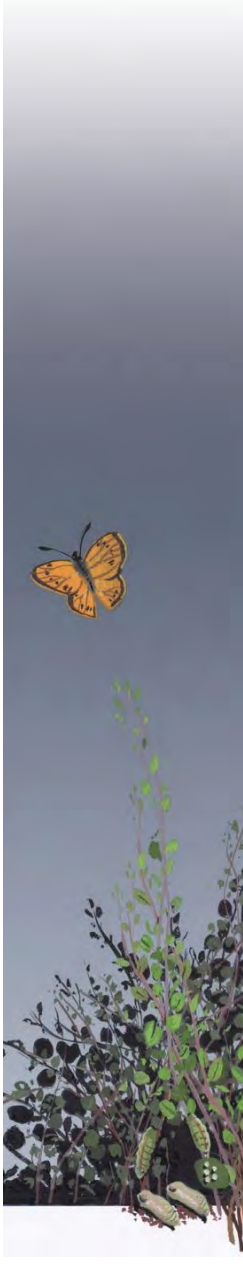
Numerator: National Mortality Collection: Fetal deaths occurring between 20 and 27 weeks gestation.

Denominator: Birth Registration Dataset and National Mortality Collection: All births 20+ weeks gestation.

2. *Late Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring 28+ weeks gestation.

Denominator: Birth Registration Dataset and National Mortality Collection: All births 28+ weeks gestation.



3. *Unspecified Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring 20+ weeks gestation where the main fetal cause of death was unspecified (ICD-10-AM P95 or R99) and there were no additional fetal or maternal causes of death listed.

Denominator: Birth Registration Dataset and National Mortality Collection: All births 20+ weeks gestation.

In the National Mortality Collection, all fetal deaths are assigned a main underlying (fetal) cause of death. In addition other fetal and maternal causes contributing to the death are also listed. In this section, the main (fetal) underlying cause of death was assigned using the following ICD-10-AM codes: Malnutrition/Slow Fetal Growth (P05), Extreme Immaturity/Low Birth Weight (P070, P072), Intrauterine Hypoxia: Pre Labour Onset (P200), Intrauterine Hypoxia: In Labour/Unspecified (P201, P209), Congenital Pneumonia (P23), Infections Specific to Perinatal Period (P35–P39), Fetal Blood Loss (P50), Unspecified Cause (P95), Congenital Anomalies: CNS (Q00–Q07), Congenital Anomalies: CVS (Q20–Q28), Chromosomal Anomalies (Q90–Q99), Congenital Anomalies: Other (remainder Q08–Q89), Other Causes (remainder ICD-10-AM).

In addition, the first maternal cause of death (if present) was assigned using the following ICD-10-AM codes: Incompetent Cervix/Premature Rupture Membranes (P010, P011), Oligohydramnios (P012), Multiple Pregnancy (P015), Placenta Praevia/Other Placental Separation/Haemorrhage (P020, P021), Other/Unspecified Placental Anomalies (P022), Compression of Umbilical Cord (P025), Chorioamnionitis (P027), Maternal Hypertensive Disorders (P000), Placental Transfusion Syndrome (P023), Other Causes (remainder ICD-10-AM).

For gestational age specific rates, the denominator was those remaining in utero at the specified gestational age (e.g. the 22 week denominator excludes all births occurring at 20 and 21 weeks)

Notes on Interpretation

Note 1: Death Registration data do not differentiate between spontaneous fetal deaths and late terminations of pregnancy (all fetal deaths 20+ weeks gestation require death registration). The admixture of spontaneous and induced fetal deaths is likely to be most prominent at earlier gestations (e.g. the high number of deaths attributed to congenital anomalies prior to 25 weeks gestation) and this must be taken into account when interpreting the data in this section.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Distribution by Cause

Intermediate Fetal Deaths: In New Zealand during 2004–2008, unspecified cause was the most frequently listed fetal cause of death for babies dying in utero between 20 and 27 weeks of gestation, followed by extreme immaturity/low birth weight and chromosomal anomalies. Congenital anomalies as a group, however, also made a significant contribution. Of those intermediate fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia / placental separation / haemorrhage and chorioamnionitis (**Table 5**).

Late Fetal Deaths: In New Zealand during 2004–2008, unspecified cause was also the most frequently listed fetal cause of death for babies dying in utero at 28+ weeks gestation, followed by malnutrition/slow fetal growth and intrauterine hypoxia. Congenital anomalies as a group, however, still made a significant contribution. Of those late fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage/other placental anomalies, and compression of the umbilical cord (**Table 6**).

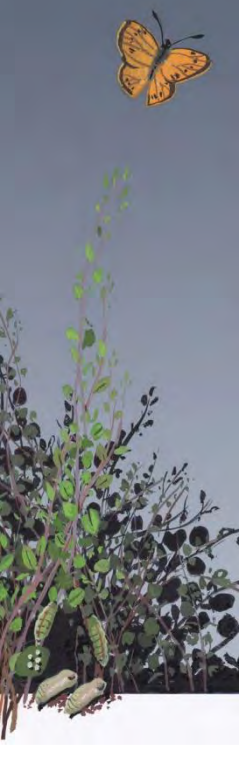


Table 5. Intermediate Fetal Deaths by Cause of Death, New Zealand 2004−2008

Cause of Death	New Zealand			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	310	62.0	99.9	24.1
Extreme Immaturity / Low Birth Weight	198	39.6	63.8	15.4
Chromosomal Anomalies	161	32.2	51.9	12.5
Congenital Anomalies: CNS	139	27.8	44.8	10.8
Congenital Anomalies: CVS	86	17.2	27.7	6.7
Congenital Anomalies: Other	133	26.6	42.9	10.4
Malnutrition / Slow Fetal Growth	79	15.8	25.5	6.2
Congenital Pneumonia	30	6.0	9.67	2.3
Infections Specific to Perinatal Period	29	5.8	9.35	2.3
Fetal Blood Loss	21	4.2	6.77	1.6
Intrauterine Hypoxia: In Labour/Unspecified	9	1.8	2.90	0.7
Intrauterine Hypoxia: Pre Labour Onset	8	1.6	2.58	0.6
Other Causes	81	16.2	26.1	6.3
Total	1,284	256.8	413.9	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	649	129.8	209.2	50.5
Placenta Praevia / Placental Separation/Haemorrhage	117	23.4	37.7	9.1
Other/Unspecified Placental Anomalies	76	15.2	24.5	5.9
Chorioamnionitis	78	15.6	25.1	6.1
Incompetent Cervix / Premature Rupture Membranes	76	15.2	24.5	5.9
Multiple Pregnancy	46	9.2	14.8	3.6
Oligohydramnios	45	9.0	14.5	3.5
Placental Transfusion Syndrome	27	5.4	8.70	2.1
Maternal Hypertensive Disorders	21	4.2	6.77	1.6
Compression of Umbilical Cord	17	3.4	5.48	1.3
Other Causes	132	26.4	42.5	10.3
Total	1,284	256.8	413.9	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CNS = Central Nervous System, CVS = Cardiovascular System

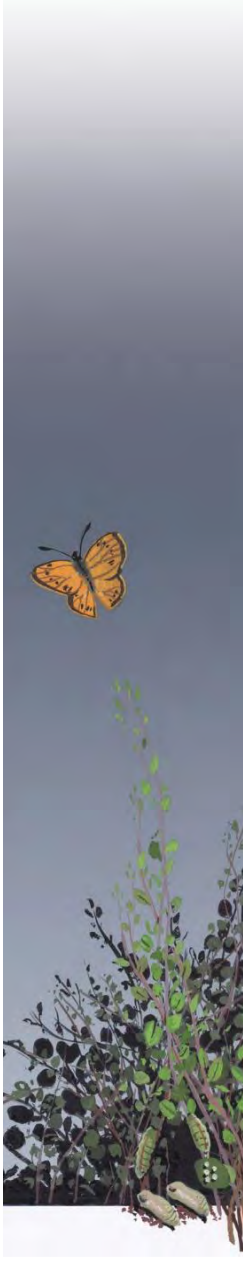


Table 6. Late Fetal Deaths by Cause of Death, New Zealand 2004−2008

Cause of Death	New Zealand			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	526	105.2	171.0	50.2
Malnutrition / Slow Fetal Growth	92	18.4	29.9	8.8
Intrauterine Hypoxia: Pre Labour Onset	55	11.0	17.9	5.2
Intrauterine Hypoxia: In Labour/Unspecified	44	8.8	14.3	4.2
Congenital Anomalies: CNS	30	6.0	9.76	2.9
Congenital Anomalies: CVS	29	5.8	9.43	2.8
Congenital Anomalies: Other	53	10.6	17.2	5.1
Chromosomal Anomalies	42	8.4	13.7	4.0
Fetal Blood Loss	38	7.6	12.4	3.6
Infections Specific to Perinatal Period	18	3.6	5.85	1.7
Congenital Pneumonia	6	1.2	1.95	0.6
Extreme Immaturity / Low Birth Weight	4	0.8	1.30	0.4
Other Causes	111	22.2	36.1	10.6
Total	1,048	209.6	340.8	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	359	71.8	116.7	34.3
Placenta Praevia / Placental Separation/Haemorrhage	108	21.6	35.1	10.3
Other/Unspecified Placental Anomalies	119	23.8	38.7	11.4
Compression of Umbilical Cord	113	22.6	36.7	10.8
Chorioamnionitis	59	11.8	19.2	5.6
Multiple Pregnancy	39	7.8	12.7	3.7
Maternal Hypertensive Disorders	30	6.0	9.76	2.9
Placental Transfusion Syndrome	19	3.8	6.18	1.8
Oligohydramnios	19	3.8	6.18	1.8
Incompetent Cervix / Premature Rupture Membranes	17	3.4	5.53	1.6
Other Causes	166	33.2	54.0	15.8
Total	1,048	209.6	340.8	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CNS = Central Nervous System, CVS = Cardiovascular System.

New Zealand Trends

In New Zealand, late fetal deaths were relatively static during the early-to-mid 2000s. While an upswing in rates was evident during 2008, it is too early to tell if this was a one off fluctuation, or the beginning of a longer term trend. Intermediate fetal deaths increased during the early 2000s, but were more variable after 2004–05, with the contribution unspecified deaths made to each category remaining relatively constant throughout this period (**Figure 1**).

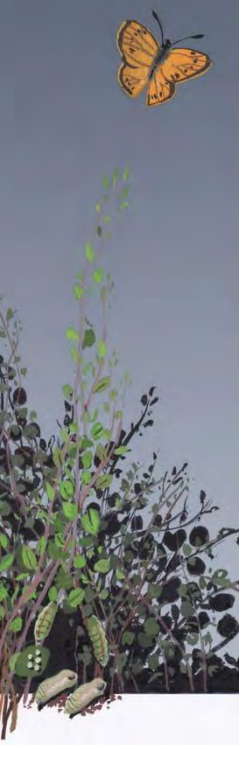
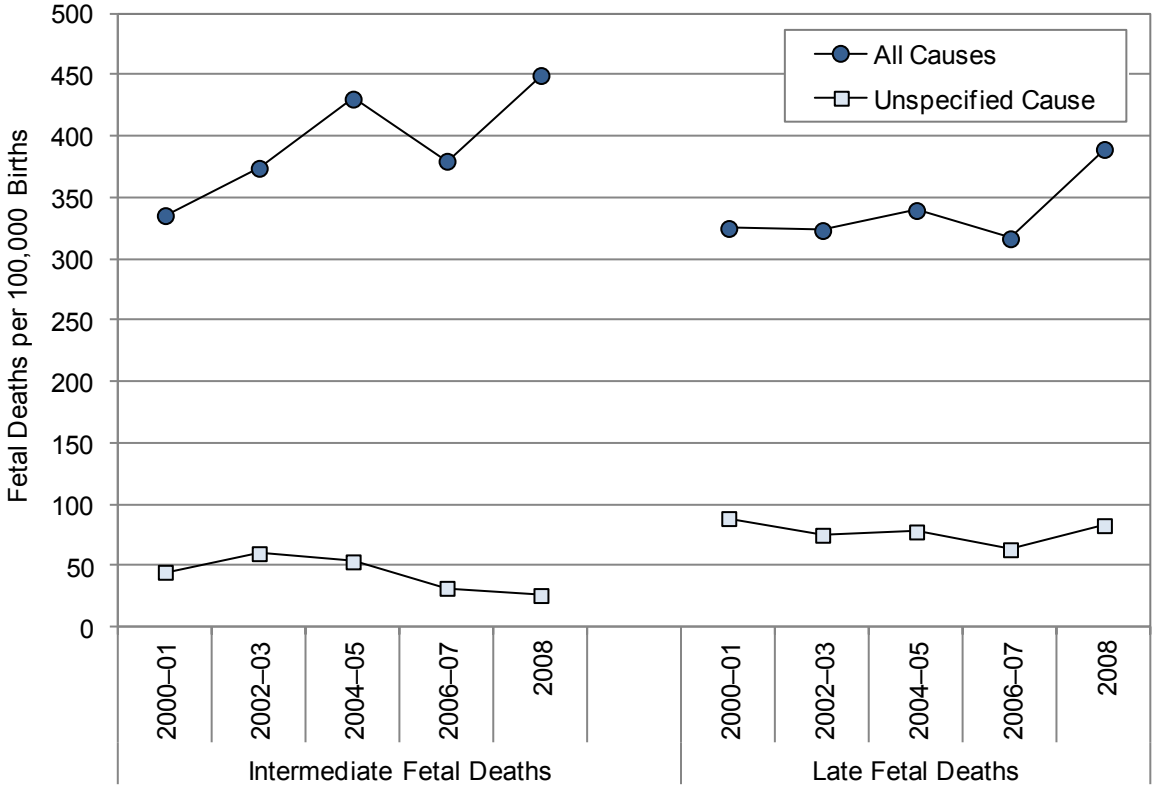
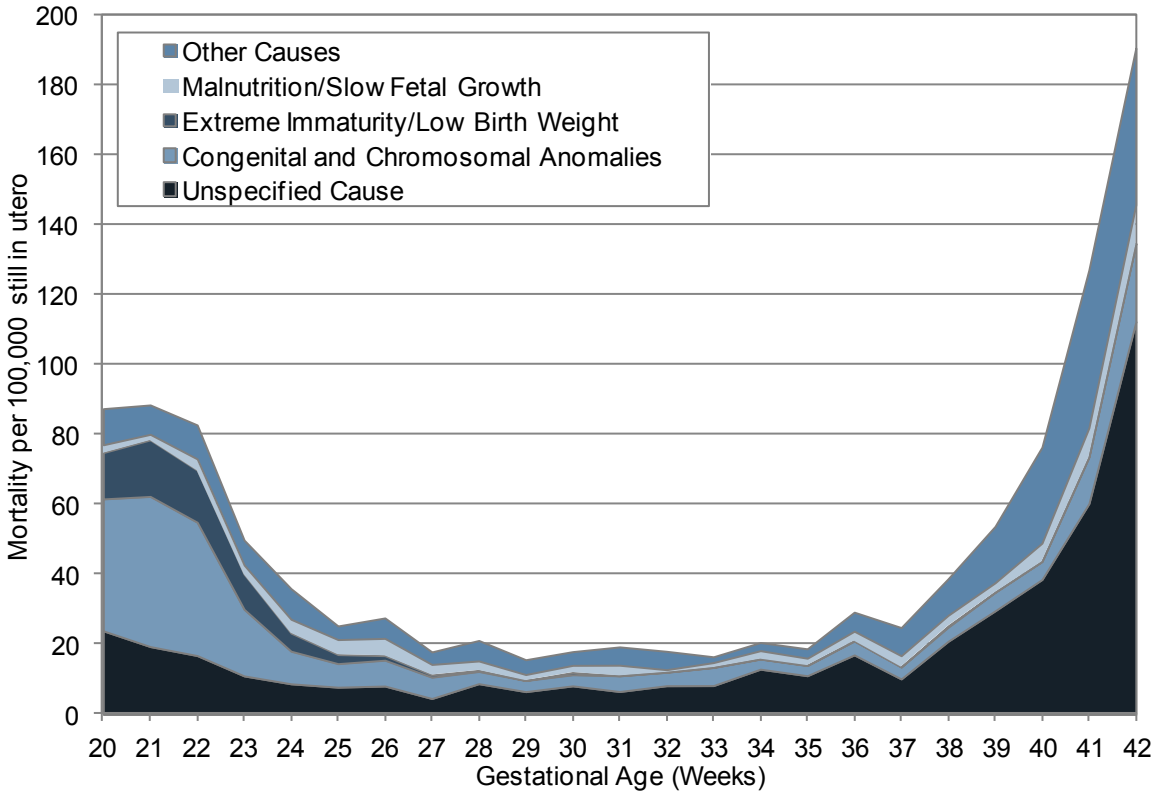


Figure 1. Intermediate and Late Fetal Deaths, New Zealand 2000−2008

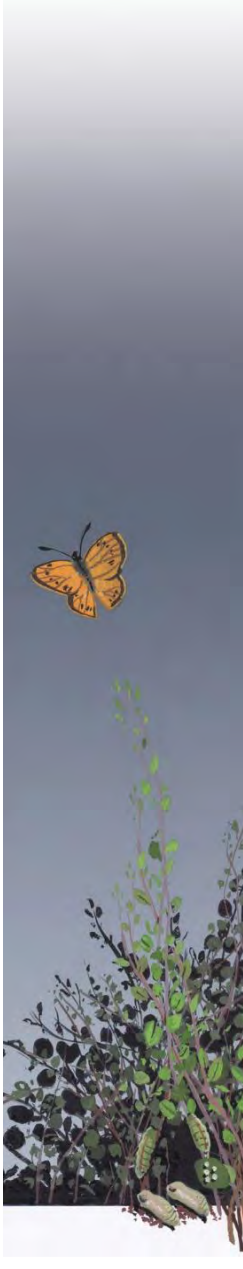


Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Figure 2. Fetal Deaths by Gestational Age and Main Fetal Cause of Death, New Zealand 2004−2008



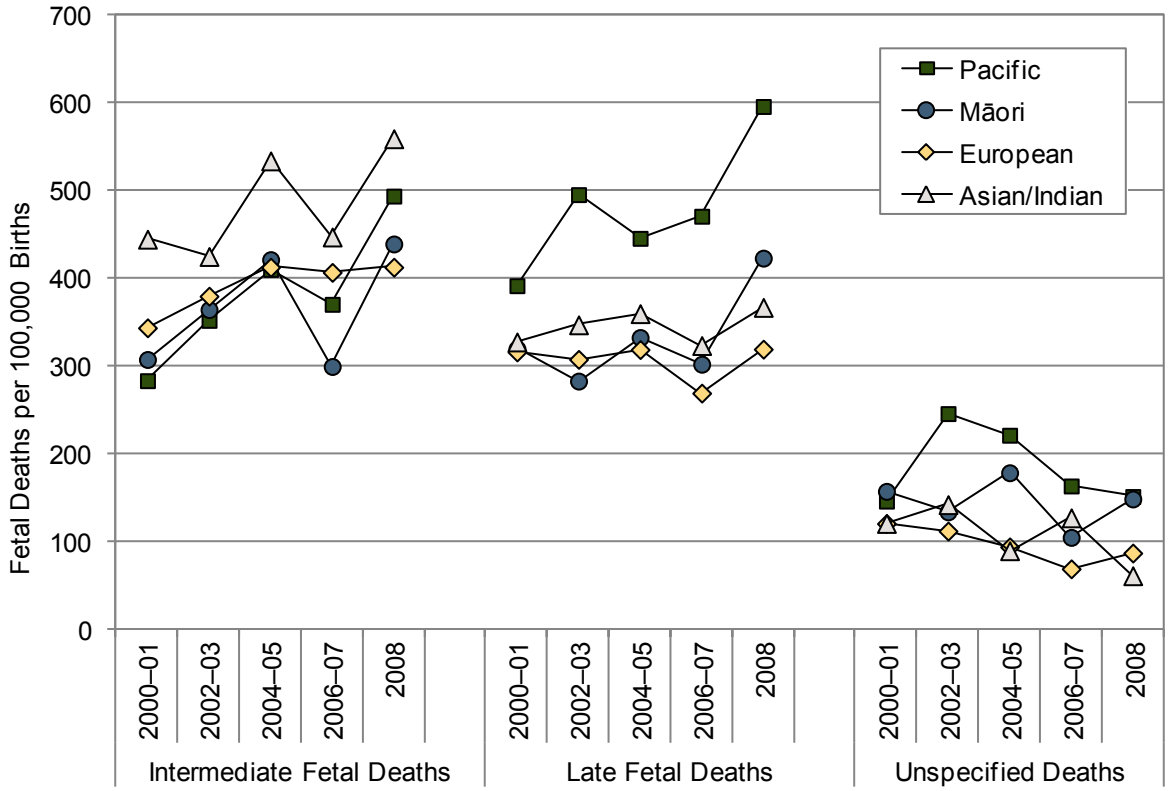
Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection



New Zealand Distribution by Gestational Age and Cause

In New Zealand during 2004–2008, fetal deaths exhibited a J-shaped distribution with gestational age. A peak was evident at <25 weeks, and rates increased rapidly again after 37 weeks. In interpreting these figures, it must be remembered that rates were calculated by dividing the number of fetal deaths at each gestational age by the number of babies remaining in utero. Thus, while the absolute number of babies dying in utero did not rise exponentially towards term, the risk for those remaining in utero increased markedly with increasing age. Further, it was not always possible to distinguish between spontaneous fetal deaths and late terminations of pregnancy and thus the high mortality rates (e.g. from congenital anomalies) in those <25 weeks must be interpreted with this in mind. When broken down by cause, fetal deaths arising from congenital anomalies and extreme immaturity/low birth weight were highest in babies 20–22 weeks gestation, while unspecified fetal deaths increased rapidly after 37 weeks (**Figure 2**).

Figure 3. Intermediate and Late Fetal Deaths and Unspecified Deaths by Ethnicity, New Zealand 2000−2008



Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: Unspecified deaths include all those 20+ weeks; Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Ethnicity, NZDep Index Decile, Maternal Age and Gender

Intermediate Fetal Deaths: In New Zealand during 2004–2008, intermediate fetal deaths were *significantly* higher for Asian/Indian babies than for European babies, and for babies born to women aged 35+ years (vs. women 30–34 years) (**Table 7**). Similar ethnic differences were seen during 2000–2008 (**Figure 3**).

Late Fetal Deaths: In New Zealand during 2004–2008, late fetal deaths were *significantly* higher for Pacific babies than for European babies, for those from average-to-more deprived (NZDep decile 5–10) areas and for babies born to teenage women (vs. women aged 30–34 years) (**Table 7**). Similar ethnic differences were seen during 2000–2008 (**Figure 3**).

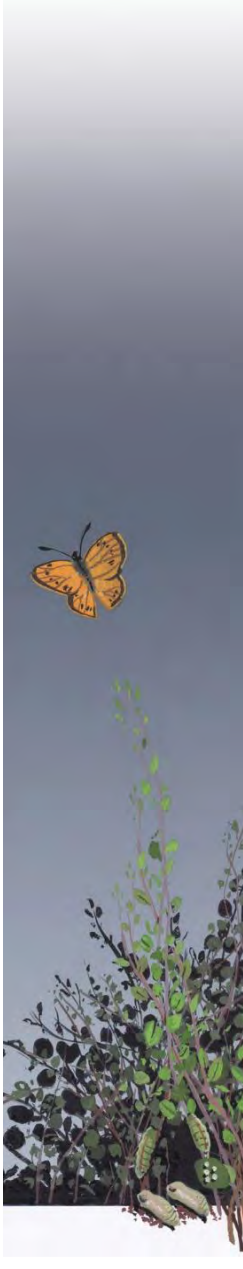
Unspecified Fetal Deaths: In New Zealand during 2004–2008, unspecified fetal deaths were *significantly* higher for Pacific and Māori babies than for European babies, and for

babies from more deprived (NZDep 7–10) areas (**Table 7**). Similar ethnic differences were seen during 2000–2008 (**Figure 3**).

Table 7. Intermediate and Late Fetal Deaths and Unspecified Deaths by Ethnicity, NZ Deprivation Index Decile, Maternal Age and Gender, New Zealand 2004−2008

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Intermediate Fetal Deaths							
NZ Deprivation Index Quintile				Maternal Age			
Decile 1–2	422.7	1.00		< 20 Years	457.1	1.24	1.00–1.54
Decile 3–4	406.2	0.96	0.79–1.16	20–24 Years	418.4	1.14	0.96–1.34
Decile 5–6	445.0	1.05	0.88–1.27	25–29 Years	387.2	1.05	0.90–1.23
Decile 7–8	396.5	0.94	0.78–1.13	30–34 Years	368.5	1.00	
Decile 9–10	414.2	0.98	0.82–1.17	35+ Years	485.2	1.32	1.13–1.53
Prioritised Ethnicity				Gender			
European	410.1	1.00		Female	394.7	1.00	
Māori	374.7	0.91	0.80–1.04	Male	427.0	1.08	0.97–1.21
Pacific	412.1	1.00	0.84–1.21				
Asian/Indian	504.8	1.23	1.03–1.47				
Late Fetal Deaths							
NZ Deprivation Index Quintile				Maternal Age			
Decile 1–2	251.0	1.00		< 20 Years	462.8	1.43	1.14–1.78
Decile 3–4	292.1	1.16	0.92–1.48	20–24 Years	351.8	1.09	0.90–1.30
Decile 5–6	324.0	1.29	1.03–1.62	25–29 Years	295.9	0.91	0.77–1.09
Decile 7–8	336.6	1.34	1.07–1.67	30–34 Years	324.1	1.00	
Decile 9–10	442.6	1.76	1.43–2.17	35+ Years	361.9	1.12	0.94–1.32
Prioritised Ethnicity				Gender			
European	298.4	1.00		Female	340.0	1.00	
Māori	339.2	1.14	0.98–1.31	Male	341.6	1.00	0.89–1.13
Pacific	488.3	1.64	1.37–1.96				
Asian/Indian	346.6	1.16	0.94–1.44				
Unspecified Cause (All Gestations)							
NZ Deprivation Index Quintile				Maternal Age			
Decile 1–2	81.6	1.00		< 20 Years	143.6	1.45	0.98–2.16
Decile 3–4	68.6	0.84	0.53–1.32	20–24 Years	127.2	1.29	0.94–1.76
Decile 5–6	85.5	1.05	0.69–1.60	25–29 Years	101.8	1.03	0.76–1.40
Decile 7–8	137.5	1.69	1.16–2.45	30–34 Years	98.9	1.00	
Decile 9–10	152.6	1.87	1.31–2.68	35+ Years	111.5	1.13	0.83–1.53
Prioritised Ethnicity				Gender			
European	81.8	1.00		Female	109.9	1.00	
Māori	141.1	1.73	1.35–2.21	Male	110.5	1.01	0.81–1.24
Pacific	182.2	2.23	1.64–3.03				
Asian/Indian	97.6	1.19	0.80–1.79				

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: Rate is per 100,000 births; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.



Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

During 2004–2008, while there was considerable variation within the region, intermediate and late fetal death rates in each of the Midland DHBs were not *significantly* different from the New Zealand rate (**Table 8**).

Table 8. Intermediate and Late Fetal Deaths, Midland DHBs vs. New Zealand 2004−2008

DHB	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Intermediate Fetal Deaths					
Waikato	109	21.8	407.1	0.98	0.81–1.20
Lakes	32	6.4	383.6	0.93	0.65–1.32
Bay of Plenty	55	11.0	377.7	0.91	0.70–1.19
Tairawhiti	14	2.8	347.7	0.84	0.50–1.42
Taranaki	24	4.8	318.2	0.77	0.51–1.15
New Zealand	1,284	256.8	413.9	1.00	
Late Fetal Deaths					
Waikato	93	18.6	350.7	1.03	0.83–1.27
Lakes	37	7.4	447.3	1.31	0.95–1.82
Bay of Plenty	42	8.4	291.3	0.85	0.63–1.16
Tairawhiti	16	3.2	401.1	1.18	0.72–1.93
Taranaki	27	5.4	360.4	1.06	0.72–1.55
New Zealand	1,048	209.6	340.8	1.00	

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Midland Region Trends

In the Midland Region during 2000–2008, large year to year variations made trends in intermediate and late fetal deaths for individual DHBs difficult to interpret, although in Taranaki, intermediate fetal deaths were consistently lower than the New Zealand rate (**Figure 4**).

Midland Region Distribution by Cause

Intermediate Fetal Deaths: Amongst DHBs in the Midland Region during 2004–2008, unspecified causes, congenital and chromosomal anomalies and extreme immaturity / low birth weight were common fetal causes of intermediate fetal deaths. Of those intermediate fetal deaths with a maternal cause listed, placenta praevia / other placental causes, chorioamnionitis, incompetent cervix / premature rupture membranes, and oligohydramnios were frequently listed causes (**Table 9** to**Table 13**).

Late Fetal Deaths: Similarly, during 2004–2008, unspecified causes, malnutrition / slow fetal growth, congenital and chromosomal anomalies and intrauterine hypoxia were common fetal causes of late fetal deaths in Midland DHBs. Of those late fetal deaths with a maternal cause listed, placenta praevia / other placental causes, compression of the umbilical cord, and chorioamnionitis were frequently listed causes (**Table 9** to**Table 13**).

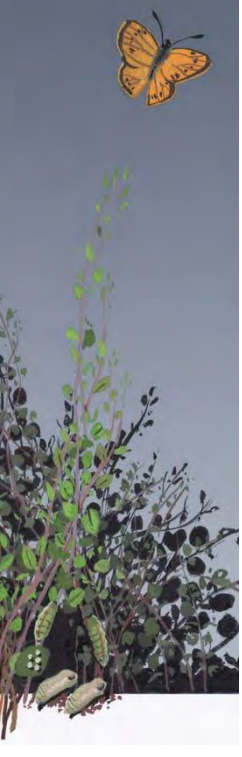
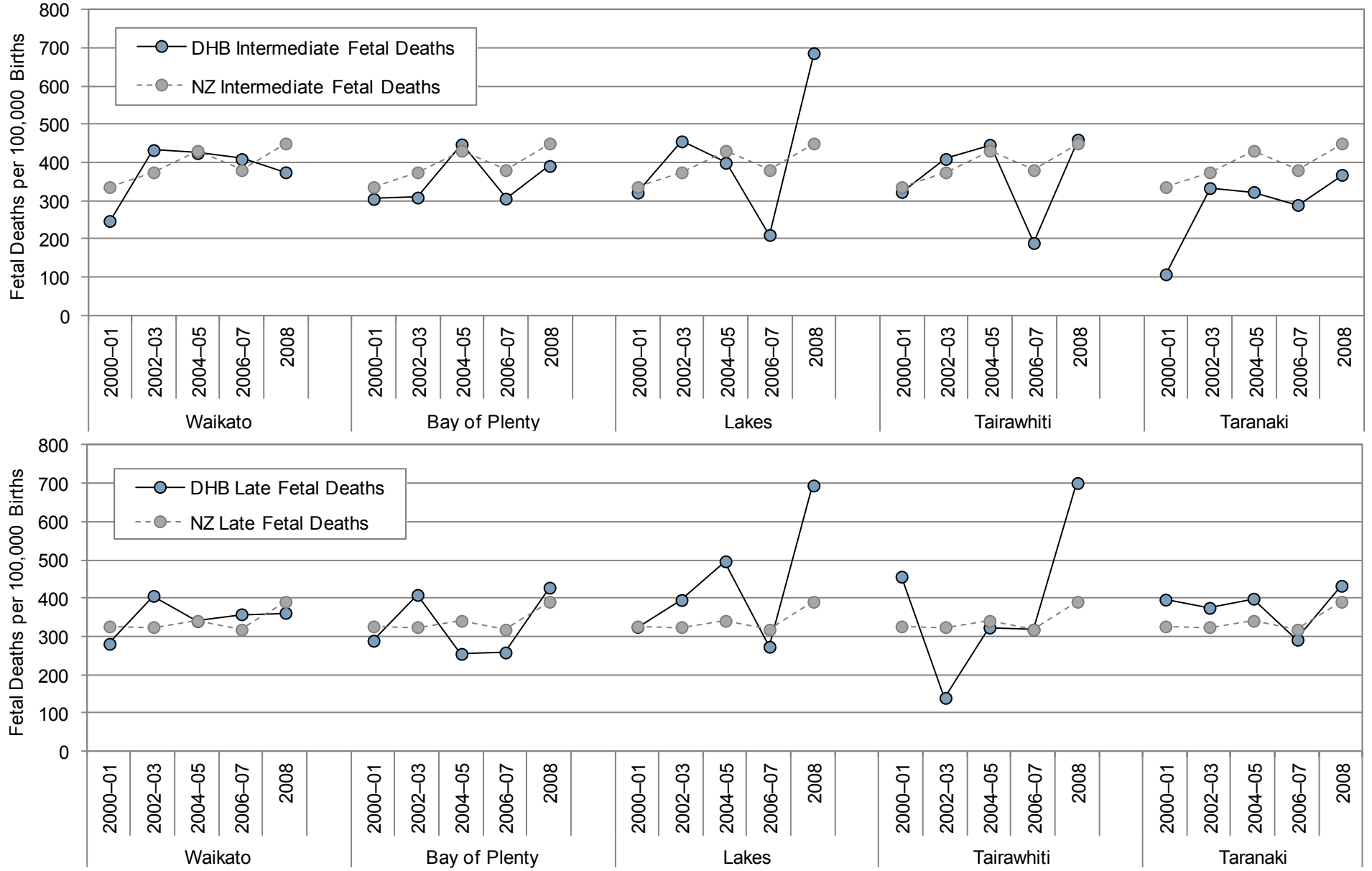


Figure 4. Intermediate and Late Fetal Deaths, Midland DHBs vs. New Zealand 2000−2008



Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Table 9. Intermediate and Late Fetal Deaths by Cause, Waikato DHB 2004−2008

Cause of Death	Waikato			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	17	3.4	63.5	15.6
Congenital Anomalies: CNS	17	3.4	63.5	15.6
Congenital Anomalies: CVS	12	2.4	44.8	11.0
Congenital Anomalies: Other	10	2.0	37.3	9.2
Extreme Immaturity / Low Birth Weight	17	3.4	63.5	15.6
Chromosomal Anomalies	12	2.4	44.8	11.0
Fetal Blood Loss	5	1.0	18.7	4.6
Malnutrition / Slow Fetal Growth	5	1.0	18.7	4.6
Infections Specific to Perinatal Period	3	0.6	11.2	2.8
Other Causes	11	2.2	41.1	10.1
Total	109	21.8	407.1	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	61	12.2	227.8	56.0
Placenta Praevia / Other Placental Causes	9	1.8	33.6	8.3
Placental Transfusion Syndrome	8	1.6	29.9	7.3
Chorioamnionitis	7	1.4	26.1	6.4
Incompetent Cervix / Premature Rupture Membranes	5	1.0	18.7	4.6
Oligohydramnios	5	1.0	18.7	4.6
Other Causes	14	2.8	52.3	12.8
Total	109	21.8	407.1	100.0
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	55	11.0	207.4	59.1
Malnutrition / Slow Fetal Growth	9	1.8	33.9	9.7
Congenital Anomalies: CNS	3	0.6	11.3	3.2
Congenital Anomalies: All Other	7	1.4	26.4	7.5
Intrauterine Hypoxia	6	1.2	22.6	6.5
Chromosomal Anomalies	4	0.8	15.1	4.3
Other Causes	9	1.8	33.9	9.7
Total	93	18.6	350.7	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	40	8.0	150.9	43.0
Placenta Praevia / Placental Separation/Haemorrhage	5	1.0	18.9	5.4
Other / Unspecified Placental Anomalies	16	3.2	60.3	17.2
Compression of Umbilical Cord	9	1.8	33.9	9.7
Other Causes	23	4.6	86.7	24.7
Total	93	18.6	350.7	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CVS = Cardiovascular System; CNS = Central Nervous System

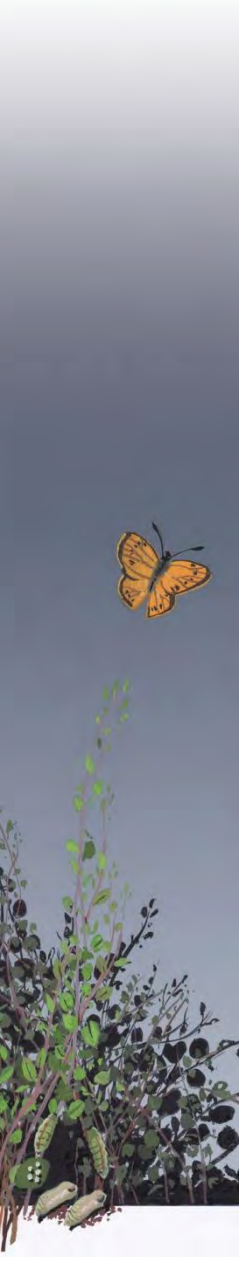


Table 10. Intermediate and Late Fetal Deaths by Cause, Bay of Plenty DHB 2004−2008

Cause of Death	Bay of Plenty			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	19	3.8	130.5	34.5
Extreme Immaturity / Low Birth Weight	11	2.2	75.5	20.0
Chromosomal Anomalies	7	1.4	48.1	12.7
Congenital Anomalies: CNS	6	1.2	41.2	10.9
Congenital Anomalies: CVS	4	0.8	27.5	7.3
Congenital Anomalies: Other	6	1.2	41.2	10.9
Other Causes	2	0.4	13.7	3.6
Total	55	11.0	377.7	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	32	6.4	219.8	58.2
Incompetent Cervix / Premature Rupture Membranes	6	1.2	41.2	10.9
Chorioamnionitis	3	0.6	20.6	5.5
Other Causes	14	2.8	96.1	25.5
Total	55	11.0	377.7	100.0
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	25	5.0	173.4	59.5
Congenital Anomalies	5	1.0	34.7	11.9
Intrauterine Hypoxia: Pre Labour Onset	4	0.8	27.7	9.5
Chromosomal Anomalies	4	0.8	27.7	9.5
Other Causes	4	0.8	27.7	9.5
Total	42	8.4	291.3	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	16	3.2	111.0	38.1
Placenta Praevia / Other Placental Causes	10	2.0	69.3	23.8
Chorioamnionitis	4	0.8	27.7	9.5
Other Causes	12	2.4	83.2	28.6
Total	42	8.4	291.3	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CVS = Cardiovascular System; CNS = Central Nervous System

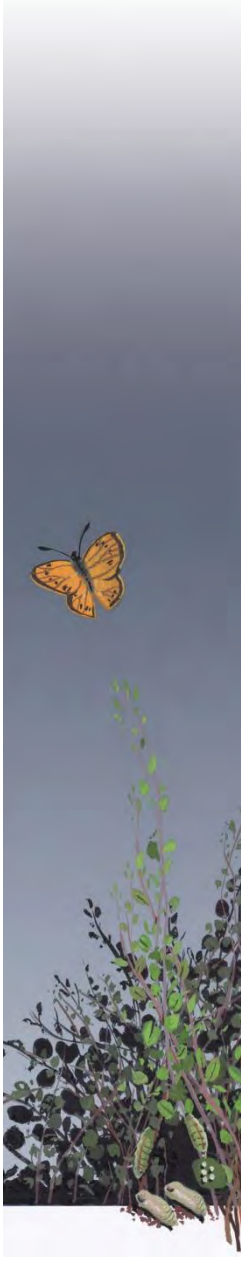


Table 11. Intermediate and Late Fetal Deaths by Cause, Lakes DHB 2004−2008

Cause of Death	Lakes DHB			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	16	3.2	191.8	50.0
Extreme Immaturity / Low Birth Weight	5	1.0	59.9	15.6
Congenital Anomalies	4	0.8	48.0	12.5
Other Causes	7	1.4	83.9	21.9
Total	32	6.4	383.6	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	11	2.2	131.9	34.4
Placenta Praevia / Placental Separation/Haemorrhage	5	1.0	59.9	15.6
Incompetent Cervix / Premature Rupture Membranes	3	0.6	36.0	9.4
Multiple Pregnancy	3	0.6	36.0	9.4
Other Causes	10	2.0	119.9	31.3
Total	32	6.4	383.6	100.0
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	26	5.2	314.3	70.3
Malnutrition / Slow Fetal Growth	3	0.6	36.3	8.1
Intrauterine Hypoxia	3	0.6	36.3	8.1
Other Causes	5	1.0	60.4	13.5
Total	37	7.4	447.3	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	14	2.8	169.2	37.8
Placenta Praevia / Placental Separation/Haemorrhage	4	0.8	48.4	10.8
Other / Unspecified Placental Anomalies	4	0.8	48.4	10.8
Compression of Umbilical Cord	4	0.8	48.4	10.8
Other Causes	11	2.2	133.0	29.7
Total	37	7.4	447.3	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

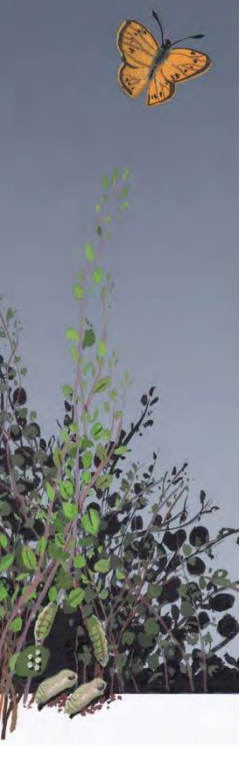


Table 12. Intermediate and Late Fetal Deaths by Cause, Taranaki DHB 2004–2008

Cause of Death	Taranaki			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	7	1.4	92.8	29.2
Extreme Immaturity / Low Birth Weight	7	1.4	92.8	29.2
Congenital Anomalies	4	0.8	53.0	16.7
Other Causes	6	1.2	79.6	25.0
Total	24	4.8	318.2	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	8	1.6	106.1	33.3
Multiple Pregnancy	4	0.8	53.0	16.7
Placenta Praevia / Placental Separation/Haemorrhage	3	0.6	39.8	12.5
Incompetent Cervix / Premature Rupture Membranes	3	0.6	39.8	12.5
Other Causes	6	1.2	79.6	25.0
Total	24	4.8	318.2	100.0
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	18	3.6	240.3	66.7
Malnutrition / Slow Fetal Growth	4	0.8	53.4	14.8
Intrauterine Hypoxia	3	0.6	40.0	11.1
Congenital Anomalies	2	0.4	26.7	7.4
Total	27	5.4	360.4	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	11	2.2	146.8	40.7
Placenta Praevia / Other Placental Causes	6	1.2	80.1	22.2
Compression of Umbilical Cord	5	1.0	66.7	18.5
Other Causes	5	1.0	66.7	18.5
Total	27	5.4	360.4	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

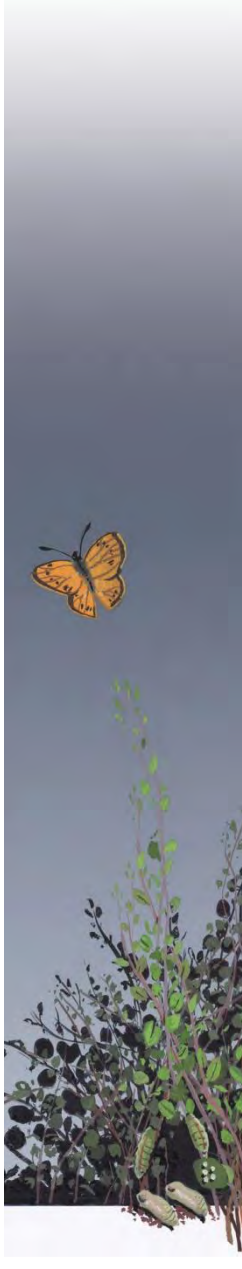


Table 13. Intermediate and Late Fetal Deaths by Cause, Tairawhiti DHB 2004−2008

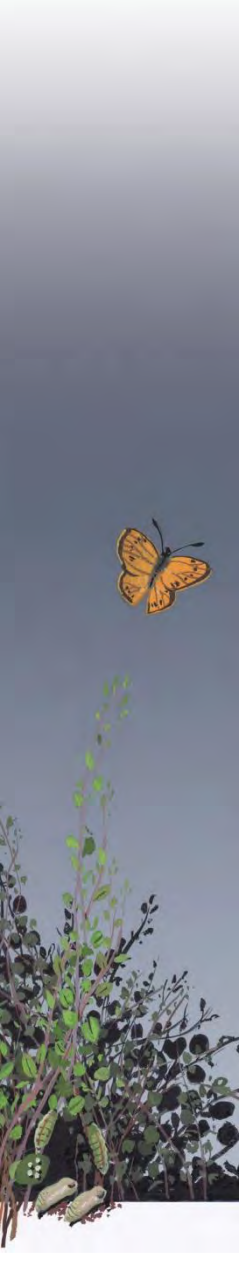
Cause of Death	Tairawhiti			
	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Intermediate Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	7	1.4	173.8	50.0
Congenital and Chromosomal Anomalies	3	0.6	74.5	21.4
Other Causes	4	0.8	99.3	28.6
Total	14	2.8	347.7	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	5	1.0	124.2	35.7
Placenta Praevia / Other Placental Causes	3	0.6	74.5	21.4
Other Causes	6	1.2	149.0	42.9
Total	14	2.8	347.7	100.0
Late Fetal Deaths				
Main Fetal Cause of Death				
Unspecified Cause	8	1.6	200.6	50.0
Congenital Anomalies	5	1.0	125.3	31.3
Malnutrition / Slow Fetal Growth	3	0.6	75.2	18.8
Total	16	3.2	401.1	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	5	1.0	125.3	31.3
Placenta Praevia / Other Placental Causes	4	0.8	100.3	25.0
Compression of Umbilical Cord	3	0.6	75.2	18.8
Other Causes	4	0.8	100.3	25.0
Total	16	3.2	401.1	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Summary

In New Zealand during 2004–2008, unspecified cause was the most frequently listed fetal cause of intermediate fetal deaths, followed by extreme immaturity/low birth weight. Congenital and chromosomal anomalies as a group however, made a significant contribution. Of intermediate fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/separation/haemorrhage and chorioamnionitis. Unspecified cause was also the most frequently listed fetal cause of late fetal deaths, followed by malnutrition/slow fetal growth. Congenital and chromosomal anomalies as a group however, also made a significant contribution. Of late fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/separation/ haemorrhage/other anomaly, and compression of the umbilical cord.

During 2004–2008, while there was considerable variation, intermediate and late fetal death rates in each of the Midland Region's DHBs were not *significantly* different from the New Zealand rate. Within the region, unspecified causes, congenital and chromosomal anomalies and extreme immaturity / low birth weight were common fetal causes of intermediate fetal deaths. Of intermediate fetal deaths with a maternal cause listed, placenta praevia / other placental causes, chorioamnionitis, incompetent cervix / premature rupture membranes, and oligohydramnios were frequently listed causes. Similarly, unspecified causes, malnutrition / slow fetal growth, congenital and chromosomal



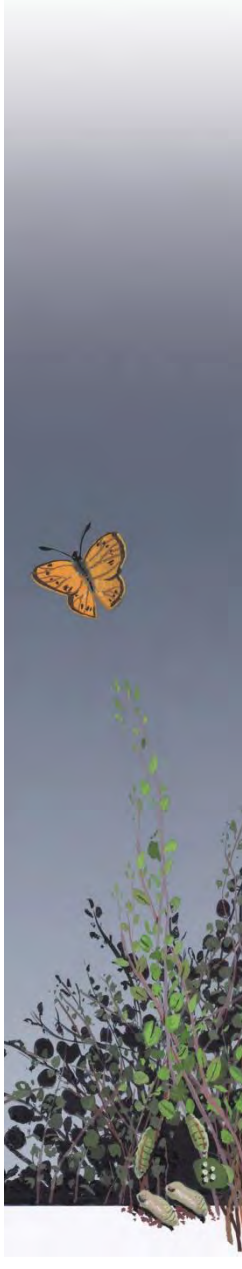
anomalies and intrauterine hypoxia were common fetal causes of late fetal deaths. Of late fetal deaths with a maternal cause listed, placenta praevia / other placental causes, compression of the umbilical cord and chorioamnionitis were frequently listed causes.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Fetal Deaths

In New Zealand at present, there is no single strategy which focuses on the prevention of fetal deaths, and thus any local strategies developed will need to incorporate evidence from a variety of sources. **Table 14** provides an overview of a range of New Zealand policy documents and evidence-based reviews which may be useful in this context. In addition, **Table 17** reviews similar publications of relevance to *Preterm Births*.

Table 14. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Fetal Deaths

Ministry of Health Policy Documents
Ministry of Health. 2011. **New Zealand Maternity Standards: A set of standards to guide the planning, funding and monitoring of maternity services by the Ministry of Health and District Health Boards**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/10767/$File/nz-maternity-stds-Sept2011.pdf These standards provide guidance for the provision of safe, equitable and high quality maternity services throughout New Zealand. They consist of three high level strategic statements to guide the funding, planning, provision and monitoring of maternity services by the Ministry of Health, DHBs, service providers and health practitioners. The standards underpin the DHB maternity service specifications, the Primary Maternity Services Notice 2007, the Maternal Referral Guidelines, and other high-level guidelines and requirements.
Ministry of Health. 2011. **Guidelines for consultation with obstetric and related medical services (Referral Guidelines)**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/maternity/$file/lmc-referral-guidelines-jul2011.pdf These guidelines are intended for lead maternity carers and outline criteria and processes for referral to primary care, referral for specialist consultation, and referral for the transfer of clinical responsibility for care, transfer of clinical responsibility for care in an emergency and emergency transport.
Ministry of Health. 2008. **Maternity Action Plan 2008–2012 - Draft for Consultation**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/8445/$File/maternity-action-plan-draft08-12.pdf This Plan was developed by the Ministry of Health with assistance from the Maternity Services Strategy Advisory Group (which provides expert advice to the Ministry). It discusses current service provision, the vision for maternity services, and current issues in maternity services, and it sets out priorities, actions and goals under the headings of leadership, quality and safety, maternity information systems and data collection, inequalities, maternity workforce and relationships and multidisciplinary co-operation.
Health Funding Authority. 2000. **Maternity Services: A Reference Document**. Hamilton: Health Funding Authority. http://www.moh.govt.nz/moh.nsf/ea6005dc347e7bd44c2566a40079ae6f/64f4a80cd43629704c2569d9001a01c9/$FILE/Maternity%20Services%20November%202000%20-%20final%20version.pdf This document provides a history of maternity services in New Zealand, and description of New Zealand's maternity services as they were in 2000 before the Health Funding Authority was dis-established and its functions were taken over by the Ministry of Health and the DHBs and it sets out a plan for the future direction of the services.
International and Australasian Guidelines
Royal College of Obstetricians and Gynaecologists (RCOG). 2011. **Reduced fetal movements (Green-top guideline; no. 57)**. London (U.K.): Royal College of Obstetricians and Gynaecologists (RCOG). http://www.rcog.org.uk/files/rcog-corp/GTG57RFM25022011.pdf The purpose of this guideline is to provide advice to clinicians, based on the best available evidence, on the management of women presenting with reduced fetal movements in pregnancy (excluding those with multiple pregnancy). The guidelines are structured as a series of clinical questions. The authors note that the available evidence is limited and that this is reflected in the low grading of some of the recommendations. Appendix 1 provides a care algorithm (flowchart) and Appendix 2 explains the grading scheme used for the evidence and recommendations. There is a comprehensive list of references.



Queensland Maternity and Neonatal Clinical Guidelines Program. 2010. **Stillbirth Care**. Brisbane: Queensland Government. http://www.health.qld.gov.au/qcg/documents/g_still5-0.pdf

These guidelines are intended for health professionals in Queensland maternity services and they are consistent with the Perinatal Society of Australia and New Zealand (PSANZ) Clinical Practice Guideline for Perinatal Mortality. They cover clinical standards, diagnosis and birth, investigations, autopsy and subsequent pregnancy care. They are concise and well referenced but do not discuss the research evidence.

Preston S, Mahomed K, Chadha Y, et al. 2010. **Clinical Practice Guideline for the Management of Women who report Decreased Fetal Movements**. Brisbane: Australian and New Zealand Stillbirth Alliance (ANZSA). http://www.stillbirthalliance.org.au/doc/FINAL%20DFM%20guideline%20Ed1V1%201_16Sept2010.pdf

The purpose of this guideline is to assist clinicians provide evidence-based best-practice management for women with singleton pregnancies who report, or are concerned about, decreased fetal movements (DFM) in the third trimester of pregnancy. It does not deal with the management of specific pregnancy conditions such as fetal growth restriction, hypertension or diabetes which may be identified in the course of care. Mothers are often concerned about DFM and there is good evidence that maternal perception of DFM is associated with many adverse outcomes. Fetal growth restriction appears to be a major contributor to these. While women should be made aware of the importance of fetal movement and provided with information, routine fetal movement counting is not recommended. The guidelines discuss the evidence and recommendations are each accompanied by an indication of the evidence level and the strength of the recommendation although the authors note that there is an absence of robust research in this area and more high quality research is needed on both screening tools and management.

Royal College of Obstetricians and Gynaecologists (RCOG). 2010. **Late intrauterine fetal death and stillbirth**. London, U.K.: Royal College of Obstetricians and Gynaecologists (RCOG). http://www.rcog.org.uk/files/rcog-corp/GTG%2055%20Late%20Intrauterine%20fetal%20death%20and%20stillbirth%2010%2011%2010.pdf

The purpose of this guideline, which is primarily for obstetricians and midwives, is to identify evidence-based options for women (and their families) who have a late intra-uterine death (after 24 weeks) and to provide guidance on general care before, during and after birth, and care in subsequent pregnancies. The levels of evidence and the grades of recommendations in this guideline follow the system used by the Scottish Intercollegiate Guidelines Network (SIGN). They cover diagnosis, investigations, labour and birth, the puerperium, psychological and social aspects of care, follow-up, pregnancy following unexplained stillbirth, clinical governance and recommendations for further research.

Flenady V, King J, Charles A, et al. 2009. **PSANZ Clinical Practice Guideline for Perinatal Mortality. Version 2.2**. Perinatal Society of Australia and New Zealand (PSANZ). http://www.stillbirthalliance.org.au/doc/Section_1_Version_2.2_April_2009.pdf

The purpose of this guideline is to assist clinicians in the audit of perinatal deaths, to enable a systematic approach to perinatal audit in Australia and New Zealand, and also to provide guidance on dealing with the psychological and social aspects of perinatal bereavement, peri-natal post-mortem examination, investigation of stillbirths and neonatal deaths and the use of perinatal mortality classifications.

National Collaborating Centre for Women's and Children's Health. 2010. **Pregnancy and complex social factors. A model for service provision for pregnant women with complex social factors**. London (UK): National Institute for Health and Clinical Excellence (NICE). http://www.nice.org.uk/nicemedia/live/13167/50861/50861.pdf

This very comprehensive 300+ page guideline, which is complementary to the NICE guideline 'Antenatal care: routine care for the healthy pregnant woman' (NICE clinical guideline 62), applies to pregnant women with complex social factors, in particular:

- women who misuse substances (alcohol and/or drugs)
- women who are recent migrants, asylum seekers or refugees, or who have difficulty speaking English,
- young women aged under 20
- women who experience domestic abuse

It is intended for health professionals caring for pregnant women, those responsible for commissioning and planning health services and it may be of relevance to those working in social services and education. It is based on, and reports on, systematic reviews of the literature aiming to determine which interventions lead to improved pregnancy outcomes.

National Institute for Health and Clinical Excellence. 2010. **Dietary interventions and physical activity interventions for weight management before, during and after pregnancy**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/13056/49926/49926.pdf

Obese women who become pregnant are at increased risk of complications during pregnancy and childbirth and babies born to obese women face higher risks of a number of adverse outcomes: fetal death, stillbirth, congenital abnormality, shoulder dystocia, macrosomia (large body size) and subsequent obesity. Pregnant women are not encouraged to diet but they can be encouraged to take regular exercise and not to "eat for two". This guideline on dietary and physical activity interventions for weight management before, during and after pregnancy are intended for NHS and other commissioners, health service managers and health professionals. The evidence reviews on which the guideline was based, and some other relevant background publications can be found at: http://guidance.nice.org.uk/PH27 .

Flenady V, New K, MacPhail J, et al. 2005. **Clinical Practice Guideline for Smoking Cessation in Pregnancy**. Brisbane: Centre for Clinical Studies, Mater Health Services.
http://www.stillbirthalliance.org.au/doc/Guideline_for_Smoking_Cessation_in_Pregnancy.pdf

The purpose of this guideline is to assist clinicians in identifying pregnant women who smoke and assisting them to quit. Smoking cessation interventions for pregnant women can reduce smoking rates and reduce pre term births and low birth weights. Smoking rates are particularly high among teenage and indigenous Australians. The guideline is based on the "5As" approach to smoking cessation (Ask, Advise, Assess, Assist, Arrange Support). For women not ready to quit, motivation interventions using the 5R's framework (relevance, risk, rewards, roadblocks and repetition) may be used to improve motivation to quit. Recommendations in the guidelines are accompanied by a grade indicating the level of evidence and by references.

Systematic and Other Reviews from the International Literature

Flenady V, Middleton P, Smith GC, et al. **Stillbirths: the way forward in high-income countries**. The Lancet, 377(9778), 1703-17.

This paper, which is one of six in the Lancet's 2011 Stillbirth Series, notes that in developed countries, disparities in stillbirth rates between different population groups indicate that there is scope for further reductions in stillbirth rates. Overweight, obesity and smoking are important modifiable risk factors. Advanced maternal age is also a risk factor. A substantial proportion of stillbirths are linked to placental pathologies and infection associated with preterm birth. National perinatal mortality audit programmes aimed at improving the quality of care could reduce stillbirth rates and an international consensus on definitions and classifications related to stillbirth is necessary. All parents should be offered a thorough investigation including a high-quality autopsy and placental histopathology. Future research should focus on screening and interventions to reduce antepartum stillbirth as a result of placental dysfunction

The other papers in the Lancet stillbirth series, which provide a global perspective on the issue of stillbirth, are:

Frøen JF, Cacciatore J, McClure EM, et al. 2011. **Stillbirths: why they matter**. The Lancet, 377(9774), 1353-66.

Lawn JE, Blencowe H, Pattinson R, et al. 2011. **Stillbirths: Where? When? Why? How to make the data count?** The Lancet, 377(9775), 1448-63.

Bhutta ZA, Yakoob MY, Lawn JE, et al. 2011. **Stillbirths: what difference can we make and at what cost?** The Lancet, 377(9776), 1523-38.

Pattinson R, Kerber K, Buchmann E, et al. **Stillbirths: how can health systems deliver for mothers and babies?** The Lancet, 377(9777), 1610-23.

Goldenberg RL, McClure EM, Bhutta ZA, et al. 2011. **Stillbirths: the vision for 2020**. Lancet, 377(9779), 1798-805.

Flenady V, Koopmans L, Middleton P, et al. 2011. **Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis**. Lancet, 377(9774), 1331-40.

This systematic review included 96 population-based studies. The highest ranking modifiable risk factor for stillbirth was found to be maternal obesity with a population attributable risk (PAR) calculated to be 8 -18% across five countries (Australia, Canada, Netherlands, UK, and USA). Advanced maternal age (> 35 years) had a PAR of 7-11% and maternal smoking had a PAR of 4-7%. In disadvantaged populations the PAR for smoking could be as high as 20%. Primiparity contributes to about 15% of stillbirths. Placental pathology has an important role in stillbirth, as indicated by the PARs for small-for-gestational-age (23%) and placental abruption (15%). Pre-existing maternal diabetes and hypertension still contribute to stillbirth in high income countries. Priority areas for stillbirth prevention are raising awareness and implementing interventions to address obesity, maternal age and smoking.

Lumley J, Chamberlain C, Dowswell T, et al. 2009. **Interventions for promoting smoking cessation during pregnancy**. Cochrane Database of Systematic Reviews(3), Art. No.: CD001055. DOI: 10.1002/14651858.CD001055.pub3

This review included fifty-six RCTs (20,000+ women) and nine cluster-randomised trials (5000+ women) of a variety of smoking cessation interventions in pregnancy. The interventions were, overall, associated with a small but statistically significant reduction in smoking in late pregnancy (risk ratio 0.94, 95% CI 0.93 to 0.96) i.e. 6% of pregnant women stopped smoking. The interventions reduced low birth weight (RR 0.83, 95% CI 0.73 to 0.95) and preterm birth (RR 0.86, 95% CI 0.74 to 0.98), and there was a 53.91g (95% CI 10.44 g to 95.38 g) increase in mean birth weight. There were no statistically significant differences in stillbirths, neonatal intensive care unit admissions, very low birth weight, perinatal or neonatal mortality but these analyses were underpowered since only a few trials reported these outcomes.

Grivell RM, Wong L, Bhatia V. 2009. **Regimens of fetal surveillance for impaired fetal growth**. Cochrane Database of Systematic Reviews, 2009(1), Art. No.: CD007113. DOI: 10.1002/14651858.CD007113.pub2.

There are wide variations in the policies and protocols for fetal surveillance in pregnancies where fetal growth impairment is suspected and there are many different techniques used for assessment of fetal growth and wellbeing. This review reports on one RCT done in New Zealand (167 women and babies) which compared a twice-weekly surveillance regimen (biophysical profile, non-stress tests, umbilical artery and middle cerebral artery Doppler and uterine artery Doppler) with the same regimen applied fortnightly (both groups had fetal growth assessed fortnightly). There was no difference between the groups in the primary maternal outcome (emergency caesarean for fetal distress) but women in the twice-weekly surveillance group were more likely to have induction of labour than those in the fortnightly surveillance group (Risk ratio 1.25, 95% CI 1.04-1.50) and overall their babies were born four day earlier. There was insufficient data to assess perinatal mortality or serious morbidity. No fetal deaths occurred in either group.

The **Cochrane Collection** contains a large number of other reviews relating to tests which may be used to assess fetal wellbeing. Some of the interventions which have been the subject of Cochrane reviews are: fetal movement counting, fetal and umbilical Doppler ultrasound, amniotic fluid index vs. single deepest vertical pocket as a screening test, biochemical tests of placental function, biophysical profiles, routine ultrasound at 24 weeks, symphysis-fundal height measurement, fetal fibronectin testing, and near infrared spectroscopy.

Flenady V, Wilson T. 2008. **Support for mothers, fathers and families after perinatal death**. Cochrane Database of Systematic Reviews, 2008(1), Art. No.: CD000452. DOI: 10.1002/14651858.CD000452.pub2.

In the developed world it is widely accepted that a perinatal death is devastating for the parents and family. This review assessed the effects of the provision of counselling or any form of medical, nursing, social or psychological support, or both, for mothers, fathers and families after perinatal death. There were no RCTs identified and the review authors state that more research is needed to determine what kinds of support and counselling are most helpful.

Rawlinson WD, Hall B, Jones CA, et al. 2008. **Viruses and other infections in stillbirth: what is the evidence and what should we be doing**? Pathology, 40(2), 149-60.

In Australia, as in other developed countries, many stillbirths are of unknown aetiology and occur in pregnancies with no known risk factors. It has been postulated that viruses and other hard-to-culture organisms may be responsible for some of these. It is known that certain viruses including rubella, human cytomegalovirus (CMV), parvovirus B19, herpes simplex virus (HSV) and varicella zoster virus (VSV) may cause intrauterine deaths but more research is needed to determine the role of other viruses and hard-to-culture organisms in stillbirths. There are now modern molecular techniques such as multiplex PCR which allow searches for multiple agents and the clinical usefulness of such testing needs to be assessed.

Dodd JM, Crowther CA. 2007. **Specialised antenatal clinics for women with a multiple pregnancy to improve maternal and infant outcomes**. Cochrane Database of Systematic Reviews, 2007(2), Art. No.: CD005300. DOI: 10.1002/14651858.CD005300.pub2.

Women who have a multiple pregnancy are at greater risk of a number of adverse outcomes, including prematurity (the greatest risk), hypertension, gestational diabetes, and stillbirth. This review assessed the benefits and harms of "specialised" antenatal clinics compared to standard antenatal care, for women with multiple pregnancy. The review authors did not identify any RCTs on this issue and they concluded that there is no evidence to support the provision of "specialised" antenatal clinics for women with multiple pregnancy.

Alfirevic Z, Devane D, Gyte Gillian ML. 2006. **Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour**. Cochrane Database of Systematic Reviews, 2006(3), Art. No.: CD006066. DOI:10.1002/14651858.CD006066.

Cardiotocography (CTG, electronic fetal monitoring) records changes in the fetal heart rate in relation to uterine contractions. It is used to identify babies who may be hypoxic so that additional methods of assessment of fetal wellbeing (e.g. blood sampling) can be used or delivery expedited by instrumental methods (with vacuum extraction or forceps) or caesarean section. This review included 12 RCTs or quasi-RCTs (37,000+ women in total), only two of which were of high quality. The authors concluded that continuous CTG during labour is associated with a reduction in neonatal seizures but no significant differences in cerebral palsy, infant mortality, or other standard measures of infant wellbeing. Continuous CTG monitoring was, however, associated with increases in caesarean section (RR 1.66, 95% CI 1.30 to 2.13, 10 trials, n=18,761) and instrumental vaginal births (RR 1.66, 95% CI 1.30 to 2.13, 10 trials n=18,761).

Other Relevant Publications

Stacey T, Thompson JMD, Mitchell EA, et al. 2011. **The Auckland Stillbirth study, a case–control study exploring modifiable risk factors for third trimester stillbirth: methods and rationale**. Australian and New Zealand Journal of Obstetrics and Gynaecology, 51(1), 3-8.

This paper reports on the Auckland Stillbirth study, a case-control study conducted from July 2006 to June 2009. Women who had a late stillbirth (≥ 28 weeks) were matched with two controls of the same gestation. Almost 60% of stillbirths were either "unexplained" (39.4%) or due to "fetal growth restriction" (18.7%). Women who had a late stillbirth were more likely to be of Pacific ethnicity (OR 1.7, 95% CI 1.2 - 2.6) and/or of parity ≥ 4 (OR 2.7, 95% CI 1.4 - 5.3).

Stacey T, Thompson JMD, Mitchell EA, et al. 2011. **Relationship between obesity, ethnicity and risk of late stillbirth: a case control study**. BMC Pregnancy & Childbirth, 11, 3.

This paper reports on the Auckland Stillbirth study, a case-control study conducted from July 2006 to June 2009. Women who had a late stillbirth (≥ 28 weeks) were matched with two controls of the same gestation as each case. In the univariate analysis of results, Pacific ethnicity, overweight and obesity, grand multiparity, not being married, not being in paid work, social deprivation, exposure to tobacco smoke and use of recreational drugs were associated with an increased risk of late stillbirth. In the multivariate analysis Maternal overweight and obesity, nulliparity, grand multiparity, not being married and not being in paid work were independently associated with late stillbirth but Pacific ethnicity was no longer significant (adjusted Odds Ratio 0.99; 0.51-1.91). The disparity in stillbirth rates between Pacific and European women can be explained by confounding factors such as high parity and maternal obesity.

PMMRC. 2011. **Fifth Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2009.** Wellington: Health Quality & Safety Commission. http://www.pmmrc.health.govt.nz/moh.nsf/Files/pmmrcfiles2011/$file/pmmrc-5th-report-2009.pdf

The Perinatal and Maternal Mortality Review Committee (PMMRC) reviews all perinatal and maternal deaths in New Zealand with the aim of identifying areas for improvement in maternal and newborn care. This report is based on the data collected by the Mortality Review Data Group. A perinatal death is defined as one occurring after 20 weeks gestation (or of a baby weighing at least 400g if gestation is unknown) and up to and including the 28th day of life. Besides reporting statistics, the report also makes recommendations for future work by the PMMRC, the Ministry of Health, lead maternity cares, DHBs and others. The most commonly reported classification of fetal deaths was unexplained (25% of all stillbirths) and other classifications which each accounted for > 10% of stillbirths were antepartum haemorrhage, specific perinatal conditions, fetal growth restriction and spontaneous preterm. Fifteen per cent of stillbirths were thought to be potentially avoidable and the most common contributing factors were barriers to accessing or engaging with maternity and health services.

Crawford B, Lilo S, Stone S, et al. 2008. **Review of the Quality, Safety and Management of Maternity Services in the Wellington Area**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/8444/$File/maternity-services-review-oct08-v2.pdf

This review followed the death of a baby at CCDHB's Kenepuru maternity facility and its objectives were to:

- Understand, based on evidence, the quality, safety and management of maternity services in the Wellington region
- Maintain public confidence in the maternity services provided to the region
- Identify opportunities for improvement

PRETERM BIRTH

Introduction

Preterm birth is defined as the birth of a baby <37 weeks completed gestation [12], with gestational age being defined as the number of completed weeks since the first day of the last menstrual period. If this date is unknown, ultrasound measurements may provide an estimate (+/- 1 week) if undertaken in the first 20 weeks of pregnancy.

Preterm deliveries comprise a heterogeneous group, which are often divided into three distinct categories [13]: (1) Idiopathic Preterm Births, where labour starts without apparent reason and without prior rupture of the membranes; (2) Preterm Premature Rupture of the Membranes, where the fetal membranes rupture prior the onset of labour, resulting in preterm delivery; and (3) Iatrogenic Preterm Births, where delivery is induced for a variety of reasons including pre-eclampsia, diabetes, and antepartum haemorrhage.

Internationally, there have been large increases in preterm birth rates during the past two decades, which have largely been in late preterm births (34-36 weeks gestation). These increases have been attributed to increasing obstetric intervention (e.g. induction of labour), higher rates of twins (as a result of assisted reproductive techniques), and delayed childbearing [14]. Similarly, New Zealand experienced increases in preterm birth rates during the 1980s and 1990s, with the most rapid increases being seen in those living in the most affluent (NZDep decile 1-2) areas and in European/Other women [6,15].

Infants born prematurely experience a range of adverse outcomes. Those born very prematurely (<32 weeks gestation) are disproportionately at risk of neonatal mortality and acquired developmental disabilities such as cerebral palsy, and intellectual disabilities [16]. Even those born between 34-36 weeks are at an increased risk of adverse outcomes, with some of the more common including respiratory distress syndrome, hypoglycaemia, hypothermia, prolonged jaundice and feeding problems [17].

The following section explores preterm birth rates using information from the Birth Registration Dataset. The section concludes with a brief review of policy documents and evidence-based reviews which consider how preterm birth might be addressed at the population level.

Data Sources and Methods

Indicator

1. *Preterm Birth Rates in Singleton Live Born Babies*

Numerator: Birth Registration Dataset: All singleton live born babies 20–36 weeks gestation

Denominator: Birth Registration Dataset: All singleton live born babies 20+ weeks gestation

Notes on Interpretation

Note 1: Year is year of registration, rather than year of birth.

Note 2: See **Appendix 4** for an overview of the Birth Registration Dataset

Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand vs. Midland Region Distribution

Midland DHBs vs. New Zealand

In the Midland Region during 2006–2010, preterm birth rates in Waikato babies were *significantly* (albeit marginally) higher than the New Zealand rate, while rates in Lakes were *significantly* lower. In contrast, preterm birth rates in Bay of Plenty, Tairawhiti and Taranaki babies were not *significantly* different from the New Zealand rate (**Table 15**).

Table 15. Preterm Birth Rates in Singleton Live Born Babies, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Percent of Live Births (%)	Rate Ratio	95% CI
Preterm Births					
Waikato	1,727	345.4	6.4	1.08	1.03–1.13
Lakes	430	86.0	5.3	0.89	0.81–0.98
Bay of Plenty	863	172.6	6.0	1.01	0.95–1.08
Tairawhiti	244	48.8	6.3	1.06	0.94–1.20
Taranaki	420	84.0	5.5	0.92	0.84–1.01
New Zealand	18,358	3,671.6	5.9	1.00	

Source: Birth Registration Dataset

New Zealand Distribution by Ethnicity, NZDep Index Decile, Maternal Age and Gender

In New Zealand during 2006–2010, preterm birth rates were *significantly* higher for males, for Māori > Asian/Indian, European and Pacific babies, for those born into more deprived (NZDep decile 6–10) areas, and babies born to younger (<25 years) or older (35+ years) mothers (**Table 16**). Similar ethnic differences were seen during 2000–2010 (**Figure 5**).

Table 16. Preterm Birth Rates in Singleton Live Born Babies by Ethnicity, NZ Deprivation Index Decile, Gender and Maternal Age, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Preterm Births							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	5.33	1.00		Decile 1–2	5.36	1.00	
Decile 2	5.39	1.01	0.94–1.09	Decile 3–4	5.57	1.04	0.99–1.09
Decile 3	5.38	1.01	0.94–1.09	Decile 5–6	5.77	1.08	1.02–1.13
Decile 4	5.74	1.08	1.00–1.16	Decile 7–8	6.14	1.15	1.09–1.20
Decile 5	5.61	1.05	0.98–1.13	Decile 9–10	6.41	1.20	1.14–1.25
Decile 6	5.89	1.11	1.03–1.19	Prioritised Ethnicity			
Decile 7	6.38	1.20	1.12–1.28	European	5.64	1.00	
Decile 8	5.95	1.12	1.04–1.19	Māori	6.58	1.17	1.13–1.20
Decile 9	6.34	1.19	1.11–1.27	Pacific	5.51	0.98	0.93–1.03
Decile 10	6.47	1.21	1.14–1.29	Asian/Indian	5.96	1.06	1.01–1.11
Maternal Age				Gender			
<20 Years	7.27	1.32	1.25–1.39	Female	5.52	1.00	
20–24 Years	6.10	1.11	1.06–1.15	Male	6.33	1.15	1.12–1.18
25–29 Years	5.54	1.00	0.96–1.05				
30–34 Years	5.52	1.00					
35+ Years	6.33	1.15	1.10–1.19				

Source: Birth Registration Dataset; Note: Rate is per 100 Live Births; Baby's Ethnicity is Level 1 Prioritised; Decile is NZDep2001

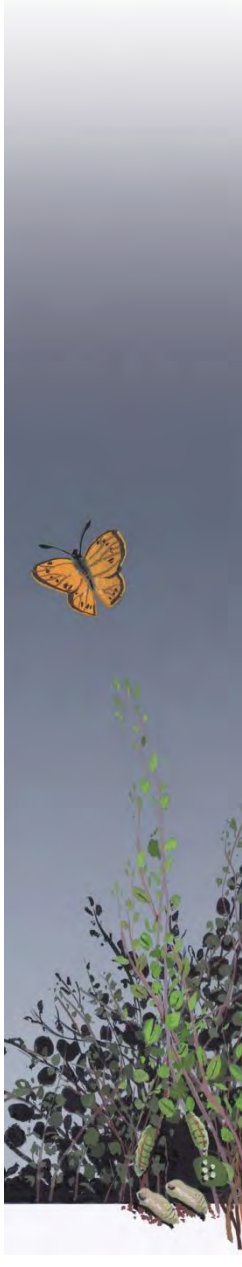
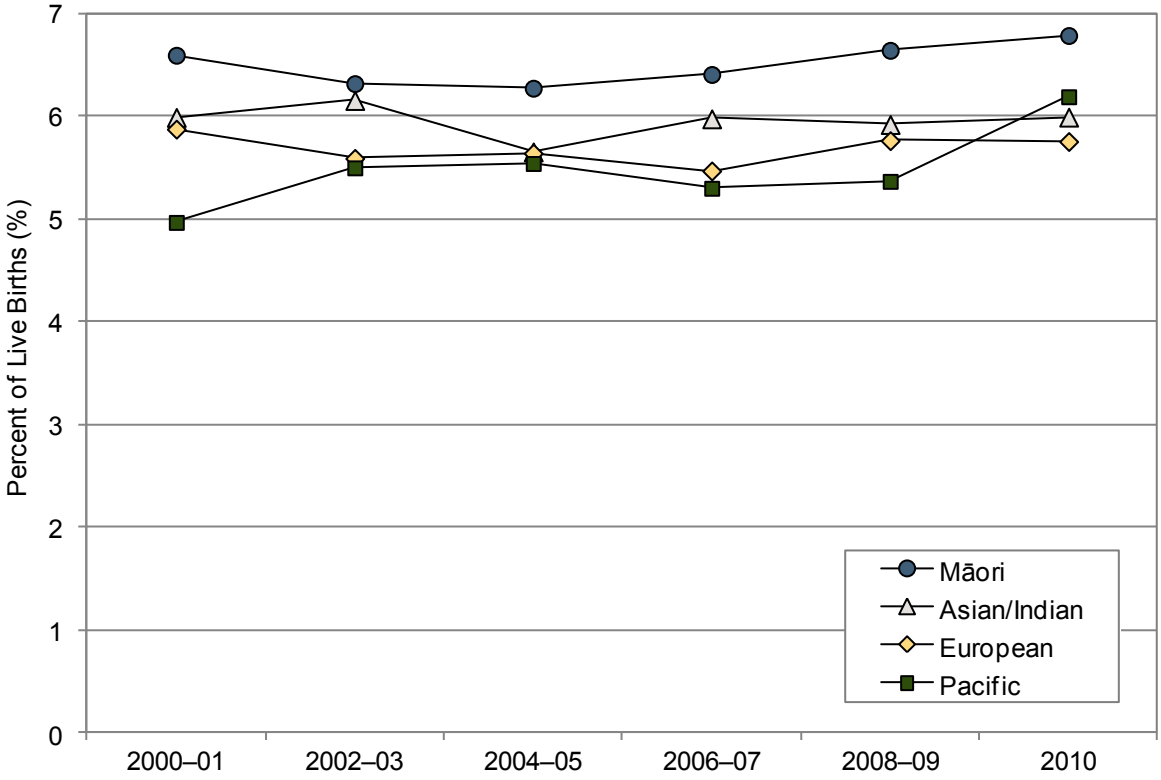


Figure 5. Preterm Birth Rates in Singleton Live Born Babies by Ethnicity, New Zealand 2000−2010



Source: Birth Registration Dataset; Note: Baby's Ethnicity is Level 1 Prioritised

Midland Region Trends

In the Midland Region, preterm birth rates in the Waikato increased between 2000 and 2009, while rates in Taranaki declined. In contrast, preterm birth rates in the Bay of Plenty, Tairawhiti and Lakes fluctuated from year to year during 2000–2010 (**Figure 6**).

Midland Region Trends by Ethnicity

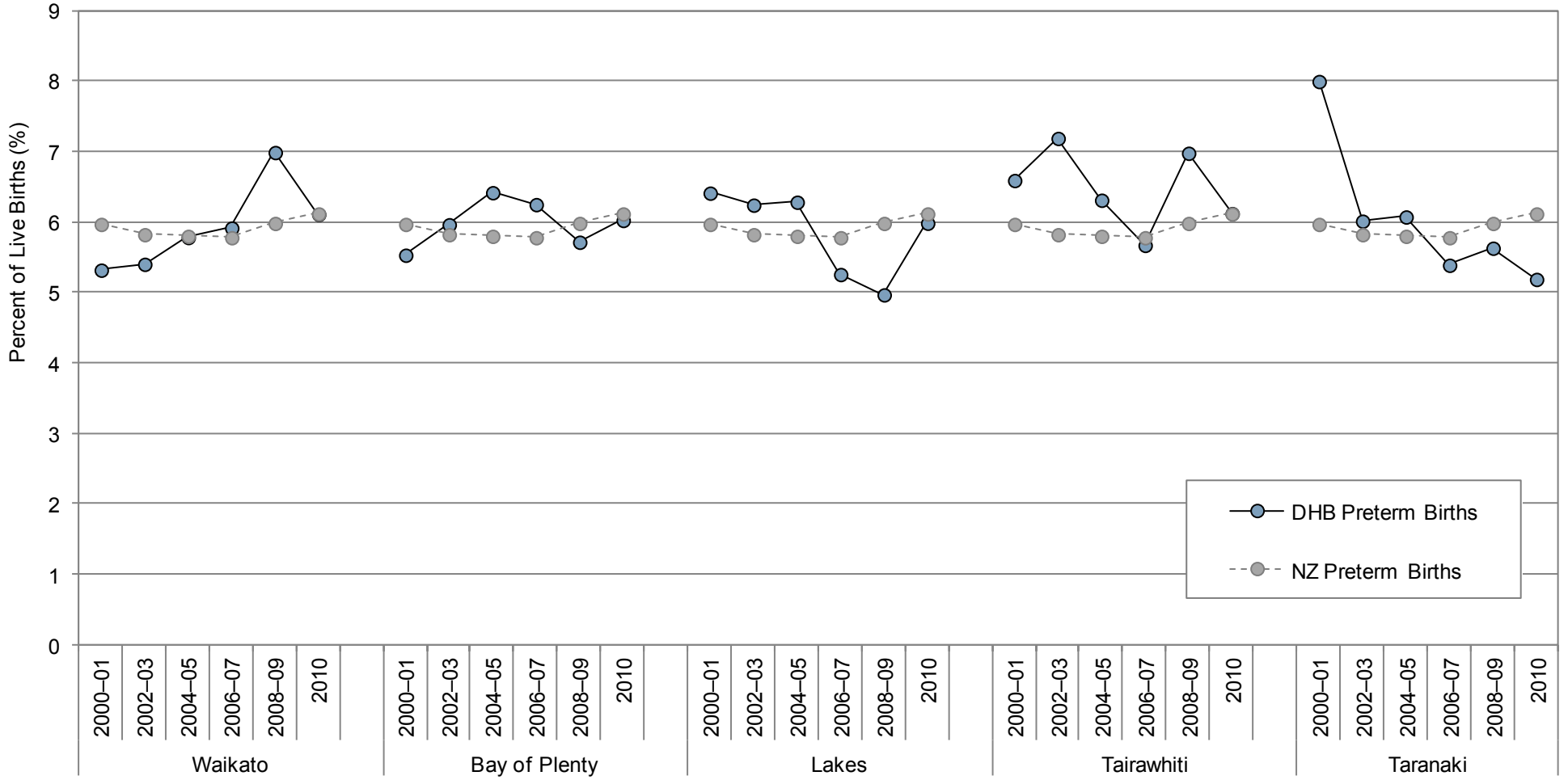
In the Midland Region, preterm birth rates during the mid-late 2000s were generally higher for Māori than for European babies, although ethnic differences were less consistent during the early 2000s in some DHBs (**Figure 7**).

Summary

In New Zealand during 2000–2010, preterm birth rates were relatively static. During 2006–2010, preterm birth rates were *significantly* higher for males, for Māori > Asian/Indian, European and Pacific babies, for those born into more deprived (NZDep decile 6–10) areas, and babies born to younger (<25 years) or older (35+ years) mothers.

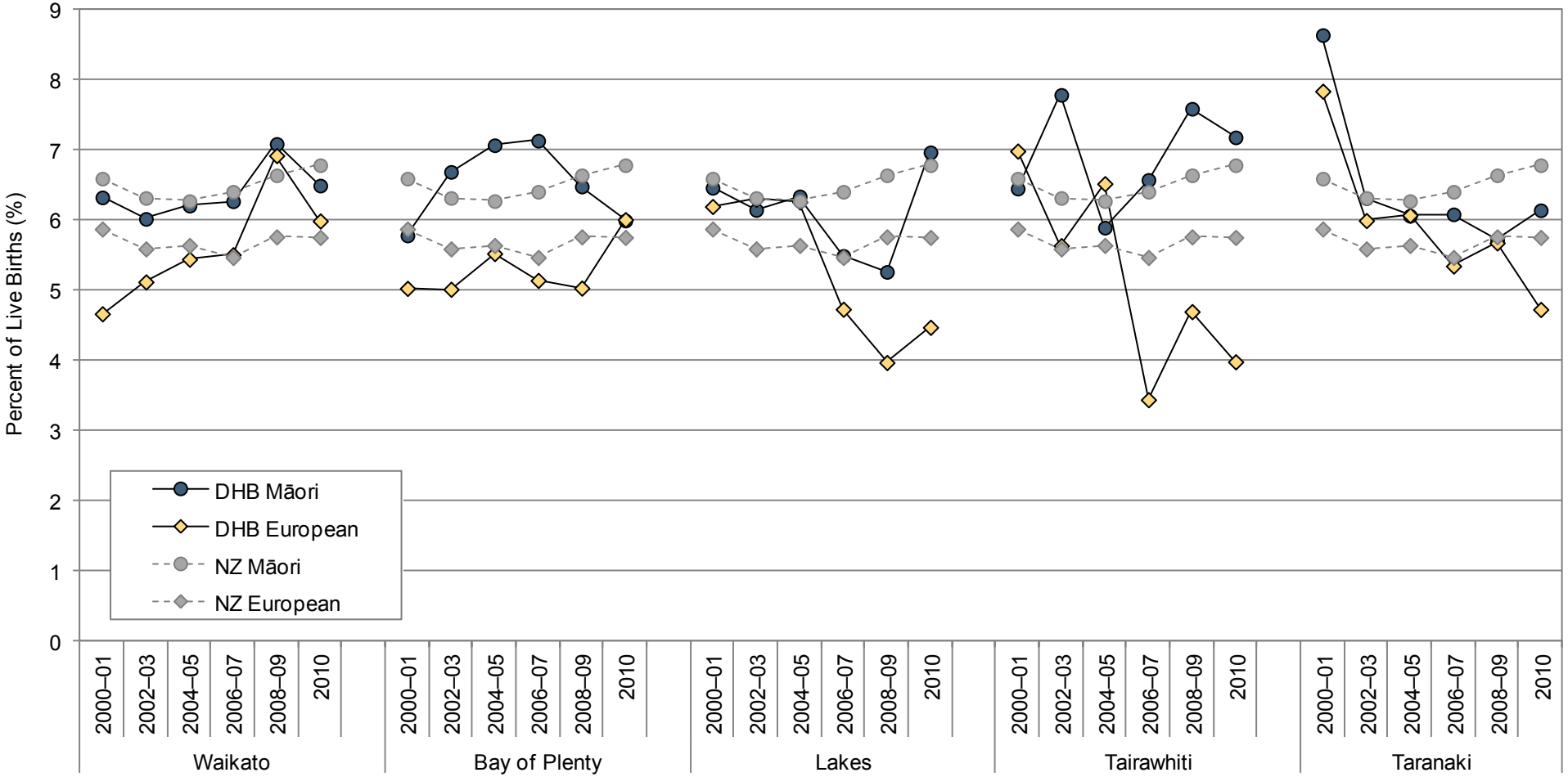
In the Midland Region during 2006–2010, preterm birth rates in Waikato babies were *significantly* (albeit marginally) higher than the New Zealand rate, while rates in Lakes were *significantly* lower. Rates in Bay of Plenty, Tairawhiti and Taranaki babies were not *significantly* different from the New Zealand rate. Preterm births in the Waikato increased between 2000 and 2009, while rates in Taranaki declined, and rates in the Bay of Plenty, Tairawhiti and Lakes fluctuated from year to year. During the mid-late 2000s preterm birth rates were generally higher for Māori than for European babies, although ethnic differences were less consistent during the early 2000s in some DHBs.

Figure 6. Preterm Birth Rates in Singleton Live Born Babies, Midland DHBs vs. New Zealand 2000−2010



Source: Birth Registration Dataset. Note: Baby's Ethnicity is Level 1 Prioritised

Figure 7. Preterm Birth Rates in Singleton Live Born Babies by Ethnicity, Midland DHBs vs. New Zealand 2000−2010



Source: Birth Registration Dataset. Note: Baby's Ethnicity is Level 1 Prioritised.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Spontaneous Preterm Birth

In New Zealand there are no policy documents which focus solely on the prevention of preterm births. However a range of Government documents exist which consider approaches to the provision of maternity services or the management of known risk factors (e.g. smoking, obesity) more generally. These are reviewed in other sections as follows:

- New Zealand publications which relate to the provision of maternity care are reviewed in **Table 14** on **Page 63**
- Publications which relate to tobacco control/smoking are reviewed in **Table 45** on **Page 160**

In addition, **Table 17** provides an overview of a range of evidence-based reviews which consider these issues in the overseas context, while **Table 14** reviews similar publications of relevance to the prevention of fetal deaths.

Table 17. Evidence-Based Reviews Relevant to the Prevention of Spontaneous Preterm Birth

International Guidelines
National Collaborating Centre for Women's and Children's Health. 2011. **Multiple pregnancy: the management of twin and triplet pregnancies in the antenatal period**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/13571/56497/56497.pdf Women with twin and triplet pregnancies have a higher risk of preterm birth. This guideline is complementary to the NICE guideline 'Antenatal care: routine care for the healthy pregnant woman' (NICE clinical guideline 62) and it specifies the additional or different care that women with twin or triplet pregnancies should receive. Chapter 8 deals specifically with preterm birth. Following discussion of the research evidence, the following recommendations are made regarding the prevention of preterm birth and its associated risks: • Be aware that women who have had a previous premature singleton birth are at increased risk • Do not use fibronectin testing alone, home uterine activity monitoring, or routine cervical length measuring (with or without fetal fibronectin) to predict the risk of spontaneous preterm birth in twin and triplet pregnancies. • Do not use the following interventions (either alone or in combination) routinely to prevent spontaneous preterm birth in twin and triplet pregnancies: bed rest (either at home or in hospital), intramuscular or vaginal progesterone, cervical cerclage or oral tocolytics. • Inform women with twin and triplet pregnancies about the benefits of targeted (when birth is imminent) corticosteroids. • Do not use single or multiple untargeted (routine) courses of corticosteroids and inform women that there is no benefit from using untargeted corticosteroids. The guideline appendices, which include the details of the evidence review (including the evidence tables) can be found at http://guidance.nice.org.uk/CG129/Guidance/Appendices
Systematic and Other Reviews from the International Literature
McCormick MC, Litt JS, Smith VC, et al. 2011. **Prematurity: an overview and public health implications**. Annual Review of Public Health, 32, 367-79. This review article explains that, largely because of the limited understanding of the basic biology underlying preterm delivery, there are few opportunities for prevention. Two strategies which could have a very small effect in reducing rates of preterm birth are decreasing higher-order multiple births resulting from the use of assisted reproductive technology and improving estimates of gestational age in early pregnancy in order to reduce the number of infants inadvertently delivered preterm because of inaccurate dates. Public health approaches to prematurity include ensuring that premature infants are delivered in a suitable facility able to deal with neonatal complications, minimising variations in quality of care between institutions, early developmental support for such infants and support for families.
Davey M-A, Watson L, Rayner Jo A, et al. 2011. **Risk scoring systems for predicting preterm birth with the aim of reducing associated adverse outcomes**. Cochrane Database of Systematic Reviews, 2011(11), Art. No.: CD004902. DOI:10.1002/14651858.CD004902.pub4. There have been many scoring systems designed to facilitate prediction of preterm birth so that appropriate interventions might reduce the incidence of preterm and very preterm birth and the associated adverse outcomes. Extensive searching by the authors of this review failed to reveal any RCTs evaluating such scoring systems. The value of scoring systems is thus unknown. Prospective studies are needed, followed by RCTs of promising systems.

Whitworth M, Quenby S, Cockerill Ruth O, et al. 2011. **Specialised antenatal clinics for women with a pregnancy at high risk of preterm birth (excluding multiple pregnancy) to improve maternal and infant outcomes**. Cochrane Database of Systematic Reviews, 2011(9), Art. No.: CD006760. DOI: 10.1002/14651858.CD006760.pub2.

Previous preterm delivery is strong predictor of preterm delivery and for this reason specialised care for women with a previous history of preterm delivery is common practice. This review considered three RCTs conducted in the 1980s comparing specialised care with standard care in women with a singleton pregnancy who were considered to be at high risk of preterm labour (3400 women all in the U.S.). The authors reported that overall there was very little difference in outcomes between specialised and standard care groups, but due to differences in study designs most outcomes were only reported by one study which limited statistical power to detect significant differences. All three studies reported on preterm birth before 37 weeks and a pooled analysis of the results suggested that there may have been fewer preterm births in the specialised care mothers but the difference was not statistically significant (RR 0.87, 95% CI 0.69 to 1.08).

Raynes-Greenow Camille H, Roberts Christine L, Bell Jane C, et al. 2011. **Antibiotics for ureaplasma in the vagina in pregnancy**. Cochrane Database of Systematic Reviews, 2011(9), Art. No.: CD003767. DOI: 10.1002/14651858.CD003767.pub3.

Heavy vaginal colonisation with ureaplasma is suspected of playing a role in preterm rupture of membranes and preterm birth but the benefits of antibiotic treatment are unclear. Based on a review of one RCT of 3 types antibiotic treatment vs. placebo in 1105 pregnant women (between 22 and 33 weeks gestation), which did not report on rates of preterm birth, the authors concluded that there was insufficient evidence to either support or refute the use of antibiotics for ureaplasma infection to prevent preterm birth.

Rubens Craig E , Victora Cesar G, Gravett Michael G, et al. 2010. **Global report on preterm birth & stillbirth: the foundation for innovative solutions and improved outcomes**. BMC Pregnancy and Childbirth, 10(Suppl 1), http://www.biomedcentral.com/bmcpregnancychildbirth/10?issue=S1.

This series of seven reviews provides a global perspective on preterm birth. The third review in the series is:

Barros F, Bhutta Z, Batra M, et al. 2010. **Global report on preterm birth and stillbirth (3 of 7): evidence for effectiveness of interventions**. BMC Pregnancy and Childbirth, 10(Suppl 1), S3.

This systematic review discusses the evidence for the effectiveness of interventions to prevent preterm birth and to improve survival among preterm newborns, particularly those applicable to low-to-middle income countries. Recommendations are rated in four categories (from strong in favour to strong against) based on the quality of evidence, how the evidence may be translated to practice in a specific setting such as low-to-middle income countries, the level of baseline risk, and on potential trade-offs between expected benefits, harms and costs. The two interventions strongly recommended for preventing preterm births are smoking cessation and the use of progesterone. The authors note that since specialised clinics are now an accepted part of antenatal services in many countries it is unlikely that further RCTs will be carried out. They suggest that further research should focus on service development.

Hodnett ED, Fredericks S, Weston J. 2010. **Support during pregnancy for women at increased risk of low birthweight babies**. Cochrane Database of Systematic Reviews, 2010(6), Art. No.: CD000198. DOI: 10.1002/14651858.CD000198.pub2.

Numerous studies have consistently shown a relationship between social disadvantage and low birthweight (<2500g). Many countries have programmes to assist women who are thought to be at risk of having a low birthweight baby and these may include advice and counselling, practical assistance (e.g. transport to clinic appointments or help with household responsibilities and care of other children), and emotional support. This review included 17 RCTs (12,264 women) of additional support, provided by either a professional (social worker, midwife or nurse) or a trained lay person, compared to routine care. Programmes of extra support made no difference to rates of either low birthweight or preterm births but they were associated with a reduced likelihood of antenatal hospital admission (3 trials, 737 women, RR = 0.79, 95% CI 0.68-0.92) and of caesarean birth (9 trials, 4522 women, RR = 0.87, 95% CI 0.78-0.97).

Alexander S, Boulvain M, Ceysens G, et al. 2010. **Repeat digital cervical assessment in pregnancy for identifying women at risk of preterm labour**. Cochrane Database of Systematic Reviews, 2010(6), Art. No.: CD005940. DOI:10.1002/14651858.CD005940.pub2.

Based on a review of two RCTs (7163 women) the authors of this review concluded that there was no evidence to support the use of repeat digital cervical assessment to reduce numbers of preterm births.

Abdel-Aleem H, Shaaban OM, Abdel-Aleem MA. 2010. **Cervical pessary for preventing preterm birth**. Cochrane Database of Systematic Reviews, 2010(9), Art. No.: CD007873. DOI: 10.1002/14651858.CD007873.pub2.

Cervical incompetence is a common contributor to preterm birth. The use of a cervical ring pessary to hold the cervix closed is a simple non-invasive alternative to cervical cerclage (“stitch”) and it does not require the use of anaesthetic. The authors of this review did not identify any well designed RCTs comparing cervical pessary with either cervical cerclage or expectant management for the prevention of preterm birth. They state that there is some evidence of benefit from non-randomised trials and that there are three on-going trials of the use of cervical pessary in women with short cervix. The results of these may either confirm or refute the benefits of cervical pessary in preventing preterm birth.

Crowther CA, Han S. 2010. **Hospitalisation and bed rest for multiple pregnancy**. Cochrane Database of Systematic Reviews, 2010(7), Art. No.: CD000110. DOI: 10.1002/14651858.CD000110.pub2.

Bed rest used to be commonly advised for women with multiple pregnancy. This review included seven trials (713 women and 1452 babies) comparing outcomes in women who were offered bed rest in hospital with those in women who were only admitted to hospital if complications occurred. There was no reduction in the risk of preterm birth or perinatal death but there may have been a decrease in the number of low birthweight (<2500g) infants in the bed rest women (risk ratio 0.92, 95% CI 0.85-1.0) although there was no difference in the number of very low birthweight infants (<1500g). There was no difference in the proportions of mothers developing hypertension or needing a caesarean. When the results for subgroups of women were analysed, there were no differences between the bed rest and the controls groups in any of the groups. The results of this review indicate that there is no benefit to be obtained from routine bed rest for women with an uncomplicated twin pregnancy.

Honest H, Forbes CA, Duree KH, et al. 2009. **Screening to prevent spontaneous preterm birth: systematic reviews of accuracy and effectiveness literature with economic modelling**. Health Technology Assessment (Winchester, England), 13(43), 1-627. http://www.hta.ac.uk/fullmono/mon1343.pdf

This is the report for a very sizeable project which aimed to identify combinations of tests and treatments to predict and prevent preterm labour. It includes two systematic reviews and a decision analysis (health economic evaluation). One systematic review aimed to determine the accuracy of 22 different tests for the prediction of preterm birth in asymptomatic women in early pregnancy and in women symptomatic with threatened preterm labour in later pregnancy. The other review assessed the effectiveness of interventions with potential to reduce spontaneous preterm births in asymptomatic women in early pregnancy and to reduce spontaneous preterm births or improve neonatal outcomes in women with a viable pregnancy and symptoms of threatened preterm labour. The economic evaluation incorporated the combined effects of test and treatments and costs in a model-based analysis.

Berghella V, Baxter JK, Hendrix NW. 2009. **Cervical assessment by ultrasound for preventing preterm delivery**. Cochrane Database of Systematic Reviews, 2009(3), Art. No.: CD007235. DOI: 10.1002/14651858.CD007235.pub2.

While measurement of cervical length by trans-vaginal ultrasound (TVU) can be used to predict preterm birth (the shorter the cervical length, the higher the risk) it is uncertain if it is useful as a screening test for the prevention of preterm birth. This review assessed the effect of knowledge of cervical length on the effectiveness of antenatal management in preventing preterm birth. The review included five RCTs (507 women) of knowledge of cervical length (obtained by TVU) vs. no knowledge of cervical length. In the three trials (290 women) involving singleton gestations with preterm labour, knowledge of cervical length was associated with a non-significant decrease in preterm birth at < 37 weeks (22.3% versus 34.7%, respectively; risk ratio 0.59, 95% CI 0.26 to 1.32) and delivery occurred on average 0.64 weeks later (95% CI 0.03 to 1.25 weeks). There were no differences in other outcomes measured. One trial in singleton gestations with premature rupture of membranes (92 women) evaluated the safety of TVU in this situation and found no difference in maternal or neonatal infection rates between the group that had TVU and the group that did not. In the one trial in twin gestations (125 women, with or without preterm labour) there was no difference between the TVU and no TVU groups in preterm birth at 36, 34 or 30 weeks, or in gestational age at delivery or other perinatal and maternal outcomes. Life table analysis showed significantly less (p= 0.02) preterm birth at < 35 weeks in the TVU group compared to the no TVU group. The authors concluded that there is insufficient evidence to recommend routine screening of either symptomatic or asymptomatic pregnant women with cervical length measurement via TVU.

Berghella V, Hayes E, Visintine J, et al. 2008. **Fetal fibronectin testing for reducing the risk of preterm birth**. Cochrane Database of Systematic Reviews, 2008(4), Art. No.: CD006843. DOI: 10.1002/14651858.CD006843.pub2.

Fetal fibronectin (FFN) is a protein which is localised at the maternal-fetal interface of the amniotic membranes and is normally found only at very low levels in cervico-vaginal secretions. Levels greater ≥ 50 ng/l at or after 22 weeks have been associated with an increased risk of preterm birth and high FFN levels have been found to be one of the best predictors of preterm birth in all populations studied to date. This review assessed the effectiveness of management based on knowledge of FFN levels, compared to management without such knowledge, for the prevention of preterm birth. This review included five RCTs (474 women) of knowledge vs. no knowledge of FNN. There was a significant decrease in preterm birth at < 37 weeks in the knowledge group compared to the no-knowledge group (15.6% vs.28.6%, Risk ratio 0.54, 95% CI 0.34 - 0.87). All other outcomes measured were similar in both groups (preterm birth at < 34, 32, or 28 weeks; gestational age at delivery; birthweight < 2500 grams; perinatal death; maternal hospitalisation; tocolysis; steroids for fetal lung maturity; and time to evaluate i.e. time between hospital arrival and a management decision being made). The authors concluded that, although FFN measurements are commonly used in labour and delivery units, there is currently little evidence to recommend such measurements. Given the associations between knowledge of FNN results and a lower incidence of preterm birth before 37 weeks, further research is worthwhile and should be encouraged.

Swadpanich U, Lumbiganon P, Prasertcharoensook W, et al. 2008. **Antenatal lower genital tract infection screening and treatment programs for preventing preterm delivery**. Cochrane Database of Systematic Reviews, 2008(2), Art. No.:CD006178. DOI: 10.1002/14651858.CD006178.pub2.

Genital tract infection is a cause of preterm birth and infection screening has been used as a means of preventing preterm birth. There are some adverse effects from treating such infections including cost and increased antibiotic resistance. The authors identified one high quality RCT (4155 women). In the intervention group the results of screening for bacterial vaginosis, trichomonas vaginalis and candidiasis were reported and women received treatment if tests were positive, and in the control group results of tests were not reported. There were significantly fewer preterm births in the intervention group (3% vs. 5%, relative risk 0.55, 95% CI 0.41-0.75) and also fewer preterm very low birthweight (<1500g) infants (RR 0.34, 95% CI 0.15-0.75) and preterm low birthweight (<2500g) infants (RR 0.48, 95% 0.34-0.66). The authors concluded that infection screening and treatment programmes in pregnant women before 20 weeks gestation reduce both preterm births and preterm low birth weights.

Othman M, Neilson JP, Alfirevic Z. 2007. **Probiotics for preventing preterm labour**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD005941. DOI: 10.1002/14651858.CD005941.pub2.

Probiotics contain live microorganisms that are believed to be beneficial to the host by restoring the normal bacterial flora (and hence displacing pathogenic bacteria) and they are used to treat infections. Maternal infections are thought to increase the risk of preterm labour by 30 - 50%. This review included two RCTs in women diagnosed with bacterial vaginosis in early pregnancy which assessed the effect of probiotics on urogenital infections. One trial in women at 34 weeks+ used fermented milk taken orally and the other used commercially available yoghurt applied vaginally. Pooled results of these two trials showed an 81% reduction in genital infection with the use of probiotics (risk ratio 0.19; 95% CI 0.08 to 0.48). The authors concluded that, although probiotics appear to be beneficial for treating vaginal infections in pregnancy, there is currently no data with which to assess their effect on preterm births.

Smaill F, Vazquez JC. 2007. **Antibiotics for asymptomatic bacteriuria in pregnancy**. Cochrane Database of Systematic Reviews, 2007(2), Art. No.: CD000490. DOI: 10.1002/14651858.CD000490.pub2.

Asymptomatic bacteriuria is relatively common in pregnancy (2-10% of women) and, if untreated, about 30% of those affected will develop acute pyelonephritis. Asymptomatic bacteriuria has been associated with both low birthweight and preterm birth. This review assessed the effect of antibiotic treatment on bacteriuria detected by screening in asymptomatic pregnant women. It included 14 RCTs of generally poor quality comparing antibiotics to placebo. Compared to placebo, antibiotics were effective at clearing symptomatic bacteriuria (risk ratio (RR) 0.25, 95% CI 0.14 to 0.48) and reducing the incidence of pyelonephritis (RR 0.23, 95% CI 0.13 to 0.41). Antibiotic treatment was also associated with a reduction in the proportion of low birthweight babies (RR 0.66, 95% CI 0.49 to 0.89) but not in the proportion of deliveries that were preterm. The authors concluded that antibiotics were effective in reducing the risk of pyelonephritis in pregnancy and that, although the observed effect on reducing low birthweight is consistent with accepted theories about the role of infection in adverse pregnancy outcomes, this association should be viewed cautiously in view of the poor quality of the included studies.

McDonald Helen M, Brocklehurst P, Gordon A. 2007. **Antibiotics for treating bacterial vaginosis in pregnancy**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD000262. DOI: 10.1002/14651858.CD000262.pub3.

Bacterial vaginosis has been associated with preterm birth (PTB) and other poor perinatal outcomes. This review assessed the effects of antibiotic treatment of bacterial vaginosis in pregnancy. Fifteen good quality RCTs (5888 women) were included and the authors calculated Peto odds ratios from pooled results where the trials were sufficiently non-heterogeneous. Antibiotic therapy was effective at eradicating bacterial vaginosis during pregnancy (10 trials, 4357 women, Peto odds ratio (POR) 0.17, 95% CI 0.15 to 0.20). Treatment did not reduce the risk of PTB at < 37 weeks (15 trials, 5888 women, POR 0.91, 95% CI 0.78 to 1.06), or the risk of preterm pre-labour rupture of membranes (four trials, 2579 women, POR 0.88, 95%CI 0.61 to 1.28). Treatment at < 20 weeks' gestation may reduce the risk of preterm birth at < than 37 weeks (5 trials, 2387 women, POR 0.72, 95% CI 0.55 to 0.95). In women with a previous PTB, treatment did not affect the risk of a subsequent PTB (five trials, 622 women, POR 0.83, 95% CI 0.59 to 1.17) but it may decrease the risk of preterm prelabour rupture of membranes (POR 0.14, 95% CI 0.05 to 0.38) and low birthweight (2 trials, 114 women, POR 0.31, 95% CI 0.13 to 0.75). In women with abnormal vaginal flora (intermediate flora or bacterial vaginosis) treatment may reduce the risk of PTB at < 37 weeks (2 trials, 894 women, POR 0.51, 95% CI 0.32 to 0.81). Clindamycin did not reduce the risk of PTB before 37 weeks (6 trials, 2406 women, POR 0.80, 95% CI 0.60 to 1.05).The authors concluded that antibiotic treatment can eradicate bacterial vaginosis in pregnancy but there is little evidence that screening and treating all pregnant women for vaginosis is an effective means of preventing preterm birth and its consequences. There is, however, limited evidence that treatment before 20 weeks may reduce the risk of PTB.

Dodd Jodie M, Flenady V, Cincotta R, et al. 2006. **Prenatal administration of progesterone for preventing preterm birth in women considered to be at risk of preterm birth**. Cochrane Database of Systematic Reviews, 2006(1), Art. No.: CD004947. DOI:10.1002/14651858.CD004947.pub2. Content updated after new search for studies (no change to conclusions), assessed as up to date in December 2008, published in Issue 2, 2009

Progesterone has a role in maintaining pregnancy probably via the inhibition of uterine smooth muscle contraction. It may be given by intramuscular injection or as a vaginal pessary. There is little long term safety data and little information about the optimal dose, route of administration, gestation to begin therapy, or duration of therapy. This review included 11 RCTs (2714 women and 3452 infants) involving comparison of progesterone vs. placebo in a variety of situations. In women with past history of spontaneous preterm birth progesterone was associated with a statistically significant reduction in the risk of preterm birth at < 34 weeks (1 study, 142 women; risk ratio (RR) 0.15; 95% CI 0.04 to 0.64), preterm birth at < 37 weeks (4 studies; 1255 women; RR 0.80; 95% CI 0.70 to 0.92), and infant birthweight < 2500 grams (2 studies; 501 infants; RR 0.64; 95% CI 0.49 to 0.83). For women with a short cervix identified on ultrasound, progesterone was associated with a statistically significant reduction in the risk of preterm birth < 34 weeks (1 study; 250 women; RR 0.58; 95% CI 0.38 to 0.87), and neonatal sepsis (1 study; 274 infants; RR 0.28; 95% CI 0.08 to 0.97). In women with a multiple pregnancy, **p**rogesterone was associated with a statistically significant reduction in the use of antenatal tocolysis (1 study; 654 women; RR 0.75;95% CI 0.57 to 0.97). In women presenting with threatened preterm labour, progesterone was associated with a statistically significant reduction in the risk of preterm birth < 37 weeks (1 study; 60 women; RR 0.29; 95% CI 0.12 to 0.69), infant birthweight < 2500 grams (1 study; 70 infants; RR 0.52; 95% CI 0.28 to 0.98); and respiratory distress syndrome (1 study; 70 infants; RR 0.30; 95% CI 0.11 to 0.83). In women with "other" risk factors for preterm birth progesterone was associated with no statistically significant differences in reported outcomes. The authors state that further research is required to assess the benefits and harms of progesterone use in women at risk of preterm labour, especially to assess longer term outcomes in infancy and childhood and also to determine the optimal timing, mode of administration and dose of administration of progesterone.

Sosa C, Althabe F, Belizan J, et al. 2004. **Bed rest in singleton pregnancies for preventing preterm birth**. Cochrane Database of Systematic Reviews, 2004(1), Art. No.: CD003581. DOI: 10.1002/14651858.CD003581.pub2.

Bed rest, either at home or in hospital, is widely recommended for preventing preterm birth in high risk women however it may increase the likelihood of venous thrombosis and it can also be stressful for the mother if, for example, she has to arrange care for other children or take time off work. The authors of this review identified one RCT (1266 women) , of uncertain methodological quality, in which 432 women were prescribed bed rest at home, 412 received a placebo intervention and 422 received no intervention. Preterm birth, the only outcome reported, was similar in the bed rest and control groups (7.9% vs. 8.5%, relative risk 0.92, 95% CI 0.62 to 1.37). The review authors concluded that there was no evidence to either support or refute the benefits of bed rest for women at increased risk of preterm birth.

Drakeley AJ, Roberts D, Alfirevic Z. 2003. **Cervical stitch (cerclage) for preventing pregnancy loss in women**. Cochrane Database of Systematic Reviews, 2003(1), Art. No.: CD003253. DOI: 10.1002/14651858.CD003253.

In women who have had previous second trimester pregnancy losses, a cervical stitch can be used to keep the cervix closed with the aim of preventing pregnancy loss. This review assessed the effectiveness and safety of both elective cerclage (before the cervix has dilated) and emergency cerclage (when the cervix has started to shorten and dilate) and also considered whether any one technique of stitch insertion is better than any other. This review included six RCTs (2175 women). Four trials compared prophylactic cerclage with no cerclage and data from these showed no overall reduction in pregnancy loss and preterm delivery rates, although there was a small reduction in births at < 33 weeks' gestation in the largest trial (relative risks 0.75, 95% CI 0.58 to 0.98). Cervical cerclage was associated with mild pyrexia, increased use of tocolytic therapy and increased hospital admissions but no serious morbidity. Two trials examined the role of therapeutic cerclage when a short cervix had been detected on ultrasound examination. Pooled results from these trials did not show a reduction in total pregnancy loss, early pregnancy loss or preterm delivery before 28 and 34 weeks in women assigned to cervical cerclage. The authors concluded that cervical cerclage should not be offered to women at low to medium risk of mid trimester loss whatever the cervical length measured via ultrasound. Small numbers in the RCTs did not allow any conclusions about the role of cervical cerclage for women who have a short cervix on ultrasound.

A more recent paper which addresses this issue is :

Berghella V, Rafael TJ, Szychowski JM, et al. 2011. **Cerclage for short cervix on ultrasonography in women with singleton gestations and previous preterm birth: a meta-analysis**. Obstetrics & Gynecology, 117(3), 663-71.

This review considered 5 RCTs and the authors' meta-analysis was confined to women with a singleton pregnancy, previous spontaneous preterm birth and a cervical length of < 25mm before 24 weeks' gestation. There were significantly fewer preterm (<35 weeks) births in the women who had cerclage: 28.4% vs. 41.3% (RR 0.70, 95% CI 0.55-0.89). There were also significantly fewer preterm births in the cerclage group at 37, 32, 28 and 24 weeks' gestation and a significant reduction in composite perinatal mortality and morbidity (15.6% vs. 24.8%, RR 0.64, 95% CI 0.45-0.91). The authors concluded that, in these particular women, cerclage significantly reduces preterm birth and composite perinatal mortality and morbidity.

INFANT MORTALITY AND SUDDEN UNEXPECTED DEATH IN INFANCY

Introduction

Infant mortality is often used as a barometer of the social wellbeing of a country [18]. New Zealand's infant mortality rates are middling by international standards, being lower than those of the USA and some Eastern European countries, but higher than those of Central and Northern Europe [19]. New Zealand's mortality during the first year of life has remained much higher than at any other point during childhood or adolescence. During 2009, a total of 308 New Zealand infants were registered as having died prior to their first birthday [20].

Despite these relatively high numbers, New Zealand's infant mortality rates have declined during the past 40 years, with rates falling from 16.9 per 1,000 in 1969, to 4.9 per 1,000 in March 2009 [20]. While infant mortality rates are generally higher for Pacific > Māori > European/Other babies, for males, and those in the most deprived areas [21], total infant mortality rates are of limited utility in guiding population health interventions, as the causes of mortality differ markedly with the age of the infant. During the neonatal period (birth–28 days) extreme prematurity, congenital anomalies and intrauterine/birth asphyxia are the leading causes of mortality, while in the post neonatal period (29–364 days) sudden unexpected death in infancy (SUDI) and congenital anomalies make the greatest contribution [22]. Thus any interventions aimed at reducing New Zealand's infant mortality rates must, in the first instance, be based on an understanding of their component causes.

The following section uses information from the National Mortality Collection to review neonatal, post neonatal and total infant mortality, as well as SUDI rates since 1990.

Data Source and Methods

Definition

1. Total Infant Mortality: Death of a live born infant prior to 365 days of life

2. Neonatal Mortality: Death of a live born infant in the first 28 days of life

3. Post Neonatal Mortality: Death of a live born infant after 28 days but prior to 365 days of life

4. Sudden Unexpected Death in Infancy (SUDI): Death of a live born infant <365 days of life, where the cause of death is SIDS, Accidental Suffocation / Strangulation in Bed or Ill-Defined/Unspecified Causes

Data Sources

Numerator: National Mortality Collection: All deaths in the first year of life, using the definitions for total infant, neonatal and post neonatal mortality outlined above. Cause of death is derived from the ICD-10-AM main underlying cause of death as follows: Extreme Prematurity (P072), Congenital Anomalies (Q00–Q99), Perinatal Conditions (P00–P96); SIDS (R95); SUDI (R95, R96, R98, R99, W75).

Denominator: Birth Registration Dataset (Live Births Only)

Notes on Interpretation

Note 1: See **Appendix 5** for an overview of the National Mortality Collection

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

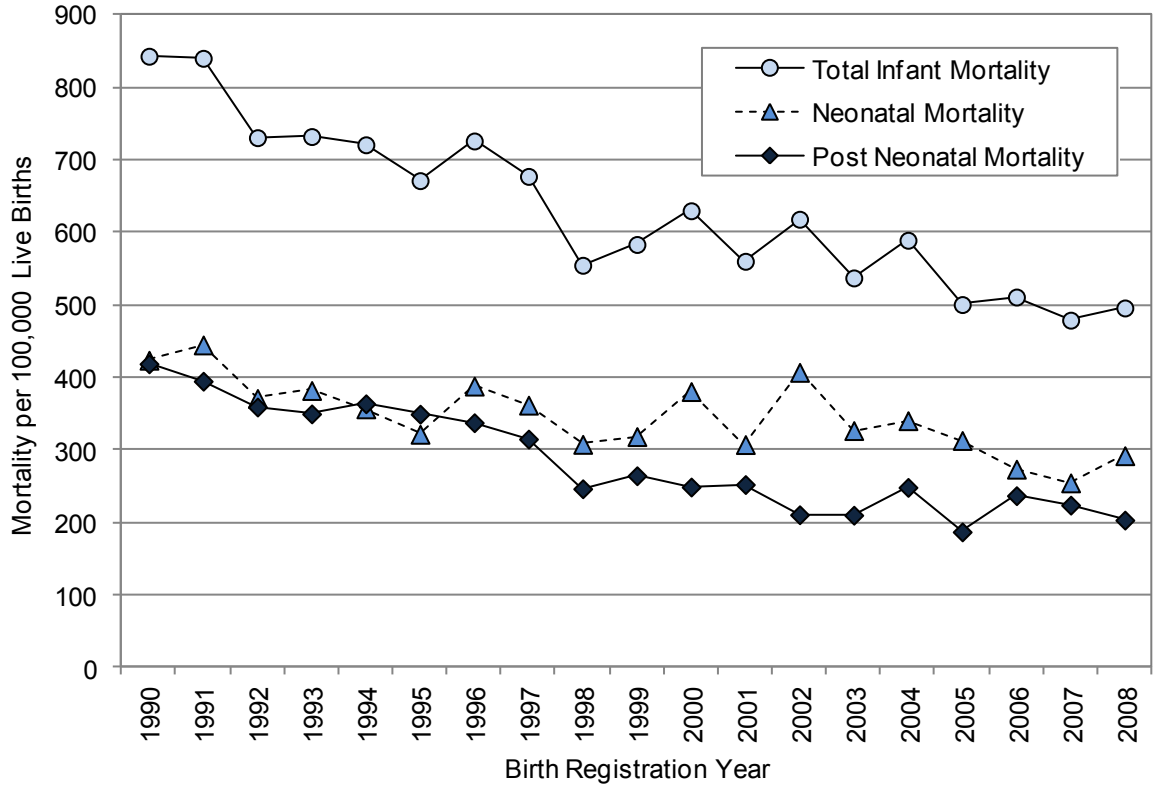
Total Infant, Neonatal and Post Neonatal Mortality

New Zealand Distribution and Trends

New Zealand Trends

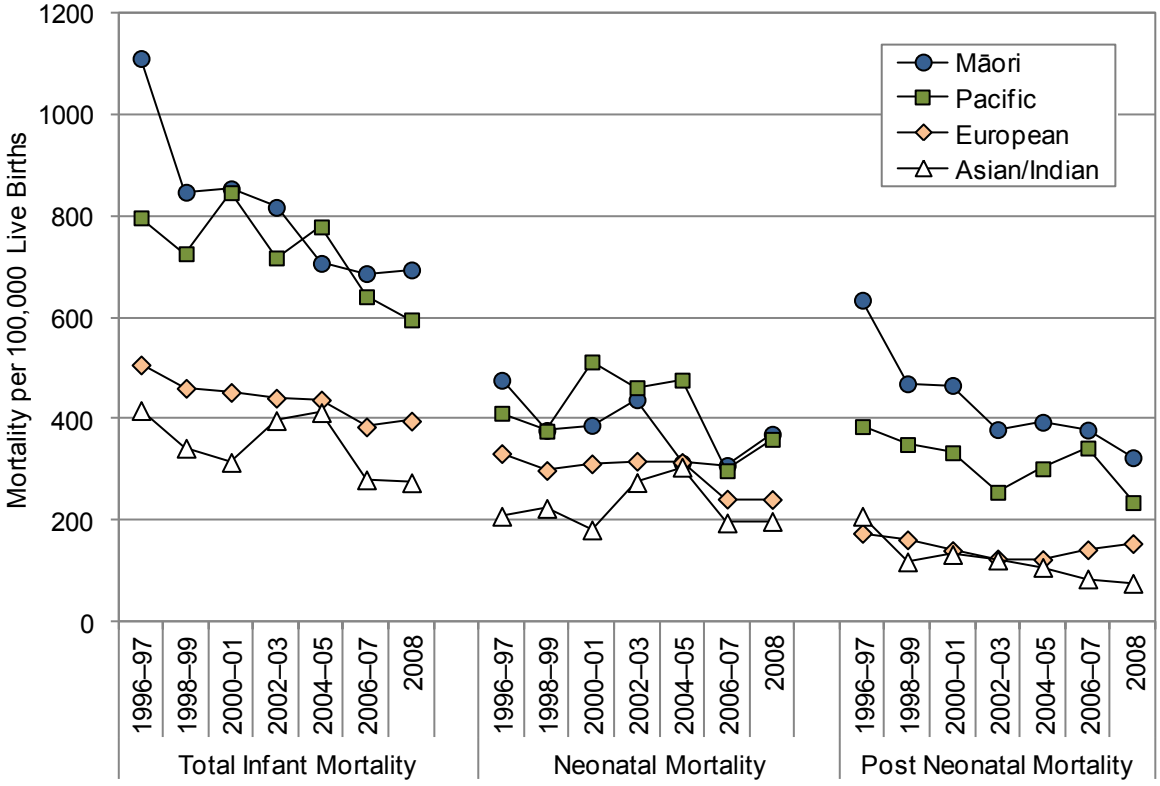
In New Zealand during 1990–2008, neonatal and post neonatal mortality both declined, with neonatal mortality exceeding post neonatal mortality from 1996 onwards (**Figure 8**).

Figure 8. Total Infant, Neonatal and Post Neonatal Mortality, New Zealand 1990−2008

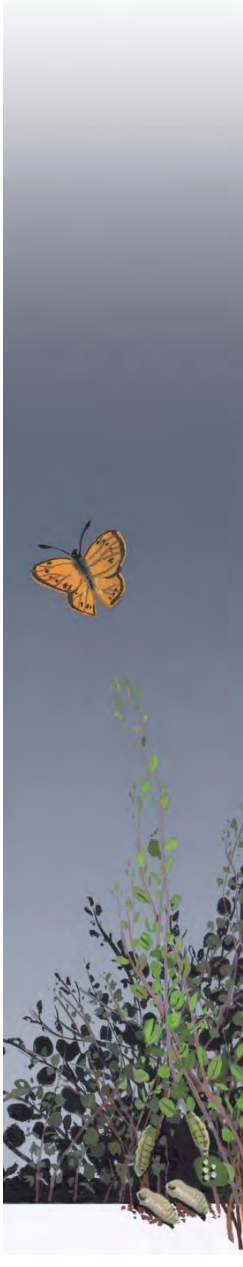


Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 9. Total Infant, Neonatal and Post Neonatal Mortality by Ethnicity, New Zealand 1996−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Ethnicity is Level 1 Prioritised



New Zealand Trends by Ethnicity

In New Zealand during the late 1990s, neonatal mortality was generally higher for Pacific and Māori > European > Asian/Indian infants, although ethnic differences were less consistent during the 2000s. In contrast, post neonatal mortality was higher for Māori > Pacific > European and Asian/Indian infants throughout 1996–2008 (**Figure 9**).

New Zealand Distribution by Cause

In New Zealand during 2004–2008, extreme prematurity and congenital anomalies were the leading causes of neonatal mortality, although intrauterine/birth asphyxia and other perinatal conditions also made a significant contribution. In contrast, SUDI was the leading cause of post neonatal mortality, followed by congenital anomalies (**Table 18**).

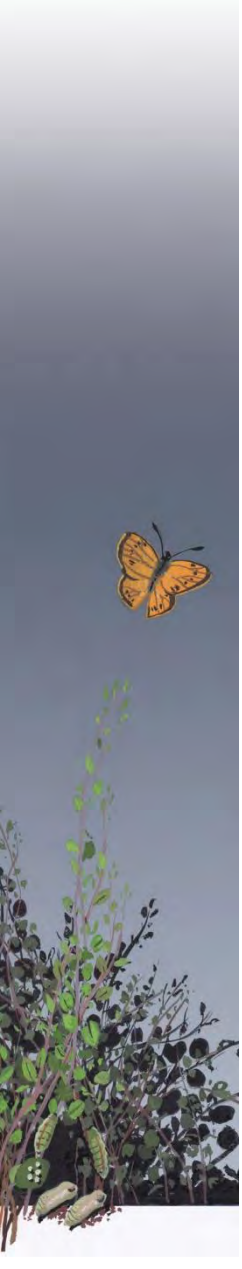
Table 18. Neonatal and Post Neonatal Mortality by Main Underlying Cause of Death, New Zealand 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent of Deaths
New Zealand				
Neonatal Mortality				
Extreme Prematurity	215	43.0	69.8	23.7
Congenital Anomalies: CVS	65	13.0	21.1	7.2
Congenital Anomalies: CNS	34	6.8	11.0	3.8
Congenital Anomalies: Other	130	26.0	42.2	14.3
Intrauterine/Birth Asphyxia	47	9.4	15.3	5.2
Other Perinatal Conditions	331	66.2	107.4	36.5
SUDI: SIDS	17	3.4	5.52	1.9
SUDI: Suffocation/Strangulation in Bed	25	5.0	8.11	2.8
SUDI: Unspecified	3	0.6	0.97	0.3
Injury / Poisoning	10	2.0	3.25	1.1
Other Causes	29	5.8	9.41	3.2
Total Neonatal Mortality	906	181.2	294.0	100.0
Post Neonatal Mortality				
SUDI: SIDS	177	35.4	57.4	26.1
SUDI: Suffocation/Strangulation in Bed	79	15.8	25.6	11.7
SUDI: Unspecified	10	2.0	3.25	1.5
Congenital Anomalies: CVS	54	10.8	17.5	8.0
Congenital Anomalies: CNS	9	1.8	2.92	1.3
Congenital Anomalies: Other	63	12.6	20.4	9.3
All Other Perinatal Conditions	73	14.6	23.7	10.8
Injury / Poisoning	30	6.0	9.74	4.4
Other Causes	183	36.6	59.4	27.0
Total Post Neonatal Mortality	678	135.6	220.0	100.0
New Zealand Total	1584	316.8	514.0	100.0

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: CVS = Cardiovascular System; CNS = Central Nervous System

New Zealand Distribution by Ethnicity, NZDep Decile, Maternal Age, Gender and Gestation at Birth

In New Zealand during 2004–2008, neonatal mortality was *significantly* higher for Pacific and Māori infants than for European infants, for males, for those in average-to-more deprived (NZDep decile 5–10) areas, for preterm infants, and those whose mothers were <25 years of age. During the same period, post neonatal mortality was also *significantly*



higher for Māori and Pacific infants than for European and Asian/Indian infants, for males, for those in average-to-more deprived (NZDep decile 5–10) areas, preterm infants, and those whose mothers were <30 years of age (**Table 19**).

Table 19. Risk Factors for Neonatal and Post Neonatal Mortality, New Zealand 2004−2008

New Zealand							
Neonatal Mortality							
Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
NZ Deprivation Index Decile				Ethnicity			
Decile 1–2	210.6	1.00		Asian/Indian	237.5	0.88	0.68–1.13
Decile 3–4	203.5	0.97	0.74–1.27	European	270.1	1.00	
Decile 5–6	282.9	1.34	1.05–1.72	Māori	323.5	1.20	1.03–1.39
Decile 7–8	309.3	1.47	1.16–1.86	Pacific	379.3	1.40	1.15–1.71
Decile 9–10	395.2	1.88	1.50–2.35	Gender			
Maternal Age Group				Female	263.3	1.00	
<20 years	504.7	1.96	1.57–2.45	Male	323.1	1.23	1.08–1.40
20–24 years	328.4	1.28	1.05–1.55	Gestation at Birth			
25–29 years	283.0	1.10	0.91–1.33	20–36 Weeks	2,695.8	31.8	27.4–36.9
30–34 years	257.0	1.00		37+ Weeks	84.7	1.00	
35+ years	246.0	0.96	0.78–1.17				
Post Neonatal Mortality							
Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
NZ Deprivation Index Decile				Ethnicity			
Decile 1–2	107.4	1.00		Asian/Indian	91.6	0.67	0.45–1.00
Decile 3–4	126.7	1.18	0.82–1.70	European	137.4	1.00	
Decile 5–6	167.0	1.55	1.11–2.18	Māori	372.3	2.71	2.28–3.22
Decile 7–8	212.1	1.97	1.43–2.72	Pacific	304.1	2.21	1.75–2.81
Decile 9–10	384.2	3.58	2.66–4.81	Gender			
Maternal Age Group				Female	191.3	1.00	
<20 years	474.0	3.44	2.66–4.45	Male	247.2	1.29	1.11–1.50
20–24 years	313.6	2.28	1.81–2.86	Gestation at Birth			
25–29 years	217.0	1.57	1.25–1.99	20–36 Weeks	879.2	5.87	4.96–6.94
30–34 years	137.8	1.00		37+ Weeks	149.9	1.00	
35+ years	144.2	1.05	0.80–1.37				

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Rates are per 100,000; Rate Ratios are unadjusted; Ethnicity is Level 1 Prioritised

Midland Region Distribution and Trends

Midland Region Trends

Total Infant Mortality: In the Midland Region during 1990–2008, total infant mortality in the Waikato DHB exhibited a general downward trend, while large year to year variations in the other four DHBs (possibly as the result of small numbers) made precise interpretation of trends difficult (**Figure 10**).

Neonatal and Post Neonatal Mortality: In the Midland Region during 1990–2008, post neonatal mortality rates in the Waikato, Bay of Plenty, Lakes and Tairawhiti DHBs exhibited a fluctuating downward trend, while neonatal mortality rates (while also fluctuating markedly) remained more static (**Figure 11**).

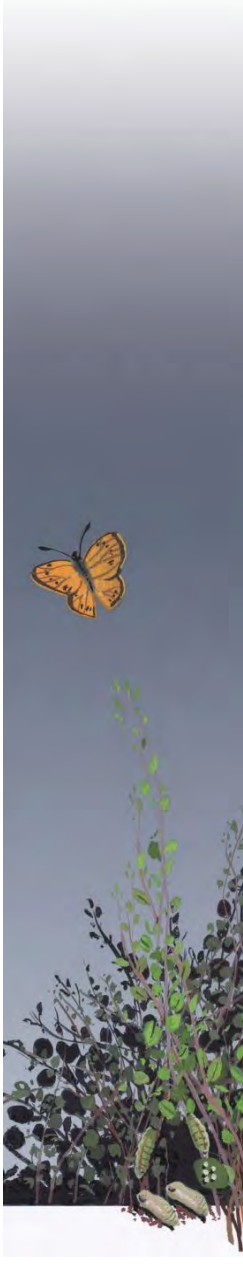
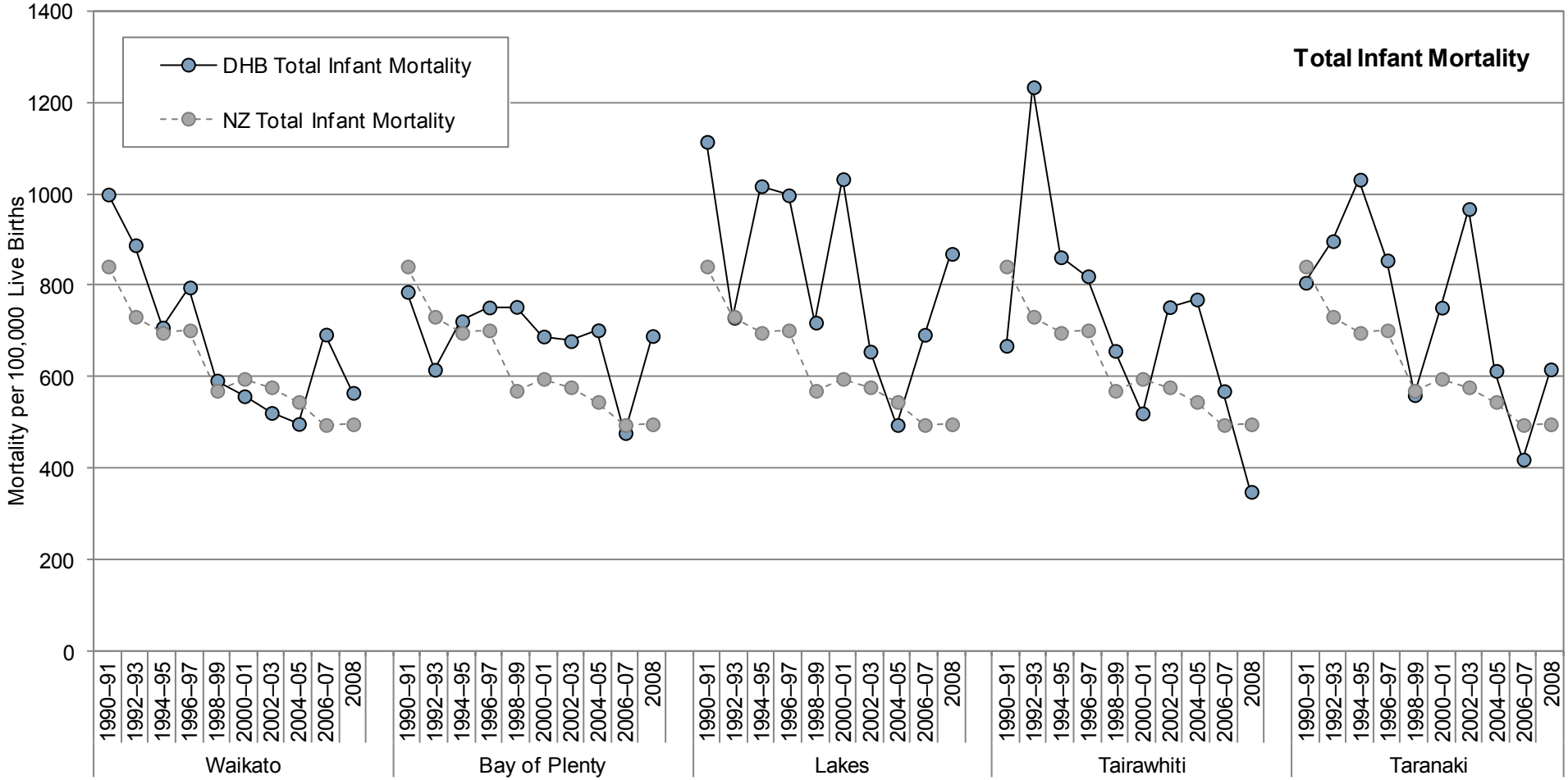
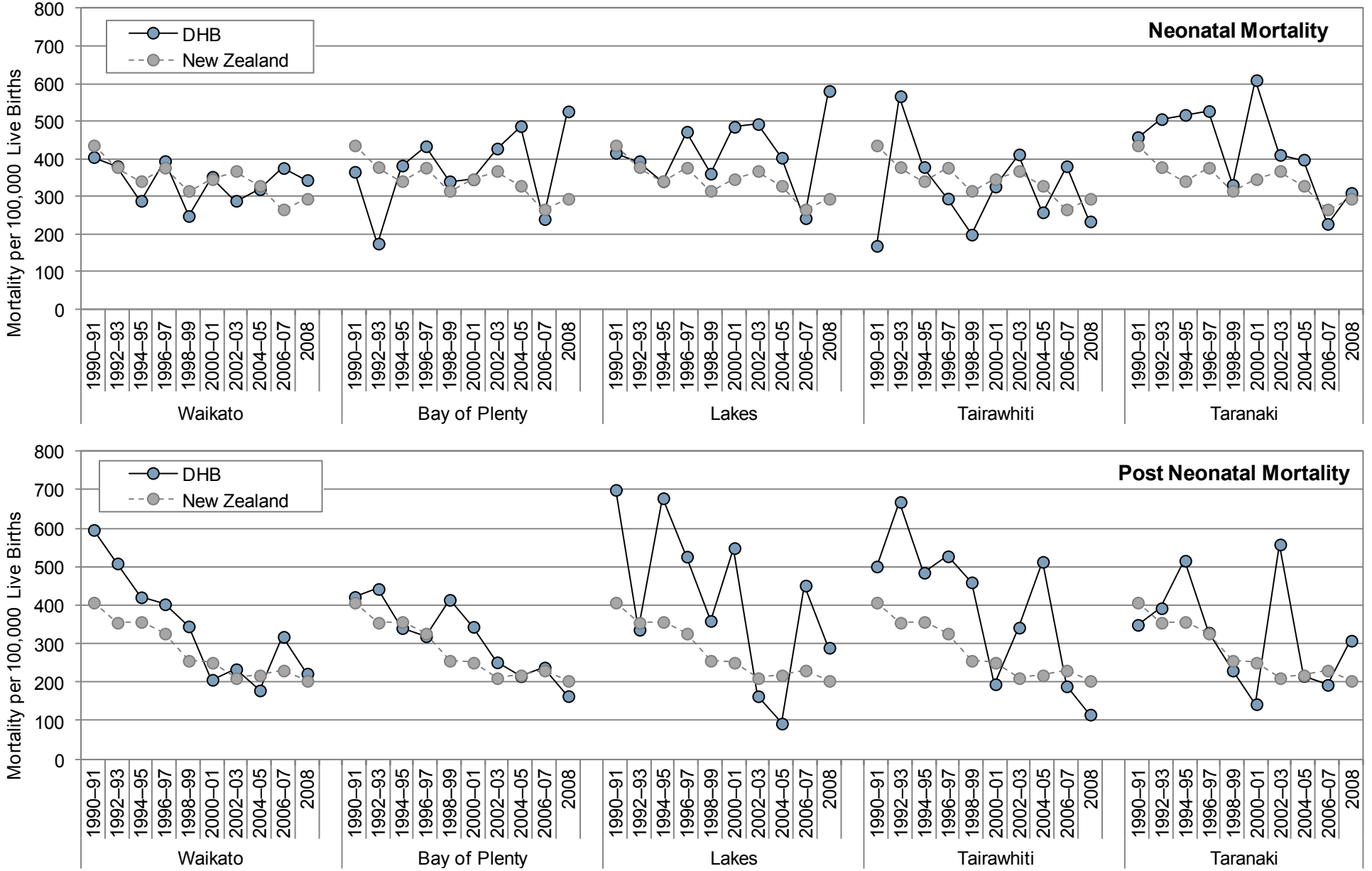


Figure 10. Total Infant Mortality, Midland DHBs vs. New Zealand 1990−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 11. Neonatal and Post Neonatal Mortality, Midland DHBs vs. New Zealand 1990−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 20. Neonatal and Post Neonatal Mortality, Midland DHBs vs. New Zealand 2004−2008

DHB	Total No. Deaths 2004–2008	No. Deaths Annual Average	Rate per 100,000	Rate Ratio	95% CI
Neonatal Mortality					
Waikato	92	18.4	345.9	1.18	0.95–1.46
Lakes	31	6.2	374.1	1.27	0.89–1.82
Bay of Plenty	57	11.4	393.7	1.34	1.03–1.75
Tairawhiti	12	2.4	299.6	1.02	0.58–1.80
Taranaki	23	4.6	306.6	1.04	0.69–1.58
New Zealand	906	181.2	294.0	1.00	
Post Neonatal Mortality					
Waikato	65	13.0	244.4	1.11	0.86–1.43
Lakes	23	4.6	277.6	1.26	0.83–1.91
Bay of Plenty	31	6.2	214.1	0.97	0.68–1.39
Tairawhiti	12	2.4	299.6	1.36	0.77–2.41
Taranaki	17	3.4	226.6	1.03	0.64–1.67
New Zealand	678	135.6	220.0	1.00	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 21. Neonatal and Post Neonatal Mortality by Main Underlying Cause of Death, Waikato DHB 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent of Deaths
Waikato				
Neonatal Mortality				
Extreme Prematurity	18	3.6	67.7	19.6
Congenital Anomalies: CVS / CNS	11	2.2	41.4	12.0
Intrauterine / Birth Asphyxia	3	0.6	11.3	3.3
Other Perinatal Conditions	38	7.6	142.9	41.3
SUDI: SIDS	5	1.0	18.8	5.4
Congenital Anomalies: Other	13	2.6	48.9	14.1
Other Causes	4	0.8	15.0	4.3
Total Neonatal Mortality	92	18.4	345.9	100.0
Post Neonatal Mortality				
SUDI: SIDS	24	4.8	90.2	36.9
SUDI: Suffocation / Strangulation in Bed	6	1.2	22.6	9.2
Congenital Anomalies: CVS	3	0.6	11.3	4.6
Congenital Anomalies: Other	5	1.0	18.8	7.7
Other Perinatal Conditions	9	1.8	33.8	13.8
All Other Causes	18	3.6	67.7	27.7
Total Post Neonatal Mortality	65	13.0	244.4	100.0
Waikato Total	157	31.4	590.3	100.0

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: CVS = Cardiovascular System; CNS = Central Nervous System

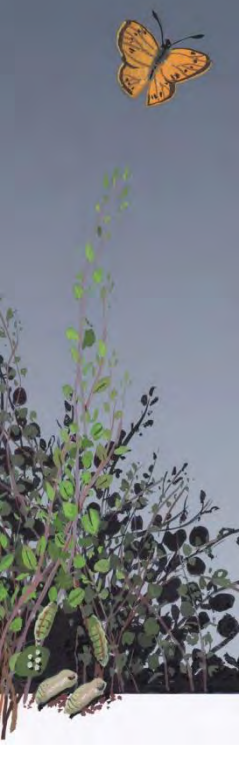


Table 22. Neonatal and Post Neonatal Mortality by Main Underlying Cause of Death, Bay of Plenty and Lakes DHBs 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent of Deaths
Bay of Plenty				
Neonatal Mortality				
Extreme Prematurity	17	3.4	117.4	29.8
Congenital Anomalies: CVS	7	1.4	48.3	12.3
Congenital Anomalies: CNS / Other	6	1.2	41.4	10.5
Intrauterine / Birth Asphyxia	6	1.2	41.4	10.5
Other Perinatal Conditions	17	3.4	117.4	29.8
All Other Causes	4	0.8	27.6	7.0
Total Neonatal Mortality	57	11.4	393.7	100.0
Post Neonatal Mortality				
SUDI: All Causes	13	2.6	89.8	41.9
Congenital Anomalies: All Types	6	1.2	41.4	19.4
Intrauterine / Birth Asphyxia / Other Perinatal Conditions	3	0.6	20.7	9.7
All Other Causes	9	1.8	62.2	29.0
Total Post Neonatal Mortality	31	6.2	214.1	100.0
Bay of Plenty Total	88	17.6	607.8	100.0
Lakes DHB				
Neonatal Mortality				
Extreme Prematurity	6	1.2	72.4	19.4
Congenital Anomalies: CNS	3	0.6	36.2	9.7
Congenital Anomalies: CVS	3	0.6	36.2	9.7
Congenital Anomalies: Other	4	0.8	48.3	12.9
Intrauterine / Birth Asphyxia / Other Perinatal Conditions	12	2.4	144.8	38.7
All Other Causes	3	0.6	36.2	9.7
Total Neonatal Mortality	31	6.2	374.1	100.0
Post Neonatal Mortality				
SUDI: SIDS	8	1.6	96.5	34.8
SUDI: Suffocation / Strangulation in Bed	5	1.0	60.3	21.7
Congenital Anomalies: Other	3	0.6	36.2	13.0
All Other Causes	7	1.4	84.5	30.4
Total Post Neonatal Mortality	23	4.6	277.6	100.0
Lakes DHB Total	54	10.8	651.7	100.0

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: CVS = Cardiovascular System; CNS = Central Nervous System

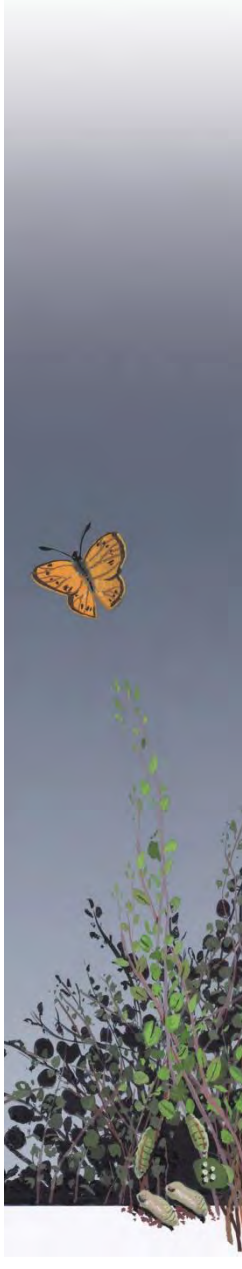


Table 23. Neonatal and Post Neonatal Mortality by Main Underlying Cause of Death, Tairawhiti and Taranaki DHBs 2004–2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent of Deaths
Tairawhiti				
Neonatal Mortality				
Extreme Prematurity	4	0.8	99.9	33.3
Congenital Anomalies: Other Perinatal Conditions	7	1.4	174.8	58.3
Other Causes	<3	s	s	s
Total Neonatal Mortality	12	2.4	299.6	100.0
Post Neonatal Mortality				
SIDS: All Causes	7	1.4	174.8	58.3
All Other Causes	5	1.0	124.8	41.7
Total Post Neonatal Mortality	12	2.4	299.6	100.0
Tairawhiti Total	24	4.8	599.3	100.0
Taranaki				
Neonatal Mortality				
Extreme Prematurity	5	1.0	66.6	21.7
Congenital Anomalies: All Types	7	1.4	93.3	30.4
Other Perinatal Conditions	11	2.2	146.6	47.8
Total Neonatal Mortality	23	4.6	306.6	100.0
Post Neonatal Mortality				
SUDI: All Causes	8	1.6	106.6	47.1
Congenital Anomalies: All Types	4	0.8	53.3	23.5
All Other Causes	5	1.0	66.6	29.4
Total Post Neonatal Mortality	17	3.4	226.6	100.0
Taranaki Total	40	8.0	533.2	100.0

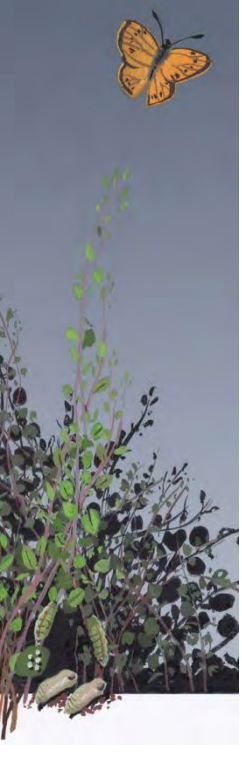
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: s: suppressed due to small numbers.

Midland DHBs vs. New Zealand

In the Midland Region during 2004–2008, while neonatal mortality rates were higher than the New Zealand rate in the Waikato, Lakes and Bay of Plenty, only in the case of the Bay of Plenty did these differences reach statistical significance. Neonatal mortality rates in Tairawhiti and Taranaki were similar to the New Zealand rate. Similarly, while post neonatal mortality rates in the Waikato, Lakes and Tairawhiti were higher than the New Zealand rate, none of these differences reached statistical significance (**Table 20**).

Midland Region Distribution by Cause

In the Midland Region during 2004–2008, congenital anomalies and extreme prematurity were the most frequent causes of neonatal mortality in all five DHBs, while SUDI was the most frequent cause of post neonatal mortality (**Table 21**).



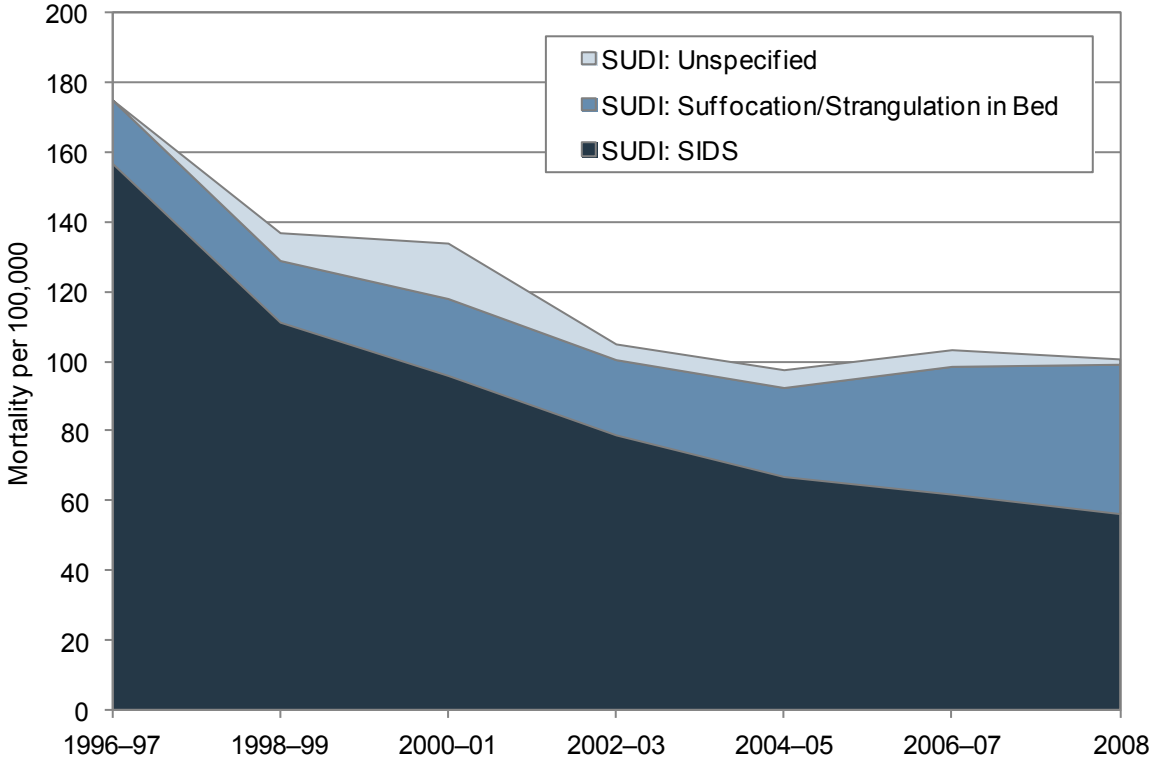
Sudden Unexpected Death in Infancy (SUDI)

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, SUDI rates declined during the late 1990s and early 2000s, but became more static after 2002–03. When broken down by SUDI sub-type, deaths attributed to SIDS continued to decline throughout 1996–2008, while deaths due to suffocation or strangulation in bed became more prominent as the period progressed. It is unclear, however, whether this represented a diagnostic shift in the coding of SUDI, or whether the sleeping environment made an increasingly greater contribution to SUDI as the period progressed (**Figure 12**).

Figure 12. Sudden Unexpected Death in Infancy by Type, New Zealand 1996−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

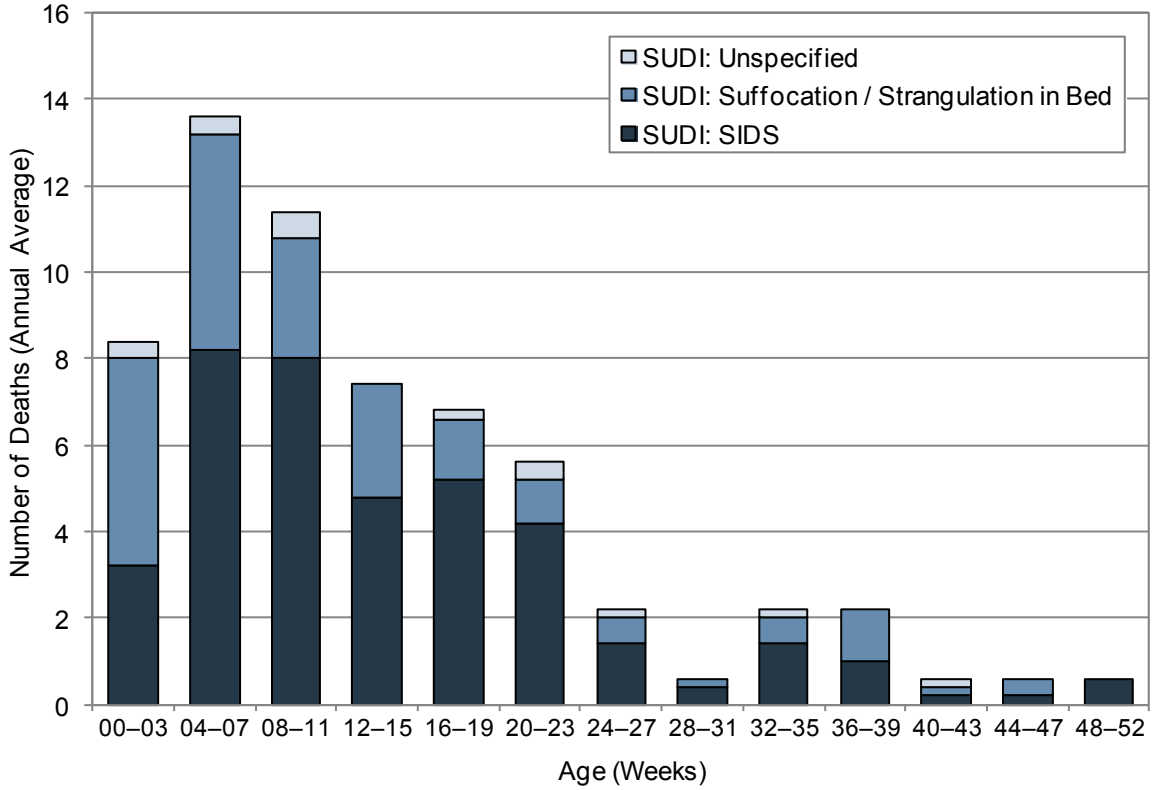
New Zealand Distribution by Age

In New Zealand during 2004–2008, SUDI mortality was highest in infants 4–7 weeks of age, followed by those aged 8–11 weeks and those 0–3 weeks. Of note, SUDI: Suffocation/Strangulation in Bed accounted for 57.1% of all SUDI deaths in those aged 0–3 weeks and 36.8% of SUDI deaths in those aged 4–7 weeks (**Figure 13**).

New Zealand Distribution by Ethnicity, NZDep Index Decile, Maternal Age, Gender, and Gestation

In New Zealand during 2004–2008, mortality from SUDI was *significantly* higher for Māori > Pacific > European > Asian/Indian infants, those from average-to-more deprived (NZDep decile 3–10) areas, preterm infants, and those whose mothers were <30 years of age (**Table 24**).Similar ethnic differences were seen during 1996–2008 (**Figure 14**).

Figure 13. Sudden Unexpected Death in Infancy by Type and Age in Weeks, New Zealand 2004−2008



Source: Numerator: National Mortality Collection

Table 24. Risk Factors for Sudden Unexpected Death in Infancy (SUDI), New Zealand 2004−2008

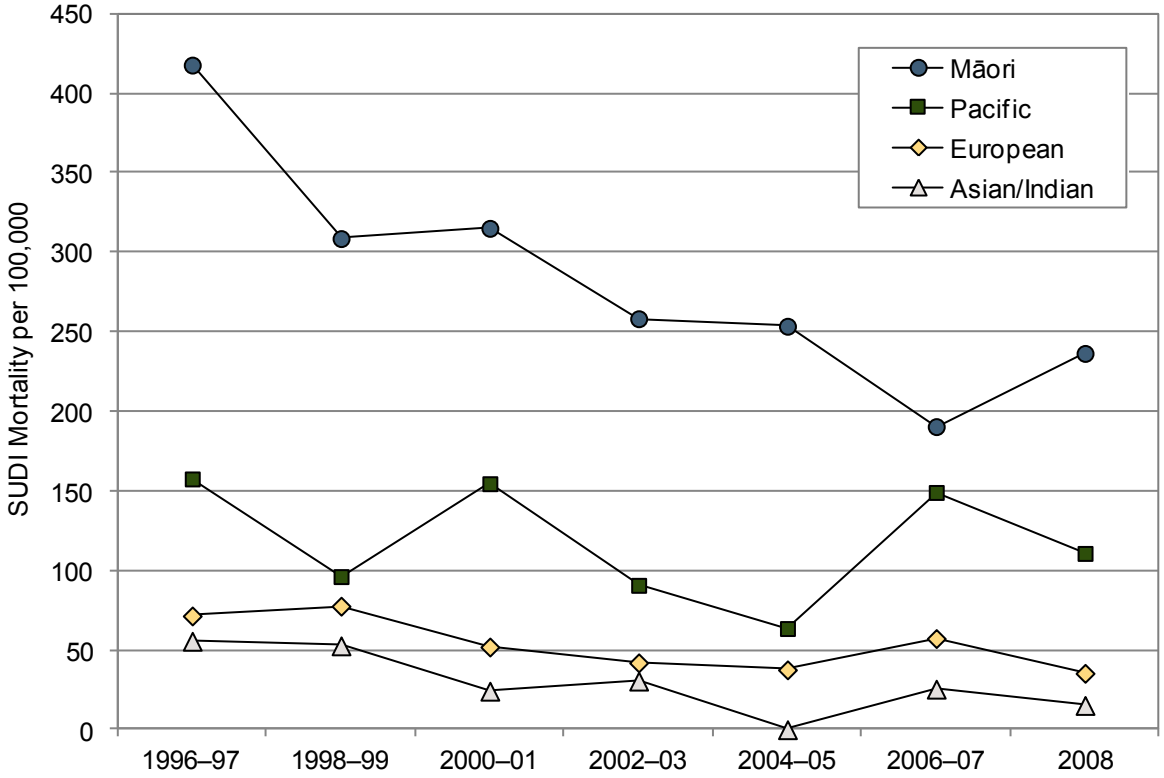
New Zealand							
Sudden Unexpected Death in Infancy (SUDI)							
Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
NZ Deprivation Index Decile				Ethnicity			
Decile 1–2	27.4	1.00		Asian/Indian	13.6	0.30	0.11–0.82
Decile 3–4	59.5	2.17	1.14–4.15	European	45.1	1.00	
Decile 5–6	66.8	2.44	1.30–4.58	Māori	223.8	4.96	3.77–6.53
Decile 7–8	92.8	3.39	1.87–6.16	Pacific	108.4	2.40	1.60–3.60
Decile 9–10	202.5	7.40	4.21–13.01	Gender			
Maternal Age Group				Female	96.0	1.00	
<20 years	276.5	4.96	3.43–7.17	Male	105.6	1.10	0.88–1.37
20–24 years	183.7	3.29	2.35–4.62	Gestation at Birth			
25–29 years	84.9	1.52	1.05–2.20	20–36 Weeks	255.7	3.23	2.42–4.32
30–34 years	55.8	1.00		37+ Weeks	79.1	1.00	
35+ years	47.1	0.84	0.54–1.32				

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: Rates are per 100,000; Rate Ratios are unadjusted; Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Season

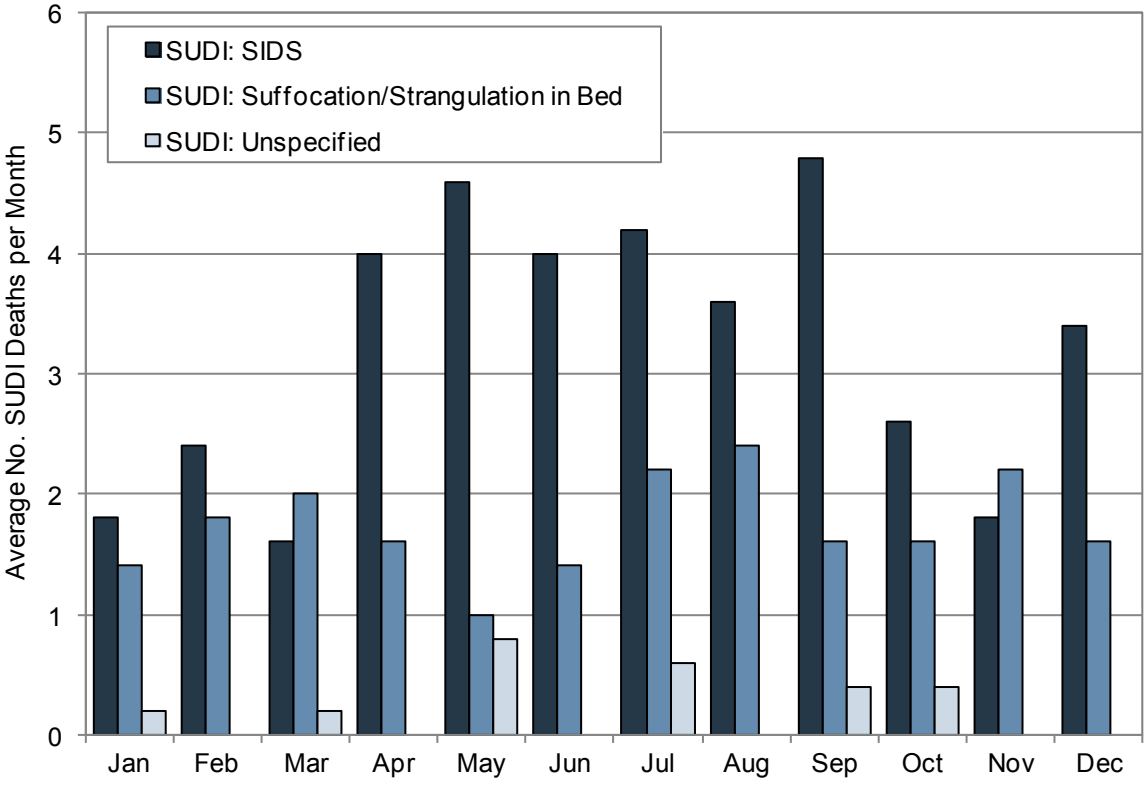
In New Zealand during 2004–2008, while small numbers make precise interpretation difficult, SUDI: SIDS was generally more common in the cooler months while SUDI: Suffocation/Strangulation in Bed was more evenly distributed through the year (**Figure 15**).

Figure 14. Sudden Unexpected Death in Infancy by Ethnicity, New Zealand 1996−2008

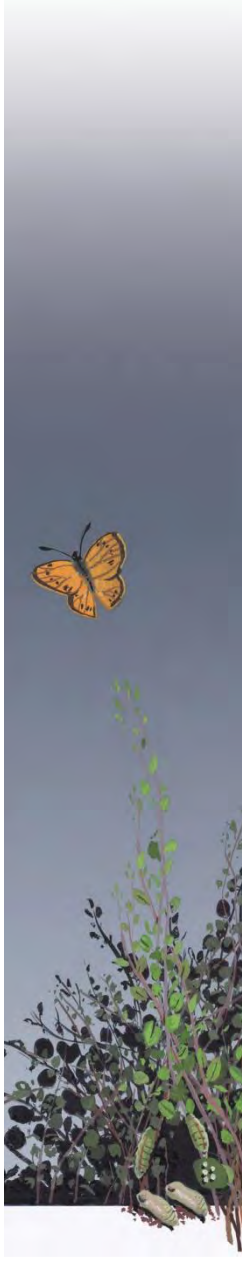


Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised.

Figure 15. Sudden Unexpected Death in Infancy by Type and Month, New Zealand 2004−2008



Source: National Mortality Collection



Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Midland Region during 2004–2008, while SUDI rates were higher than the New Zealand rate in the Waikato, Lakes and Tairawhiti, in none of these cases did these differences reach statistical significance. SUDI rates in the Bay of Plenty and Taranaki were similar to the New Zealand rate (**Table 25**).

Table 25. Sudden Unexpected Death in Infancy, Midland DHBs vs. New Zealand 2004−2008

DHB	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
SUDI in Infants <1 Year					
Waikato	35	7.0	131.6	1.30	0.92–1.85
Lakes	13	2.6	156.9	1.55	0.89–2.71
Bay of Plenty	14	2.8	96.7	0.96	0.56–1.64
Tairawhiti	7	1.4	174.8	1.73	0.82–3.66
Taranaki	8	1.6	106.6	1.06	0.52–2.13
New Zealand	311	62.2	100.9	1.00	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Midland Region Trends

In the Bay of Plenty, Lakes and Tairawhiti during 1996–2008, SUDI rates declined, although an upswing in rates was evident in Lakes after 2004–05. SUDI rates in the Waikato and Taranaki were more variable during this period (**Figure 16**).

Summary

Neonatal and Post Neonatal Mortality: In New Zealand during 1990–2008, neonatal and post neonatal mortality both declined. Neonatal mortality was higher for Pacific and Māori > European > Asian/Indian infants during the late 1990s, although differences were less evident in the 2000s. Post neonatal mortality was higher for Māori > Pacific > European and Asian/Indian infants throughout 1996–2008. Both outcomes were also *significantly* higher for males, those from average-to-more deprived areas, preterm infants and those with younger mothers.

In the Midland Region during 2004–2008, congenital anomalies and extreme prematurity were the most frequent causes of neonatal mortality in all five DHBs, while SUDI was the most frequent cause of post neonatal mortality. While neonatal mortality was higher than the New Zealand rate in the Waikato, Lakes and Bay of Plenty, only in the Bay of Plenty did these differences reach statistical significance. Similarly, while post neonatal mortality in the Waikato, Lakes and Tairawhiti was higher than the New Zealand rate, none of these differences reached statistical significance.

SUDI: In New Zealand, SUDI rates declined during the late 1990s–early 2000s, but became more static after 2002–03. SUDI deaths due to SIDS declined throughout 1996–2008, while those due to suffocation or strangulation in bed became more prominent as the period progressed. It is unclear whether this represented a diagnostic shift in the coding of SUDI, or whether the sleeping environment made an increasingly greater contribution as the period progressed. During 2004–2008, SUDI was highest in infants 4–7 weeks of age. SUDI was also *significantly* higher for Māori > Pacific > European > Asian/Indian infants, for those from average-to-more deprived (NZDep decile 3–10) areas, for preterm infants, and those with mothers <30 years of age.

In the Midland Region during 2004–2008, while SUDI rates were higher than the New Zealand rate in the Waikato, Lakes and Tairawhiti, in none of these cases did these differences reach statistical significance.

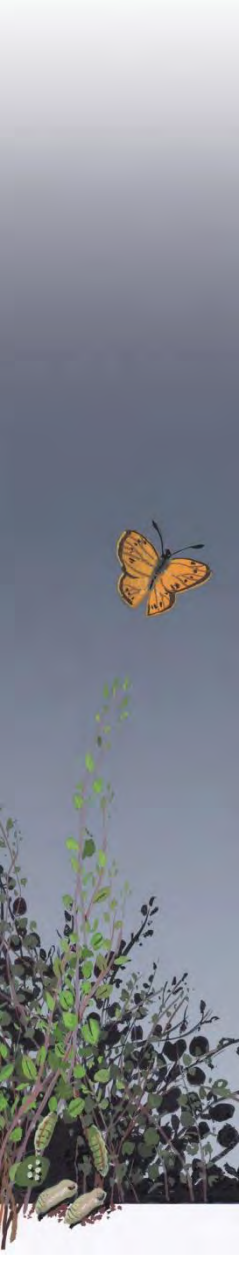
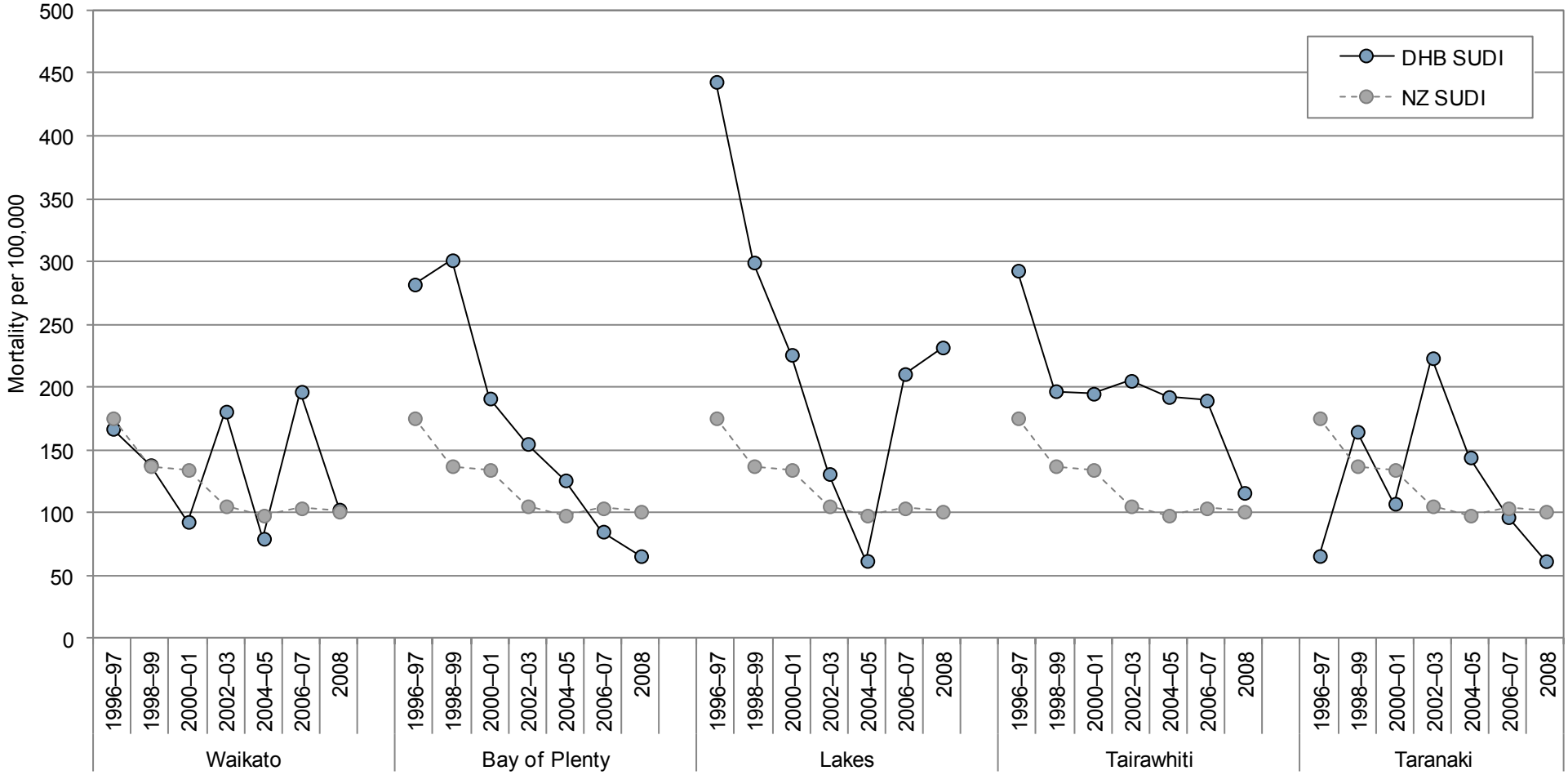


Figure 16. Sudden Unexpected Death in Infancy, Midland DHBs vs. New Zealand 1996−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Local Policy Documents and Evidence-Based Reviews Relevant to Infant Mortality and SUDI

There are no Ministry of Health Policy documents which focus specifically on Sudden Unexpected Death in Infancy (SUDI), however the Ministry of Health and the Child and Youth Mortality Review Committee (CYMRC) have reviewed recommendations for preventing SUDI and the CYMRC has published a position paper: **Preventing Sudden Unexpected Death in Infancy** which is briefly discussed in **Table 26 ,** along with a range of other evidence-based reviews which may be useful for those wishing to develop local strategies for SUDI prevention

There are also a range of Government policy documents and evidence-based reviews which consider population level approaches to known SUDI risk and protective factors. Two such factors are reviewed in other sections of this report:

- Publications which relate to **Tobacco Control/Smoking** are reviewed in **Table 45** on **Page 160**
- Publications which relate to **Breastfeeding** are considered in **Table 27** on **Page 101**

Table 26. Local Policy Documents and Evidence-Based Reviews Relevant to SUDI Prevention

Ministry of Health Policy Documents
There are no Ministry of Health Policy documents which focus specifically on SUDI however the Ministry of Health and the Child and Youth Mortality Review Committee (CYMRC) have reviewed recommendations for preventing Sudden Unexpected Death in Infancy (SUDI) and the CYMRC has published a position paper: **Preventing sudden unexpected death in infancy** which can be viewed on the Ministry website at: http://www.moh.govt.nz/moh.nsf/indexmh/preventing-sudi-health-practitioner-info-apr08?Open
International Guidelines
Task Force on Sudden Infant Death Syndrome. 2011. **SIDS and Other Sleep-Related Infant Deaths: Expansion of SIDS and Other Sleep-Related Infant Deaths**. Pediatrics, 128(5), 1030-39. This policy statement from the American Academy of Pediatrics is an expansion of previous AAP recommendations. The new recommendations not only focus on SIDS prevention but also on safe sleep environments that can reduce the risk of all sleep-related infant deaths including suffocation, asphyxia and entrapment. The recommendations described in this publication include placing the baby in a supine position to sleep, using a firm sleeping surface, breastfeeding, sharing a room (but not a bed), routine immunisations, considering the use of a pacifier, and avoiding soft bedding, overheating and exposure to tobacco smoke, alcohol and illicit drugs. The evidence base for these recommendations is published as: Task Force on Sudden Infant Death Syndrome. 2011. **Technical Report: SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment**. Pediatrics, 128(5), e1341-e67.
Hymel K. 2006. **Distinguishing sudden infant death syndrome from child abuse fatalities**. Pediatrics 118(1) 421-7. This clinical report from the American Academy of Pediatrics provides guidance for professionals regarding procedures to help avoid stigmatizing families of sudden infant death syndrome victims while allowing accumulation of appropriate evidence in potential cases of infanticide.
Systematic and Other Reviews from the International Literature
Mitchell EA, Blair PS, L'Hoir MP. 2006. **Should pacifiers be recommended to prevent sudden infant death syndrome**? Pediatrics, 117(5), 1755-8. This review reports that there is consistent evidence of a reduction in SIDS with pacifier ("dummy") use although the mechanism for the effect is unknown. Pacifier use might lead to reduced duration of breastfeeding but study results are conflicting. In New Zealand pacifier use is low overall (c. 10%) but there is wide variation within the country from c. 3% in the far south to c. 30% in the northern North Island. Pacifier use has some adverse effects: it appears to decrease the duration of breastfeeding and it is associated with higher risk of infective symptoms, particularly otitis media. The authors conclude that it is certainly appropriate to stop discouraging pacifier use but if parents wish to use a pacifier they should be advised to do so only once breastfeeding is established and only when the infant is expected to sleep..
Hauck FR, Omojokun OO, Siadaty MS. 2005. **Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis**. Pediatrics, 116(5), e716-23. This paper reports on a meta-analysis of the results of seven case-control studies investigating the association between pacifier use and SIDS risk. The summary odds ratio (SOR) for usual pacifier use was calculated to be 0.90 (95% CI 0.59-0.85) using univariate odds ratios and 0.71 (95% CI 0.59-0.85) using multivariate odds ratios. For pacifier use during the last sleep the SORs using univariate and multivariate ORs were 0.47 (95% CI 0.40-0.55) and 0.39 (95% CI 0.31-0.50) , respectively. Published case-control studies therefore demonstrate that pacifier use is associated with a significantly reduced risk for SIDS, particularly when an infant is placed for sleep. The authors estimate that one SIDS death would be averted for every 2733 infants who are given a pacifier when placed for sleep. They recommend that pacifiers be offered to infants to reduce the risk of SIDS but that for breastfeeding infants, pacifier use should be introduced after breastfeeding is well established.

Ponsonby A-L, Dwyer T, Cochrane J. 2002. **Population trends in sudden infant death syndrome**. Seminars in Perinatology, 26(4), 296-305.

This review article reports on recent trends in sudden infant death syndrome. It is based on a review of medical literature as well as national government data from various countries (including New Zealand) and internet resources. It notes that while there have been striking reductions in SIDS in many countries largely attributable to decreases in the proportion of infants sleeping prone, within countries the decline has not occurred to the same extent in different ethnic and socioeconomic groups.

Useful Websites and Other Publications

McManus V, Abel S, McCreanor T, et al. 2010. Narratives of deprivation: **Women's life stories around Māori sudden infant death syndrome**. Social Science & Medicine, 71(3), 643-9.

This paper reports on life story interviews conducted between 2002 and 2004 with nineteen Māori mothers whose infants died of SIDS. These mothers' stories have common themes of alienation, marginalisation and exclusion and lives lived with serious deprivation within an affluent society. It is unhelpful to view some risk factors as non-modifiable and the authors argue that new approaches that build on the WHO Social determinants of health framework are needed to stem the tide of deaths of Māori babies from SIDS.

Child and Youth Mortality Review Committee, Te Rōpū Arotake Auau Mate o te Hunga Tamariki Taiohi. 2011. **Sudden Unexpected Death in Infancy**.

http://www.cymrc.health.govt.nz/moh.nsf/indexcm/cymrc-resources-sudi?Open&m_id=4.1

This webpage provides links to a number of useful resources and websites including:

Fifth Report to the Minister of Health: Reporting mortality 2002–2008

http://www.cymrc.health.govt.nz/moh.nsf/pagescm/347/$File/cymrc-sudi-report-2009.pdf

Chapter 1 of this publication deals with sudden unexpected death in infancy. It provides data from 2002-2008, qualitative data gathered from local mortality review, and recommendations from the CYMRC on how to reduce incidents of SUDI in New Zealand.

Whakawhetu: National SIDS Prevention for Māori

http://www.maorisids.org.nz

Whakawhetu was established in March 1994 to decrease SIDS mortality rates in the Māori community. Originally, the organisation was known as Māori SIDS but was rebranded as Whakawhetu in 2011. The organisation delivers national and regional services that focus on co-ordination and provision of evidence-based research with the purpose of assisting whānau, health professionals and communities to reduce the incidence of SIDS/SUDI. There is a research and information library on the website.

TAHA Well Pacific Mother and Infant Service

http://www.taha.org.nz

The Pacific Health Programme, in the Department of Māori and Pacific Health at the University of Auckland, has developed a SUDI prevention programme for Pacific families in Auckland.

Change for Our Children

www.changeforourchildren.co.nz

Change for our Children is on a mission to build a strong culture of respect for children that is visible in our country's systems and services, conversations and communities, hearts and homes. This site contains, among other useful resources, information on the pepi-pod project which provides a means of enabling babies to be close to a parent but have their own safe sleeping space (under the safe start programme tab on the website), and some useful publications both from the organisation and elsewhere.

Ministry of Health. 2010. **Fetal and Infant Deaths 2007**. Wellington: Ministry of Health.
http://www.moh.govt.nz/moh.nsf/Files/fetalinfantdeaths/$file/fetal-infant-deaths07-dec10.pdf

This publication presents data on deaths that occurred before one completed year of life and were registered in the 2007 calendar year and information on the underlying causes of these deaths.

Schluter PJ, Paterson J, Percival T. 2007. **Infant care practices associated with sudden infant death syndrome: findings from the Pacific Islands Families study**. Journal of Paediatrics & Child Health, 43(5), 388-93.

The Pacific Islands Families Study followed a cohort of Pacific infants born at Middlemore Hospital between 15 March and 17 December 2000. Mothers (1376 in total) were interviewed about infant care practices at around six weeks after the birth of their infant. Bed sharing was found to be common (50% of infants) and mostly occurred in the parents' bed. Most infants (95%) wholly or partly shared a bedroom with their parents. Despite these practices, and the socio-economic disadvantage of many Pacific families the rate of SIDS among Pacific families is substantially lower than the Māori SIDS rate. The authors of this paper state "Mothers need to receive adequate information antenatally about the risks and benefits of room-sharing, bed-sharing and safe-sleeping practices and environments should they decide or have no option but to bed-share".

BREASTFEEDING

Introduction

The World Health Organisation recommends that infants be exclusively breastfed for the first six months of life and that breastfeeding, together with the provision of nutritionally adequate and safe complementary foods, should continue until a child reaches two years of age or beyond [23]. Breastfeeding has considerable health benefits for both the baby and the mother. Breastfed babies have lower rates of common childhood infections such as diarrhoea, respiratory infections and otitis media and lower rates of SIDS [24]. A recent U.S. Agency for Healthcare Research and Quality report concluded that formula feeding was associated with higher risks for major chronic conditions such as type 2 diabetes, asthma and obesity which are becoming more common [25]. Mothers who breastfeed have lower rates of post-partum haemorrhage, lose their extra pregnancy weight faster, are less likely to become pregnant again soon after their baby's birth and have lower rates of breast cancer and ovarian cancer [24,26,27].

In New Zealand only about 12% of babies are exclusively breastfed for six months, yet in 2005 80.5% of infants born in Baby Friendly Hospitals were exclusively breastfed on discharge [27]. While the decision to breastfeed or not is a personal one and mothers should not be made to feel guilty if they are unable to, or choose not to breastfeed, the success rate among mothers who wish to breastfeed can be improved if there is active support from their families, friends, communities, clinicians, health care leaders, employers and policymakers [24].

The following section reviews breastfeeding rates at <6 weeks, 3 months and 6 months using data from the Plunket Client Information System.

Data Sources and Methods

Indicator

1. Exclusive / Full Breastfeeding Rates in Plunket Babies at <6 Weeks, 3 Months and 6 Months of Age

Numerator: Plunket Client Information System: The number of Plunket babies exclusively / fully breastfed at <6 weeks (2 weeks to 5 weeks, 6 days), 3 months (10 weeks to 15 weeks, 6 days) and 6 months (16 weeks to 7 months, 4 weeks).

Denominator: Plunket Client Information System: The number of babies in contact with Plunket at these ages

Notes on Interpretation

Plunket is New Zealand's largest provider of support services for the development, health and wellbeing of children under five. Nationally it provides Well Child services to >90% of all new babies in New Zealand. Of those families, around 22% identify as Māori, with approximately 80% of all Māori newborn babies being signed up with Plunket. Plunket have breastfeeding data dating back to 1922, with more detailed information being available in recent years (although Māori and Pacific mothers may be under-reported in these samples).

Plunket's breastfeeding definitions, which are similar to the World Health Organisation's are as follows [28]:

**Exclusive Breastfeeding*: The infant has never, to the mother's knowledge, had any water, formula or other liquid or solid food. Only breast milk, from the breast or expressed, and prescribed medicines have been given from birth.

**Fully Breastfed*: The infant has taken breast milk only and no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours.

**Partially Breastfed*: The infant has had some breast milk and some infant formula or other solid food in the past 48 hours.

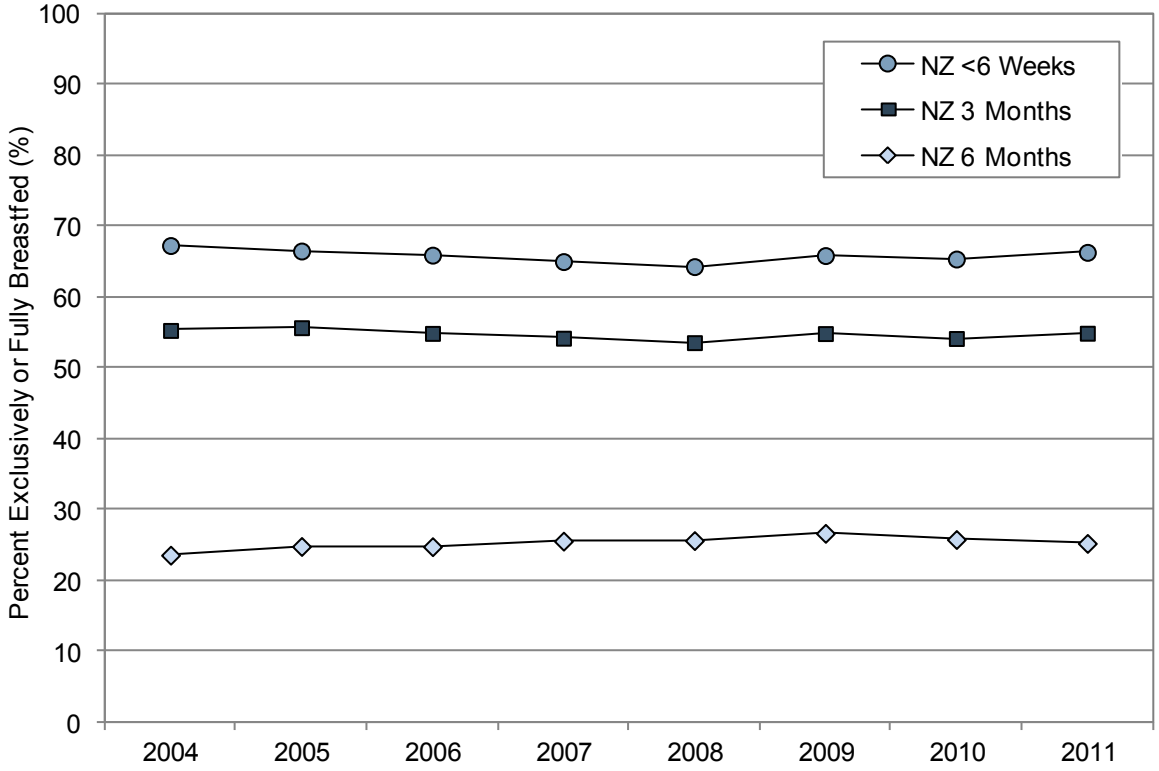
**Artificially Fed*: The infant has had no breast milk, but has had an alternative liquid such as infant formula, with or without solid food in the past 48 hours.

New Zealand Distribution and Trends

New Zealand Trends by Age

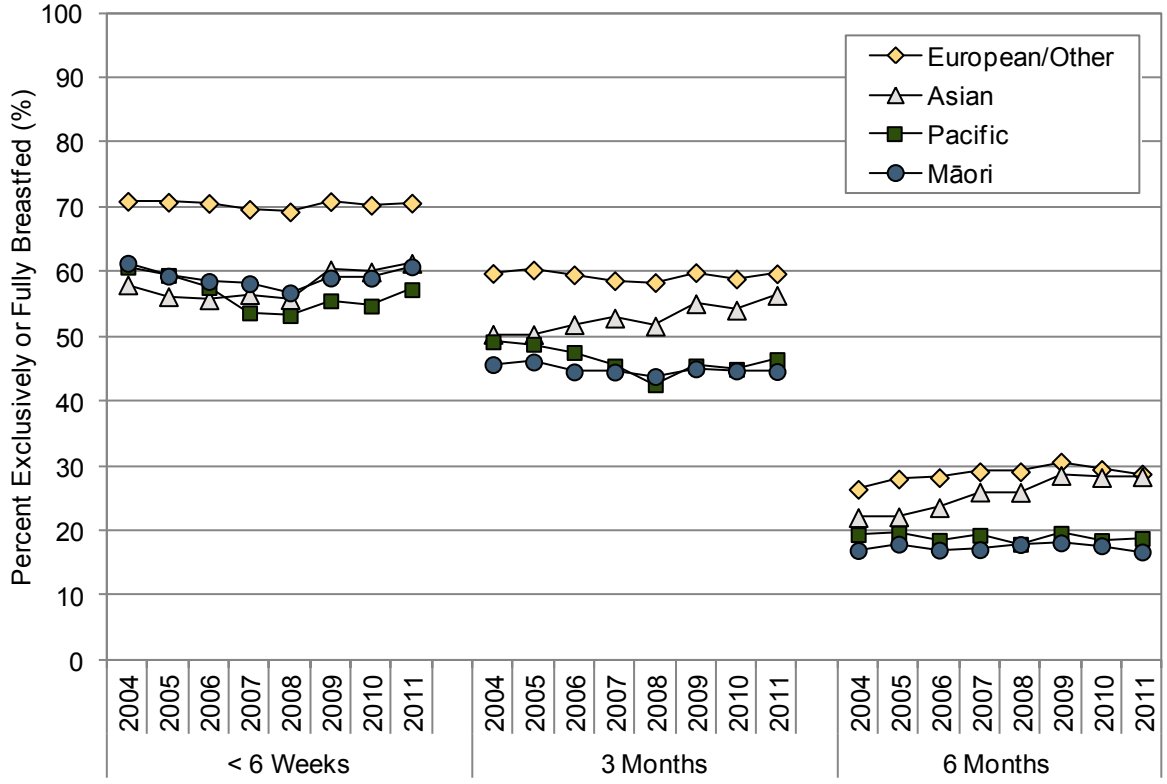
In New Zealand during the years ending June 2004–2011, the proportion of babies who were exclusively or fully breastfed remained fairly static, with exclusive/full breastfeeding rates in the year ending June 2011 being 66.3% at <6 weeks, 54.9% at 3 months and 25.2% at 6 months of age (**Figure 17**).

Figure 17. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age, New Zealand, Years Ending June 2004−2011



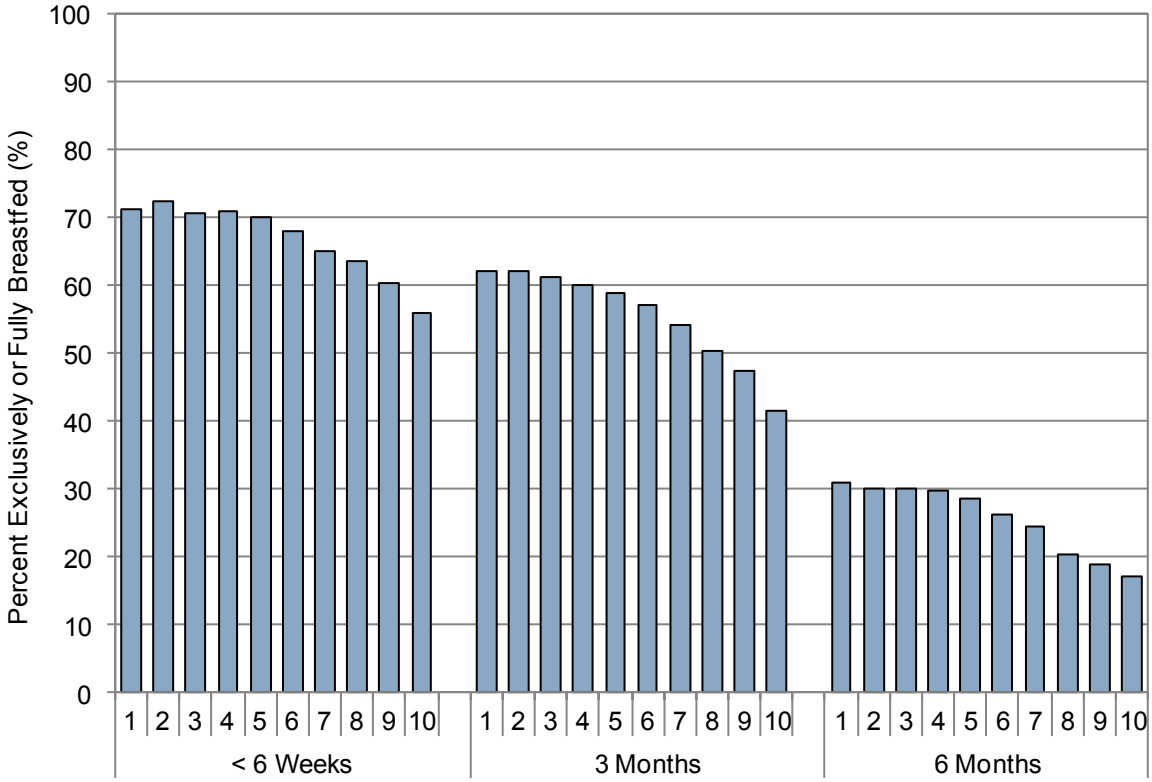
Source: Plunket Client Information System

Figure 18. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age and Ethnicity, New Zealand, Years Ending June 2004−2011



Source: Plunket Client Information System

Figure 19. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age and NZ Deprivation Index Decile, New Zealand, Year Ending June 2011



Source: Plunket Client Information System

New Zealand Trends by Ethnicity

In New Zealand during the years ending June 2004–2011, exclusive/full breastfeeding rates at <6 weeks of age were consistently higher for European/Other babies than for babies of other ethnic groups. At 3 and 6 months of age however, exclusive/full breastfeeding rates were generally higher European/Other > Asian/Indian > Māori and Pacific babies, with differences between Asian/Indian and Māori and Pacific babies increasing as the period progressed (**Figure 18**).

New Zealand Distribution by NZDep Decile

In New Zealand during the year ending June 2011, exclusive/full breastfeeding rates at <6 weeks, 3 months and 6 months were generally lower for babies from the most deprived (NZDep decile 10) areas, than for babies from average or less deprived areas (**Figure 19**).

Midland Region Distribution and Trends

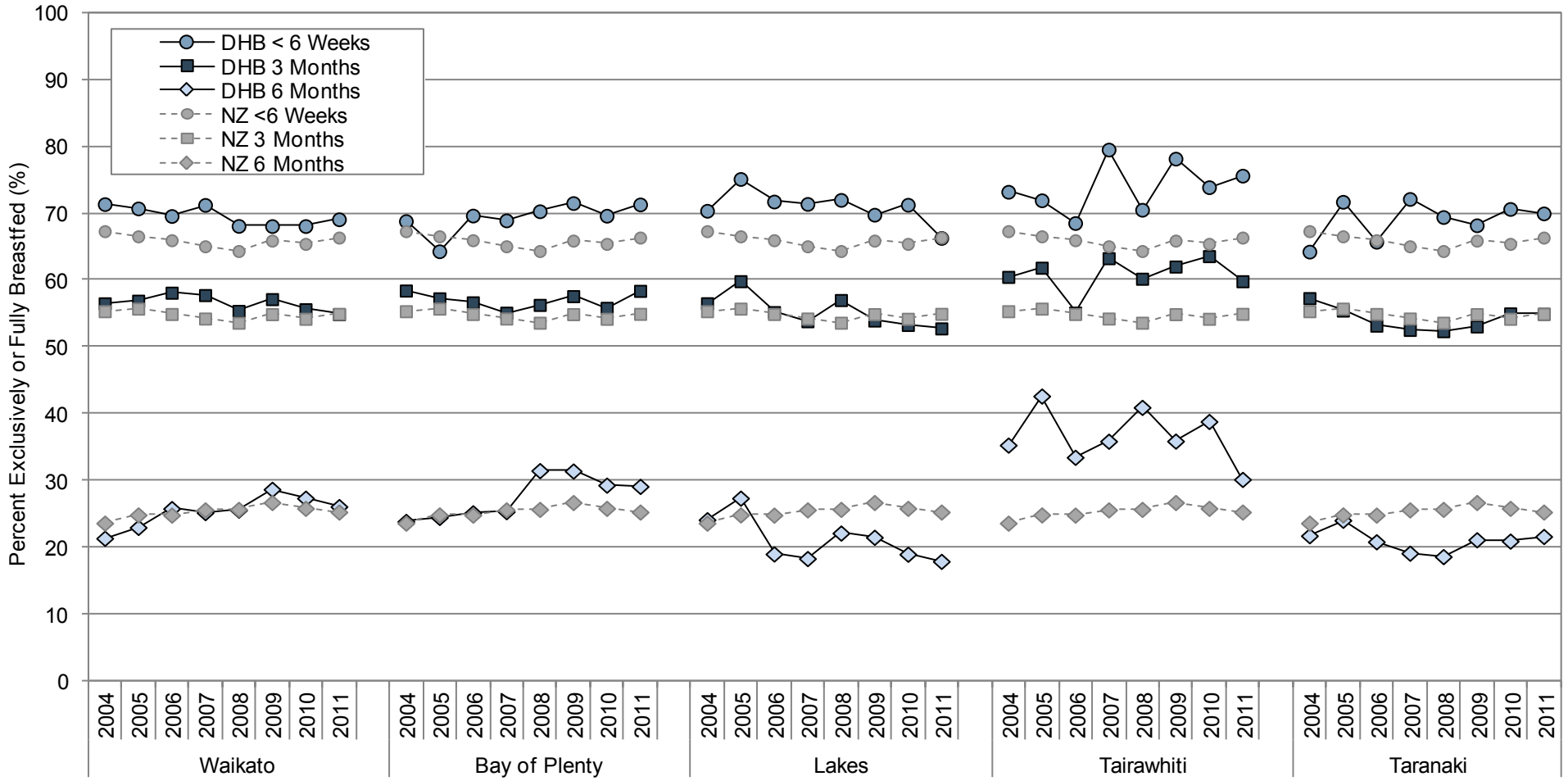
Midland DHBs vs. New Zealand

During the years ending June 2004–2011, exclusive/full breastfeeding rates at <6 weeks were generally higher than the New Zealand rate in all Midland DHBs. By 3 months however, rates in most DHBs were closer to the New Zealand rate, with the exception of Tairawhiti, where rates remained consistently higher, as they did at 6 months of age. During the late 2000s, breastfeeding rates in Lakes and Taranaki were lower than the New Zealand rate, while rates in the Bay of Plenty were higher (**Figure 20**).

Midland Region Distribution by NZDep Decile

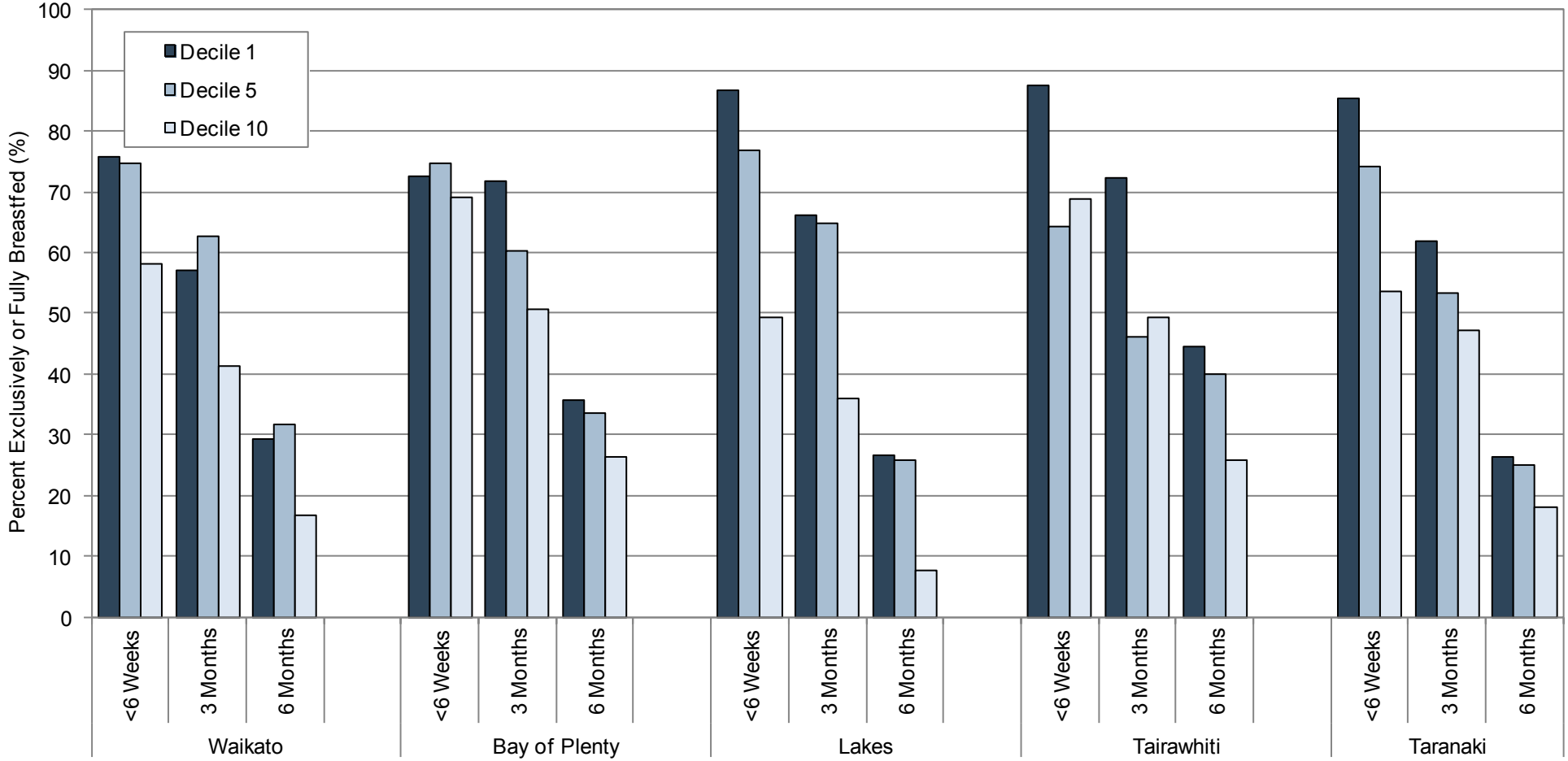
In the Midland Region during the year ending June 2011, exclusive/full breastfeeding rates at <6 weeks, 3 months and 6 months were lower for babies living in the most deprived (NZDep decile 10) areas, than for babies living in the least deprived (NZDep decile 1) areas in all five DHBs (**Figure 21**).

Figure 20. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age, Midland DHBs vs. New Zealand Years Ending June 2004−2011



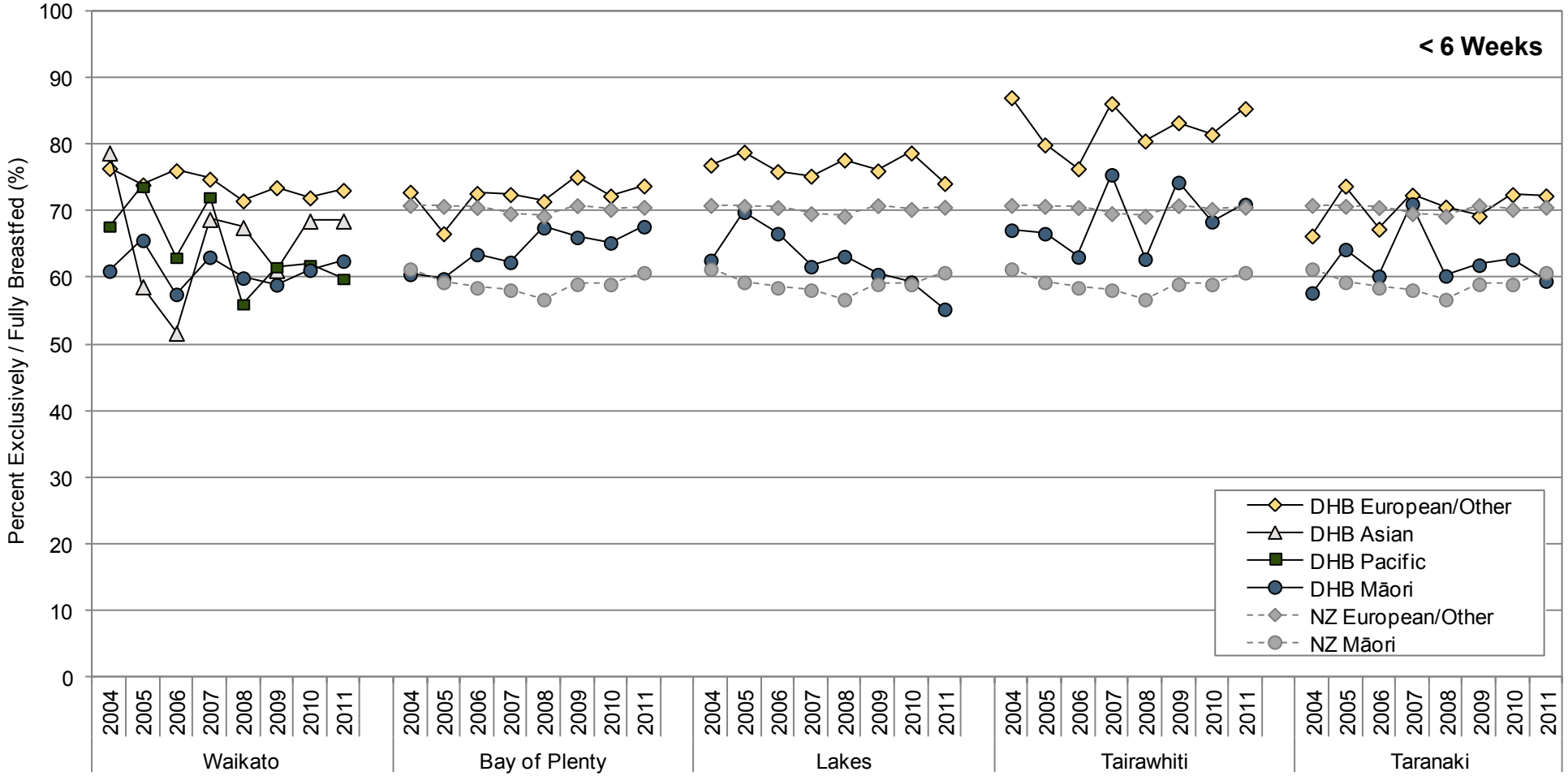
Source: Plunket Client Information System

Figure 21. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age and NZ Deprivation Index Decile, Midland DHBs Year Ending June 2011



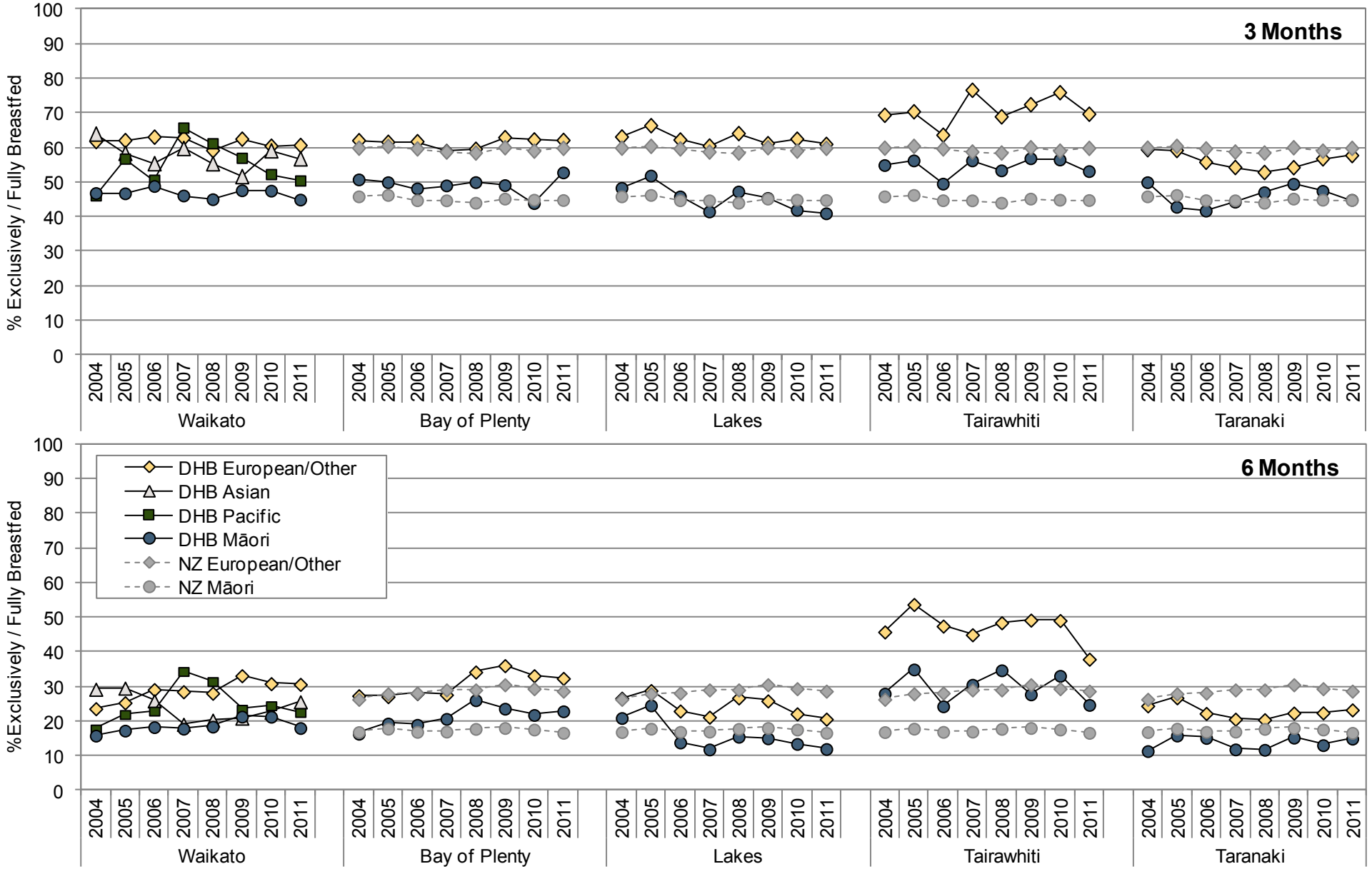
Source: Plunket Client Information System

Figure 22. Proportion of Plunket Babies who were Exclusively or Fully Breastfed at Less Than 6 Weeks by Ethnicity, Midland DHBs vs. New Zealand
Years Ending June 2004−2011



Source: Plunket Client Information System

Figure 23. Proportion of Plunket Babies who were Exclusively or Fully Breastfed at 3 Months and 6 Months by Ethnicity, Midland DHBs vs. New Zealand Years Ending June 2004−2011



Source: Plunket Client Information System

Midland Region Distribution by Ethnicity

In the Midland Region during the years ending June 2004–2011, exclusive/full breastfeeding rates at <6 weeks, 3 months and 6 months were higher for European/Other babies than for Māori babies in all five DHBs. Differences for Pacific and Asian babies in the Waikato were more variable during this period (**Figure 22**, **Figure 23**).

Summary

In New Zealand during June 2004–2011, the proportion of babies who were exclusively or fully breastfed remained fairly static, with exclusive/full breastfeeding rates in the year ending June 2011 being 66.3% at <6 weeks, 54.9% at 3 months and 25.2% at 6 months of age. When broken down by ethnicity, exclusive/full breastfeeding rates at <6 weeks were consistently higher for European/Other babies than for babies of other ethnic groups. At 3 and 6 months however, rates were generally higher for European/Other > Asian/Indian > Māori and Pacific babies, with differences between Asian/Indian and Māori and Pacific babies increasing as the period progressed.

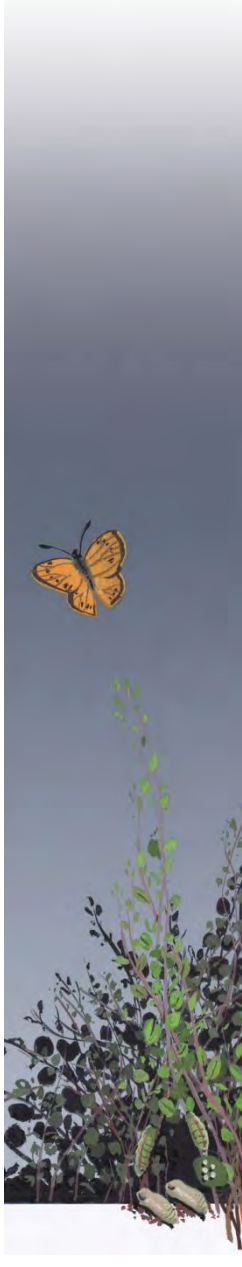
During June 2004–2011, exclusive/full breastfeeding rates at <6 weeks were higher than the New Zealand rate in all Midland DHBs. By 3 months however, rates in most DHBs were closer to the New Zealand rate, with the exception of Tairawhiti, where rates remained consistently higher, as they did at 6 months. During the late 2000s, breastfeeding rates in Lakes and Taranaki were lower than the New Zealand rate, while rates in the Bay of Plenty were higher. During 2011, breastfeeding rates at all three ages were lower for babies living in the most deprived (NZDep decile 10 vs. decile 1) areas. During 2004–2011, rates at all three ages were also higher for European / Other babies than for Māori babies.

Local Policy Documents and Evidence-Based Reviews Relevant to the Promotion of Breastfeeding

In New Zealand there are a range of policy documents relevant to the promotion and support of breastfeeding and these are briefly summarised in **Table 27**, along with a number of evidence-based reviews which consider these issues in the overseas context.

Table 27. Local Policy Documents and Evidence-Based Reviews Relevant to the Promotion or Support of Breastfeeding

Ministry of Health Policy Documents
National Breastfeeding Committee. 2009. **National Strategic Plan of Action for Breastfeeding 2008-2012**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/8939/$File/breastfeeding-action-plan.pdf This Plan contains the advice of the National Breastfeeding Committee to the Director General of Health. The Plan recognises that the influences on breastfeeding rates are complex and that cultural change is required to improve breastfeeding rates. While the heath sector has the leading role in the protection, promotion and support if breastfeeding all sectors of society need to be involved. The Plan proposes objectives to describe what needs to be done and a list of desired outcomes in each of the following settings: government, family and community, health services, and workplaces, childcare and early childhood education.
Ministry of Health. 2008. **Food and Nutrition Guidelines for Healthy Infants and Toddlers (Aged 0-2): A background paper (4th Ed)** Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/7756/$File/food-and-nutrition-guidelines-0-2-may2011.pdf This paper provides up to date policy advice and information on nutrition and physical activity for infants and toddlers to be used: as a basis for education programmes to support families and children, to guide and support health practitioners in their work, to provide a basis for preparing policies on the protection, promotion and support of breastfeeding and to identify inequalities so that education and support can be targeted at reducing inequalities related to nutrition and physical activity. Chapter 3 includes concise but comprehensive guidelines on breastfeeding. Exclusive breastfeeding is recommended until an infant is six months of age. Chapters 7, 8, and 9 relate specifically to Māori, Pacific and Asian infants and toddlers respectively.



Ministry of Health. 2007. **Implementing and Monitoring the International Code of Marketing of Breast-milk Substitutes in New Zealand: The Code in New Zealand**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/6604/$File/breastmilk-substitutes-marketing-code-aug07.pdf

This document provides a New Zealand Interpretation of *International Code of Marketing of Breast-Milk Substitutes* (WHO 1981) and relevant World Health Assembly resolutions (to which New Zealand is a signatory). It includes the Code of Practice for Health Workers in New Zealand and the Code of Practice for the Marketing of Infant Formula.

Ministry of Health. 2006. **Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/4676/$File/food-and-nutrition-guidelines-preg-and-bfeed.pdf

This publication is intended for the use of health practitioners, educators and caregivers to assist them to provide advice and support to pregnant and breastfeeding women and their families in achieving a healthy lifestyle.

Ministry of Health. 2004. **Child and Youth Health Toolkit**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf

Chapter 9 deals with breastfeeding which is one of the child health indicators previously monitored by the Ministry. It provides evidence-based information on how to improve breastfeeding rates, and is intended for use by DHB funders and planners, health professionals and providers. Measures which may help to improve breastfeeding rates are stated to be achieving Baby Friendly Hospital Initiative accreditation for maternity facilities and Baby Friendly Accreditation of primary care practitioners, and better coordination between lead maternity carers and well child providers. It is important that all health professionals provide consistent and accurate advice for the optimal support of women.

Ministry of Health. 2002. **Breastfeeding: A Guide to Action** Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/f872666357c511eb4c25666d000c8888/c1a26ae746d7b471cc256c770008660d/$FILE/breastfeeding.pdf

The aim of this Action Plan is to achieve an improvement in the breastfeeding rates of Māori and Pacific peoples and of other New Zealanders. The seven goals of the Action Plan are to:

- establish an intersectoral breastfeeding committee
- achieve Baby Friendly Hospitals throughout New Zealand
- gain active participation of Māori and Pacific whānau to improve breastfeeding promotion, advocacy and support
- establish nationally consistent breastfeeding reporting and statistics
- increase breastfeeding promotion, advocacy and co-ordination at both national and local levels
- ensure pregnant women can access antenatal education
- ensure high quality and on-going postpartum care

Systematic and Other Reviews From the International Literature

U.S. Department of Health and Human Services. 2011. **The Surgeon General's Call to Action to Support Breastfeeding**. Washington, DC: U.S. Department of Health and Human Services, Office of the Surgeon General. http://www.surgeongeneral.gov/topics/breastfeeding/calltoactiontosupportbreastfeeding.pdf

The U.S. Surgeon General has identified 20 key actions to improve support for breastfeeding. These are presented under the headings: Actions for Mothers and their Families, Actions for Communities, Actions for Healthcare, Actions for Employment, Actions for Research and Surveillance, and Actions for Public Health Infrastructure. As well as setting out implementation strategies for each action, this report has chapters on the importance of breastfeeding, rates of breastfeeding in the U.S., barriers to breastfeeding, and breastfeeding from a public health perspective. Links to resources related to the report including Action Guides for doctors, nurses and healthcare leaders, and the executive summary can be found on this CDC website: http://www.cdc.gov/breastfeeding/promotion/calltoaction.htm

Jaafar SH, Jahanfar S, Angolkar M, et al. 2011. **Pacifier use versus no pacifier use in breastfeeding term infants for increasing duration of breastfeeding**. Cochrane Database of Systematic Reviews, 2011(3), Art. No.: CD007202. DOI:10.1002/14651858.CD007202.pub2.

The World Health Organisation's *Ten steps to successful breastfeeding* recommends avoiding the use of pacifiers for breastfeeding infants. This review reports that a meta-analysis of two RCTs (involving healthy full term breastfeeding infants) indicated that pacifier use had no significant effect on the proportion of infants exclusively breastfed at three months (risk ratio (RR) 1.00), or at four months (RR 0.99) and it also had no effect on the proportion of infants partially breastfed at three months (RR 1.00), or at 4 months (RR 1.01). The authors concluded that pacifier use by healthy term breastfeeding infants of motivated mothers did not significantly affect either the prevalence or duration of full or partial breastfeeding but "there is insufficient information on the potential harms of pacifiers on infants and mothers".

Crepinsek MA, Crowe L, Michener K, et al. 2010. **Interventions for preventing mastitis after childbirth**. Cochrane Database of Systematic Reviews, 2010(8), CD007239.

Complications of lactation, including mastitis, are common reasons given by mothers for weaning their infants. This review assessed the effects of preventive strategies for mastitis and their effects on subsequent lactation. Three RCTs compared various antibiotics vs. no antibiotics for preventing mastitis. (Two of the 3 trials were very small and the largest trial involved women with HIV.) One RCT (211 mother infant pairs) compared a 30 minute breastfeeding education session with usual care and one RCT (40 participants) compared anti-secretory factor (AF) in cereal vs. a similar cereal without AF. Overall, the studies were considered to be poor in quality and design and the review authors concluded that there was insufficient evidence to show effectiveness of any of the interventions.

Mangesi L, Dowswell T. 2010. **Treatments for breast engorgement during lactation**. Cochrane Database of Systematic Reviews, 2010(9), Art. No.: CD006946. DOI: 10.1002/14651858.CD006946.pub2.

Breast engorgement is common in new mothers and can be painful and distressing. It can inhibit successful establishment of breast feeding and it is associated with more serious illness such as breast infection. This review included eight RCTs or quasi-RCTs of different treatments for breast engorgement (744 women in total): cabbage leaves (two studies), acupuncture (two studies), cold gel packs (one study), pharmacological treatments (two studies) and ultrasound (one study). The review authors concluded that, while some of these interventions may be promising, the available evidence from the trials was insufficient to justify widespread implementation of any of the interventions.

Jahanfar S, Ng C-J, Teng Cheong L. 2009. **Antibiotics for mastitis in breastfeeding women**. Cochrane Database of Systematic Reviews, 2009(1), Art. No.: CD005458. DOI: 10.1002/14651858.CD005458.pub2.
Content updated after new search for studies, no change in conclusions, published in Issue 7, 2010

Mastitis, which may be either infective (often due to *Staphylococcus aureus*) or non-infective, is usually treated by effective milk removal, pain medication and antibiotics. The aim of this review was to investigate the effectiveness of antibiotic therapies for relieving symptoms of mastitis. The authors found only one small RCT (25 participants) comparing amoxicillin with cephradine (no significant difference found) and a three-armed 1984 study which compared "supportive therapy" (breast emptying alone), antibiotics plus supportive therapy, and no therapy. The 1984 study had some design problems (including analysing individual breasts rather than women and since some women had two affected breasts the treatment effect in each breast would not have been independent) however the findings suggested that symptoms resolved more rapidly in women who received antibiotics. The authors concluded that there was insufficient evidence to either confirm or refute the effectiveness of antibiotic therapy for mastitis during lactation.

Becker GE, McCormick FM, Renfrew MJ. 2008. **Methods of milk expression for lactating women**. Cochrane Database of Systematic Reviews, 2008(4), Art. No.: CD006170. DOI: 10.1002/14651858.CD006170.pub2.

For a number of reasons, including prematurity, illness, abnormalities or separation some babies are not able to be fed at their mother's breast but they can be fed expressed breast milk. This review evaluated the acceptability, effectiveness, safety, effects on milk composition and bacterial contamination of milk, and cost implications of a variety of methods of milk expression, including hand expression and manual, battery and electric pumps. This review included 12 studies which were either RCTs, quasi-RCTs or cross-over trials and six of these (397 mothers) provided data suitable for the analyses. Most studies were instigated by pump manufacturers. One study found that, compared to hand expression, a significantly greater volume of milk was expressed (over the six days after birth) both with an electric pump (373.10 ml, 95% CI 161.09 to 585.1 ml) and with a foot-operated pump (212.10 ml, 95% CI 9.39 to 414.8ml) although this difference may not be clinically significant. The difference in milk volume expressed between the electric pump and the foot-operated pump was not significant. One study found that women provided with a relaxation tape produced a greater volume of milk at one expression (34.70 ml, 95% CI 9.51 to 59.89). One study found that simultaneously pumping both breasts saved time compared to sequential pumping (3.50 hours/week, 95% CI 1.39 to 5.61) but there was no difference in milk volume. Different pumping methods showed no differences in milk contamination, breastfeeding at discharge, fat content of milk or serum prolactin. There was poor reporting of maternal satisfaction, adverse effects on mothers and economic effects of interventions. The authors state that further high quality, independently funded research is needed.

The National Breastfeeding Advisory Committee. 2007. **Protecting, Promoting and Supporting Breastfeeding in New Zealand: A review of breastfeeding in New Zealand, and of the evidence for successful interventions supporting breastfeeding**. Wellington: The National Breastfeeding Advisory Committee.
http://www.moh.govt.nz/moh.nsf/pagesmh/7530/$File/nbac-litreview.pdf

This literature review was commissioned by the National Breastfeeding Advisory Committee to inform the development of the National Strategic Plan of Action for Breastfeeding (above). It covers the context and history of breastfeeding in New Zealand, the local and global legislative and policy context for breastfeeding, social and clinical issues influencing breastfeeding and a literature review of the evidence for interventions supporting breastfeeding. It concludes with a concise summary of common interventions undertaken both in New Zealand and internationally and briefly assesses the quality of these interventions based on the evidence from the literature. Interventions of proven effectiveness were:

- Training health professionals in the psycho-social and physiological elements of breastfeeding and lactation management
- Accreditation to the Baby Friendly Hospital Initiative and implementation of the 10 Steps to successful breastfeeding, particularly the following clinical practices: kangaroo care, training of staff, early initiation of breastfeeding, the promotion of exclusive breastfeeding and limitation of any form of supplementation, and on-demand breastfeeding
- Skilled peer support provided by well-trained and knowledgeable peers
- Home visitation as a service delivery mechanism
- The provision of adequate workplace facilities in which to express breast milk or to breastfeed
- Childcare that is supportive of breastfeeding.

Promising interventions identified included prenatal education, biological nurturing approaches, social marketing, support for fathers, family/whanau and friends, and developing breastfeeding friendly business and public spaces.

Abdulwadud OA, Snow ME. 2007. **Interventions in the workplace to support breastfeeding for women in employment**. Cochrane Database of Systematic Reviews, 2007(3), Art. No.: CD006177. DOI: 10.1002/14651858.CD006177.pub2.

The authors of this review were unable to identify any RCTs or quasi-RCTs evaluating the effectiveness of workplace interventions in promoting breastfeeding among women returning to paid work after the birth of their child. They say "current sources of information on this important public health topic are limited to two US-based non-experimental studies. In both studies, the participants were self-selected and there were no true control groups".

Moore ER, Anderson GC, Bergman N. 2007. **Early skin-to-skin contact for mothers and their healthy newborn infants**. Cochrane Database of Systematic Reviews, 2007(3), Art. No.: CD003519. DOI: 10.1002/14651858.CD003519.pub2.

Early skin-to-skin contact (SSC) involves placing the naked baby (ideally soon after birth) prone on the mother's bare chest and covered across the back with a blanket. It is thought that this elicits innate mammalian behaviours from both the mother and the neonate and promotes the release of maternal oxytocin which increases maternal skin temperature (thus warming the neonate) and also decreases maternal anxiety and enhances mother-infant bonding and the likelihood of spontaneous breastfeeding. This review included thirty studies (1925 mother-infant dyads) which were either RCTs of quasi-RCTs comparing early SSC with usual hospital care, however only 8 out of 64 outcome measures had data from more than two of the trials which limited the possibilities for meta-analysis. SCC had statistically significant positive effects on breastfeeding at one to four months post birth (10 trials; 552 participants) (odds ratio (OR) 1.82, 95% CI 1.08 to 3.07), and breastfeeding duration (seven trials; 324 participants) (weighted mean difference (WMD) 42.55, 95% CI -1.69 to 86.79). There were trends found for improved summary scores with early SCC for maternal affectionate love/touch during observed breastfeeding (four trials; 314 participants) (standardized mean difference (SMD) 0.52, 95% CI 0.07 to 0.98) and maternal attachment behaviour (six trials; 396 participants) (SMD 0.52, 95% CI 0.31 to 0.72). One trial (44 participants) found that SSC infants cried for a shorter length of time (WMD -8.01, 95% CI 8.98 to 7.04). Late preterm infants with early SCC had better cardio-respiratory stability (one trial; 35 participants) (WMD 2.88, 95% CI 0.53 to 5.23). No adverse effects from SCC were found. The authors concluded "SSC appears to have some clinical benefit, especially for breastfeeding and for temperature and cardio-respiratory stability in late preterm infants".

Gagnon AJ, Sandall J. 2007. **Individual or group antenatal education for childbirth or parenthood, or both**. Cochrane Database of Systematic Reviews, 2007(3), Art. No.: CD002869. DOI: 10.1002/14651858.CD002869.pub2.

Antenatal education programmes for childbirth and/or parenthood are commonly recommended for pregnant women and their partners. This review assessed the effect of such programmes on knowledge acquisition, anxiety, sense of control, pain, labour and birth support, breastfeeding, infant-care abilities, and psychological and social adjustment. This review included nine RCTs of structured educational programmes provided during pregnancy (to either parent) which were of a general nature (i.e. they did not have a specific focus such as increasing breastfeeding success, improving maternal mental health or reducing smoking). The review included nine trials involving 2284 women. Sample sizes were small and no consistent results were found. There was no data reported on anxiety, breastfeeding success or general social support and the largest study, which examined an educational intervention designed to increase rates of vaginal after previous caesarean section, found that it did not have the desired effect. The authors concluded that the effects of general antenatal education for childbirth and/or parenthood are largely unknown.

Britton C, McCormick FM, Renfrew MJ, et al. 2007. **Support for breastfeeding mothers**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD001141. DOI: 10.1002/14651858.CD001141.pub3.

This review, which assessed the effectiveness of support for breastfeeding mothers, included 34 RCTs or quasi-RCTs (29,385 mother-infant pairs) comparing extra support for breastfeeding mothers with usual care. When all forms of extra support were analysed together there was found to be an increase in duration of "any breastfeeding" (relative risk of stopping any breastfeeding before six months 0.91, 95% CI 0.86 - 0.96). The effect on duration of exclusive breastfeeding was greater than that on "any breastfeeding" (RR 0.81, 95% CI 0.74 to 0.89). The provision of both lay and professional support together significantly extended the duration of any breastfeeding (RR before 4-6 weeks 0.65, 95% 0.51 to 0.82; RR before 2 months 0.74, 95% CI 0.66 to 0.83) but the effect on exclusive breastfeeding was less clear because there was only one high quality trial reporting this outcome and the numbers analysed were small. The use of WHO/UNICEF training significantly prolonged the duration of exclusive breastfeeding (RR 0.69, 95% CI 0.52 to 0.91). The authors state that further research is needed to identify the aspects of support that are most beneficial.

Dyson L, Renfrew M, McFadden A, et al. 2006. **Promotion of breastfeeding initiation and duration: Evidence into practice briefing**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/niceMedia/pdf/EAB_Breastfeeding_final_version.pdf

This document does not represent NICE guidance but is the culmination of work commissioned by the former Health Development Agency (whose functions were transferred to the National Institute for Clinical Excellence when it became the National Institute for Health and Clinical Excellence). It sets out a series of evidence-based actions for promoting both the initiation and the continuation of breastfeeding, particularly among population groups where breastfeeding rates are low. These were developed from a list of interventions for which there is international research evidence of effectiveness which became a list of "what will really work in practice in England". The evidence-based actions are:

- Baby Friendly Initiative (BFI) in the maternity and community services
- Education and/or support programmes
- Changing policy and practice within community and hospital settings in order to support effective positioning and attachment, encourage baby-led feeding, and encourage women with "insufficient milk" through supportive care, teaching technique, providing sound information and reassurance.
- Abandoning the following policies in clinical care in hospitals and the community: restricting timing and/or frequency of breastfeeds in immediate post-natal care, restricting mother-baby contact from birth onwards, routine or medically unjustified supplementary feeding, separating babies from mothers for the treatment of jaundice, and the provision of hospital discharge packs containing promotional material for formula.
- Complementary telephone peer or volunteer support
- Education and support from one professional (targeted particularly to low income women)
- Education and support throughout the first year
- Media programmes targeting teenagers to improve attitudes towards breastfeeding

The briefing (above) is largely based on one evidence briefing and three systematic reviews but appendix B provides details of the individual studies relating to each of the effective and the harmful interventions and the full list of references is contained in appendix D. The publications on which this briefing is largely based are:

Renfrew M, Dyson L, Wallace L, et al. 2005. **The effectiveness of public health interventions to promote the duration of breastfeeding**. London: National Institute of Health and Clinical Excellence. http://www.nice.org.uk/niceMedia/pdf/Breastfeeding_vol_1.pdf

The authors note that there are gaps in the evidence base relating to disadvantaged groups and that these gaps are widest in clinical issues, public policy and women's key concerns. They state "There is very little research to inform any aspect of public policy." Despite this assertion the first two pages of this review contain concise lists of beneficial and harmful interventions (with references) and the remainder of the 176 pages contain a review of the evidence in four chapters: Public Health Interventions, Public Policy Interventions, Clinical Interventions and Health professional and lay breastfeeding educator/counsellor training, education and practice change. The additional appendices for this review (dealing with the methodology) can be found at: http://www.nice.org.uk/niceMedia/pdf/Breastfeeding_vol_2.pdf and a useful summary of this review is at: http://www.nice.org.uk/niceMedia/pdf/Breastfeeding_summary.pdf

Protheroe L, Dyson L, Renfrew M J, et al. 2003. **The effectiveness of public health interventions to promote the initiation of breastfeeding: Evidence briefing**. London: Health Development Agency. http://www.nice.org.uk/nicemedia/documents/breastfeeding_evidencebriefing.pdf

This evidence briefing is a review of reviews published since 1996 about public health interventions for promoting the initiation of breastfeeding. The evidence is reviewed under the headings of Health education, Health sector initiatives, Training of health professionals, Social support from health professionals, Peer support programmes, Media campaigns, Multi-faceted interventions and Packages of interventions: the Scandinavian experience. A useful summary of this publication can be found at: http://www.nice.org.uk/niceMedia/documents/breastfeeding_summary.pdf

Dyson L, McCormick F, Renfrew MJ. 2005. **Interventions for promoting the initiation of breastfeeding**. Cochrane Database of Systematic Reviews, 2005(2), Art. No.: CD001688. DOI: 10.1002/14651858.CD001688.pub2.

This review evaluated the effectiveness of interventions to encourage women to breastfeed in terms of changes in the number of women who start breastfeeding. It included eleven trials and data from eight trials (1553 women) was used in the statistical analyses. Data from five studies involving 582 low-income mostly ethnic minority women in the U.S., who typically have low breastfeeding rates, showed that, compared to usual care, breastfeeding education had a significant effect in increasing breastfeeding initiation rates (risk ratio (RR) 1.57, 95% CI 1.15 to 2.15, P = 0.005). Analyses of different sub-groups showed that, regardless of ethnicity and feeding intentions, both one-to-one, needs-based, informal education sessions and generic, formal antenatal education sessions are effective in producing an increase in breastfeeding initiation rates among low-income women but the review authors concluded that needs-based, informal, repeated education sessions are likely to result in larger increases. They note that these findings are based on studies on low-income women in the U.S. and may not be applicable to other places.

Hector D, King L, Webb K. 2004. **Overview of recent reviews of interventions to promote and support breastfeeding**. Sydney: NSW Centre for Public Health Nutrition University of Sydney, NSW Department of Health. http://www.health.nsw.gov.au/pubs/2004/pdf/bf_interventions.pdf

This Australian publication summarises systematic reviews of interventions to promote breastfeeding and provides a framework and describes a process for systematic intervention planning. It is intended for those working to improve the breastfeeding practices of the NSW population. The authors note that while there is evidence relating to education and support strategies designed to enhance mothers' personal skills, and to health service strategies to make hospital practices conducive to breastfeeding there is no evidence of effective strategies related to public policy, supportive environments or community action. Chapter 3 covers determinants of breastfeeding, Chapter 4 Intervention options, Chapter 5 the sources of information and Chapter 6 conclusions and recommendations.

Kramer MS, Kakuma R. 2002. **Optimal duration of exclusive breastfeeding**. Cochrane Database of Systematic Reviews, 2002(1), Art. No.: CD003517. DOI: 10.1002/14651858.CD003517.

This review assessed the effects on child health, growth and development, and on maternal health, of six month's exclusive breastfeeding compared to three to four month's exclusive breastfeeding with mixed breastfeeding thereafter until six months (mixed breastfeeding involves the addition of complementary liquid or solid foods.) The results of two controlled trials and 18 observational studies (from both developed and developing countries) suggest that exclusive breastfeeding for six months has a number of benefits over exclusive breastfeeding for three to four months followed by mixed breastfeeding. These benefits are: lower risk of gastrointestinal infection, more rapid maternal weight loss and delayed return of menstrual periods. Benefits in terms of reduced risks of other infections or risks of allergic disease have not been demonstrated. Exclusive breastfeeding for six months has not been shown to impair growth but it has been associated with a reduced blood iron levels in infants in developing countries.

Fairbank L, O'Meara S, Renfrew MJ. 2000. **A systematic review to evaluate the effectiveness of interventions to promote the initiation of breastfeeding**. Health Technology Assessment, 4(25), 1-171. http://www.hta.ac.uk/fullmono/mon425.pdf

This review identified promotion programmes which are effective in increasing the number of women who start to breastfeed. In addition it assessed the impact of such programmes on the duration and/or exclusivity of breastfeeding and identified implications for practice within the UK and priority areas for future research. It included 14 RCTs, 16 non-RCTs and 29 before-and-after studies. The authors concluded that three types of interventions are useful in developed countries: education (informal small group antenatal education, one-to-one health education and peer support programmes), packages of intervention which include a peer support programme and/or a media campaign combined with structural changes to the health sector and/or health education activities, and structural changes in hospital practices to promote breastfeeding, for example rooming in.

Tedstone A, Dunce N, Aviles M, et al. 1998. **Effectiveness of interventions to promote healthy feeding in infants under one year of age: a review**. London: Health Education Authority. http://www.nice.org.uk/nicemedia/documents/effective_feeding_infants.pdf

This review included 20 (older) studies of interventions to promote breastfeeding. The authors state that "In the majority of studies included interpretation of the impact of the intervention was hampered by the quality of evaluation, study design weaknesses or failure to report methodologies fully". In summarising the main findings, the authors stated: "The most successful breastfeeding promotions were based in the U.S.A. and, in general, were long term, spanning the pre- and post-natal periods and intensive, involving multiple contacts with a professional breastfeeding promoter or peer counsellor. Weaker evidence from single studies suggests that including partners or incentives or changing the contents of hospital; discharge packs may facilitate breastfeeding". The least successful programmes were: those implemented in the post-natal period only, those where promotion of breastfeeding was only part of a programme, those involving special visits to the hospital or clinic in addition to routine visits, and those provided by telephone only.

Other Relevant Publications

Department of Labour. 2010. **Breastfeeding in the workplace: a guide for employers**. Wellington: Department of Labour. http://www.dol.govt.nz/er/holidaysandleave/parentalleave/infantfeeding/breastfeeding.pdf

Under section 69Y of the Employment Relations Act 2000, since 1 April 2009 employers have been required, as far as it reasonable and practicable, to provide appropriate breaks and facilities for employees who wish to breastfeed their infants or express milk during working hours. This publication provides guidance for employers on this issue.

New Zealand Breastfeeding Authority Board. 2011. **WHO/UNICEF Baby Friendly Hospital Initiative Documents for Aotearoa New Zealand 2011**. Christchurch: New Zealand Breastfeeding Authority Board. http://www.babyfriendly.org.nz/resources/resources_bf.html

The Ministry of Health has contracted the New Zealand Breastfeeding Authority Board (NZBA) to develop and manage the Baby Friendly Hospital Initiative (BFHI) which is a global effort launched by the WHO and UNICEF in 1991 to implement practices that protect, promote and support breastfeeding. The New Zealand BFHI documents have been developed from the WHO BFHI documents (see below) to reflect the unique circumstances of New Zealand's health system and acknowledge the Treaty of Waitangi principles of protection, partnership and participation. The format of the documents differs somewhat from that of the WHO documents.

The New Zealand BFHI documents, which can be found on the NZBA website (select BFHI resources from the drop down list under the resources tab) are:

Forward; Part 1: Background and Baby Friendly Implementation in New Zealand; Part 2: The NZBA Criteria for BFHI; Part 3: Self-Appraisal Questionnaire; Part 4: BFHI Assessment Manual; Part 5: BFHI Assessment Summary; Part 6: Resources for Aotearoa New Zealand; Part 7: BFHI Annual Self-Appraisal Questionnaire

New Zealand Breastfeeding Authority. **Baby Friendly Community Initiative**. http://www.babyfriendly.org.nz/baby_friendly/mat_ass_stages.html accessed 10/11/11.

The Ministry of Health has contracted the New Zealand Breastfeeding Authority Board (NZBA) to facilitate the implementation of the Baby Friendly Community Initiative (BFCI) in health services in the community. The BFCI consists of a seven point plan for the protection, promotion and support of breastfeeding in the community (details of which can be found on the website) in order to achieve three objectives: to increase the proportion of babies who are breastfed, to increase the duration of exclusive breastfeeding, and to sustain breastfeeding beyond six months alongside feeding with appropriate, adequate and safe complementary foods. The BFCI also included standards of care for the non-breastfeeding mother and her baby.

World Health Organization, UNICEF. 2009. **Baby-Friendly Hospital Initiative Revised, updated and expanded for integrated care**. Geneva: World Health Organization and UNICEF. http://www.who.int/nutrition/publications/infantfeeding/9789241594950/en/index.html

These documents are revisions of the original 1992 BFHI guidelines and the first four of the five sections of the revised BFHI package are available on the website. The five sections are 1. Background and Implementation, 2. Strengthening and Sustaining the BFHI: A course for decision-makers, 3. Breastfeeding Promotion and Support in a Baby-friendly Hospital: a 20-hour course for maternity staff, 4. Hospital Self-Appraisal and Monitoring, and 5. External Assessment and Reassessment. Section 5 is for limited distribution only to external assessors.

ISSUES MORE COMMON IN CHILDREN, OR CHILDREN AND YOUNG PEOPLE

TOTAL AVOIDABLE MORBIDITY AND MORTALITY

IN DEPTH TOPIC: MODELS OF PRIMARY HEALTH CARE DELIVERY FOR CHILDREN

Introduction

Children under the age of 15 years are over-represented in New Zealand's ambulatory sensitive hospitalisations (ASH). Among 0-4 year olds, an average of over 18,000 ASH cases per annum have been admitted to hospital over the last ten years (see *Ambulatory Sensitive Hospitalisations*, **page 139**) and in 2007, reducing ASH in this young population was identified as a priority for action by the Ministry of Health [29].

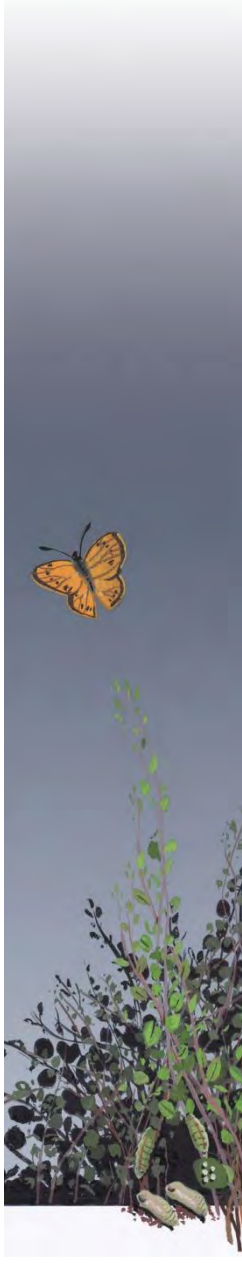
ASH is used as a measure of effectiveness for primary health care delivery. This in-depth topic, therefore, considers primary health care delivery in New Zealand and identifies interventions that could contribute to reducing ASH, i.e. those avoidable hospitalisations arising from acute and chronic conditions that can be treated or managed within a primary care system. The following questions are addressed:

1. What are the health conditions that most commonly result in ASH among children and what does primary health care offer to reduce these avoidable hospital admissions?
2. How is New Zealand's primary health care organised with respect to children's care?
3. What are the barriers to accessing primary health care in New Zealand that mean children are not receiving appropriate and timely primary health care?
4. What can New Zealand learn from the international literature and experience regarding barriers to reducing ASH, and what interventions have worked?
5. What aspects of primary health care could be modified by DHBs to achieve the desired health gains for children in New Zealand?

Common Conditions Leading to ASH in Young Children

ASH data quantify cases where hospitalisation could have been avoided. Among the total population, contributors to ASH are identified as acute diseases, injury and chronic conditions [30]. As can be seen in the *Ambulatory Sensitive Hospitalisations* section starting on **page 139**, common conditions for New Zealand children leading to avoidable hospitalisation are respiratory illnesses, asthma, dental conditions and skin infections. A large proportion of ASH cases are aged <5 years, and among these, a common characteristic of many of the conditions seen is an acute or abrupt onset. Some however, could also be addressed by improved management of chronic conditions, of which asthma is the most common. The 2006/07 NZ Health Survey, which included data from 4921 children aged 0-14 years, indicates that 31.7% of 0-4 year olds have a chronic condition [31]. A reduction in ASH rates in New Zealand children, therefore, requires acute infectious and communicable diseases and chronic conditions to be either prevented or well managed in the community. Effective, efficient and accessible primary health care services are critical to achieving such a reduction.

A systematic review of effective interventions for reducing ASH among all age groups was undertaken in New Zealand in 2008 [30]. From 146 articles that met their criteria, the authors identified five care processes that highlighted individual, organisational and systems issues that they considered, if addressed, would be beneficial to reducing ASH. They also made three recommendations arising from the review, two of which are relevant to children. Expanding access to primary care for children, the poor and the underserved was expected to reduce the burden of ASH, and specifically implementing asthma-related educational and monitoring interventions may eventually reduce ASH in children and adults [30]. A major limitation of this review was the reviewers' brief which was to examine strategies to reduce ASH. Interventions that improved health outcomes were not included unless they also reduced ASH.



What Primary Health Care Offers

A consistent relationship has been shown between more or better primary care and improved health outcomes [32,33]. Starfield et al, who are leading primary care researchers in the United States (US), observed that *"The beneficial effects of primary care on mortality and morbidity can be attributed at least in part to the focus of primary care on the person rather than the management of particular diseases"* [32](p480). Systematic reviews predominately examine primary care with respect to outcomes for the adult population, however, there are benefits to children evident, such as lower rates of infant mortality and low birth weight [32]. In addition to immediate acute cases leading to childhood ASH, many of the adult conditions amenable to strategies used in primary care are initiated in childhood or adolescence. These include patterns of eating, exercising, exposure to smoking and alcohol, and many are linked to the social determinants of health.

According to Starfield and her colleagues, better primary health care benefits health because it increases access to health services for relatively deprived population groups; contributes to the quality of clinical care by focusing on the patients' health in general (where specialist services focus on the outcome for the specific condition); attends to the patient's condition in the context of other health problems or concerns; is able to promote preventive interventions not directly related to one disease or condition; fosters the management of health problems before they become serious enough to require hospitalisation or emergency services; and reduces unnecessary specialist care [32]. Other advantages include the ability to provide continuity of care, with a specific example being the increased likelihood of disadvantaged children making preventive visits when their source of care is a good primary care practitioner.

New Zealand's Primary Health Care

Effective primary health care is expected to reduce ASH for adults and children. How the system operates is a function of its underlying philosophy, how it has been set up, and how it operates within the Zealand health system, and in the community as a whole. The following sections note key aspects of the New Zealand primary health care system and its delivery in relation to children.

In the early 2000s, policy changes were introduced into New Zealand. A preparatory discussion document circulated in 2000 called '*Future Shape of Primary Health Care'* reflected the underlying philosophy: *"People need primary health care services that take a broad view, covering physical (tahatinana), mental (tahahinengaro), social (tahawhänau) and spiritual (tahawairua) aspects."* Signalled in the document was the expansion of primary health care from the traditional service provided by the general practitioner (GPs): *" the combination of services required might be beyond the scope of a single primary care organisation and that collaboration would be required"* [34].

In 2001, the New Zealand Strategy for Primary Health Care was released, reinforcing an underlying approach: *"Quality primary health care means essential health care based on practical, scientifically sound, culturally appropriate and socially acceptable methods that:*

- *are universally acceptable to people in their communities;*
- *involve community participation;*
- *are integral to and a central function of New Zealand's health system; and*
- *are the first level of contact with our health system."* [35].

Expectations were that primary health care providers would work with population groups who had poor health or were missing out on services, provide services to improve and maintain the health of the population and provide the first line of services to restore health when people were unwell. In addition, primary health care services were to involve their communities, especially iwi/Māori communities, in their governing processes and service design and evaluation in a meaningful way. They were also to involve all providers and

practitioners in the organisation's decision-making and work cooperatively with other professionals who delivered primary care including the community pharmacy, physiotherapy, dental health, family planning, sexual health, midwifery and traditional healers [36].

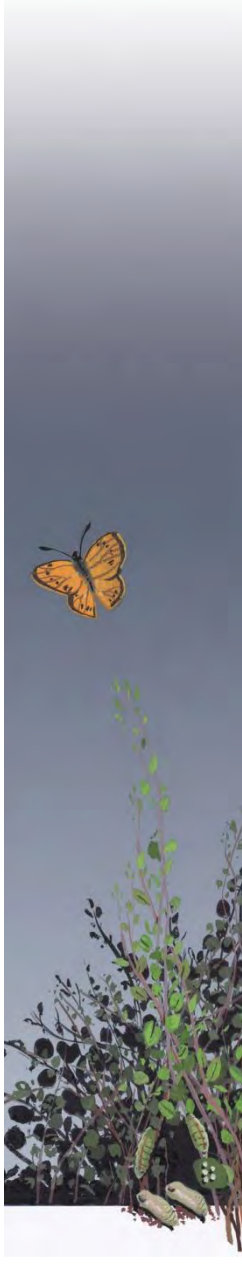
The intent of the New Zealand strategy was consistent with the World Health Organization guidelines on primary health care that emphasised meeting goals for equity, social justice, and social development [37,38]. However, commentators have since identified difficulties for New Zealand in implementing such sweeping policy changes, particularly noting the speed of implementation, the complexity of the New Zealand funding process and an overlying question as to whether the hoped-for gains could actually be delivered in practice [39]. A comparison of the New Zealand system with that of Australia, Canada, the United Kingdom, the United States, the Netherlands, Japan, Hong Kong and Taiwan identified that, with the exception of the Netherlands, most countries struggle to meet four key dimensions of the WHO reforms related to: universal coverage, service delivery, public policy and leadership [40]. The authors identified that barriers to New Zealand achieving these WHO dimensions were the on-going existence of primary care charges to the patient (despite policy intended to reduce these costs) and a lack of capacity to coordinate with secondary care in relation to service delivery and with public health on public policy.

More recently, primary health care policy in New Zealand has focused more closely on coordination with secondary services and reducing demands on this sector. In 2009, the Ministry of Health called for feasibility studies to develop Integrated Family Health Centres (IFHC). Preference was to be given to those applications from services that included a wide range of health professionals, would be open for extended hours and have walk-in access options, and planned to provide a wide range of services, for example, diagnostics and/or radiology [41,42]. "*Better, Sooner, More Convenient Health Care in the Community*" showcases the studies [41] and reiterates the emphasis. For example, in their IFHC programme Midlands Health Network intended to reduce the predicted increase in demand on the health system from the growing older population and to put the patient at the centre of the care process [43]. Two expectations signalled were that nurses would play a major role in service delivery, and that information technology (IT) development was important: the latter to facilitate communication between the patient and the multidisciplinary team in primary health care, and also between primary health care and secondary level specialists. The programmes presented in "*Better, Sooner, More Convenient Health Care in the Community*" highlight an active rather than reactive role for primary health care, with the emphasis on a curative role, or one of managing disease rather than modifying the context that generate the undesirable ASH rates among children for whom the primary health care organisation is responsible [41]. No evaluations appear to be available to date on these proposals.

Funding of Primary Health Care in New Zealand

New Zealand's secondary health care system is paid from public monies, but its primary health care has never been a free service at first point of contact in this country. The original intention was for primary services to be free prior to the 1938 legislation that established the basis of much of New Zealand's health system [44], however, general practitioners were able to retain a for-profit system. This resulted in a mixed public-private funded system for primary health care [45]. Concerns about the barriers such a fee for service model posed to primary care access for children however, lead to the introduction the *Free Child Health Care Scheme* (FCHCS) in 1996. At its initiation the scheme offered an increased subsidy of $32.50 per consultation for children under the age of 6 years, with doctors retaining the right to charge co-payments as required [46].

Further changes were initiated in the early 2000s when primary care shifted from medical care being predominantly provided by for-profit general practices, to District Health Boards (DHBs) being charged with the overall responsibility for "*assessing the health and disability needs of communities in their regions, and managing resources and service delivery to best meet those needs" [47]*. Funding under this scheme was for not-for-profit Primary Healthcare Organisations (PHOs) on the basis of capitation. Patients were required to



enrol in one of the PHOs in order for subsidies, whether for visits or prescriptions or other services, to be available to them and to the service provider. In reality, patients often continued to face a co-payment for services [48]. However, the system reflected a considerable change in primary care organisation especially as it meant PHOs (and GPs) were now publicly accountable for the funding they received [44].

A number of the funding changes were intended to make access to primary health care easier. Most useful to child health was the low cost 'Access' subsidy available to PHOs who had at least 50% of their population with high needs. The introduction of this subsidy appears to have resulted in a reduction in the co-payment required for the visit, although the alternative subsidy (for other PHOs categorised as Interim) may not have been passed on as faithfully to patients as patient fees did not reduce [44]. The funding process was modified further to reduce the cost barrier for the least advantaged. For example, a community services card was introduced that limited payment for services, including for pharmaceuticals, for those who met criteria such as low income. Free primary health care for children under 6 years was extended to all participating PHOs, not only those on Access. However, the subsidy for under 6s may not operate universally, as after-hours services are not included in the subsidy scheme. Some PHOs address this by choosing to confer the child's subsidy to after-hours services.

Alongside these changes, two additional initiatives were implemented that have assisted in maintaining low or zero fees for many children. The Very Low Cost Access Scheme was introduced in 2006 to encourage PHOs to deliver low cost primary care. To be eligible, practices had to commit (amongst other measures) to free consultations for children under six years of age. In 2007, the *Zero Fees for Under Sixes* package was introduced that provided additional funding for practices committed to providing free care to children, which alongside annual adjustments for capitation, brought total funding to $45.70 per notional visit (see text box below) [46].

Very Low Cost Access Scheme

http://www.moh.govt.nz/moh.nsf/indexmh/phcs-projects-lowcost

The Very Low Cost Access payment was introduced on 1 October 2006. It is designed to support PHOs that charge very low fees in order to reduce health inequalities in high needs communities. It is a voluntary initiative, which provides extra funding in return for PHOs and individual practices agreeing to maintain fees within certain thresholds. Current (as at September 2011) fee thresholds are:

Zero fees for children 0-5 years

$11.50 for children 6-17 years

$17.00 for adults 18 years and older

New practices to the program must meet the eligibility criteria of 50% high needs population (Māori, Pacific or NZDep Quintile 5). The PHO must also be participating in the PHO Performance Programme, and must have entered into the most current version of the PHO Agreement.

Zero Fees for Under 6s

http://www.moh.govt.nz/moh.nsf/indexmh/phcs-projects-lowcost-under6s

From January 2008, a fee has been available to practices that commit, each quarter, to providing free standard consultations to children under 6 years. It is a voluntary opt on/opt off scheme designed to support more practices to provide free primary care to children. Practices must belong to a PHO that is participating in the PHO Performance Programme and that has entered into the most current version of the PHO Agreement. Practices receiving a Very Low Cost Access payment cannot receive the Under 6s payment as well.

New Zealand Children's OECD Rating

Despite the changes made to the primary health care system that, in theory, have the potential to address some of New Zealand's inefficiencies, the 2009 OECD report, *Doing Better for Children* ranked New Zealand at 29 out of 30 countries for 'health and safety comparative policy-focused child wellbeing' [49]. OECD advice was for New Zealand to focus its policies on child poverty and child health, especially during the early years of the child's life. The lack of spending particularly on younger children was identified, as this was only half of that spent on children when they were older. The high rate of ASH in New Zealand, that is the level of hospitalisations for preventable infections, illness and conditions, may reflect this very poor result.

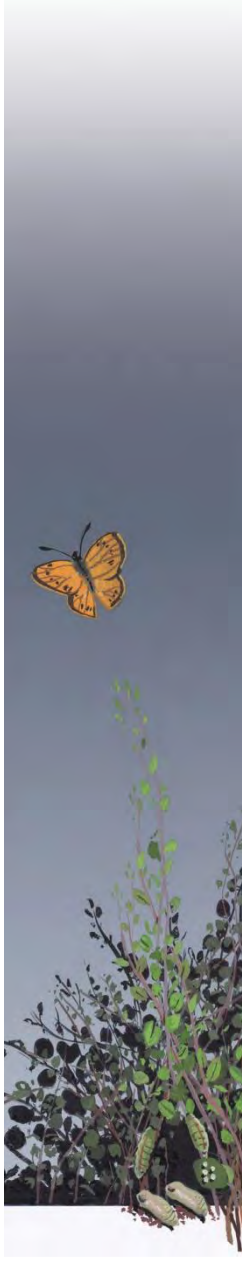
Delivery of Primary Health Care to New Zealand Children

At present, children under 5 years have two main points of entry into primary health care in New Zealand. They can be enrolled with a Primary Healthcare Organisation (PHO). The PHO receives a subsidy for free care to under 6 year olds which is available to all participating PHOs as an incentive to ensure young children can access timely adequate primary health care. Most young children also access primary care through the child health services delivered through WellChild/Tamariki Ora (WC/TO) contracts funded by the Ministry of Health [50]. Additional primary health care services are accessed as children get older through health nurses in schools or in the community (see also *Models of Primary Health Care Delivery for Young People* on **Page 393**). For children under 15 years, gaining access to a PHO is, in general, contingent on their carer being willing to access the service on their behalf. Barriers for adults in accessing primary health care thus may also be relevant to children accessing these services.

The WellChild/Tamariki Ora National Schedule is the basis of contracts that the Ministry of Health has predominantly with non-governmental organisations (NGOs). The Plunket Society delivers the programme to nearly 90% of young children nationally [51], while a number of Māori and Pacific Health providers are contracted to deliver the programme to specific communities. The WC/TO contractors support work undertaken within PHOs with home visitors advising parents and carers on services available, and how to access the services of their PHO. The WC/TO contract specifically requires home visitors to cover topics with their clients, one of which is to provide advice on the recognition of childhood illness [50]. Service providers are *'to assist families to recognise childhood illness, treat symptoms (e.g. fever), and access appropriate care in a timely way'* (p49). In addition to providing this information, home visitors mentor parents to act on such information. The effectiveness of this cannot be assumed, however, as the provision of WC/TO services is rationed. From age 4-6 weeks until the child is nearly 5 years old, there are 8 visits from, or to, professionals and community workers funded as the basic visiting programme [52]. Children at high risk of poor health outcomes may be offered a greater number of visits and they may be eligible for family support programmes coordinated by the Ministry of Social Development [53]. More frequent visits provide greater exposure to advice on the recognition of acute illness and appropriate responses, although the reasons for the child being at high risk may compromise a carer's receptiveness to advice. Research continues to call for more comprehensive information on the barriers to timely access of primary care, especially in high deprivation areas and rural locations, to avoid children requiring hospitalisation. These barriers are complex and likely to involve dynamic factors around behaviour and social and physical environments.

New Zealand Research on Barriers to Primary Health Care and Possible Solutions

The following section briefly considers selected articles from a considerable body of New Zealand research that has examined primary health care in this country. Few refer directly to children, however, their findings, discussions and conclusions address a number of aspects around barriers that are relevant to children's access to primary health care. Barriers related to convenience, timeliness, cost, after-hours access and cultural needs have been identified [54]. The capacity and capability of the workforce also affects access. The nurse-led programme is a commonly used model for expanding consultation time in a primary care setting. Evolving from a curative approach to one of prevention, combined with the public health model, offers additional complementary interventions to reduce acute and chronic conditions among children, a process central to the international thinking and advice for primary health care in the 21st century [37]. Research has also called for better electronic systems as patient health information is not exchanged, or not accessible to those who need it to treat the patient adequately. These points are discussed further as they are factors that DHBs can address through their responsibility for primary health care provision in their area.



Access

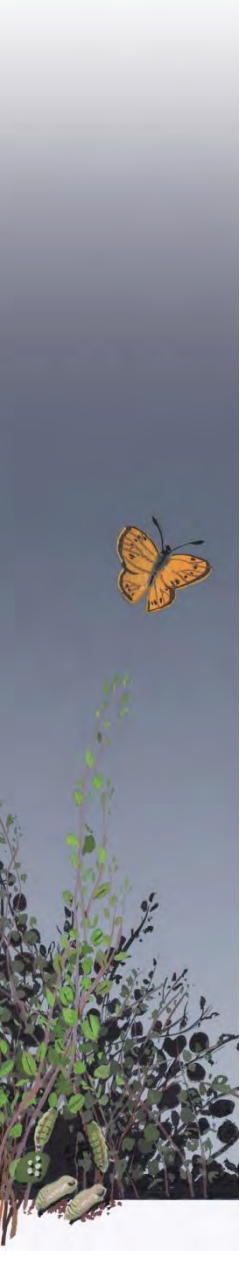
Barriers to accessing primary health care vary between people and communities, but the result is that people cannot use a service effectively if access is poor. The ASH rate is one potential measure of the effectiveness of primary health care, but it is a measure of failure. Other measures are possible that consider the use of services. In a literature review on access to primary care for Māori and Pacific peoples, Barwick describes a number of criteria relevant to measuring access to care that include whether a patient gets appropriate services in appropriate amounts, in a timely fashion in a suitable location, or whether a person perceives that they have been able to obtain the care they believe is necessary [54]. Being affiliated to a primary medical care provider is one measure of access, as primary medical care is an important subset of primary health care. Jatrana and Crampton used this measure in some of their New Zealand research [45]. Results in their study were not as expected as there was no significant difference in affiliation between those living in the most deprived and those living in the least deprived areas. Those in more deprived areas, however, are more likely to experience illnesses which could logically be expected to increase affiliation [45].

Crampton and colleagues also reported findings from an examination of time spent visiting the GP per annum, as a measure of access. They found that children under 5 years visited primary medical care, on average, 6.95 times a year compared to an average of 3.99 visits by those aged 6-17 years [55]. Findings in this study indicated some differences across deprivation areas with under 5s in the least deprived areas visiting an average of 6.6 visits a year compared to 8.0 among children from the most derived areas. For all ages, however, those in the most deprived areas did not have a greater annual exposure than other areas, but Māori, Pacific and Asian ethnic groups had a lower exposure in comparison to Europeans. Among patients living in the most deprived areas, Pacific patients had 24.1 fewer minutes visiting time a year compared to European patients. These data were not available for children. Barnett and Malcolm identify further complexities in the social and community context, when their investigation of ASH rates in Christchurch practices showed that ASH rates were not associated with deprivation in the same ways for Māori and for European peoples [56]. Their study showed a higher level of hospitalisation for Māori in low deprivation areas compared to Māori in high deprivation areas. Their conclusion was that more specific targeting is required to reduce avoidable hospitalisation among high risk patients in high deprivation areas [57].

Non-profit organisations are more likely to provide services in the more deprived areas and there are organisational requirements for effective provision of care. When comparing for-profit and non-profit primary care organisations, Crampton et al found some revealing differences in light of good access in primary care. Non-profit organisations were more likely to have written policies on quality management, were more likely to carry out locality service planning and community needs assessments, but were less likely to have specific items of equipment [58].

Cost

Cost is often a barrier to accessing primary health care, and a critical contribution is the fact that New Zealand's health care is not free at first point of contact. Hider et al described the system as follows: "*New Zealand has unusually high financial barriers to access for primary care. The costs of a visit to the GP are met by a mixture of out-of-pocket expenses, means-tested subsidies, social insurance payments for injury and schemes designed separately to cover practice nurses, pharmaceuticals and investigations" [59]*. Policies introduced in New Zealand in the early 2000s were intended to address disparities in health outcomes and to make primary care more accessible from the perspective of patient cost. Langton and Crampton examined the main funding formulae in New Zealand in relation to their success in achieving the Primary Health Care Strategy's intention [60]. They reported that the initial introduction of the Access subsidy distributed funding to groups with high deprivation rates which had proportionally more Māori and Pacific people, and also younger people included. Subsequent changes that extended the funding to include the Interim PHOs (that is, those not on the Access subsidy) benefited non-Māori



/non-Pacific peoples in PHOs. The authors noted that inequity in the system still existed, but DHBs could influence the development of innovative services through their contracting requirements with PHOs [60].

Other researchers have also noted, this time in relation to one of the subsidies available for patients with chronic conditions, Care Plus, that enrolment is only weakly related to need factors, and it seems to work best for patients who have easier access to health care [57]. These authors considered that the existence of co-payments continued to create difficulty for poorer patients with chronic conditions, despite the intention that subsidies should reduce barriers. It has been found, however, when comparing for-profit and non-profit organisations, that non-profit organisations charge lower patient fees per visit thereby reducing financial barriers to access [58].

Similarly, Fancourt et al note that despite the changes initiated during the early-mid 2000s, by 2007, only 61% of primary care practices had no charges for children under 6 years during work hours, with the national average being a $5 co-payment per consultation [46]. By 2010, 78% of practices were providing free care to the children under 6 years, potentially suggesting that further work may be required to ensure that cost is not a significant barrier to New Zealand children accessing primary healthcare. In this context, the Very Low Cost Access Scheme and the Zero Fees for Under 6s Scheme (see text box on **Page 114**) may provide support for PHOs and practices wishing to reduce primary care cost barriers for children.

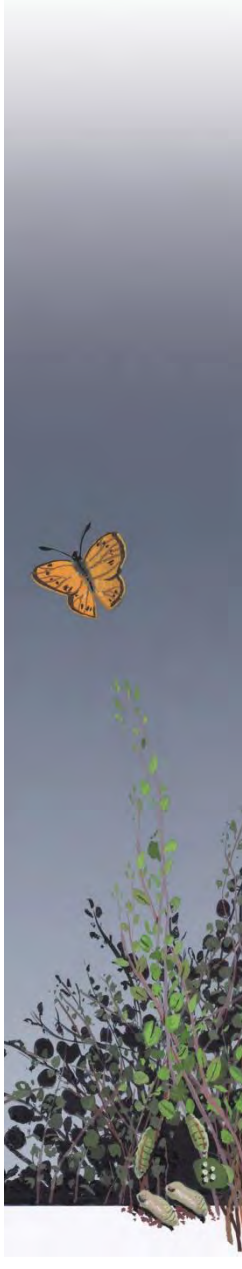
After-Hours

The lack of after-hours GP services is also a major barrier in New Zealand to accessing timely primary care for some children [61] and is one reason for the use of emergency department services. Some areas, and these are much more likely to be high deprivation or rural, are poorly serviced after normal working hours because existing services are unable to provide adequate backup. Private after-hours/emergency medical services have developed in various urban locations in New Zealand in response to demand for after-hours services, and because doctors have sought to address the problem collectively [59].

Where children are concerned, the acute onset of some childhood serious illnesses can mean immediate medical attention is required. While this may be possible to obtain during the working day, even when there is an after-hours service available, a further barrier to seeking attention after-hours is the high cost of the consultation. The free consultations for the under 6s subsidy does not apply to after-hours services, and an inability to pay is likely to result in an emergency department visit or admission to hospital if the acute condition becomes more serious because of the delay. Potentially this may result in a more serious long-term health outcome for the child.

In response to these concerns, an *After Hours Primary Health Care Working Party* was convened in 2005 to review after-hours primary care in New Zealand and to make recommendations as to how access might be improved [62]. The Working Party recommended that DHBs, in collaboration with PHOs and after-hours service providers, should take a lead role in the planning of after-hours services in their regions, but that the responsibility for delivering after-hours services should remain with PHOs. PHOs however, needed to demonstrate to DHBs that they had 24-hour arrangements in place, either by subcontracting with their member practices, or by contracting other after-hours providers.

The Working Party noted however, that it was important to appreciate that 24 hour primary care did not mean 24 hour access to routine non-urgent care, but only a capacity to meet the needs of patients who could not be safely deferred until the regular appointment was available [62]. They thus also argued for reducing demand on after-hours services by implementing strategies to ensure good access during normal working hours, and by extending the ‘normal’ working hours (for example, have the PHO open to 10pm) and also by having better communication regarding how patients could best to use an after-hours service (that is, for acute or urgent cases) [62]. The report also suggested PHOs should make funding follow the patient with one option being that PHOs have an arrangement with after-hours providers so there are no high costs for prescriptions or consultation. The



report noted that normal working hours for a service should be those that were appropriate to meeting the community's needs [62].

The Working Party made a series of recommendations specific to DHBs, including that DHBs work in collaboration with PHOs, after-hours service providers and Emergency Departments to identify current after-hours services and resources, and any mismatches between health needs and existing service provision. Having undertaken such a process they recommended that DHBs develop and implement a *District After Hours Service Plan* for their region (including rural communities) that ensured after-hours primary care within current resources. It was recommended that Service Plans followed the *Principles Based Planning Framework for After Hours Primary Health Care*, which was provided as an Appendix to the report. The report also described a range of after-hours service delivery models which had been used to cater to the needs of different populations. While each of these models had been implemented in New Zealand, no information was provided on the effectiveness of these models, or whether they had been evaluated in the local context [62]. The main models are outlined in the text box below.

Models of After-Hours Primary Care [62]

Practice-Based

In this model, after-hours primary care is provided by a single practice. The model is most often utilised in rural areas that are too distant from other practices for a collaborative network to be viable (e.g. remote island communities, large rural areas with sparse populations). Advantages include continuity, access to existing health records, low fees, no claw-back issues and good community connections (arising as the practice is the usual point of care for most patients). Problems inherent with the model include difficulties in maintaining an after-hours roster (which may be onerous, particularly in areas with large numbers of visitors which may place high demands on weekend after-hours call), issues with recruiting locums, and the lack of back up if the rostered GP/nurse is busy or becomes unwell. Further, access to laboratory and radiology may be limited after-hours. Possible solutions to address these issues include enhanced links with the ambulance service, improved daytime access to reduce the need for after-hours calls, contingency planning for busy periods, expanding the role of nursing services, telephone triage, and after-hours service fees for casual patients.

Collaborative Network of Practices

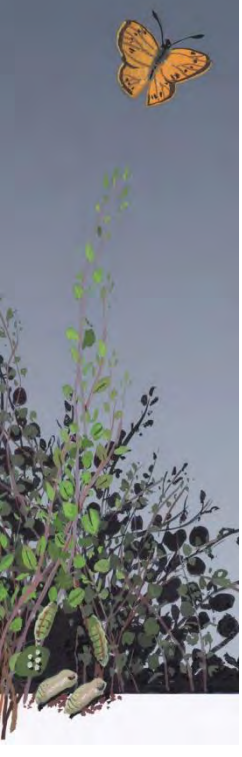
This model is most useful for rural areas where sharing rosters with practices in neighbouring small towns provides reasonable access (within 60 minutes). Services are provided from within the extended local area with collaboration allowing individual GPs/nurses to maintain a reasonable roster which reduces after-hours and weekend calls. Potential disadvantages include confusion about where to access care, and, if several facilities are utilised, problems may be experienced with ensuring sufficient GPs/nurses for the roster, and access to laboratory and X-ray services. Possible solutions include: rostering late and weekend clinics to reduce call outs, ensuring first and second call rosters to provide back up for busy times, making enhanced use of the nursing workforce, and integrating after-hours services with rural hospital services where possible.

Dedicated After-Hours Facility: Accident and Medical Clinics

This model involves an independent organisation operating a dedicated 24-hour facility with doctors and nurses who are employed on contract or salary. Such services are often only financially sustainable in large urban areas where there are high patient volumes. Such services relieve pressure on GPs to provide after-hours services and typically have good communication with patient's existing GPs for continuing care. Many have access to laboratory, X-ray and pharmacy services. Disadvantages however include the fact that most clinics have high patient charges, which may discourage those on lower incomes, some are not open overnight, and in some cases, eligible PHO patients may not receive prescription subsidies. Further, fee for service deductions may be a significant issue for practices in the clinic's catchment, and the provision of care during work hours may compromise local practice viability. Potential solutions include PHOs entering into agreements with after-hours service providers which allow lower fees and prescription costs for their enrolees and DHBs ensuring that clinics that are not open 24 hours have an on-call service or formal arrangements in place with other providers to meet their after-hours obligations.

Dedicated After-Hours Facilities

This model uses a collaboration of local GPs on a roster to provide after-hours services from a dedicated facility. It may employ salaried medical officers during the day and may have PHO or GP governance arrangements. Most suitable for urban areas, this model may also be applied to smaller cities. Advantages include good access, the use of a pre-existing primary care trained workforce and the potential for communication amongst rostered GPs to ensure continuity of care. Potential disadvantages include high patient charges, GPs having to work overnight and then the next day, issues with spreading the load of after-hours work, and some practices not contributing to the roster but their patients using the service. Potential solutions include PHOs developing arrangements where funding can follow the patient, supplementing GP rosters with dedicated after-hours nurses in a triage role, and charging higher fees for the patients of GPs not contributing to the roster.



Co-Location of Emergency Department and After-hours Primary Care
This model, which co-locates a dedicated after-hours facility with a hospital emergency department, is most applicable to smaller cities where a separate after-hours primary care facility is not sustainable and there are mutual benefits in the ED and the after-hours primary health care service sharing facilities and workforce. Advantages include one site for all after-hours services, good access to ED and hospital staff in emergencies and hospital records being available for continuity of care. It may also reduce over-utilisation of ED by primary care patients and ensures good access to laboratory and X-ray services. Disadvantages however include compromising the viability of other after-hours services, patients being resistant to paying for services located in an ED, fee collection issues, and GP fatigue after busy overnight shifts. Potential solutions include effective community consultation, patient information and clear signage, consistent application by staff of access criteria direct to ED, GPs arranging rosters so they do not work a full day in their practice after working overnight, and establishing the after-hours clinic as a separate legal entity.

Nurse Led Triage Systems and After-hours Services
Nurse led triage systems and after-hours services (with GP telephone support) have been used in rural areas with GP shortages. In one high-need rural area remote from an ED facility, nursing staff access after-hours telephone advice from GPs from 5–10 pm weekdays, and from 8 am – 10 pm weekends and public holidays. Otherwise, after-hours medical advice is from the nearest ED which is 45 km away. Advantages of models like this include continuity of care in the local area and the reduction of GP after-hours call requirements. Problems, however, include patients needing to travel to the nearest ED if they require a doctor urgently overnight, nurses being unable to prescribe, and potentially onerous rosters for nurses, coupled with the requirement to ensure good access to continuing nursing education to maintain professional standards. Possible solutions include optimising ambulance arrangements, developing protocols and standing orders for nurse prescribing, and recruiting more GPs to increase support to nurses after-hours.

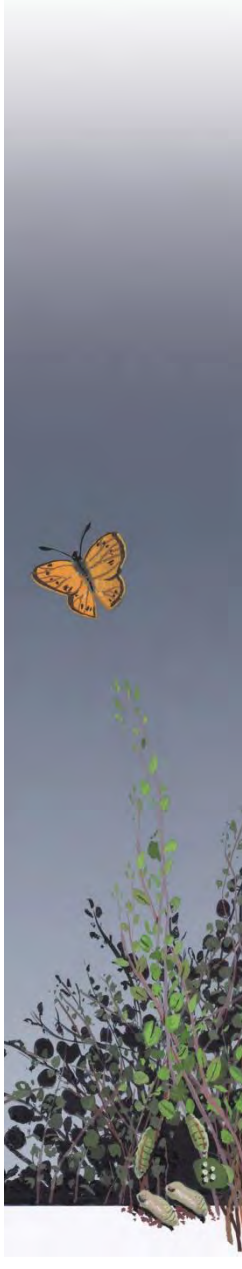
Other Models and Arrangements
Other models specific to particular locations include a combination of extended hours (until 8 or 11pm) with a house call service overnight, a collaboration of GPs and nurses from a single practice providing extended hours in an existing practice facility, and the hospital ED providing telephone triage and all after-hours services overnight (after 11 pm) for whole district (only applicable in rural areas).

Cultural Needs

From their examination of primary health care services in Christchurch Barnett and Malcolm argued that organisational and provider characteristics affect avoidable hospitalisations [57]. They conclude that quality of a service is important, while other measures sometimes used, such as the number of GPs or patients per GP, were not significant for hospital admission rates. Barwick's review of access to primary care for Māori and Pacific peoples identified critical elements of effective health services particularly relevant to underserved people [54]. Criteria noted ranged from the technical and clinical competence of staff to serve consumers sensitively, to the underlying factors such as whether the philosophical base includes appropriate frameworks such as the Treaty of Waitangi and Whare Tapa Wha [63], and practical organisational details such as how the appointment system and waiting times are organised and whether these are appropriate for the community. Her report also identified underlying issues around the operation of the service such as the importance of working in partnership with Māori and Pacific people, and of building trust [54].

Language can be a major barrier to the utilisation of primary health care. Culturally specific health services are one alternative, but for many, there are insufficient people in the community for such services to be provided [54]. While one option has been to use professional interpreters, they are expensive and may need training for the medical setting. There can be problems, however, with using non-professional interpreters such as friends and family. Having bilingual/bicultural community health workers is one strategy that appears to improve access [54] and non-profit organisations employing more Māori and Pacific Island staff (compared to for-profit organisations) is seen as reducing cultural barriers to access [58].

Better targeting is required to reduce avoidable hospitalisation among patients in higher deprivation areas but doing so may not be easy. For example, ASH rates in Christchurch practices did not simply reflect deprivation, but potential ethnic differences in hospitalisations [56]. Unlike European rates, Māori rates for hospitalisation in Christchurch were not strongly related to deprivation. Taking into consideration findings from other New Zealand studies, Barnett and Malcolm suggest such differences could be due to the relatively small population of Māori in more affluent areas. The resultant lack of awareness of Māori health needs by providers might be evinced in a lower quality of care, fewer visits



to the GP and consequently more hospitalisations. Alternatively, the difference could be due to the level of ethnic concentration rather than system discrimination or that where there are fewer deprived patients, those with health needs are more visible and they are admitted to hospital [56]. Another conclusion could be, however, that in high deprivation areas, while fees may be lower, consultation time may be shorter [56].

Nurse-Led Initiatives

Ministry of Health strategy documents indicate that the role of nurses and nurse-led initiatives are expected to become an integral part of primary health care system in New Zealand. The document "*Better Sooner and More Convenient Health Care in the Community*" [41] provides examples of nurse-led programmes and identifies advantages in the collaboration of health professionals in meeting the health needs of their patient population. References to nurse-led programmes are commonly made in relation to the management of chronic conditions [64,65]. Asthma is the condition that affects a large number of children and contributes significantly to ASH rates, and nurses often lead educational programmes to facilitate self-management for asthma. Other initiatives include programmes to better integrate Lead Maternity Carers and Well Child immunisation at the practice level, services to prevent rheumatic heart disease, and the provision of front line primary health care services in rural areas without access to a general practitioner. Examples of the kinds of initiatives that could be developed and evaluated in New Zealand are given in the text box below.

Local Examples of Nurse-Led Primary Care Initiatives

Nurse Practitioner Led Project to Integrate Maternity and Primary Healthcare

An audit at a South Auckland general practice found that immunisation rates and the timeliness of immunisation in infants was sub-optimal, with anecdotal evidence also suggesting that many women had difficulties accessing midwives for first and second trimester pregnancy care. A nurse practitioner led practice initiative was introduced to coordinate the care of pregnant women between general practice staff and midwives [66]. It involved:

- Recording the details of pregnant women in a "birth book" at the time of confirmation of the pregnancy
- Liaising with the woman to ensure she had a midwife soon after confirmation of pregnancy
- Recruiting an independent midwife to the practice
- Contacting the pregnant woman when 36 weeks to renew the relationship with the practice
- Sending a congratulations letter and reminder when the infant was four weeks old, inviting the infant for its six week check and first immunisation
- Contacting the woman when the infant was five weeks old to book them for a six week check appointment if they had not already arranged one
- Establishing weekly clinics at three local high schools to work with the school nurses to identify pregnant teenage girls and offer coordinated primary care services.

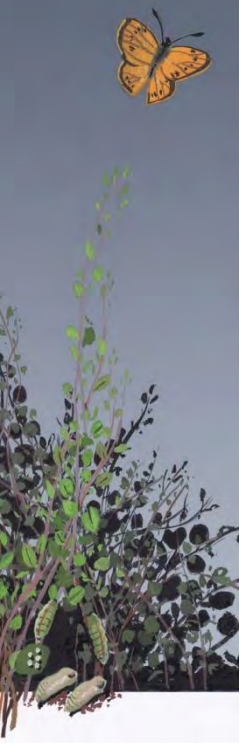
Prior to the program being implemented the audit had shown that only 52% of infants received their immunisations on time. In the year following the introduction of the new model of care, the percentage of infants (6 weeks-6 months) receiving their immunisations on time ranged from 94-100%, with the details of the woman's midwife being recorded in the practice notes in 94% of cases.

Nurse-Led Rheumatic Fever Secondary Prophylaxis Programme

Rheumatic heart disease is considered a preventable chronic disease. In Auckland, confirmed cases of rheumatic fever are notified to the Medical Officer of Health, and patients are then listed on the Auckland Rheumatic Fever Register. This Register was established in 1981 to streamline parenteral benzathine penicillin delivery, and to prevent further episodes of rheumatic fever. Research had suggested that with a clinic-based oral penicillin prophylaxis programme, recurrent attacks in Auckland had accounted for 20% of hospital admissions, but this was reduced to 6% with a parenteral penicillin community nurse delivered programme [67].

As a consequence, community nursing services now deliver the rheumatic fever secondary prophylaxis programme in Auckland. Registered nurses, working from community nursing offices and under delegated authority, deliver 3-monthly prescriptions of parenteral benzathine penicillin. The majority occur through the school, but may also be delivered at home, at work, or at a community nurse-run clinic. Syringes are pre-filled, and patients remain on the programme at least for 10 years or until 21 years of age. Counties Manukau District Health Board also employ Māori and Samoan community health workers to facilitate education and compliance [67].

The effectiveness of the program was evaluated by means of an audit of Rheumatic Fever Register data from 1998-2000 [67], which assessed the compliance of patients enrolled on the rheumatic fever secondary prophylaxis programme. Results showed compliance rates across the three Auckland DHBs ranging from 80% to 100% for individual community nursing offices, with the authors concluding that community-based



nurse-led secondary prophylaxis programmes were able to deliver excellent patient compliance levels, and that community health workers had a key role to play in facilitating compliance.

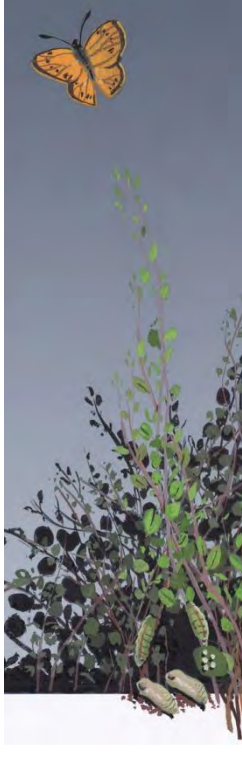
Health Reporoa Incorporated
The Health Reporoa innovation is a community-initiated, nurse-led serivce, which provides first-contact services for a small rural community [68,69]. The innovation received an initial $250,000 Ministry of Health funding, with the contract subsequently being taken over by Lakes DHB. The project involved three nurses expanding their practice to provide free first-level contact primary health care in outreach clinics and homes for an isolated rural community with limited GP services and no public transport. Two other nurses provide holiday and study relief. Total clinic time increased from 10 hours per week, to 30 hours a week across five sites between 2003 and 2006. By 2008, clinics were located in four sites for 28.5 hours per week. Community members began attending the additional clinics immediately, with numbers fluctating depending on whether flu vaccinations and other health screening activities were also being run concurrently. A Ministry of Health evaluation in 2007 found that the innovation was considered a success by all those involved at Reporoa, it met the DHBs objectives and although not leading to a transition towards PHO care, it met the other goals of the Ministry in purchasing and innovation. It was seen as being highly successful and provided essential first level services to the community [69].

While many of the projects listed above involve the provision of outreach services to the community, a number of researchers have also considered the role nurses play within primary care practices themselves. In this context Hefford et al examined the contribution of practice nurses to PHOs in a report that aimed *"to explore the financial benefits to Primary Health Organisations (PHOs) and general practices (GPs) of employing practice nurses" [65].* Their investigation examined the utilisation of practice nurses and whether improved use increased the cost effectiveness and value for money of a general practice. Drawing qualitative and quantitative data from nine practices, they found a wide variety in the work undertaken by practice nurses, and considerable differences in the proportion of the work volume within the practice that they undertook. Barriers to expanding the utilisation of practice nurses were a lack of space, insufficient nurses, insufficient experience and skills, and patients expecting to see a doctor. The GP's expectations of the role of the practice nurse also appeared to be important. Financially they considered there were opportunities for practices to develop new ways to deliver services using practice nurses, and that these could be financially viable. In particular, the use of nurses where there is a fixed fee for a service, regardless of who delivered the service, means utilising nurses is cost effective. In many cases, an appropriate co-payment regime will make transfer of a wide range of clinical tasks from GPs to nurses cost effective. Although not universal for all types of general practice, there can be financial advantages in practices exploring new ways to provide clinical services that involve the practice nurse, and also taking advantage of the workforce potential by expanding nurses' capabilities in general practice [65].

However, while additional funding was provided in the early 2000s for the development of innovative nurse-led primary health care projects [69], more recently funding to enable systems to change to more inclusive nurse-led programmes has been less forthcoming. Little work has been undertaken on the need for additional funding for an interim period, in order to implement new initiatives while current services are maintained so as not to disadvantage patients further. However, Barnett and Malcolm note: "*Compared to countries, like the United Kingdom, which make greater use of integrated 'health care centres' often involving nurse-led multi-disciplinary teams, New Zealand appears to have under-estimated the funds and human resources needed to support the change of practice required to establish and run multi-disciplinary chronic care clinics in general practice"* [56](p205).

Primary Health Care and Public Health

Immunisation has reduced a number of the childhood diseases that are fatal or permanently disabling, but there are areas in New Zealand where immunisation rates are too low for effective eradication of disease. Primary health care is often involved in ensuring immunisation programmes are effective so threats to child wellbeing and increasing emergency department visits are mitigated. Factors that are equally important for reducing demands from acute and chronic conditions among children on both primary and secondary health services in New Zealand are clean water, food hygiene, good food supply, warm housing, adequate and safe places to live, and safe roads. For example,



rheumatic fever should not be occurring in New Zealand [41] and is strongly associated with inequalities and poor social and economic conditions [70]. Growing up in poverty during the crucial early years increases the risk of longer-term negative outcomes, such as heart disease and poor dental health that could be avoided [71], and if prevented would reduce ASH in older age groups in future years. In New Zealand a marked rise in hospitalisations began in 1992, shortly after a significant rise in child poverty [22].

Ministry of Health strategy documents from the early 2000s proposed greater collaboration between primary health care and public health [36]. "*Public Health in a Primary Health Care Setting"* was part of proposed comprehensive changes to primary health care that have not been realised [40], but systemic factors for poor health that exist within communities, and in the population at large, affect the delivery of primary health care. Tension exists between the delivery of primary health care and the use of the public health model and the delivery of population health. This is to be expected given the differences in priority: individual versus population. "*Public Health in a Primary Health Care Setting"* identified these differing foci as 'the wants of a single patient versus the needs of the greater population', but presented them as being complementary rather than mutually exclusive. This report iterated how members of the PHO team can adopt these differing roles, but may opt instead to actively collaborate or partner with agencies skilled in implementing programmes using a public health model to achieve set goals [36].

Information Systems

New Zealand research has called for good patient record systems to ensure those who are working with the patient have up-to-date information [61]. Integrated information systems would enable better communication and better linkage between services, which in turn would contribute to improved patient health outcomes. Development of electronic communications will be essential as a wider range of service providers become involved in delivering primary health care [72]. Some District Health Boards seeking to establish Integrated Family Health Centres have also identified the importance of having IT to enable 'seamless care' for their patients [43]. Major problems still exist and systems are criticised for being haphazard at the primary health care level with different software programmes that still cannot work adequately or cannot facilitate the necessary linkage to contribute to better care [64,72].

Linked to systems that provide adequate patient information exchange is the developing of electronic linkage between primary and secondary health services by which primary health professionals can obtain information and advice to inform their diagnoses, intervention, and practice. Trials are beginning in New Zealand to explore the development of such systems, but these have not yet been evaluated.

Addressing Barriers to Good Primary Health Care: International Experience

Internationally, primary health care is recognised as a critical component of any health system seeking to improve health outcomes [73] [74] [75] [76] [77]. Sanderson and Dixon undertook a consensus development process to develop a list of common conditions likely to be ambulatory sensitive in England [78]. Using panels of clinicians, they identified conditions for which avoidable admissions could be reduced, estimating that for 30 of the 174 conditions listed at least 70% of admissions could be avoided, and for a further 66 conditions, a 50-69% reduction was possible through prevention of disease onset or timely and effective ambulatory care. This study included all age groups; however, primary health care was seen to play a major role in reducing avoidable hospitalisation of children.

Having access to services is critical, particularly given the acute nature of many child illnesses resulting in avoidable admissions, and that primary healthcare delivery is intended to meet the needs of the community. Poor access is most common where deprivation is high. The following sections consider key features of access, and possible resolutions to access barriers such as cost, out-of-hours services, and possible measures proposed to address them. These include workforce issues such as nurse-led

programmes, or the need or otherwise for community based specialists rather than generalist physicians, and the possible contributors to more effective primary health care such as the interaction between primary health care and public health and the value of health information exchange (HIE) for expanding the role of primary care. Interventions identified have varying degrees of success.

Access

Kringos et al's systematic review of primary care lists seven features for defining access to primary care [33]: availability, geographic accessibility (for example, distance travelled), how systems are organised to accommodate access (hours open, waiting times), affordability, acceptability (patient satisfaction), utilisation of services and equality in access (services provided on the basis of need not individual or social characteristics). These offer a constructive checklist for assessing the delivery of primary health care.

Internationally, barriers to accessing primary health care are often framed in terms of the long term requirements for improved child health: namely, equity, social justice and social development [37]. These international frameworks and guidelines concur with WHO philosophy and at the practical level advocate for the involvement of the individuals, carers and the community as partners in health because they are critical to primary health care being able to function effectively [37,38,74]. Integrated care is promoted, but requires health systems to focus on prevention rather than maintaining a hospital-centred, doctor-dependent, curative approach.

Cost

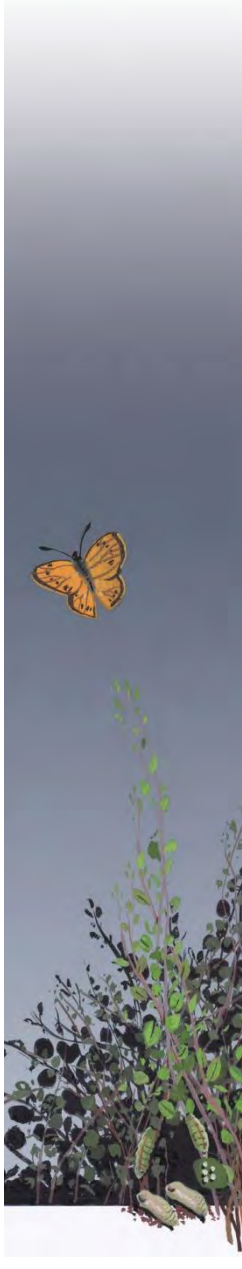
Cost is a barrier to accessing primary health care. From a comparison undertaken on attributes of four WHO primary health care reform dimensions in nine countries (Germany, Netherlands, UK, US, Canada, Japan, New Zealand, South Korea and Taiwan) [40], only the UK and the Netherlands provided primary care free of charge. Other countries ranged between having no government or social insurance for primary health care through to having universal access albeit with some co-payment [40]. The UK system is funded from taxation and is intended to provide free first point of contact care as well as secondary and tertiary health services [79]. Despite this intent, the UK still has major concerns regarding health inequalities and barriers, in addition to cost, exist especially for those living in high deprivation areas [76]. Better targeting of services and the use of financial incentives for GPs to engage with their at-risk patients has been used to improve access. Responsibility within high level systems and infrastructure is also advocated, for example, conducting cost benefit analyses when appraising the impact of interventions on inequalities, and establishing accountability processes for evaluations in the future [76]. There is little evidence that financial incentives to GPs are effective, although they have been reported to improve the level of reporting [80].

Out of Hours

While international studies have identified having after-hours primary health care as a solution to provide for the needs of the community, how this is achieved is dependent on the system and how after-hours services are provided and funded. It would appear there is no systematic review on after-hours primary health care services, but a National Audit Office report from the UK indicated it has systems in place to improve the delivery of out-of-hours care in the primary health care setting, but it noted that the cost was greater than expected [81]. This National Audit Office report made a number of recommendations to the primary care trusts, which perform a similar role to the PHO in New Zealand. These recommendations included advising primary care services to: benchmark their costs against those of other geographically comparable providers to identify areas for improvement; understand the local drivers of use of unscheduled services; analyse patient flows, case-mix, and how socio-economic groups use different services; and not only to seek patient feedback but to use research expertise to ensure that the feedback process is properly undertaken [81].

Cultural Needs

Establishing responsive primary health care services for children in bicultural or multicultural communities is inherent in undertaking an assessment of the community



needs in preparation for developing an integrated system. This is emphasised in a number of reports and guidelines [37,38,74].

Type of Service Provided

The type of workforce the service provides will influence use. Services need to meet the needs of the local population [81]. While none of the UK National Audit Office reports make specific mention of children, the child's primary carer's experience with a service is likely to affect how accessible the service is perceived to be. In this regard, Gillam and Florin discuss the role of the primary health care organisation in facilitating better use of services to reduce inequalities. One example is that increasing female professionals may be essential if an aim was to increase cervical screening, particularly among some ethnic groups [75]. If the service is perceived not to meet cultural needs, timely medical attention for a sick child may be much less likely to occur.

Financial incentives, particularly for family physicians, have been implemented to improve primary health care delivery. A recent systematic review examined the effects on the practice of family physicians of different payments, such as fee for service or capitation, on physician behaviour [82]. It found no evidence that one type of payment method was more advantageous for health outcomes. In some studies in low and middle income countries, having a part payment by the patient resulted in better outcomes, but other studies suggested that payment simply resulted in the physicians recording their processes better. Gosden et al found that fee-for-service did have some effect on the quantity of service provided, but there was no evidence regarding the effect on health outcomes [83]. Campbell et al noted that in England, while there were improvements for the conditions for which targets were set (at least until the target was reached), quality of care for other conditions did not improve, and continuity of care was not necessarily maintained [84].

Specialists versus Generalists

Specialisation is common in the US, but US researchers, Starfield et al, were critical of this in their examination of specialist services. Better outcomes were attained where there was consistent primary health care with generalist services compared to specialist services [32]. They concluded that this may be because generalists recognise the context of the condition as a critical factor, over and beyond the diagnosis of a particular condition. The authors agreed that generalists needed to be able to access the services of specialists easily, but they argued that there were more effective ways of accessing the knowledge and skills of specialist services in primary care than having more specialists in the community setting.

General practitioner training in working with children, however, is seen as being important. A pilot study in the UK, reviewing paediatric deaths, recommended that there should be training for primary health care professionals in working with children as this would lead to more appropriate attention being given to serious infections and conditions among children [85]. Increasing the skills of GPs in working with children with respect to parenting programmes has also been identified as an intervention that improves access [86].

Transport

A UK review found from asking whether a patient needed their own transport to access primary health care, that people without cars had poorer access to primary care than those with private transport [87]. In addition, the cost of transport to the health service for the individual was a barrier to utilising services. To be accessible, primary care needs to be situated where people live, and where people do their business in order to reduce problems of access [87].

Nurse-Led Initiatives

Increasing demand for health care, pressures to contain costs, poor access to services in deprived areas and workforce shortages have been identified as factors for the extension of nursing roles in primary health in the UK [88]. Nurses are expected to enhance the quality of the primary care service, substitute for doctors where there is a shortage and reduce costs because they are cheaper to employ than doctors [88]. Gains evident in reducing inequalities in health in the 1990s in England were achieved because of nurse-

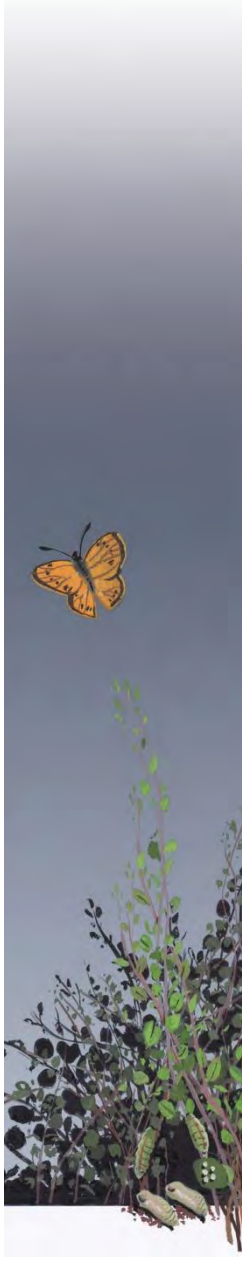
led delivery of strategies such as childhood immunisation. Nurses' ability to manage chronic disease has also been identified [88]. The latter appears to be an area that nurse-led programmes provide good quality clinical care. However, in the UK context reduction of costs is rarely achieved, possibly because nurses have longer consultations than doctors do. There is a potential loss of personal continuity of care with multidisciplinary teams, particularly if the teams are large. Additional costs may be incurred because the system required for incorporating nurse-led programmes is different to a traditional GP model [88].

In a systematic review of nurses working as substitutes for primary health care doctors, the impact of nurse substitution was examined in terms of the outcome for the patient, the process of care, and resource utilisation and cost (direct and indirect) [89]. From the 16 eligible studies reviewed, the authors concluded that high quality outcomes could occur for patients with appropriate trained nurses, and the use of nurses could also result in greater levels of patient satisfaction than occurred with doctors. Relevant measures used in the various studies included were provision of information, lifestyle advice, nutrition and exercise. One study noted that nurses were significantly less likely to have lapses in care with patients who were unstable compared to doctors [89]. Substitution of nurses for doctors could reduce the latter's' workload, but only if nurse time is not consumed meeting unmet need or if they are not generating increased demand for care. Whether cost savings can be achieved depends on the use of services, on the salary of the respective professionals and can also be affected by nurses having longer consultations which may reduce possible savings. Laurant et al argue for further research as the review indicated methodological issues that require further attention. For example, although nurses undertake a wide range of care, only a narrow range of these roles have been subjected to rigorous evaluation [89]. There is less evidence for effectiveness in alternative strategies proposed, such as case management, evidence-based care pathways, or shared learning among health professionals to improve health outcomes for patients [64].

Considerable use of nurse-led health care has been reported within the UK primary health care system [64] and the number of nurses employed in general practice in the UK has risen by 44% over the decade [90]. Effects of changes to the role of the nurse have also been examined in a selection of Australian general practices [91]. A number of problems were identified in this study. The lack of a primary health care training for nurses was of concern although it was noted that those who engaged in this role tended to have considerable, and varied, nursing experience and were more likely to be older women. Funding policy requirements limited nurse-led practice and the lack of recognition, and therefore the funding, of a number of activities nurses undertook still needed to be addressed. Inter-professional relationships and an organisation's climate impact on the nursing role and it was suggested that organisations needed to develop their team work rather than continue in a hierarchical workforce (in which GPs direct and supervise nurses) in order to take advantage of funding opportunities [91].

Lay Workers in Primary Health Care

The use of lay workers in primary and community health care is common. Reservations have been expressed in relation to home visiting and lay workers in US studies [92]. A recent review, however, examining lay worker involvement in relation to maternal and child health and managing infectious disease was more positive. Its measures of success were at the individual and the organisational level [93]. Outcomes at the individual level were health behaviours, health care outcomes (mortality, physiological measures and self-report symptom resolution) and harm from adverse effects. At the organisational level, outcomes were the utilisation of services, the consultation process, recipient satisfaction, costs and social development measures (for example the development of support groups). Compared to usual health care services, lay workers contributed to increasing the number of children immunised. While all studies in the review were limited by the low quality of the evidence (mainly due to wide confidence intervals), the authors concluded that the engagement of lay workers probably resulted in fewer deaths among the under 5s, reduced the number of children suffering from fever, diarrhoea and pneumonia, and increased in the number of parents seeking help for a sick child. The quality of evidence



was moderate for the studies on the benefits of the lay workers in maintaining breastfeeding to 6 months [93].

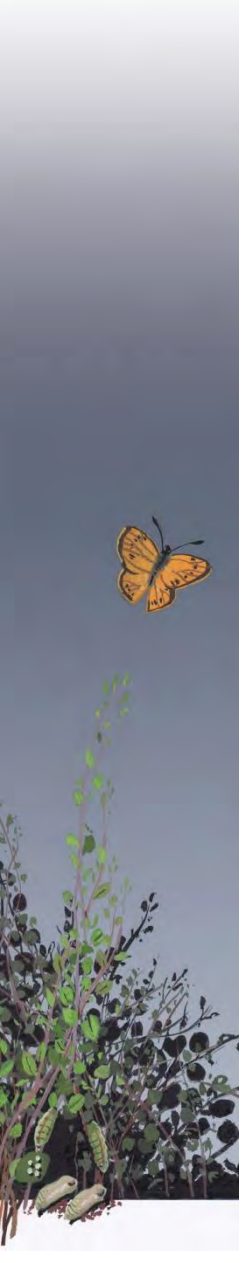
Primary Health Care - Public Health Interface

The breadth of activities expected of primary health care may make tackling inequalities within neighbourhood populations difficult [75]. However, the Netherlands Health Council recommends “close cooperation” between primary care, preventive healthcare, public health and occupational health [73]. Lee et al developed an integrated model that expands this thinking, seeing primary health care being to *“reduce all causes of mortalities, lead to better health status, and uptake of preventive services, and reduce hospitalisation.”* [94](p i78).

However, there is tension between working for the health of the individual and the health of the population [75] and the lack of evidence of the effect can be a barrier to developing a strong primary health and public health interface. Gillam and Florin also note that evidence is strongest for secondary and tertiary prevention interventions, which aligns with traditional roles of clinicians, reinforcing GPs in undertaking these actions. However, if organisational and community interventions are evaluated only with an experimental design then crucial factors are likely to be missed [75]. The lack of research methods to evaluate the effects of complex and dynamic interventions continues to be a problem, and is compounded by the lack of commitment to funding such research. A further complication is the time delay required for measuring health outcomes, sometimes in terms of decades or half a lifetime, such as the effects of interventions for cardio vascular disease.

Seeking to reduce avoidable admissions to secondary care has the potential to increase the load on the primary health care system. Unless the treatment of the acute and chronic conditions that comprise ASH can be managed within the community population, the problem will have only been shifted. An additional function for more effective primary health care is to reduce the probability of the condition occurring in the first place. Lee et al identify the role of primary health care in their interconnected and comprehensive health improvement model which implies that primary health care needs to look to the future. This requires actively collaborating with public health and other health professionals and allied professionals to forestall the development of chronic conditions among its young patients, most of which can be addressed through addressing the social determinant of health. [37]. (See Lee et al’s model.)

A trial by Margolis et al aimed to improve health outcomes of pregnant women and their infants in an urban area in North Carolina [95]. The primary objective was *“to achieve changes in the process of care delivery at the level of clinical interaction between care providers and patients that would lead to improved health and developmental outcomes for the family.”* Interventions selected were evidence-based and addressed major risk factors, for example, poverty or ineffective care systems. At the community level, changes in policy were sought that would result in improved resource availability: for clinical care, to engage multiple practice organisations, to increase the chance of affecting most, if not all, families in the community, and to enhance communication between the various organisations to improve coordination. The time frame of the study was too short for outcomes to be realised during the study period, but methods to improve implementation were identified. Removing barriers to effective service delivery involved staff training, the use of protocols, and regular feedback. At the individual level, interventions involved intense home visiting for poor pregnant women and where children were at risk of adverse health outcomes. The intervention resulted in fewer visits to the emergency department or admissions to hospital for injury or poisoning among young children. Intervention mothers were more likely to have made 4 or more well-child visits by the time the child was 12 months old, and were more likely to have had an introductory visit to the physician than those in the control group. While still at a preliminary stage, and despite the complexity of developing such a programme, the authors concluded that population-based, tiered, interrelated interventions were feasible within the primary health care context and that there were a number of positive effects. [95]



Information Systems

Some benefits of improved patient information systems have been noted. The Netherlands Health Council suggests the introduction of electronic multidisciplinary patient records as being desirable and congruent with the increasing use of IT by patients for health-related purposes [73]. The National Health Service Scotland report was more guarded. It considered that information systems were not the solution to the problems faced in providing good primary care, but they did help with addressing some of the associated problems [74].

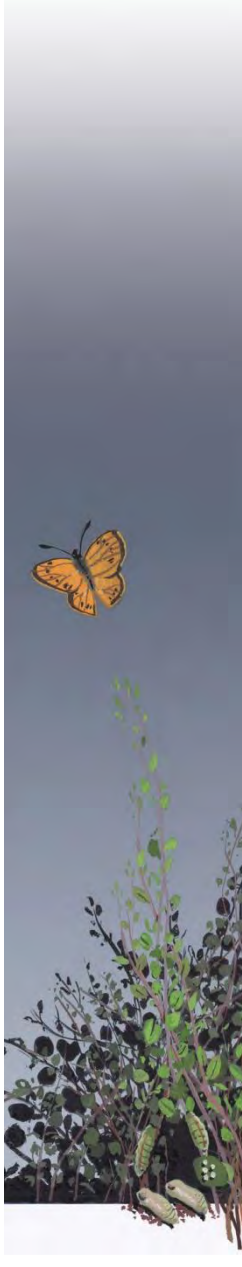
A systematic review examining the participation in health information exchanges (HIE) and the use of electronic health records (EHRs) in the US [96] indicates that a major benefit of HIE to primary care is the improved access to test results. There was less evidence, however, that HIE improved the quality and safety of the care received and there were barriers to small practices, particularly around financial and technical issues. The review identified a number of barriers that could be addressed, but required commitment to change. Potential problems from security breaches, liability and competitive disadvantages in introducing a broad health information exchange (HIE) are largely unresolved. Cost is a significant barrier to the adoption of IT systems as setting up, technical assistance, training of staff are expensive and there is also reduced productivity when a new system is introduced. Small practices would be most affected. Other barriers are the lack of staff expertise especially where existing staff do not have the skills or interest in running an IT system. Savings are unclear because, for example, a practice may not achieve the efficiency suggested in theory because staff perform multiple roles and an electronic system may not be replacing one staff member. Concerns about privacy, for example, sharing information on mental health and chemical dependency, or a patient's fear of discrimination based on health-related conditions were raised. Other concerns included the potential for treatment to be taken but for it to be based on inaccurate data, and the question of who owns the data would need to be resolved [96]. While not insurmountable, if these barriers are not addressed, hoped-for health outcomes may not be possible. New Zealand research indicates that DHBs could influence the provision of primary health care to reduce these problems through their contracting mechanisms. Additional resources are likely to be required to ensure existing systems are retained until newer systems are fully operational to ensure children are not disadvantaged further by change.

Conclusions

Reducing ASH rates among young children in New Zealand requires a primary health care system that is accessible to children and their families. International research has identified the components of good access to be availability, geographic accessibility, hours open, waiting times, affordability, acceptability, and services that are provided on the basis of need not on individual or social characteristics [33]. Good primary health care is flexible, uses a range of health professionals, addresses public health issues and is responsive to cultural and language needs of its population and provides a range of confidential, non-judgemental and supportive services. Four areas that have the potential to improve the utilisation of primary health care services in New Zealand for children are a) service access, particularly hours open and free services for children in areas where they are needed; b) greater utilisation of nurse-led programmes within PHOs to maximise the skill and experience of a range of health professionals; c) better collaboration between primary health care and public health in order to prevent, not just cure, illnesses common in ASH; and d) improved health information exchange within primary care services and between the primary and secondary sector.

Service Access, Hours Open and Free Services

Primary health care needs sufficient capacity to see young children in a timely fashion. Doing so has the potential to reduce the demand on secondary services. Complex funding systems and subsidies are barriers for primary health providers and given the characteristics of the services that currently operate well in high deprivation areas, primary health care providers need a high level of organisation and well-functioning teams. Actions



that would assist a reduction in ASH for children include a) adequate primary health care services in high deprivation areas (where the need is greatest); b) free access to primary health care for young children regardless of when it is sought (for example, ensuring funding follows the patient into after-hours services); c) normal primary care services being available for extended hours to meet the needs of their community (for example, being open until 10pm); and d) interventions to improve PHOs' ability to meet cultural and language needs for their population.

Greater Utilisation of Nurse-Led Initiatives

Experience suggests that greater utilisation of nurse-led initiatives is likely to provide more adequately for needs in the community for urgent medical attention and the management of chronic conditions. Other advantages are that greater involvement of practice nurses may allow more time for GP consultation. The lack of such time is a reason for unmet need and subsequent ASH. Nurse-led initiatives are seen as more likely to extend the range of primary health care provided into public health interventions and to foster a preventive rather than a curative approach to delivering primary health care. Indications are that initially these services may increase costs for the primary health care sector, but that the long term gains for children outweigh this short-term effect.

Primary Health Care and Public Health Collaboration

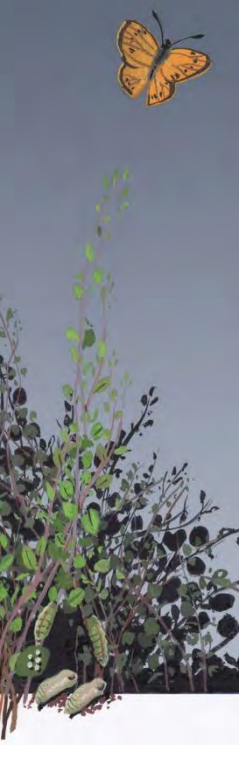
Increasing involvement and collaboration between primary health care and public health is advocated internationally to improve child health. Expanding the response from a curative model to one incorporating preventive medicine and the public health model has the potential to reduce ASH among young children. Basic public health initiatives associated with clean water, food hygiene, and warm housing are factors linked to the prevention of infectious diseases. These diseases are central to many of the acute conditions for which children require medical attention, and currently for which they are overusing hospital services when primary health care should be available. Collaboration and partnerships can be within the PHO, but may also be between services, agencies and non-governmental organisations.

Health Information Exchange

While not proven to reduce ASH, developing efficient electronic information systems to ensure reliable and ethically safe communication between primary health care providers, specialists and applied health professionals is seen as making timely care more feasible and sustainable in the community. The current lack of systems is resulting in slow responses, inefficiencies in patients being seen, and inconvenience to patient and health professional alike from double handling or loss of critical information. This strategy will not solve the problem, but can help the development of a more responsive service.

In Conclusion

Systematic reviews and research are currently calling for further work to identify the most effective interventions to improve the barriers of access to primary care. Expectations that child ASH rates will be resolved immediately through increased access to primary health care are unrealistic, but primary health care, if operating in the broadest sense, that is, inclusive of preventive medicine and public health models, is considered internationally as being a constructive way to develop a sustainable approach to reducing ASH and the demands it places on secondary services, and more importantly on the health of children.



MOST FREQUENT CAUSES OF HOSPITAL ADMISSION AND MORTALITY IN CHILDREN

Introduction

Before considering the more detailed analyses in the sections which follow, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality in Midland's children during the past five years, with a view to gaining an overall context within which to consider the relative importance of the various health issues experienced by the region's children in recent years.

Data Sources and Methods

Indicator

1. *Most Frequent Reasons for Hospital Admission in Children Aged 0–14 Years (excluding neonates)*

Numerator: National Minimum Dataset: Hospital admissions for children aged 0–14 years (excluding neonates) by primary diagnosis (acute and arranged admissions) or primary procedure (waiting list admissions).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Most Frequent Causes of Mortality in Children Aged 1–14 Years*

Numerator: National Mortality Collection: Mortality for children aged 1–14 years by main underlying cause of death (**Appendix 5**).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Primary Diagnoses/ Cause of Death: Acute URTI (J00-J04, J050, J051, J06); Bronchiolitis (J21); Asthma (J45, J46); Bacterial/Viral/Other Pneumonia (J12-J18, J100, J110); Gastroenteritis (A00-A09, R11, K529); Skin Infections (L00-L04, L050, L08, H000, H010, J340, L980); Meningococcal Disease (A39); Bacterial Meningitis (G00-G01); Dental Conditions (K00-K08); Neoplasm/Chemotherapy/Radiotherapy (C00-D48, Z510, Z511); Mental Health (F00-F99); Abdominal/Pelvic Pain (R10); Viral Infection NOS (B349); Renal Failure (N17-N19); Immune Disorders (D80-D89); Metabolic Disorders (E70-E89); Haemolytic Anaemias (D55-D59); Fever of Unknown Origin (R508, R509); Removal of Internal Fixation Device (Z470); Dialysis (Z49); Appendicitis (K35-K37); Injury/Poisoning (S00-T79 Excluding ED Cases); Urinary Tract Infection (N10, N11, N12, N300, N301, N302, N303, N308, N309, N390); Constipation (K590).

Injuries (Mortality): Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34).

Procedures (Procedure or Block Code): Grommets (4163200, 4163201); Tonsillectomy +/− Adenoidectomy (4178900, 4178901); Adenoidectomy without Tonsillectomy (4180100); Procedures on Extraocular Muscles (block 215-220); Myringoplasty (block 313); Procedures on Nose (block 370-381); Dental Procedures (block 450-490); Inguinal Hernia Repair (block 990); Gastrointestinal Procedures (block 850-1011); Haemodialysis (block 1059); Orchidopexy (block 1186); Circumcision (3065300); Hypospadias Repair (block 1198); Procedures on the Cervix (block 1274-1278); Musculoskeletal Procedures (block 1360-1579); Procedures on Skin/Subcutaneous Tissue (block 1600-1660); Magnetic Resonance Imaging (MRI)(block 2015);

Notes on Interpretation

Note 1: Because hospital admissions during the neonatal period are likely to be heavily influenced by perinatal factors and/or result from preterm infants transitioning through different levels of neonatal care (e.g. from neonatal intensive care, to Level 1–3 special care baby units), neonatal admissions have been excluded from this analysis. Similarly, infant mortality is also likely to be heavily influenced by perinatal factors, and thus this section is restricted to an analysis of mortality in children aged 1–14 years (see the Infant Mortality section for a review of the most frequent causes of mortality in those aged <1year).

Note 2: In order to maintain consistency with the injury section, all injury admissions with an Emergency Medicine Specialty Code (M05–M08) on discharge have been excluded (see **Appendix 3** for rationale).

Note 3: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, with an admission date 7+ days after the date the decision was made that the admission was necessary.

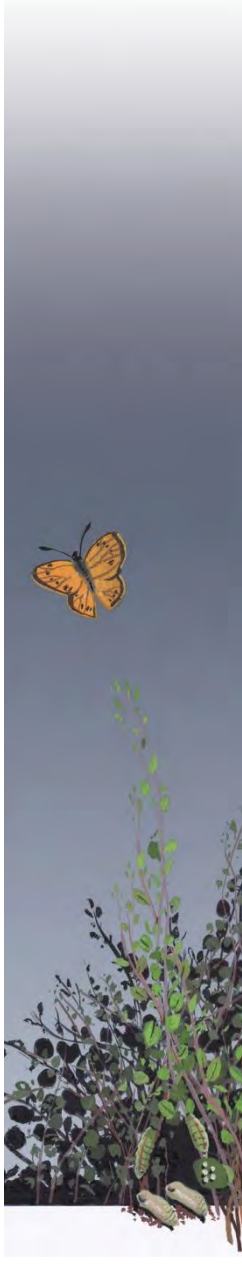
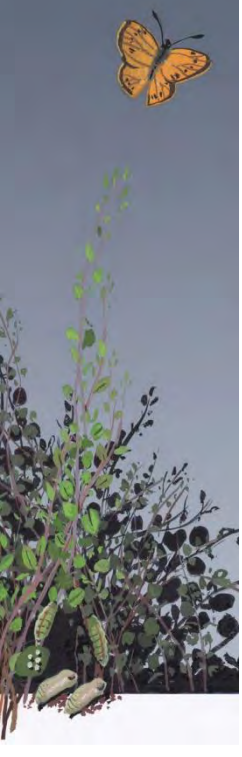


Table 28. Most Frequent Reasons for Hospital Admission in Children Aged 0–14 Years (Neonates Excluded) by Admission Type, New Zealand 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	51,697	10,339.4	11.6	15.9
Gastroenteritis	26,088	5,217.6	5.84	8.0
Bronchiolitis	25,731	5,146.2	5.76	7.9
Acute URTI	24,282	4,856.4	5.44	7.5
Asthma	23,742	4,748.4	5.32	7.3
Viral Infection NOS	17,264	3,452.8	3.87	5.3
Bacterial/Viral/Other Pneumonia	16,415	3,283.0	3.68	5.0
Skin Infections	14,637	2,927.4	3.28	4.5
Abdominal/Pelvic Pain	8,765	1,753.0	1.96	2.7
Urinary Tract Infection	6,377	1,275.4	1.43	2.0
Appendicitis	4,796	959.2	1.07	1.5
Constipation	3,484	696.8	0.78	1.1
Fever of Unknown Origin	3,372	674.4	0.76	1.0
Other Diagnoses	98,734	19,746.8	22.1	30.3
Total Acute Admissions	325,384	65,076.8	72.9	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	10,966	2,193.2	2.46	19.0
Injury / Poisoning	4,610	922.0	1.03	8.0
Dental Conditions	3,760	752.0	0.84	6.5
Dialysis	1,730	346.0	0.39	3.0
Other Diagnoses	36,602	7,320.4	8.20	63.5
Total Arranged Admissions	57,668	11,533.6	12.9	100.0
Waiting List Admissions by Primary Procedure				
Dental Procedures	27,843	5,568.6	6.24	20.7
Grommets	25,608	5,121.6	5.74	19.0
Tonsillectomy +/− Adenoidectomy	13,134	2,626.8	2.94	9.7
Musculoskeletal Procedures	11,372	2,274.4	2.55	8.4
No Procedure Listed	6,750	1,350.0	1.51	5.0
Gastrointestinal Procedures	5,563	1,112.6	1.25	4.1
Procedures on Skin/Subcutaneous Tissue	4,391	878.2	0.98	3.3
Inguinal Hernia Repair	3,595	719.0	0.81	2.7
Adenoidectomy without Tonsillectomy	2,468	493.6	0.55	1.8
Orchidopexy	2,047	409.4	0.46	1.5
Procedures on Extraocular Muscles	2,035	407.0	0.46	1.5
Myringoplasty	1,848	369.6	0.41	1.4
Other Procedures	28,148	5,629.6	6.31	20.9
Total Waiting List Admissions	134,802	26,960.4	30.2	100.0
New Zealand Total	517,854	103,570.8	116.0	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.



New Zealand Distribution

New Zealand Hospital Admissions

In New Zealand during 2006–2010, injury/poisoning, gastroenteritis and bronchiolitis were the most frequent reasons for an acute hospital admission in children aged 0–14 years. Neoplasms/chemotherapy/radiotherapy, injury/poisoning and dental conditions were the most frequent reasons for arranged admissions, while dental procedures, grommets and tonsillectomy +/− adenoidectomy were the most frequent reasons for a waiting list admission (**Table 28**).

New Zealand Mortality

In New Zealand during 2004–2008, neoplasms were the most frequent cause of mortality in children aged 1–14 years, followed by congenital anomalies and vehicle occupant transport injuries (**Table 29**).

Table 29. Most Frequent Causes of Mortality in Children Aged 1−14 Years by Main Underlying Cause of Death, New Zealand 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Mortality in Children Aged 1–14 Years				
New Zealand				
Neoplasms	121	24.2	2.93	15.4
Congenital Anomalies	92	18.4	2.23	11.7
Transport: Vehicle Occupant	77	15.4	1.86	9.8
Transport: Pedestrian	46	9.2	1.11	5.9
Transport: Cyclist	12	2.4	0.29	1.5
Transport: Motorbike	9	1.8	0.22	1.1
Transport: Other	12	2.4	0.29	1.5
Drowning / Submersion	39	7.8	0.94	5.0
Assault	23	4.6	0.56	2.9
Intentional Self-Harm	20	4.0	0.48	2.5
Electricity / Fire / Burns	20	4.0	0.48	2.5
SUDI	17	3.4	0.41	2.2
Epilepsy / Status Epilepticus	17	3.4	0.41	2.2
Falls	11	2.2	0.27	1.4
Mechanical Forces: Inanimate	11	2.2	0.27	1.4
Bacterial/Non-Viral Pneumonia	9	1.8	0.22	1.1
Asthma	8	1.6	0.19	1.0
Undetermined Intent	7	1.4	0.17	0.9
Accidental Poisoning	7	1.4	0.17	0.9
Meningococcal Disease	7	1.4	0.17	0.9
Viral Pneumonia	6	1.2	0.15	0.8
Bacterial Meningitis	5	1.0	0.12	0.6
Other Causes	209	41.8	5.06	26.6
New Zealand	785	157.0	19.0	100.0

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

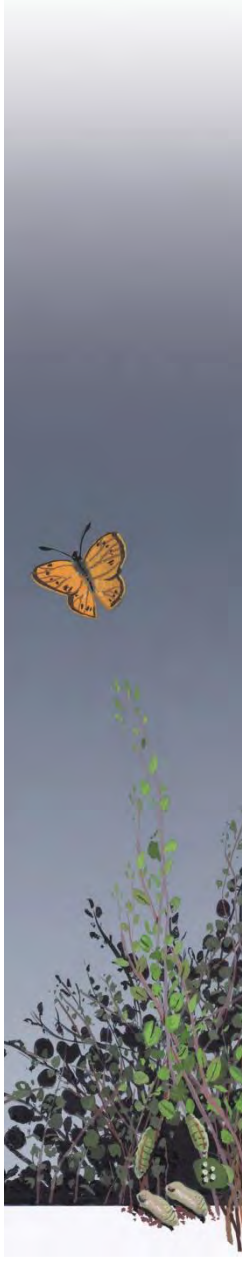


Table 30. Most Frequent Reasons for Hospital Admission in Children Aged 0−14 Years (Neonates Excluded) by Admission Type, Waikato 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Waikato 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	4,049	809.8	10.3	17.3
Bronchiolitis	2,160	432.0	5.50	9.2
Gastroenteritis	1,696	339.2	4.32	7.3
Acute URTI	1,671	334.2	4.26	7.1
Asthma	1,290	258.0	3.29	5.5
Skin Infections	984	196.8	2.51	4.2
Abdominal/Pelvic Pain	965	193.0	2.46	4.1
Bacterial/Viral/Other Pneumonia	830	166.0	2.11	3.6
Viral Infection NOS	782	156.4	1.99	3.3
Urinary Tract Infection	407	81.4	1.04	1.7
Fever of Unknown Origin	357	71.4	0.91	1.5
Appendicitis	353	70.6	0.90	1.5
Constipation	290	58.0	0.74	1.2
Other Diagnoses	7,538	1507.6	19.2	32.3
Total Acute Admissions	23,372	4,674.4	59.5	100.0
Arranged Admissions by Primary Diagnosis				
Dental Conditions	1,065	213.0	2.71	20.7
Neoplasm / Chemotherapy / Radiotherapy	958	191.6	2.44	18.6
Injury / Poisoning	276	55.2	0.70	5.4
Metabolic Disorders	79	15.8	0.20	1.5
Other Diagnoses	2,769	553.8	7.05	53.8
Total Arranged Admissions	5,147	1,029.4	13.1	100.0
Waiting List Admissions by Primary Procedure				
Grommets	2,531	506.2	6.45	20.5
Dental Procedures	2,340	468.0	5.96	18.9
Tonsillectomy +/− Adenoidectomy	1,355	271.0	3.45	11.0
Musculoskeletal Procedures	885	177.0	2.25	7.2
No Procedure Listed	866	173.2	2.21	7.0
Gastrointestinal Procedures	642	128.4	1.64	5.2
Procedures on Skin/Subcutaneous Tissue	364	72.8	0.93	2.9
Inguinal Hernia Repair	336	67.2	0.86	2.7
Adenoidectomy without Tonsillectomy	280	56.0	0.71	2.3
Orchidopexy	200	40.0	0.51	1.6
Procedures on Nose	150	30.0	0.38	1.2
Procedures on Extraocular Muscles	115	23.0	0.29	0.9
Other Procedures	2,303	460.6	5.87	18.6
Total Waiting List Admissions	12,367	2,473.4	31.5	100.0
Waikato Total	40,886	8,177.2	104.1	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

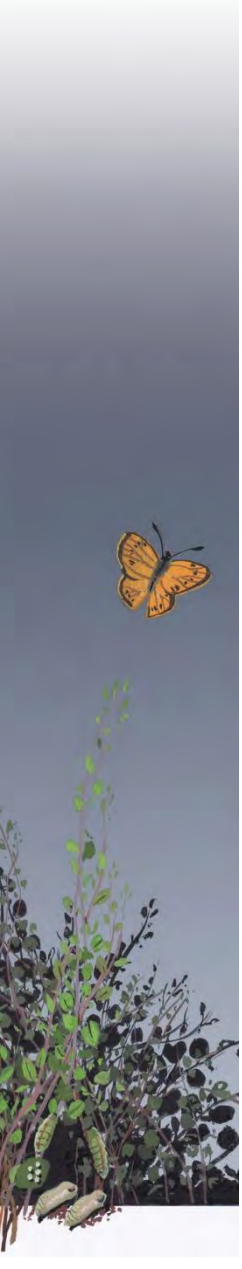


Table 31. Most Frequent Reasons for Hospital Admission in Children Aged 0−14 Years (Neonates Excluded) by Admission Type, Bay of Plenty 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Bay of Plenty 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	3,234	646.8	14.5	16.1
Acute URTI	1,801	360.2	8.10	9.0
Bronchiolitis	1,732	346.4	7.79	8.6
Gastroenteritis	1,713	342.6	7.70	8.5
Asthma	1,497	299.4	6.73	7.5
Viral Infection NOS	963	192.6	4.33	4.8
Skin Infections	868	173.6	3.90	4.3
Bacterial/Viral/Other Pneumonia	838	167.6	3.77	4.2
Abdominal/Pelvic Pain	445	89.0	2.00	2.2
Urinary Tract Infection	283	56.6	1.27	1.4
Appendicitis	276	55.2	1.24	1.4
Constipation	180	36.0	0.81	0.9
Fever of Unknown Origin	176	35.2	0.79	0.9
Other Diagnoses	6,073	1214.6	27.3	30.2
Total Acute Admissions	20,079	4,015.8	90.3	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	477	95.4	2.15	11.4
Injury / Poisoning	183	36.6	0.82	4.4
Dental Conditions	119	23.8	0.54	2.8
Removal of Internal Fixation Device	108	21.6	0.49	2.6
Other Diagnoses	3,301	660.2	14.8	78.8
Total Arranged Admissions	4,188	837.6	18.8	100.0
Waiting List Admissions by Primary Procedure				
Dental Procedures	1,783	356.6	8.02	25.1
Grommets	1,104	220.8	4.97	15.5
Tonsillectomy +/− Adenoidectomy	823	164.6	3.70	11.6
Musculoskeletal Procedures	594	118.8	2.67	8.3
No Procedure Listed	448	89.6	2.02	6.3
Gastrointestinal Procedures	350	70.0	1.57	4.9
Procedures on Skin/Subcutaneous Tissue	184	36.8	0.83	2.6
Inguinal Hernia Repair	183	36.6	0.82	2.6
Circumcision	163	32.6	0.73	2.3
Adenoidectomy without Tonsillectomy	114	22.8	0.51	1.6
Myringoplasty	95	19.0	0.43	1.3
Procedures on Extraocular Muscles	81	16.2	0.36	1.1
Other Procedures	1,194	238.8	5.37	16.8
Total Waiting List Admissions	7,116	1,423.2	32.0	100.0
Bay of Plenty Total	31,383	6,276.6	141.2	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

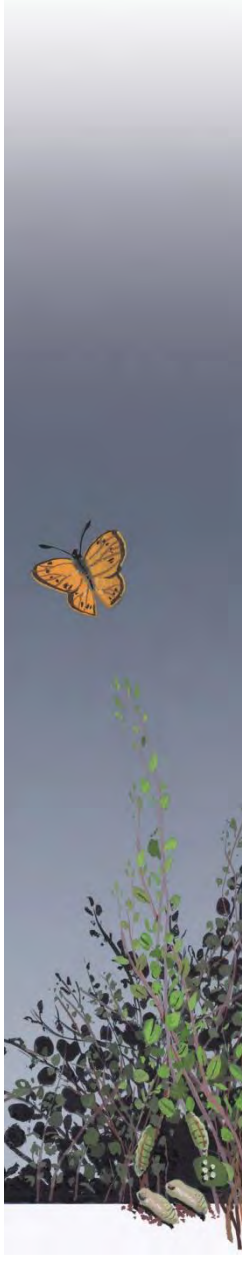


Table 32. Most Frequent Reasons for Hospital Admission in Children Aged 0−14 Years (Neonates Excluded) by Admission Type, Lakes DHB 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Lakes DHB 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	1,542	308.4	12.9	14.6
Bronchiolitis	1,008	201.6	8.42	9.6
Asthma	889	177.8	7.43	8.4
Acute URTI	878	175.6	7.34	8.3
Gastroenteritis	716	143.2	5.98	6.8
Bacterial/Viral/Other Pneumonia	581	116.2	4.86	5.5
Viral Infection NOS	555	111.0	4.64	5.3
Skin Infections	499	99.8	4.17	4.7
Abdominal/Pelvic Pain	238	47.6	1.99	2.3
Urinary Tract Infection	207	41.4	1.73	2.0
Appendicitis	160	32.0	1.34	1.5
Fever of Unknown Origin	97	19.4	0.81	0.9
Constipation	68	13.6	0.57	0.6
Other Diagnoses	3,116	623.2	26.0	29.5
Total Acute Admissions	10,554	2,110.8	88.2	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	219	43.8	1.83	11.4
Injury / Poisoning	87	17.4	0.73	4.5
Haemolytic Anaemias	70	14.0	0.59	3.7
Metabolic Disorders	52	10.4	0.43	2.7
Other Diagnoses	1,486	297.2	12.4	77.6
Total Arranged Admissions	1,914	382.8	16.0	100.0
Waiting List Admissions by Primary Procedure				
Dental Procedures	975	195.0	8.15	25.4
Grommets	745	149.0	6.23	19.4
Tonsillectomy +/− Adenoidectomy	338	67.6	2.82	8.8
Musculoskeletal Procedures	263	52.6	2.20	6.8
No Procedure Listed	256	51.2	2.14	6.7
Gastrointestinal Procedures	177	35.4	1.48	4.6
Inguinal Hernia Repair	119	23.8	0.99	3.1
Procedures on Skin/Subcutaneous Tissue	90	18.0	0.75	2.3
Myringoplasty	80	16.0	0.67	2.1
Orchidopexy	57	11.4	0.48	1.5
Circumcision	52	10.4	0.43	1.4
Adenoidectomy without Tonsillectomy	43	8.6	0.36	1.1
Other Procedures	648	129.6	5.42	16.9
Total Waiting List Admissions	3,843	768.6	32.1	100.0
Lakes DHB Total	16,311	3,262.2	136.3	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

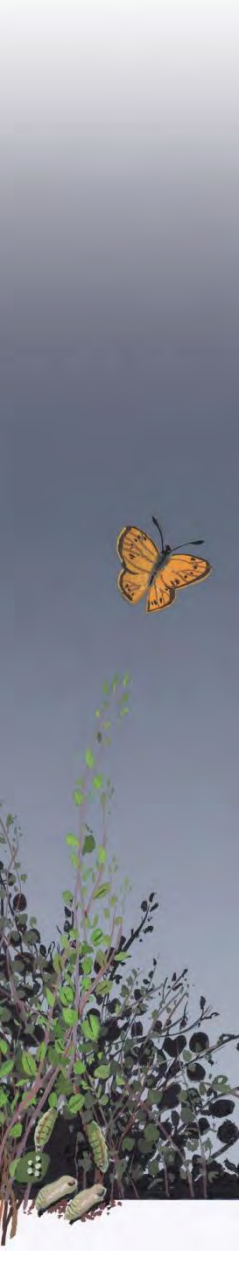


Table 33. Most Frequent Reasons for Hospital Admission in Children Aged 0−14 Years (Neonates Excluded) by Admission Type, Tairawhiti 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tairawhiti 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	1,000	200.0	17.3	17.1
Acute URTI	581	116.2	10.0	9.9
Bronchiolitis	507	101.4	8.76	8.6
Gastroenteritis	403	80.6	6.96	6.9
Asthma	372	74.4	6.43	6.3
Viral Infection NOS	281	56.2	4.85	4.8
Bacterial/Viral/Other Pneumonia	280	56.0	4.84	4.8
Skin Infections	279	55.8	4.82	4.8
Abdominal/Pelvic Pain	126	25.2	2.18	2.1
Constipation	121	24.2	2.09	2.1
Appendicitis	72	14.4	1.24	1.2
Fever of Unknown Origin	63	12.6	1.09	1.1
Urinary Tract Infection	59	11.8	1.02	1.0
Other Diagnoses	1,719	343.8	29.7	29.3
Total Acute Admissions	5,863	1,172.6	101.3	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	128	25.6	2.21	13.4
Injury / Poisoning	81	16.2	1.40	8.5
Dental Conditions	77	15.4	1.33	8.1
Constipation	54	10.8	0.93	5.7
Other Diagnoses	614	122.8	10.6	64.4
Total Arranged Admissions	954	190.8	16.5	100.0
Waiting List Admissions by Primary Procedure				
Dental Procedures	601	120.2	10.4	30.6
Grommets	347	69.4	5.99	17.6
Musculoskeletal Procedures	167	33.4	2.88	8.5
Tonsillectomy +/− Adenoidectomy	130	26.0	2.25	6.6
No Procedure Listed	102	20.4	1.76	5.2
Procedures on Skin/Subcutaneous Tissue	70	14.0	1.21	3.6
Gastrointestinal Procedures	62	12.4	1.07	3.2
Inguinal Hernia Repair	40	8.0	0.69	2.0
Procedures on Nose	34	6.8	0.59	1.7
Orchidopexy	28	5.6	0.48	1.4
Adenoidectomy without Tonsillectomy	27	5.4	0.47	1.4
Procedures on Extraocular Muscles	25	5.0	0.43	1.3
Other Procedures	334	66.8	5.77	17.0
Total Waiting List Admissions	1,967	393.4	34.0	100.0
Tairawhiti Total	8,784	1,756.8	151.7	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

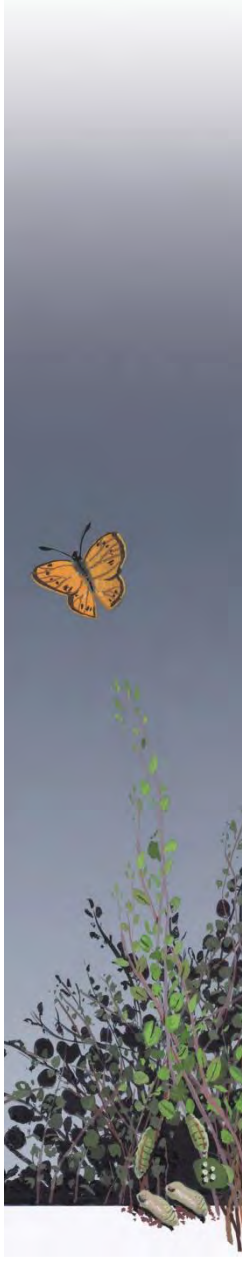


Table 34. Most Frequent Reasons for Hospital Admission in Children Aged 0−14 Years (Neonates Excluded) by Admission Type, Taranaki 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Taranaki 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	1,126	225.2	10.1	16.8
Asthma	571	114.2	5.11	8.5
Gastroenteritis	491	98.2	4.39	7.3
Bronchiolitis	450	90.0	4.02	6.7
Acute URTI	432	86.4	3.86	6.4
Bacterial/Viral/Other Pneumonia	322	64.4	2.88	4.8
Viral Infection NOS	255	51.0	2.28	3.8
Skin Infections	229	45.8	2.05	3.4
Abdominal/Pelvic Pain	199	39.8	1.78	3.0
Appendicitis	119	23.8	1.06	1.8
Urinary Tract Infection	112	22.4	1.00	1.7
Fever of Unknown Origin	75	15.0	0.67	1.1
Constipation	57	11.4	0.51	0.9
Other Diagnoses	2,260	452.0	20.2	33.7
Total Acute Admissions	6,698	1,339.6	59.9	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	318	63.6	2.84	24.2
Dental Conditions	64	12.8	0.57	4.9
Injury / Poisoning	55	11.0	0.49	4.2
Removal of Internal Fixation Device	24	4.8	0.21	1.8
Other Diagnoses	854	170.8	7.64	64.9
Total Arranged Admissions	1,315	263.0	11.8	100.0
Waiting List Admissions by Primary Procedure				
Dental Procedures	855	171.0	7.64	23.9
Grommets	782	156.4	6.99	21.8
Tonsillectomy +/− Adenoidectomy	367	73.4	3.28	10.3
Musculoskeletal Procedures	232	46.4	2.07	6.5
Gastrointestinal Procedures	148	29.6	1.32	4.1
No Procedure Listed	118	23.6	1.06	3.3
Inguinal Hernia Repair	116	23.2	1.04	3.2
Circumcision	100	20.0	0.89	2.8
Procedures on Skin/Subcutaneous Tissue	82	16.4	0.73	2.3
Procedures on Extraocular Muscles	58	11.6	0.52	1.6
Orchidopexy	55	11.0	0.49	1.5
Adenoidectomy without Tonsillectomy	52	10.4	0.46	1.5
Other Procedures	614	122.8	5.49	17.2
Total Waiting List Admissions	3,579	715.8	32.0	100.0
Taranaki Total	11,592	2,318.4	103.6	100.0

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

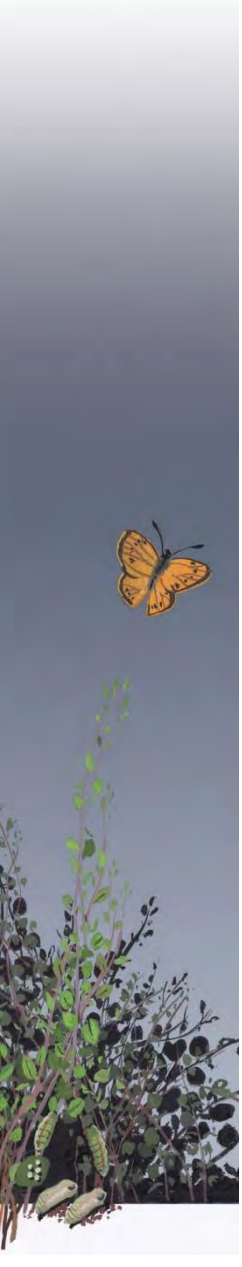
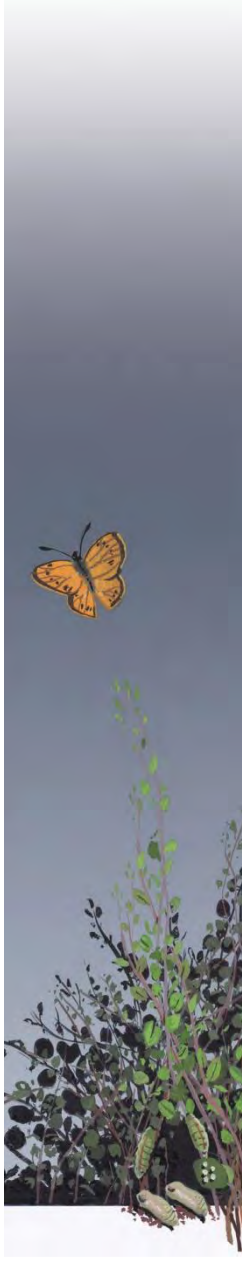


Table 35. Most Frequent Causes of Mortality in Children Aged 1−14 Years by Main Underlying Cause of Death, Midland DHBs 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Mortality in Children Aged 1–14 Years				
Waikato				
Neoplasms	13	2.6	3.54	14.6
Congenital Anomalies	10	2.0	2.72	11.2
Transport: Vehicle Occupant	8	1.6	2.18	9.0
Transport: Pedestrian	6	1.2	1.63	6.7
Transport: All Other Causes	3	0.6	0.82	3.4
Drowning / Submersion	4	0.8	1.09	4.5
Other Causes	45	9.0	12.2	50.6
Waikato Total	89	17.8	24.2	100.0
Bay of Plenty				
Transport: Vehicle Occupant	5	1.0	2.41	9.6
Transport: Pedestrian	3	0.6	1.45	5.8
Transport: All Other Causes	4	0.8	1.93	7.7
Drowning / Submersion	5	1.0	2.41	9.6
Neoplasms	3	0.6	1.45	5.8
Electricity / Fire / Burns	3	0.6	1.45	5.8
Assault	3	0.6	1.45	5.8
Other Causes	26	5.2	12.5	50.0
Bay of Plenty Total	52	10.4	25.1	100.0
Lakes DHB				
Congenital Anomalies	5	1.0	4.42	23.8
Neoplasms	3	0.6	2.65	14.3
Transport: Vehicle Occupant	3	0.6	2.65	14.3
Other Causes	10	2.0	8.83	47.6
Lakes DHB Total	21	4.2	18.5	100.0
Tairawhiti				
All Causes	11	2.2	19.9	100.0
Tairawhiti Total	11	2.2	19.9	100.0
Taranaki				
Transport: All Causes	4	0.8	3.70	26.7
Epilepsy / Status Epilepticus	3	0.6	2.78	20.0
Neoplasms	3	0.6	2.78	20.0
Other Causes	5	1.0	4.63	33.3
Taranaki Total	15	3.0	13.9	100.0

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population



Midland Region Distribution

Midland Region Hospital Admissions

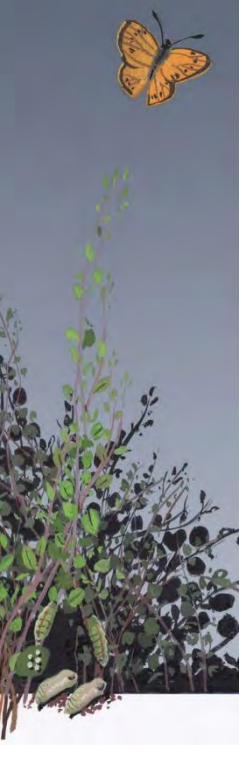
Amongst DHBs in the Midland Region during 2006–2010, injury/poisoning was the leading reason for acute hospital admissions in children aged 0–14 years, followed by a range of infectious and respiratory diseases (e.g. bronchiolitis, asthma, gastroenteritis, acute upper respiratory infections). Neoplasms/chemotherapy/radiotherapy, injury/poisoning and dental conditions were the most frequent reasons for arranged admissions, while dental procedures and grommets were the most frequent reasons for a waiting list admission (**Table 30** to **Table 34**).

Midland Region Mortality

Amongst Midland DHBs during 2004–2008, transport injuries, congenital anomalies, neoplasms and drowning / submersion were common causes of mortality in children aged 1–14 years (**Table 35**).

Summary

Amongst DHBs in the Midland Region during 2006–2010, injury/poisoning was the leading reason for acute hospital admissions in children aged 0–14 years, followed by a range of infectious and respiratory diseases (e.g. bronchiolitis, asthma, gastroenteritis, acute upper respiratory infections). Neoplasms/chemotherapy/radiotherapy, injury/poisoning and dental conditions were the most frequent reasons for arranged admissions, while dental procedures and grommets were the most frequent reasons for a waiting list admission. During 2004–2008, transport injuries, congenital anomalies, neoplasms and drowning / submersion were common causes of mortality in children aged 1–14 years.



AMBULATORY SENSITIVE HOSPITALISATIONS

Introduction

Ambulatory sensitive hospitalisations (ASH) are often used as a measure for assessing the performance of primary health care [97]. From 2007, the Ministry of Health identified reducing ASH among children aged 0-4 years in New Zealand as a priority [98]. The measure is not used to assess failure in individual cases however, but to identify conditions where a specific intervention could reduce groups of admissions [99]. Common conditions implicated in ASH among New Zealand children aged 0-4 years are gastroenteritis, respiratory infections, dental conditions and asthma [97]. Commonalities in these conditions are the abrupt nature of their onset and/or their infectious origin. The primary health care response to these conditions often needs to be swift if it is to avoid the need for admission to hospital. Acute conditions, therefore, place specific demands on primary health services which are different to the predominantly chronic conditions that constitute ASH among older people [30]. Cardiovascular disease, for example, requires interventions developed with the patient over time to avoid ASH. In New Zealand, childhood ASH peaks first around one year of age and then again around 4-7 years [97]. Rates for males are higher, as are those for Pacific children, and it is more prevalent among those who live in average to more deprived areas [97].

The following sections review ASH in children aged 0-4 years using information from the National Minimum Dataset. Factors that could assist the development of appropriate primary health care services and treatment to reduce ASH rates among children are reviewed in more detail in the in-depth topic commencing on **Page 111**.

Data Sources and Methods

Indicator

1. Ambulatory *Sensitive Hospitalisations (ASH) in Children Aged 0–4 Years*

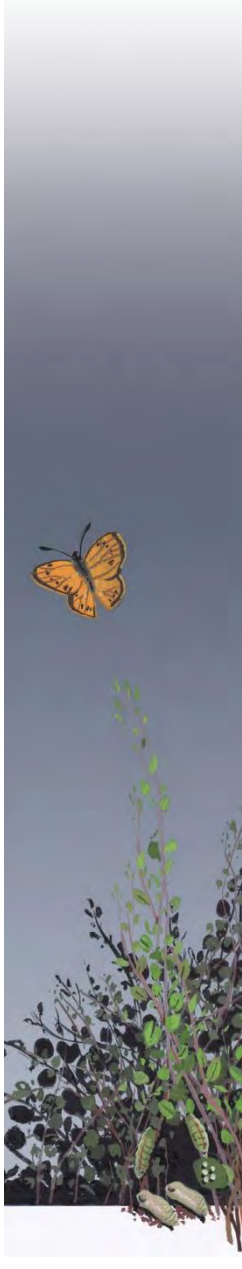
Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for ambulatory sensitive conditions in children aged 0–4 years. Includes admissions with an ICD-10-AM primary diagnosis of Asthma (J45–46), Bronchiectasis (J47), Skin Infections (H000, H010, J340, L01–L04, L08, L980), Constipation (K590), Dental Caries/Other Dental Conditions (K02, K04, K05), Dermatitis and Eczema (L20–30), Gastroenteritis (A02–A09, R11, K529), Gastro-Oesophageal Reflux (K21), Nutritional Deficiency (D50–D53, E40–E46, E50–E56, E58–E61, E63–E64), Bacterial/Non-Viral Pneumonia (J13–J16, J18), Rheumatic Fever/Heart Disease (I00–I09), Otitis Media (H65–H67), Acute Upper Respiratory Tract Infections (excluding croup) (J00–J03, J06), Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella; ≥6 months: Pertussis, Diphtheria, Hepatitis B; ≥16 months: Measles, Mumps, Rubella (A35, A36, A37, A80, B16, B180, B181 A33, A34, P350, B05, B06, B26, M014); >4 years: Urinary Tract Infections (N10, N12, N300, N390, N309, N136).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: *Age Filters*: The 0–4 year age group has been selected for this analysis as it aligns with the Ministry of Health's previous paediatric ASH Target (0–4 years). Neonatal admissions (0–28 days) have been excluded on the basis that issues arising in the neonatal period are likely to be heavily influenced by antenatal/perinatal factors, and as a consequence are likely to require different care pathways from conditions arising in the community (e.g. pneumonia in a very preterm infant). The only exceptions are neonatal tetanus and congenital rubella, which are potentially preventable by timely (maternal) access to immunisation. Further, age filters have also been applied to some vaccine preventable diseases (e.g. measles ≥16 months) on the basis that these conditions may not be (primary care) preventable, prior to the age at which immunisation for the relevant condition is due. Similarly, a >4 year age criteria has been applied to urinary tract infections, on the basis that younger children may require hospitalisation for further investigation.

Note 2: *Admission Type Filters*: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission is a non-acute admission with an admission date <7 days after the decision was made that the admission was required. A waiting list admission is a planned admission, where the admission date is 7+ days after the decision was made that the admission was necessary. In this section, all analyses include acute and arranged (semi-acute) admissions only, with the exception of dental conditions, which also include waiting list admissions (as some DHBs routinely admit dental conditions from the waiting list, while others admit the majority as arranged admissions, potentially creating artefactual DHB differences if



the entire burden of dental morbidity is not captured). This restriction was applied in order to eliminate the large number of cases where the primary diagnosis was e.g. otitis media, but where the main reason for admission was for the insertion of grommets, as it was felt that the role primary care played in preventing acute admissions (e.g. for acute otitis media), was likely to differ from the one it played in ensuring children had access to waiting list procedures (e.g. for the insertion of grommets).

Note 3: *Emergency Department Filters*: In order to deal with the issue of inconsistent uploading of Emergency Department (ED) cases to the National Minimum Dataset (see **Appendix 3**), the Ministry of Health has traditionally applied a number of filters to its ASH analyses [100,101]. These filters exclude Accident and Emergency cases which meet the following criteria:

- The admission and discharge dates are the same AND,
- The patient was not discharged dead (i.e., discharge type not in 'DD') AND,
- The health specialty code is in ('M05', 'M06', 'M07', or 'M08').

While the NZ Child and Youth Epidemiology service does not recommend the use of such filters in the paediatric population (see **Appendix 3** for a discussion of these issues), in order to allow DHBs to assess the impact ED cases have on their ASH rates, all the analyses in this section are presented with both ED cases included and excluded. In contrast to the Ministry of Health filters described above however, all ED cases have either been totally included or excluded, not just those admitted and discharged on the same day (as in the paediatric population many presentations occur late in the evening, with children then being discharged in the early hours of the following day, potentially making their total length of stay similar to that of ED day cases).

For those DHBs without a dedicated paediatric emergency department, who assess the majority of their cases in a Paediatric Assessment Unit or on the Paediatric Ward, the ED included and excluded analyses may be identical. Local variations in the way health specialty codes are assigned to such cases may profoundly influence the differences seen between the ED included and excluded rates.

Note 4: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Distribution by Primary Diagnosis

In New Zealand during 2006–2010, gastroenteritis, acute upper respiratory infections and asthma were the most frequent causes of ASH in children 0–4 years when emergency department (ED) cases were included, while gastroenteritis, dental conditions and asthma were the most frequent causes when ED cases were excluded (**Table 36**).

New Zealand Trends

In New Zealand during 2000–2010 when ED cases were included, ASH rates in children 0–4 years gradually increased, whereas when ED cases were excluded, ASH rates were more static (**Figure 24**).

New Zealand Distribution by Age

In New Zealand during 2006–2010, ASH rates were highest in infants and one year olds, with rates then tapering off rapidly between one and two years, and then again between four and seven years of age. The exclusion of ED cases did not alter this overall pattern appreciably (**Figure 25**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, ASH rates in children 0–4 years were *significantly* higher for males, for Pacific > Māori > Asian/Indian > European children, and those living in average-to-more deprived (NZDep decile 3–10) areas. Similar patterns were seen when ED cases were excluded, although admission rates for Asian/Indian were *significantly* lower than for European children (**Table 37**). Similar ethnic differences were seen during 2000-2010 (**Figure 26**).

Table 36. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand Ambulatory Sensitive Hospitalisations 0–4 Years				
Emergency Department Cases Included				
Gastroenteritis	21,329	4,265.8	14.8	23.0
Acute Upper Respiratory Tract Infections	15,595	3,119.0	10.8	16.8
Asthma	15,511	3,102.2	10.8	16.7
Dental Conditions	13,261	2,652.2	9.21	14.3
Bacterial/Non-Viral Pneumonia	10,898	2,179.6	7.57	11.8
Skin Infections	7,743	1,548.6	5.38	8.4
Otitis Media	2,804	560.8	1.95	3.0
Dermatitis and Eczema	2,215	443.0	1.54	2.4
Constipation	1,523	304.6	1.06	1.6
Gastro-Oesophageal Reflux	1,353	270.6	0.94	1.5
Bronchiectasis	204	40.8	0.14	0.2
Nutritional Disorders	170	34.0	0.12	0.2
VPD ≥ 6 Months: DTP, Polio, HepB	77	15.4	0.05	0.1
VPD ≥ 16 Months: MMR	26	5.2	0.02	<0.1
Rheumatic Fever/Heart Disease	19	3.8	0.01	<0.1
New Zealand Total	92,728	18,545.6	64.4	100.0
Emergency Department Cases Excluded				
Gastroenteritis	15,415	3,083.0	10.7	20.2
Dental Conditions	13,228	2,645.6	9.19	17.3
Asthma	12,075	2,415.0	8.39	15.8
Acute Upper Respiratory Tract Infections	11,985	2,397.0	8.32	15.7
Bacterial/Non-Viral Pneumonia	9,223	1,844.6	6.41	12.1
Skin Infections	7,327	1,465.4	5.09	9.6
Otitis Media	2,249	449.8	1.56	2.9
Dermatitis and Eczema	2,060	412.0	1.43	2.7
Constipation	1,230	246.0	0.85	1.6
Gastro-Oesophageal Reflux	1,224	244.8	0.85	1.6
Bronchiectasis	200	40.0	0.14	0.3
Nutritional Disorders	157	31.4	0.11	0.2
VPD ≥ 6 Months: DTP, Polio, HepB	70	14.0	0.05	0.1
VPD ≥ 16 Months: MMR	21	4.2	0.01	<0.1
Rheumatic Fever/Heart Disease	18	3.6	0.01	<0.1
New Zealand Total	76,482	15,296.4	53.1	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

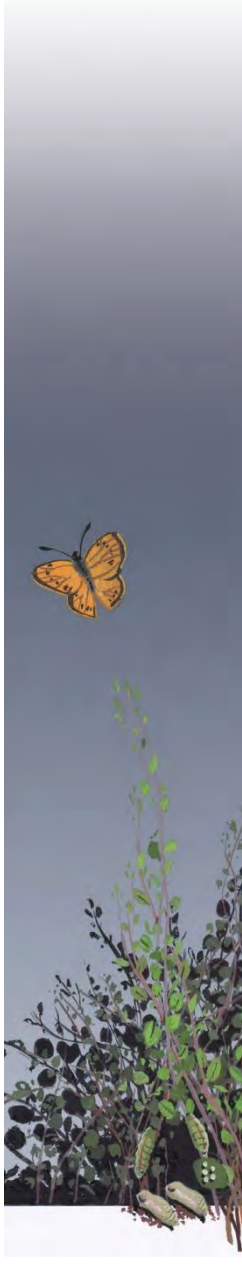
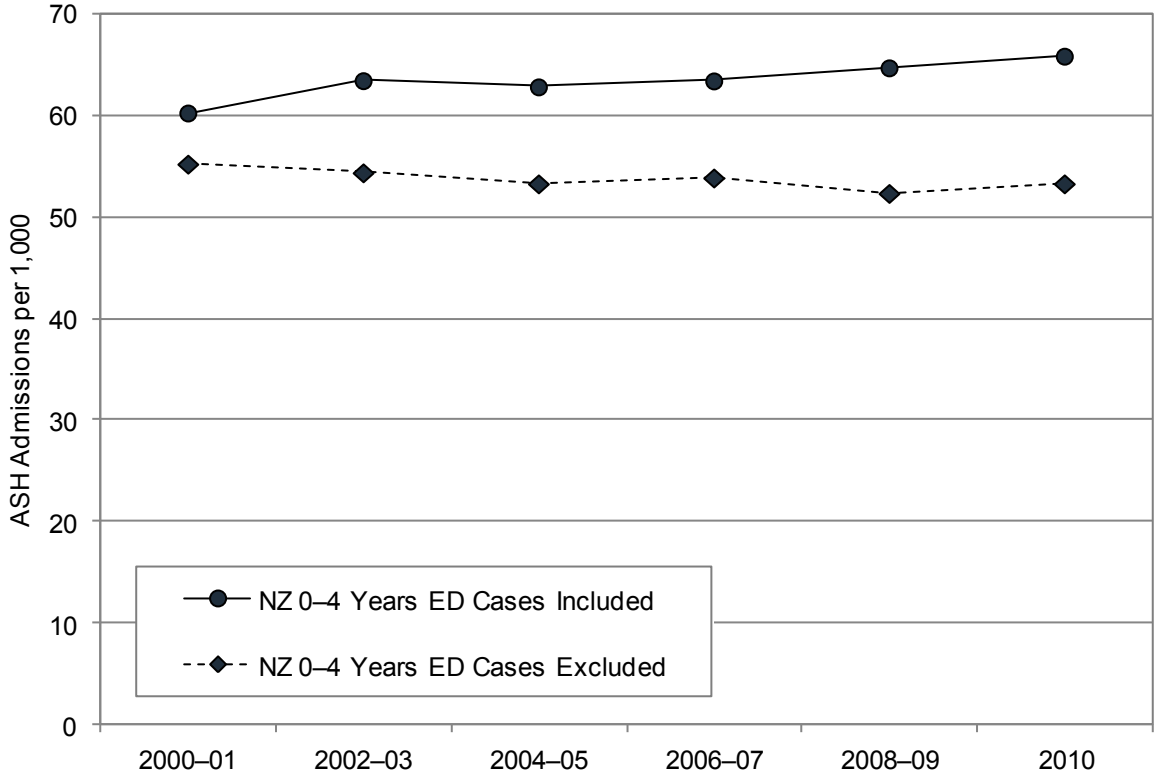
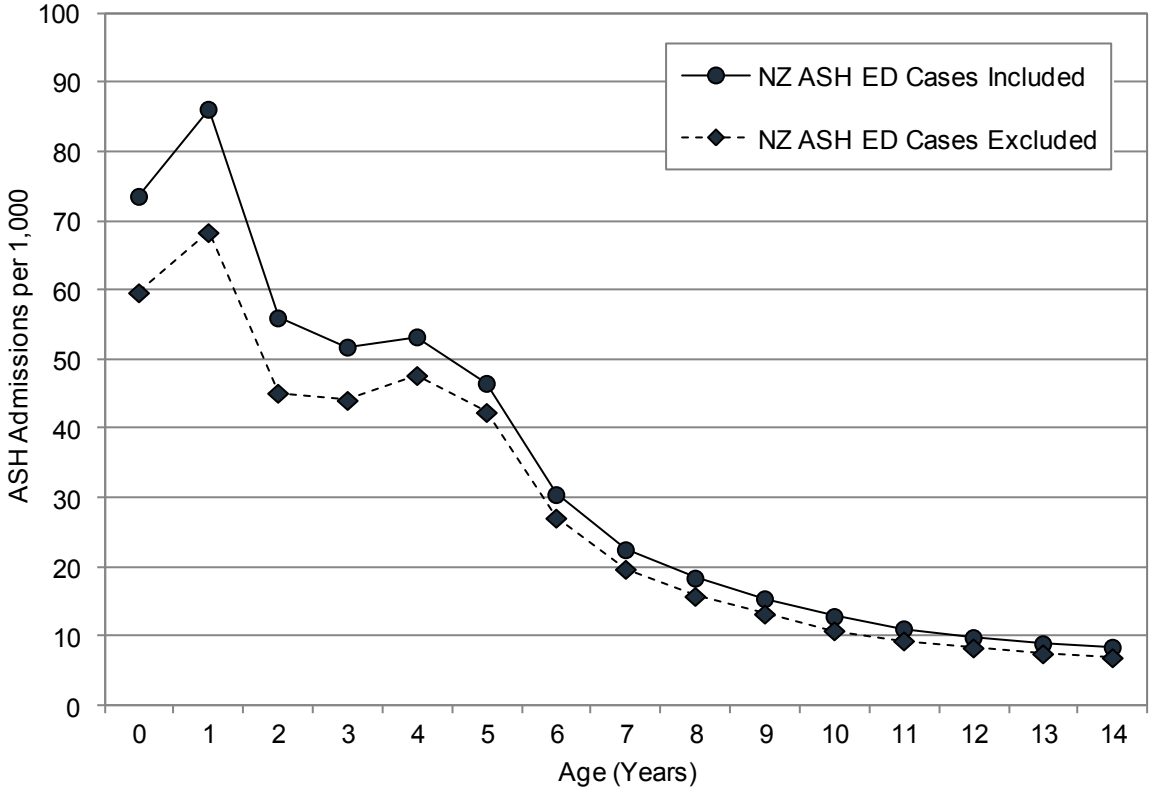


Figure 24. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population.

Figure 25. Ambulatory Sensitive Hospitalisations in Children Aged 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Table 37. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Ambulatory Sensitive Hospitalisations 0–4 Years							
Emergency Department Cases Included							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	37.1	1.00		Decile 1–2	36.5	1.00	
Decile 2	35.9	0.97	0.93–1.01	Decile 3–4	44.2	1.21	1.18–1.24
Decile 3	41.9	1.13	1.09–1.17	Decile 5–6	57.2	1.57	1.53–1.61
Decile 4	46.3	1.25	1.20–1.29	Decile 7–8	72.5	1.98	1.94–2.03
Decile 5	53.6	1.44	1.39–1.50	Decile 9–10	97.2	2.66	2.60–2.72
Decile 6	60.2	1.62	1.57–1.68	Prioritised Ethnicity			
Decile 7	67.2	1.81	1.75–1.87	European	47.7	1.00	
Decile 8	76.9	2.07	2.01–2.14	Māori	80.7	1.69	1.67–1.72
Decile 9	90.9	2.45	2.37–2.53	Pacific	116.8	2.45	2.41–2.49
Decile 10	102.7	2.77	2.68–2.85	Asian/Indian	55.2	1.16	1.13–1.19
Gender							
Female	58.9	1.00					
Male	69.7	1.18	1.17–1.20				
Emergency Department Cases Excluded							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	31.3	1.00		Decile 1–2	29.8	1.00	
Decile 2	28.1	0.90	0.86–0.94	Decile 3–4	35.6	1.20	1.16–1.23
Decile 3	33.3	1.06	1.02–1.11	Decile 5–6	46.7	1.57	1.53–1.61
Decile 4	37.7	1.20	1.15–1.25	Decile 7–8	60.6	2.04	1.98–2.09
Decile 5	43.4	1.38	1.33–1.44	Decile 9–10	80.8	2.71	2.65–2.78
Decile 6	49.5	1.58	1.52–1.64	Prioritised Ethnicity			
Decile 7	57.1	1.82	1.76–1.89	European	40.6	1.00	
Decile 8	63.5	2.03	1.95–2.10	Māori	70.4	1.73	1.71–1.76
Decile 9	75.0	2.39	2.31–2.48	Pacific	88.2	2.17	2.13–2.22
Decile 10	85.8	2.74	2.65–2.83	Asian/Indian	37.9	0.93	0.91–0.96
Gender							
Female	48.6	1.00					
Male	57.4	1.18	1.17–1.20				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population; Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001

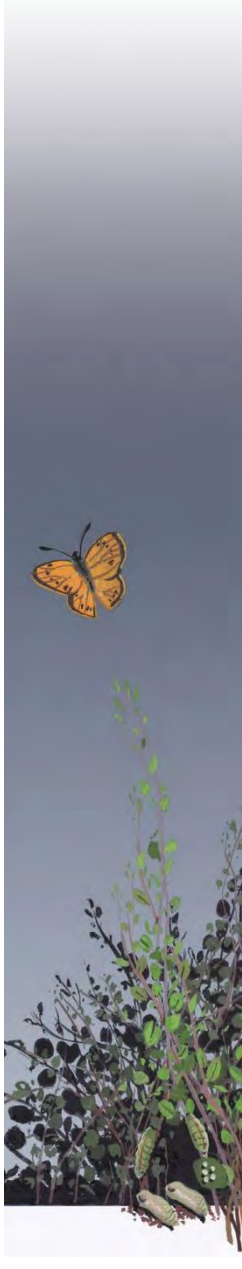
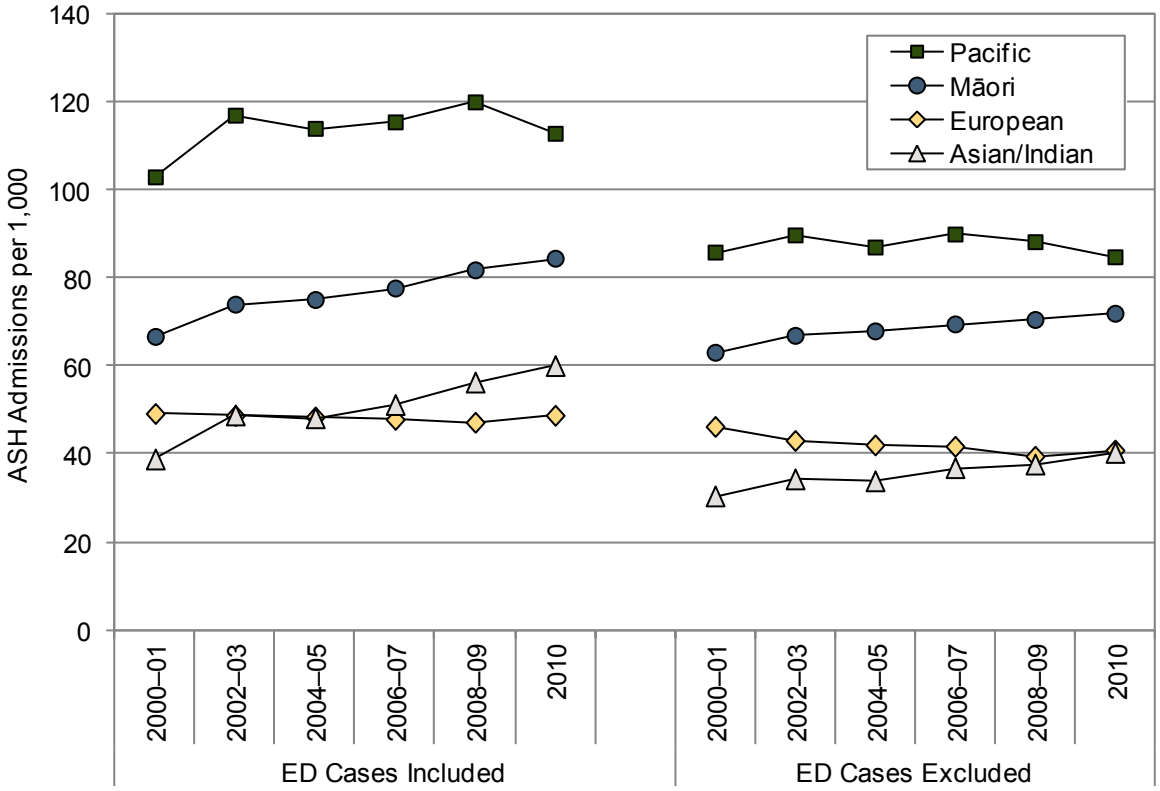


Figure 26. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population; Note: Ethnicity is Level 1 Prioritised

Midland Region Distribution and Trends

Table 38. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Ambulatory Sensitive Hospital Admissions 0–4 Years					
Emergency Department Cases Included					
Waikato	6,387	1277.4	50.9	0.79	0.77–0.81
Lakes	3,226	645.2	84.3	1.31	1.27–1.35
Bay of Plenty	5,976	1195.2	87.5	1.36	1.32–1.39
Tairawhiti	1,831	366.2	101.0	1.57	1.50–1.64
Taranaki	1,769	353.8	50.9	0.79	0.75–0.83
New Zealand	92,728	18,545.6	64.4	1.00	
Emergency Department Cases Excluded					
Waikato	4,667	933.4	37.2	0.70	0.68–0.72
Lakes	2,952	590.4	77.1	1.45	1.40–1.50
Bay of Plenty	5,533	1106.6	81.0	1.52	1.49–1.57
Tairawhiti	1,817	363.4	100.3	1.89	1.81–1.97
Taranaki	1,660	332.0	47.7	0.90	0.86–0.94
New Zealand	76,482	15,296.4	53.1	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only; Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Midland DHBs vs. New Zealand

In the Waikato and Taranaki during 2006–2010, ASH in children 0–4 years were *significantly* lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti ASH were *significantly* higher, irrespective of whether ED cases were included or excluded (**Table 38**).

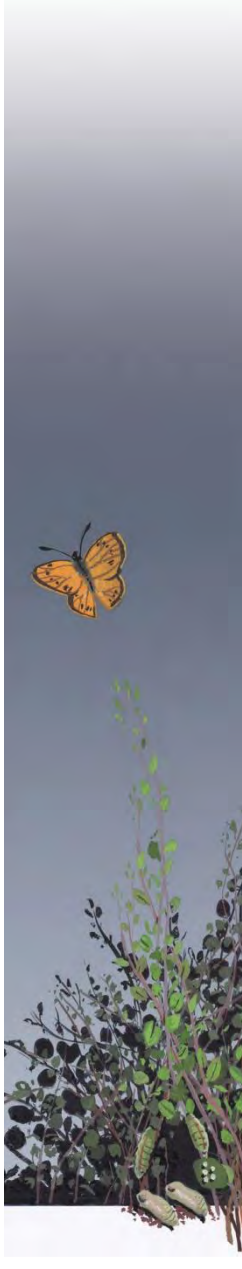
Table 39. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, Waikato 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Waikato ASH 0–4 Years				
Emergency Department Cases Included				
Gastroenteritis	1,418	283.6	11.3	22.2
Dental Conditions	1,363	272.6	10.9	21.3
Acute Upper Respiratory Tract Infections	1,095	219.0	8.72	17.1
Asthma	841	168.2	6.70	13.2
Skin Infections	508	101.6	4.05	8.0
Bacterial/Non-Viral Pneumonia	492	98.4	3.92	7.7
Otitis Media	308	61.6	2.45	4.8
Dermatitis and Eczema	117	23.4	0.93	1.8
Constipation	110	22.0	0.88	1.7
Gastro-Oesophageal Reflux	105	21.0	0.84	1.6
Nutritional Disorders	16	3.2	0.13	0.3
VPD ≥ 6 Months: DTP, Polio, HepB	7	1.4	0.06	0.1
Bronchiectasis	5	1.0	0.04	0.1
Rheumatic Fever/Heart Disease	<3	s	s	s
Waikato Total	6,387	1,277.4	50.9	100.00
Emergency Department Cases Excluded				
Dental Conditions	1,359	271.8	10.8	29.1
Gastroenteritis	793	158.6	6.32	17.0
Asthma	604	120.8	4.81	12.9
Acute Upper Respiratory Tract Infections	559	111.8	4.45	12.0
Skin Infections	474	94.8	3.78	10.2
Bacterial/Non-Viral Pneumonia	404	80.8	3.22	8.7
Otitis Media	201	40.2	1.60	4.3
Dermatitis and Eczema	92	18.4	0.73	2.0
Gastro-Oesophageal Reflux	80	16.0	0.64	1.7
Constipation	74	14.8	0.59	1.6
Nutritional Disorders	14	2.8	0.11	0.3
VPD ≥ 6 Months: DTP, Polio, HepB	6	1.2	0.05	0.1
Bronchiectasis	5	1.0	0.04	0.1
Rheumatic Fever/Heart Disease	<3	s	s	s
Waikato Total	4,667	933.4	37.2	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Midland Region Distribution by Primary Diagnosis

In the Waikato during 2006–2010, gastroenteritis, dental conditions and acute upper respiratory infections were the most frequent causes of ASH in children 0–4 years when



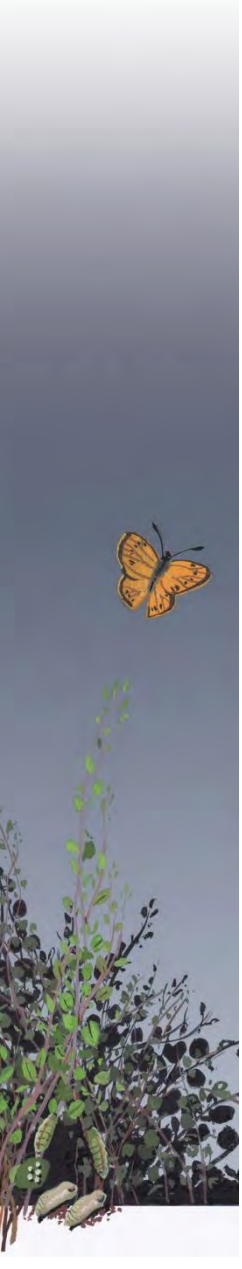
ED cases were included, while dental conditions, gastroenteritis and asthma were the most frequent causes when ED cases were excluded (**Table 39**).

In Bay of Plenty during 2006–2010, gastroenteritis, acute upper respiratory infections and asthma were the most frequent causes of ASH in children irrespective of whether ED cases were included or excluded (**Table 40**).

Table 40. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, Bay of Plenty 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Bay of Plenty ASH 0–4 Years				
Emergency Department Cases Included				
Gastroenteritis	1,393	278.6	20.4	23.3
Acute Upper Respiratory Tract Infections	1,230	246.0	18.0	20.6
Asthma	980	196.0	14.3	16.4
Dental Conditions	689	137.8	10.1	11.5
Bacterial/Non-Viral Pneumonia	520	104.0	7.61	8.7
Skin Infections	455	91.0	6.66	7.6
Otitis Media	295	59.0	4.32	4.9
Dermatitis and Eczema	207	41.4	3.03	3.5
Gastro-Oesophageal Reflux	106	21.2	1.55	1.8
Constipation	78	15.6	1.14	1.3
VPD ≥ 6 Months: DTP, Polio, HepB	8	1.6	0.12	0.1
Nutritional Disorders	8	1.6	0.12	0.1
Bronchiectasis	4	0.8	0.06	0.1
Rheumatic Fever/Heart Disease	<3	s	s	s
VPD ≥ 16 Months: MMR	<3	s	s	s
Bay of Plenty Total	5,976	1,195.2	87.5	100.0
Emergency Department Cases Excluded				
Gastroenteritis	1,247	249.4	18.3	22.5
Acute Upper Respiratory Tract Infections	1,081	216.2	15.8	19.5
Asthma	911	182.2	13.3	16.5
Dental Conditions	689	137.8	10.1	12.5
Bacterial/Non-Viral Pneumonia	507	101.4	7.42	9.2
Skin Infections	439	87.8	6.43	7.9
Otitis Media	267	53.4	3.91	4.8
Dermatitis and Eczema	198	39.6	2.90	3.6
Gastro-Oesophageal Reflux	102	20.4	1.49	1.8
Constipation	70	14.0	1.02	1.3
Nutritional Disorders	8	1.6	0.12	0.1
VPD ≥ 6 Months: DTP, Polio, HepB	7	1.4	0.10	0.1
Bronchiectasis	4	0.8	0.06	0.1
Rheumatic Fever/Heart Disease	<3	s	s	s
VPD ≥ 16 Months: MMR	<3	s	s	s
Bay of Plenty Total	5,533	1,106.6	81.0	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.



In Lakes during 2006−2010, asthma, gastroenteritis and acute upper respiratory infections were the most frequent causes of ASH in children when ED cases were included, while asthma, dental conditions and gastroenteritis were the most frequent causes when ED cases were excluded (**Table 41**).

Table 41. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, Lakes DHB 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Lakes ASH 0–4 Years				
Emergency Department Cases Included				
Asthma	610	122.0	15.9	18.9
Gastroenteritis	583	116.6	15.2	18.1
Acute Upper Respiratory Tract Infections	572	114.4	14.9	17.7
Dental Conditions	537	107.4	14.0	16.6
Bacterial/Non-Viral Pneumonia	352	70.4	9.20	10.9
Skin Infections	269	53.8	7.03	8.3
Otitis Media	131	26.2	3.42	4.1
Dermatitis and Eczema	89	17.8	2.33	2.8
Gastro-Oesophageal Reflux	37	7.4	0.97	1.1
Constipation	33	6.6	0.86	1.0
Bronchiectasis	8	1.6	0.21	0.2
VPD ≥ 6 Months: DTP, Polio, HepB	3	0.6	0.08	0.1
Nutritional Disorders	<3	s	s	s
Lakes DHB Total	3,226	645.2	84.3	100.00
Emergency Department Cases Excluded				
Asthma	543	108.6	14.2	18.4
Dental Conditions	535	107.0	14.0	18.1
Gastroenteritis	505	101.0	13.2	17.1
Acute Upper Respiratory Tract Infections	485	97.0	12.7	16.4
Bacterial/Non-Viral Pneumonia	343	68.6	8.96	11.6
Skin Infections	263	52.6	6.87	8.9
Otitis Media	117	23.4	3.06	4.0
Dermatitis and Eczema	83	16.6	2.17	2.8
Gastro-Oesophageal Reflux	35	7.0	0.91	1.2
Constipation	30	6.0	0.78	1.0
Bronchiectasis	8	1.6	0.21	0.3
VPD ≥ 6 Months: DTP, Polio, HepB	3	0.6	0.08	0.1
Nutritional Disorders	<3	s	s	s
Lakes DHB Total	2,952	590.4	77.1	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

In Tairawhiti during 2006–2010, acute upper respiratory infections, gastroenteritis and dental conditions were the most frequent causes of ASH in children, irrespective of whether ED cases were included or excluded (**Table 42**).

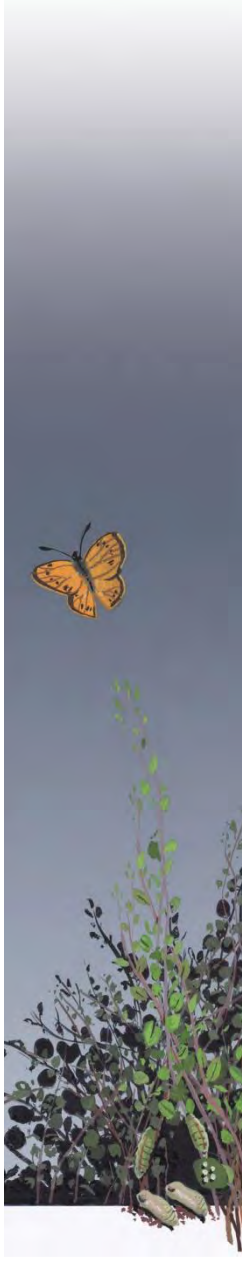


Table 42. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, Tairawhiti 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tairawhiti ASH 0–4 Years				
Emergency Department Cases Included				
Acute Upper Respiratory Tract Infections	369	73.8	20.4	20.2
Gastroenteritis	347	69.4	19.2	19.0
Dental Conditions	338	67.6	18.7	18.5
Asthma	240	48.0	13.2	13.1
Bacterial/Non-Viral Pneumonia	213	42.6	11.8	11.6
Skin Infections	149	29.8	8.22	8.1
Dermatitis and Eczema	63	12.6	3.48	3.4
Otitis Media	58	11.6	3.20	3.2
Constipation	27	5.4	1.49	1.5
Gastro-Oesophageal Reflux	16	3.2	0.88	0.9
Bronchiectasis	4	0.8	0.22	0.2
Nutritional Disorders	3	0.6	0.17	0.2
VPD ≥ 6 Months: DTP, Polio, HepB	3	0.6	0.17	0.2
VPD ≥ 16 Months: MMR	<3	s	s	s
Tairawhiti Total	1,831	366.2	101.0	100.00
Emergency Department Cases Excluded				
Acute Upper Respiratory Tract Infections	366	73.2	20.2	20.1
Gastroenteritis	343	68.6	18.9	18.9
Dental Conditions	338	67.6	18.7	18.6
Asthma	237	47.4	13.1	13.0
Bacterial/Non-Viral Pneumonia	211	42.2	11.6	11.6
Skin Infections	149	29.8	8.22	8.2
Dermatitis and Eczema	63	12.6	3.48	3.5
Otitis Media	58	11.6	3.20	3.2
Constipation	25	5.0	1.38	1.4
Gastro-Oesophageal Reflux	16	3.2	0.88	0.9
Bronchiectasis	4	0.8	0.22	0.2
Nutritional Disorders	3	0.6	0.17	0.2
VPD ≥ 6 Months: DTP, Polio, HepB	3	0.6	0.17	0.2
VPD ≥ 16 Months: MMR	<3	s	s	s
Tairawhiti Total	1,817	363.4	100.3	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

In Taranaki during 2006–2010, gastroenteritis, asthma and dental conditions were the most frequent causes of ASH in children, irrespective of whether ED cases were included or excluded (**Table 43**).

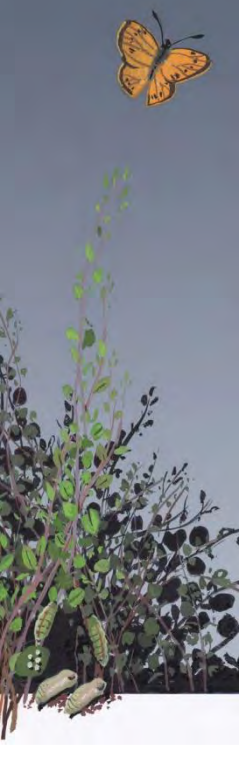


Table 43. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Primary Diagnosis, Taranaki 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Taranaki ASH 0–4 Years				
Emergency Department Cases Included				
Gastroenteritis	370	74.0	10.6	20.9
Asthma	355	71.0	10.2	20.1
Dental Conditions	355	71.0	10.2	20.1
Acute Upper Respiratory Tract Infections	237	47.4	6.81	13.4
Bacterial/Non-Viral Pneumonia	207	41.4	5.95	11.7
Skin Infections	105	21.0	3.02	5.9
Dermatitis and Eczema	49	9.8	1.41	2.8
Otitis Media	38	7.6	1.09	2.1
Gastro-Oesophageal Reflux	27	5.4	0.78	1.5
Constipation	23	4.6	0.66	1.3
Bronchiectasis	<3	s	s	s
Nutritional Disorders	<3	s	s	s
Taranaki Total	1,769	353.8	50.9	100.00
Emergency Department Cases Excluded				
Dental Conditions	355	71.0	10.2	21.4
Gastroenteritis	339	67.8	9.75	20.4
Asthma	321	64.2	9.23	19.3
Acute Upper Respiratory Tract Infections	211	42.2	6.07	12.7
Bacterial/Non-Viral Pneumonia	203	40.6	5.84	12.2
Skin Infections	103	20.6	2.96	6.2
Dermatitis and Eczema	46	9.2	1.32	2.8
Otitis Media	30	6.0	0.86	1.8
Gastro-Oesophageal Reflux	27	5.4	0.78	1.6
Constipation	22	4.4	0.63	1.3
Bronchiectasis	<3	s	s	s
Nutritional Disorders	<3	s	s	s
Taranaki Total	1,660	332.0	47.7	100.0

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Midland Region Trends

In the Waikato, ASH rates in children 0–4 years declined during the early-2000s, reached their lowest point in 2006–07 and then increased again, while rates in the Bay of Plenty increased throughout 2000–2010. ASH also increased in Lakes and Tairawhiti during the early-mid 2000s, with rates reaching their highest point in Tairawhiti in 2004–05 and in Lakes in 2008–09, before declining again. In contrast, in Taranaki, ASH rates declined during the early-mid 2000s, reached their lowest point in 2006–07 and then increased again (**Figure 27**).

Midland Region Distribution by Ethnicity

In the Midland Region during 2000-2010, ASH rates in children 0–4 years were higher for Māori children than for European children in all five DHBs, although differences for Waikato Pacific and Asian/Indian children were more variable. These differences were present irrespective of whether ED cases were included or excluded (**Figure 28**).

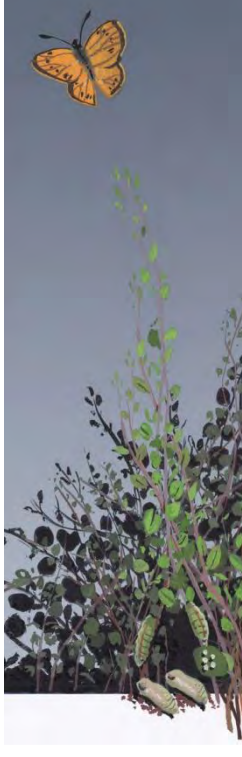
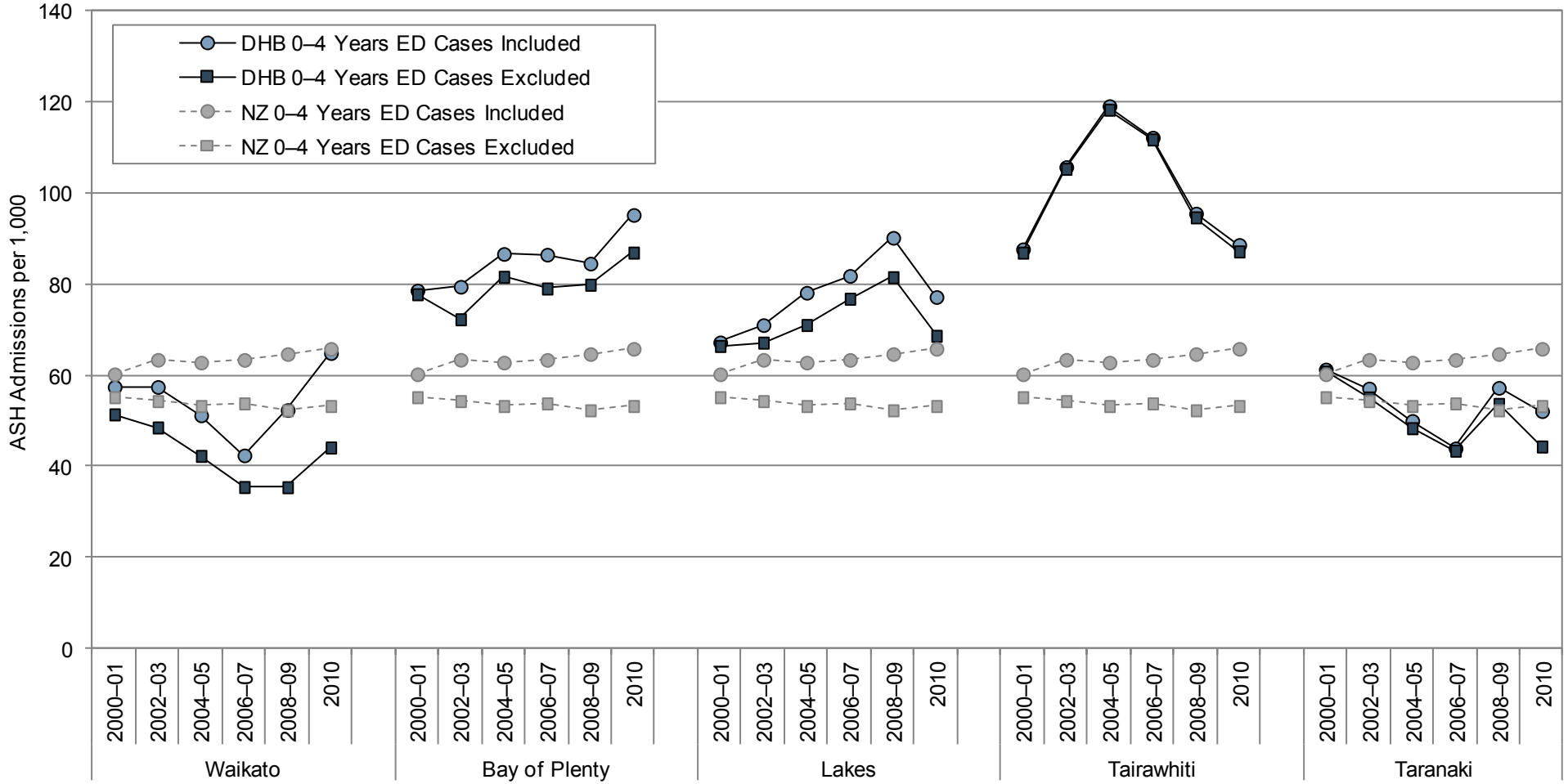
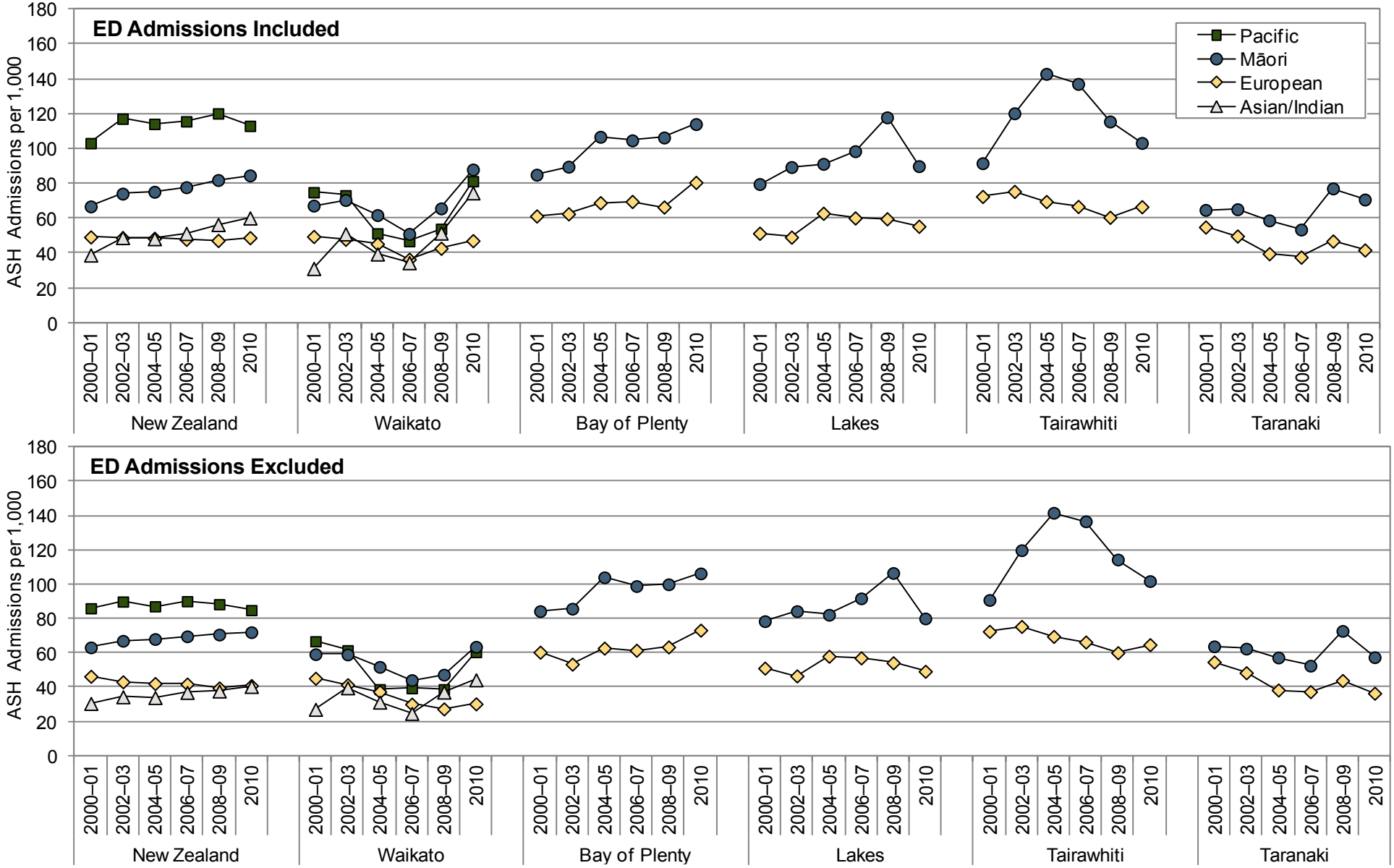


Figure 27. Ambulatory Sensitive Hospitalisations in Children Aged 0–4 Years, Midland DHBs vs. New Zealand 2000–2010



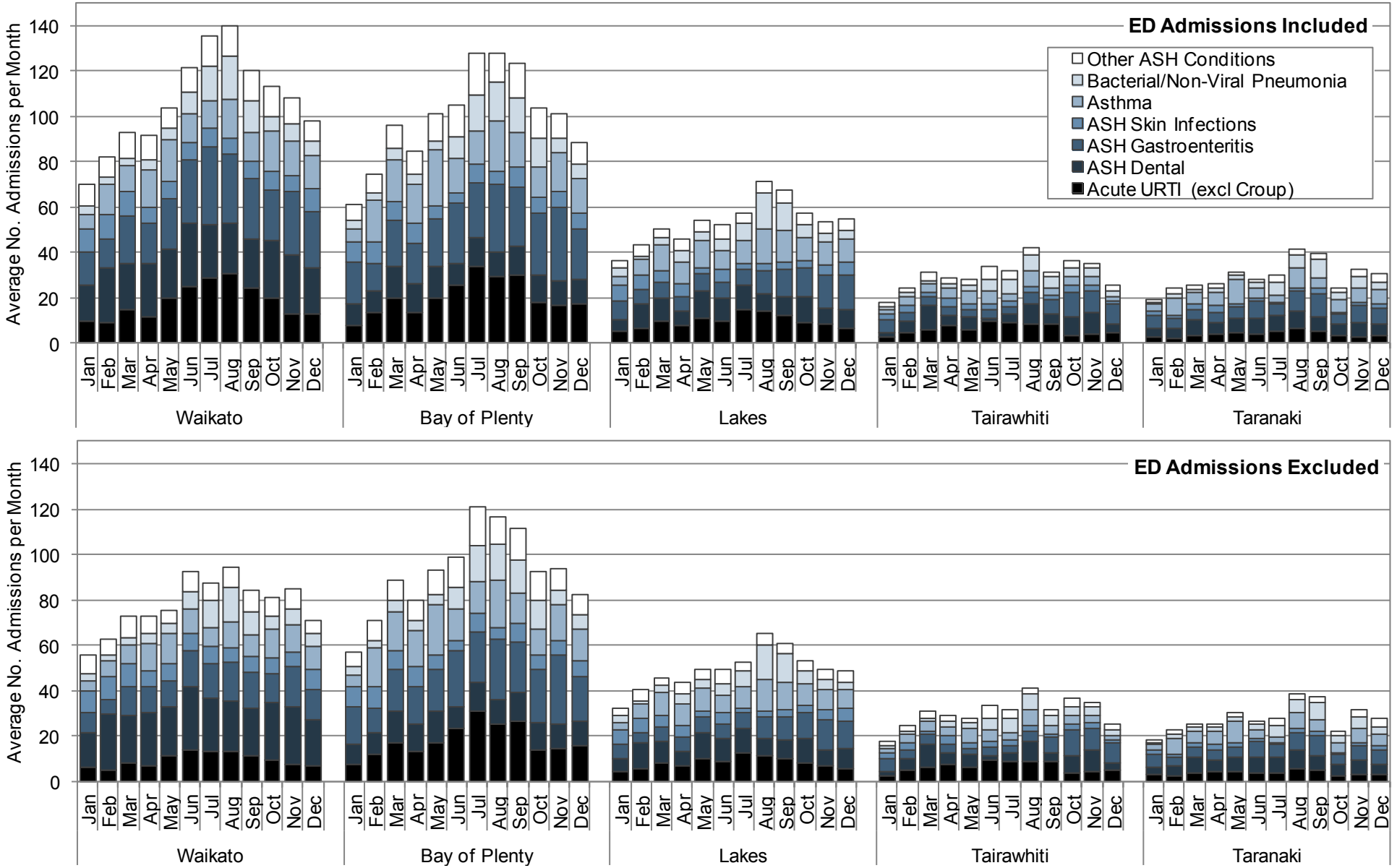
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only; Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Figure 28. Ambulatory Sensitive Hospitalisations in Children Aged 0–4 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population; Note: Ethnicity is Level 1 Prioritised

Figure 29. Ambulatory Sensitive Hospitalisations in Children Aged 0–4 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Acute and semi -acute admissions only, Neonates excluded)

Midland Region Distribution by Season

Amongst Midland DHBs during 2006–2010, ASH in children 0–4 years were generally higher in winter and spring, irrespective of whether ED cases were included or excluded (**Figure 29**).

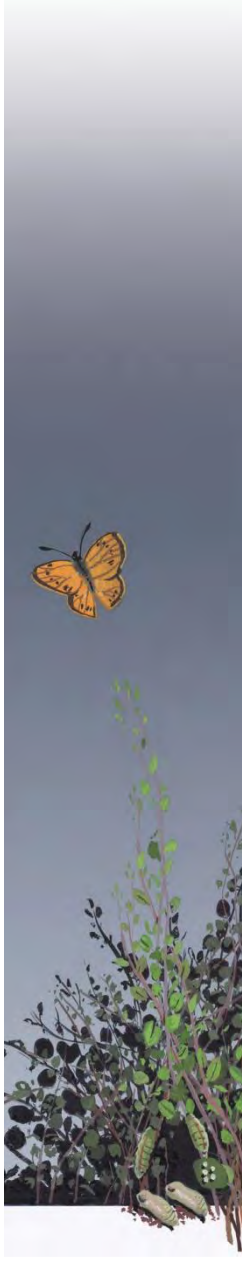
Summary

In New Zealand during 2006–2010, gastroenteritis, acute upper respiratory infections and asthma were the most frequent causes of ambulatory sensitive hospitalisations (ASH) in children 0–4 years when emergency department (ED) cases were included, while gastroenteritis, dental conditions and asthma were the most frequent causes when ED cases were excluded. When broken down by age ASH rates were highest in infants and one year olds, with rates then tapering off rapidly between one and two years, and then again between four and seven years of age. ASH rates were also *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those from average-to-more deprived (NZDep decile 3–10) areas. Similar patterns were seen when ED cases were excluded, although admission rates for Asian/Indian were *significantly* lower than for European children.

In the Waikato, ASH rates in children 0–4 years declined during the early-2000s, reached their lowest point in 2006–07 and then increased again, while rates in the Bay of Plenty increased throughout 2000–2010. ASH also increased in Lakes and Tairawhiti during the early-mid 2000s, with rates reaching their highest point in Tairawhiti in 2004–05 and in Lakes in 2008–09, before declining again. In contrast, in Taranaki, ASH rates declined during the early-mid 2000s, reached their lowest point in 2006–07 and then increased again. During 2006–2010, ASH in Waikato and Taranaki children were *significantly* lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti, ASH were *significantly* higher. ASH were also higher for Māori children than for European children in all five DHBs, with the number of admissions also being higher in winter and spring.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Ambulatory Sensitive Hospitalisations

The in-depth topic commencing on **Page 111** reviews the literature with a view to identifying effective approaches to improve the responsiveness of primary care to children and/or reduce ambulatory sensitive hospitalisations in this age group.



INFECTIOUS AND RESPIRATORY DISEASES

INTRODUCTION TO INFECTIOUS AND RESPIRATORY DISEASES SECTION

Introduction

New Zealand children experience a large burden of avoidable morbidity and mortality as a result of infectious and respiratory diseases. Examples include whooping cough, pneumonia, bronchiolitis and tuberculosis [102]. In 2001, a review of New Zealand's approaches to infectious disease control [103] found that in the past, well-organised government-run programmes had eliminated some infectious diseases transmitted from animals (e.g. *Brucella abortis* and hydatids). In more recent times however, the reviewers noted that success in controlling infectious diseases had been mixed, with rates of rheumatic fever, tuberculosis and enteric infections being high, and with many of these conditions disproportionately affecting Māori and Pacific peoples [103]. A more recent review also noted the significant contribution poverty, poor housing, poor nutrition, smoking, air pollution and difficulties with accessing primary, secondary and tertiary healthcare made to the burden of respiratory and infectious diseases in New Zealand children [102].

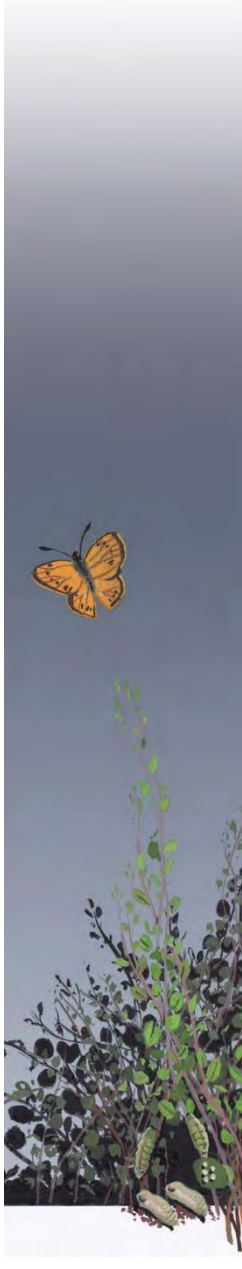
Given their significant impact on the wellbeing of New Zealand children, infectious and respiratory diseases have been awarded a relatively high priority in this report, with a range of conditions being reviewed in three main sections as follows:

1. **Upper Respiratory Tract Conditions**: This section contains two chapters:
    - *Acute Upper Respiratory Infections and Tonsillectomy* reviews acute and arranged hospital admissions for a range of acute upper respiratory tract infections in children, as well as waiting list admission for tonsillectomy +/− adenoidectomy.
    - *Middle Ear Conditions: Otitis Media and Grommets* reviews acute hospital admissions for otitis media in children, as well as arranged and waiting list admission for the insertion of grommets.
2. **Lower Respiratory Tract Conditions**: This section contains four chapters, with the first reviewing hospital admissions and mortality from *Bronchiolitis* in infants. The remaining chapters review hospital admissions and mortality from *Pneumonia, Asthma* and *Bronchiectasis* in children and young people aged 0-24 years.
3. **Infectious Diseases**: This section contains six chapters, with the first reviewing hospital admissions and mortality from *Pertussis* in infants. The remaining chapters review hospital admissions and mortality from *Meningococcal Disease, Tuberculosis, Acute Rheumatic Fever and Rheumatic Heart Disease, Serious Skin Infections* and *Gastroenteritis* in children and young people aged 0-24 years.

While each of these conditions is unique in terms of its distribution, risk factor profile and management, from a population health perspective they share a set of common determinants including housing, nutrition, exposure to second hand cigarette smoke and access to primary health care. As a result, there is some merit in reviewing approaches to their prevention collectively, and the section that follows thus provides a brief overview of local policy documents and evidence-based reviews which consider population level approaches to the prevention or control of infectious and respiratory disease.

Local Policy Documents and Evidence-Based Reviews Relevant to Infectious and Respiratory Diseases

Given their multi-factorial aetiology (e.g. exposure to infectious agents, cigarette smoke, poor nutrition, sub-standard housing, overcrowding), approaches to the prevention of infectious and respiratory diseases take a variety of forms. The following tables thus



review local policy documents and evidence-based reviews which consider approaches to the prevention of infectious and respiratory diseases under the following sub-headings:

1. **Generic Approaches to Infectious and Respiratory Diseases:** A range of local policy documents and evidence-based reviews consider approaches to infectious and respiratory diseases in general, and these are briefly summarised in **Table 44**.
2. **Exposure to Second Hand Cigarette Smoke** is a well known risk factor for respiratory and infectious diseases. **Table 45** considers local policy documents and evidence-based reviews which explore population and individual level approaches to tobacco control, with an emphasis on the prevention of second hand cigarette smoke exposure. Interventions which aim to prevent the uptake of smoking in young people will be considered in next year's report.
3. **Substandard Housing and Crowding** are well recognised upstream determinants of respiratory and infectious disease. **Table 46** summarises a number of documents which consider approaches to improving housing at the population level.
4. **Breastfeeding** confers significant protection against respiratory and infectious disease and interventions aimed at increasing its uptake are reviewed in the **Breastfeeding Section** commencing on **Page 94**.
5. **Immunisation** confers protection against a number of respiratory and infectious diseases and interventions aimed at increasing coverage will be reviewed in more detail in next year's report.
6. Interventions aimed at specific respiratory and infectious diseases are also considered in the following sections: **Acute Upper Respiratory Infections** (Page 167), **Otitis Media** (Page 188), **Bronchiolitis** (Page 209), **Pneumonia** (Page 219), **Asthma** (Page 234), **Bronchiectasis** (Page 247), Pertussis (Page 259), **Meningococcal Disease** (Page 267), **Tuberculosis** (Page 276), **Rheumatic Fever** (Page 284), **Serious Skin Infections** (Page 294), and **Gastroenteritis** (Page 311).

Table 44. Local Policy Documents and Evidence-Based Reviews Which Consider Generic Approaches to Infectious and Respiratory Diseases

Ministry of Health Policy Documents
Ministry of Health. 2007. **Direct Laboratory Notification of Communicable Diseases National Guidelines**. Wellington: Ministry of Health. http://www.surv.esr.cri.nz/LabSurv/Documents/dln-national-guidelines-dec07.pdf The purpose of these guidelines is to inform those working in the health sector, so that they can fulfil their legislative requirements (Section 74AA of the Health Act 1956) with respect to notifying a Medical Officer of Health (and a territorial authority for some conditions) when a notifiable disease case is suspected and when it is confirmed by laboratory testing. Many of the infectious diseases covered in this report are notifiable diseases including acute gastroenteritis (in some situations only), meningitis, vaccine preventable diseases (including pertussis), tuberculosis and rheumatic fever.
Ministry of Health. 2001. **An Integrated Approach to Infectious Disease: Priorities for Action**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/0/B1A861634F82C22CCC256AFA00792AF6/$File/integratedapproachtoinfectiousdisease-prioritiesforaction.pdf This publication addresses the NZ Health Strategy objective: "To reduce the incidence and impact of infectious disease". It sets out key priorities for action to assist DHBs and PHOs with determining resource allocations. The six infectious diseases in the highest priority category are: vaccine-preventable disease, infectious respiratory diseases, blood-borne infections, sexually transmitted infections, food-borne enteric diseases and hospital-acquired infections, particularly antibiotic-resistant infections. Environmentally acquired and close-contact infectious diseases are given lower priority. For each group of diseases objectives, targets and strategies are set out together with responsibilities for central government, health services, local government agencies, non-health organisations such as schools, youth organisations and workplaces, communities and individuals, and surveillance and research organisations.
Ministry of Health. 1998. **Communicable Disease Control Manual**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/49ba80c00757b8804c256673001d47d0/019e54d1de5e73534c25666e00835b79/$FILE/cdcm.pdf This manual provides information on the prevention of communicable diseases in New Zealand and protocols for their control. Part One covers vaccine-preventable diseases. Part Two covers food and waterborne diseases. Parts 3 and 4 cover rare diseases and other notifiable diseases.

Systematic and Other Reviews of the International Literature

Jefferson T, Del Mar C, Dooley L, et al. 2010. **Physical interventions to interrupt or reduce the spread of respiratory viruses**. Cochrane Database of Systematic Reviews, 2010(1), Art. No.: CD006207. DOI: 10.1002/14651858.CD006207.pub3. (republished, online with edits, Issue 7 2011)

This review considers the effectiveness of physical interventions such as isolation, quarantine, hand washing and wearing masks, gloves and gowns in preventing the spread of respiratory viruses, particularly during epidemics. It includes 66 papers from 67 studies of various types (RCTs, cluster-RCTs, case-control studies, cohort studies and before-and-after studies). The reviewers concluded that hand washing interventions are effective, particularly when directed at younger children. This may be because they are less capable of managing their own hygiene as well as having longer-lived infections and more social contact (thus being more likely to make other people ill). Barrier methods such as gowns, gloves and masks are also effective, as is isolation of suspected cases. These interventions are even more effective when used in combination. The benefits of adding virucidals or antiseptics to normal hand washing are uncertain. There was limited evidence of the superior effectiveness of N95 respirators over simple surgical masks however the respirators were more expensive and more uncomfortable to wear. The authors state that N95 respirators may be useful in very high risk situations but that further research is needed to define these situations.

Aiello AE, Coulborn RM, Perez V, et al. 2008. **Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis**. American Journal of Public Health, 98(8), 1372-81

This review considered 30 articles reporting randomised or quasi-randomised intervention trials in community settings investigating the effect of hand hygiene measures on rates of gastrointestinal and respiratory disease. Meta-analysis was used to generate pooled rate ratios. Improvements in hand hygiene resulted in a reduction in respiratory illness rates of 21% (95% CI 5% - 34%) and a reduction in gastrointestinal illness rates of 31% (95% CI 19% - 42%). Use of soap together with hand hygiene education showed the greatest benefit in reducing both respiratory and gastrointestinal disease. Antibacterial soap was no more effective than plain soap. Reductions in rates of gastrointestinal illness were found for the use of either alcohol-based sanitizer (pooled results of 5 studies, RR = 0.77, 95% CI 0.52 – 1.13) or benzalkonium chloride (pooled results of 2 studies, RR = 0.58, 95% CI 0.30 – 1.12). The pooled results of 6 studies showed that alcohol based sanitizers were only weakly effective in preventing respiratory disease (RR=0.93, 95% CI 0.84 – 1.03) but the pooled results of 2 studies indicated that benzalkonium chloride sanitizers were protective against respiratory disease (RR = 0.60, 95% CI 0.45 – 0.81).

Lee T, Jordan NN, Sanchez JL, et al. 2005. **Selected nonvaccine interventions to prevent infectious acute respiratory disease**. American Journal of Preventive Medicine, 28(3), 305-16.

This review of 38 population based studies of various designs, mostly described as “interventional” aimed to identify non-vaccine preventive measures that could be feasible in military settings. They concluded that promoting hand washing and reducing crowding may offer benefits in reducing respiratory disease.

Centre for Reviews and Dissemination. 2011. **Selected nonvaccine interventions to prevent infectious acute respiratory disease** (Structured abstract). Database of Abstracts of Reviews of Effects, 2011(3).

The reviewers at the CRD stated that this review has a number of limitations which may limit its reliability. In particular there were no inclusion criteria for study design and the quality of the included studies was not assessed. Also, since the authors were especially concerned with preventing illness in military settings they may have overlooked some studies in other community settings.

Other Relevant Publications

The Asthma and Respiratory Foundation of New Zealand, Innes Asher and Cass Byrnes, editors. 2006. **Trying to Catch our Breath: The burden of preventable breathing disorders in children and young people**. Wellington: The Asthma and Respiratory Foundation of New Zealand. http://www.asthmanz.co.nz/files/PDF-files/Burden_FullDocument.pdf

This document reviews a range of significant respiratory conditions in New Zealand children, including whooping cough, pneumonia, bronchiolitis, tuberculosis, bronchiectasis, obstructive sleep apnoea, asthma, and smoking related respiratory illness. It emphasises the significant contribution poor housing, poverty, poor nutrition, issues with access to health care (primary, secondary and tertiary), smoking and air pollution make to the burden of paediatric respiratory disease in this country. The report also makes a number of recommendations, some of which involve changes to government policy. Recommendations specifically for DHBs include: monitoring appropriate indicators of child and youth respiratory health, developing strategies to reduce rates of respiratory disease including specific strategies for Māori and Pacific children and young people, developing Māori workforce capability, developing strategies to improve nutrition, implementing a systems approach to identifying smoking/smoke exposure in patients, improving smoking cessation programmes for parents and adults; increasing awareness of key respiratory symptoms amongst the public and health professionals, and implementing the Paediatric Society’s best practice guidelines.

Table 45. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Second Hand Cigarette Smoke Exposure

Ministry of Health Policy Documents and Other Relevant Publications
Ministerial Committee on Drug Policy. 2007. **2007. National Drug Policy 2007–2012** Wellington: Ministry of Health. http://www.ndp.govt.nz/moh.nsf/pagescm/685/$File/nationaldrugpolicy20072012.pdf The National Drug Policy 2007-2012 outlines a single framework for the Government's policy for tobacco, alcohol, illegal and other drugs.
Ministry of Health. 2004. **Clearing the Smoke: A five-year plan for tobacco control in New Zealand (2004–2009)**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/0/AAFC588B348744B9CC256F39006EB29E/$File/clearingthesmoke.pdf There are 5 objectives in the tobacco control plan, with preventing harm to non-smokers from second-hand smoke being the third. There are a number of guiding principles for the plan including giving substantial weight to interventions for which there is strong scientific evidence of effectiveness. The plan states that there is strong evidence from both New Zealand and overseas that counselling pregnant women to quit is effective. While the plan states that there is insufficient evidence for the effectiveness of community education in reducing second-hand smoke in the home, it indicates that the Ministry will consider media campaigns to promote smoke-free homes and cars.
There are a considerable number of other Ministry of Health publications relating to tobacco control and the majority of them can be found on the following webpage: http://www.moh.govt.nz/moh.nsf/indexmh/tobacco-resources-publications. A few of the most relevant are listed below:
Ministry of Health. 2009. **Implementing the ABC Approach for Smoking Cessation - Framework and work programme**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/8794/$File/implementing-abc-approach-smoking-cessation-feb09.pdf This document outlines the **ABC** approach to stopping smoking: **Ask** everyone whether or not they smoke, Provide **Brief** advice on quitting, then offer, refer to, or provide evidence-based **Cessation** treatment. Pregnant women are identified as a priority group and are the focus of the Tackling Smoking in Pregnancy Project.
Wilson N. 2007. **Review of the Evidence for Major Population-Level Tobacco Control Intervention**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/6142/$File/review-evidence-major-population-level-tobacco-control-interventions.pdf Chapter 5 of this publication deals with population-level approaches to reducing exposure to second-hand smoke. It cites the U.S. Surgeon General's report (see below) which found that workplace smoking bans and bans on smoking indoors in hospitals, restaurants, bars and offices were effective in reducing exposure to second-hand smoke (in New Zealand, under the Smoke-free Environments Amendment Act 2003, smoking is banned in schools and early childhood centres, licensed premises and workplaces). It reports that there has been little research on the effectiveness of banning outdoor smoking. Some city councils have bans on smoking in parks and some universities and hospitals ban outdoor smoking. It reported that although bans on smoking in cars where children are passengers have been implemented in several places since 2006 there were no evaluations reported when the review was done in 2007. It discusses New Zealand research and mass media campaigns. Chapter 7 is entitled "Interventions and research that DHBs can consider". It is suggested that DHBs could be involved in community education to reduce exposure to second-hand smoke in homes and cars.
Ministry of Health. 2007. **New Zealand Smoking Cessation Guidelines.** Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/6663/$File/nz-smoking-cessation-guidelines-v2-aug07.pdf This publication provides evidence-based guidance for healthcare workers in their work with people who smoke tobacco, in particular those who belong to the priority groups: Māori, Pacific peoples, pregnant women and people who use mental health and addiction services. The guidelines recommend the **ABC** approach. (see above)
Ministry of Health. 2001. **New Zealand Health Strategy DHB Toolkit: Tobacco Control**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5542/$File/tobacco-control-toolkit.pdf This publication aims to assist DHBs in implementing the New Zealand Health Strategy priority population health objective: Reducing smoking (and the harm from second-hand smoke). A more recent brief publication, which addresses one of the six 2010/11 government health targets for DHBs is: Ministry of Health. 2011. **Targeting Smokers: Better Help for Smokers to Quit**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/10704/$File/targeting-smokers-to-quit.pdf
Systematic and Other Reviews From the International Literature
Callinan JE, Clarke A, Doherty K, et al. 2010. **Legislative smoking bans for reducing second hand smoke exposure, smoking prevalence and tobacco consumption**. Cochrane Database of Systematic Reviews, 2010(4), Art. No.: CD005992. DOI:10.1002/14651858.CD005992.pub2. This review included 50 studies and found that there was consistent evidence that smoking bans reduced second hand smoke (SHS) exposure in workplaces, restaurants, pubs and public places. No studies reported any change in smoke exposure in cars after the implementation of public place smoking bans (5 studies, one of which measured the percentage of children exposed). In general, the studies which measured SHS in homes (15 in total) reported no change although a few, including one from New Zealand, reported reduced exposure.

Priest N, Roseby R, Waters E, et al. 2008. **Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke**. Cochrane Database of Systematic Reviews, 2008(4), Art. No.: CD001746. DOI: 10.1002/14651858.CD001746.pub2.

This review is based on the findings of 36 controlled trials of various interventions, most of which were undertaken in high income countries. Thirty-one trials were done in healthcare settings, (16 "well child", 13 "ill child" and 2 unspecified) and 4 used interventions targeted at populations or communities. Only 11 of the 36 studies reported a statistically significant effect of the intervention in reducing children's exposure to environmental tobacco smoke. Four of these used intensive counselling interventions for smoking parents. Whether the child was well or ill when they visited a healthcare facility made no difference to the effectiveness of parent smoking cessation interventions. The authors concluded that there was no clear evidence for recommending any particular type of intervention, or setting for intervention, however the evidence did provide limited support for more intensive counselling interventions for parents. Interventions aimed at changing participants' attitudes and behaviours were more effective than those which aimed to increase participants' knowledge.

U.S. Department of Health and Human Services. 2006. **The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General**. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. http://www.surgeongeneral.gov/library/secondhandsmoke/report/fullreport.pdf

This comprehensive report (600+ pages) reviewed a large body of evidence, which included all relevant observational and experimental studies. The evidence was analysed to identify causal associations between smoking and disease using the "Surgeon General's Criteria" or the "Hill criteria". These criteria included: consistency of association, strength of association, specificity of association, temporality of association and coherence of association.

Chapter 6 reviewed studies linking children's respiratory illnesses with second hand smoke. Updated meta-analyses of the health effects of parental smoking were undertaken, with the reviews finding there was sufficient evidence to infer a causal relationship between parental smoking and:

- Lower respiratory illnesses and middle ear disease in children
- Cough, phlegm, wheeze and breathlessness and ever having asthma in school age children
- The onset of wheeze illnesses in early childhood. However there was only suggestive, but not sufficient, evidence to infer a causal relationship between parental smoking and the onset of childhood asthma.

There was also sufficient evidence to infer a causal relationship between maternal smoking in pregnancy, and exposure to second hand smoke after birth, and impaired lung function in childhood.

Chapter 5 concerned the reproductive and developmental effects of second hand smoke on fertility, pregnancy (spontaneous abortion and fetal deaths), infant deaths, sudden infant death syndrome (SIDS), preterm delivery and low birth weight (these are discussed elsewhere in the relevant sections of this report).

Chapter 10 dealt with the control of second-hand smoke. It covered attitudes and beliefs about second-hand smoke and policy approaches to controlling second-hand smoke exposure. Due to workplace smoking bans the home is now the predominant place of exposure to second hand smoke for both adults and children. Members of a household can voluntarily adopt smoking rules. The only such rule effective in protecting non-smokers is making the home completely smoke-free. It is stated that there are no clearly established interventions for reducing smoke exposure at home. Table 10.16 (p 622) provides details on a number of studies assessing the effectiveness of interventions to reduce second hand smoke exposure in children at home. Two U.S. RCTs, one involving 291 smoking parents of young children and one involving 108 mothers of young children, were found to have produced substantial reductions in second hand smoke exposure. In one, the intervention was a 30-45 minute motivational interview with a trained health educator and four follow-up telephone counselling calls. In the other study the intervention was a seven-session three-month counselling intervention. A systematic review by Gehrman and Hovell (2003) is also reported on in this chapter (see below).

An abbreviated version of the sections of above publication relevant to children has been published as:

U.S. Department of Health and Human Services. 2007. **Children and Second hand Smoke Exposure. Excerpts from The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General.** Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. http://www.surgeongeneral.gov/library/smokeexposure/report/fullreport.pdf

Thomson G, Wilson N, Howden-Chapman P. 2006. **Population level policy options for increasing the prevalence of smokefree homes**. Journal of Epidemiology & Community Health, 60(4), 298-304.

This review considered the effectiveness of population level tobacco policies on the prevalence of smokefree homes in Britain, the U.S., Australia and New Zealand. It also considered the cost-effectiveness of policy options and their effects on reducing inequalities in second hand smoke exposure. In all four countries there was some evidence for an association between the introduction of comprehensive tobacco control programs and increases in the prevalence of smokefree homes (comprehensive programmes were defined as involving all of the following: active policies on tobacco prices, effective education, smokefree places policies, and population level cessation support). There was indirect evidence that, within comprehensive tobacco control programmes, policies to change the public's knowledge and behaviour regarding second hand smoke (e.g. mass media campaigns) may be effective in increasing the proportion of homes that are smokefree but there was conflicting evidence regarding their effects on inequalities in the prevalence of smokefree homes. The review did not find any evidence regarding the cost-effectiveness or otherwise of comprehensive tobacco control programmes for increasing the proportion of homes that are smokefree. The reviewers concluded that comprehensive tobacco control programmes which aim to reduce the prevalence of smoking in the whole population are likely to be the best option for increasing the prevalence of smoke free homes.

Gehrman CA, Hovell MF. 2003. **Protecting children from environmental tobacco smoke (ETS) exposure: a critical review**. Nicotine & Tobacco Research, 5(3), 289-301.
This review reports on 19 studies, 12 of which were RCTs, published between 1987 and 2002. Eleven of the 19 studies (and 8 of the 12 RCTs) found significant reductions in ETS exposure as a result of an intervention. There were 10 physician based interventions (e.g. providing brief counselling +/- take home publications at well child appointments), and 8 home-based interventions. In general, the home based interventions were more intensive, involving a greater number and duration of contacts between health care advisors and parents. They also seemed to be more effective although this conclusion is based on a relatively small number of heterogeneous studies of variable methodological rigour.
Centre for Reviews and Dissemination. 2011. **Protecting children from environmental tobacco smoke (ETS) exposure: a critical review** (Structured abstract). Database of Abstracts of Reviews of Effects (3).
The reviewers at the CRD noted that this review lacked a quality assessment and that "the unknown validity of methods used to assess outcomes, and the inconsistent results among studies mean that the conclusions may not be reliable."
Other Relevant Publications and Websites
Tobacco Control Reference Group. 2009. **The Beginner's Guide to Tobacco Control**. Wellington: The Health Sponsorship Council (HSC). http://www.hsc.org.nz/pdfs/The_Beginner's_Guide.pdf
This concise, well referenced New Zealand publication aims "*to provide all the information you need to get up to speed quickly when you start working in the tobacco control sector*". It covers key information sources, both local (governmental and non-governmental) and international, the history of tobacco control, health promotion and public health, research, addiction and smoking cessation, priority groups, the effects of tobacco and second-hand smoke, facts and figures, the Framework Convention on Tobacco Control, and the tobacco industry.
Freeman B, Chapman S, Storey P. 2008. **Banning smoking in cars carrying children: an analytical history of a public health advocacy campaign**. Australian & New Zealand Journal of Public Health, 32(1), 60-5.
This paper reports on 12 years of advocacy for the banning of smoking in cars with children and the eventual passage of legislation in South Australia and Tasmania. It states that the issue received extensive and emotive media coverage and that public opinion studies have shown consistently strong support for laws banning smoking in cars with children.
American Academy of Pediatrics **Julius B. Richmond Center of Excellence**http://www.aap.org/richmondcenter/
This site provides information about the AAP Julius B. Richmond Center of Excellence which has as its mission to improve child health by eliminating exposure to tobacco and second-hand smoke. Also on the website are links to a large number of useful resources for both families and professionals.

Table 46. Local Policy Documents and Evidence-Based Reviews Relevant to Housing

New Zealand Policy Documents
Housing New Zealand Corporation. 2009. **Orama Nui Housing Strategy for Pacific Peoples**. Wellington: Housing New Zealand Corporation. http://wellingtonfijicommunity.files.wordpress.com/2010/06/hnz-pacific-housing-strategy-nov-2009.pdf
This strategy aims to ensure that "*All Pacific Peoples have a choice of housing in safe and healthy communities*". It sets out a strategic direction for the ten year period 2009-2019. It notes that Pacific peoples have the lowest rates of home ownership in New Zealand, frequently live in poor and/or overcrowded housing and make up 25% of state housing tenants nationally. The strategy focuses on improving the ability of Housing New Zealand Corporation to deliver services to Pacific peoples. Four key outcomes are set out along with objectives to achieve those outcomes including improving the quality of state housing, assisting Pacific people towards home ownership, improving the Corporation's ability to communicate effectively with Pacific people and obtain good information about their needs, and working with other community and business agencies (including local councils and churches) to facilitate joint housing initiatives.
The Energy Efficiency and Conservation Authority. 2007. **New Zealand Energy Efficiency and Conservation Strategy**. Wellington: EECA http://www.eeca.govt.nz/sites/all/files/nzeecs-07.pdf
Section 2 of this strategy is entitled "Energywise Homes". Its key objective is "Warm, dry healthy homes, improved air quality and reduced energy costs". The strategy acknowledges the relationship between cold and damp homes and poor health and also the barriers families face in investing in energy efficiency and renewable energy. It sets out the details of the Energywise Homes package announced in the 2007 budget. Funding is available to help with the costs of home insulation and the installation of clean heating with extra funding available for community services card holders.
Housing New Zealand Corporation. 2005. **Building the Future: The New Zealand Housing Strategy**. Wellington: Housing New Zealand Corporation. http://www.hnzc.co.nz/hnzc/dms/380D2C40C069A4CE4665F55A8C4523D1.pdf
This publication sets out priorities for housing and a programme of action for the next ten years from 2005. The Government's vision for housing is stated to be that "All New Zealanders have access to affordable, sustainable, good quality housing appropriate to their needs." Seven areas of action are set out to achieve six strategic goals: Increased access to affordable and sustainable housing, more efficient and effective housing markets, increased choice and diversity in housing markets, improved housing standards across tenures, increased integration of housing with the community and other services, and increased capability in the housing sector.

Systematic and Other Reviews from the International Literature
Sauni R, Uitti J, Jauhiainen M, et al. 2011. **Remediating buildings damaged by dampness and mould for preventing or reducing respiratory tract symptoms, infections and asthma**. Cochrane Database of Systematic Reviews, 2011(9), Art. No.: CD007897. DOI: 10.1002/14651858.CD007897.pub2. This review included two RCTs (294 participants), one cluster RCT (4407 participants) and five controlled before and after studies (1837 participants) involving a variety of interventions to remediate moisture damaged buildings. Each study assessed the effects of the interventions on some of the following outcomes: asthma and respiratory symptoms, presence of mould, medication use, sick days, hospital admissions, emergency department visits, measured lung function, self-reported allergy and other symptoms, number of respiratory infections, indoor temperature, and stress/mental illness. The authors found moderate to low quality evidence in adults that repairing houses and offices decreased respiratory infections and asthma-related symptoms. The study also found when physician visits for all respiratory conditions were considered, there were no differences between pupils of a mould-damaged school and a control school before or after remediation.
Fisk WJ, Eliseeva EA, Mendell MJ. 2010. **Association of residential dampness and mould with respiratory tract infections and bronchitis: a meta-analysis**. Environmental Health: A Global Access Science Source, 9, 72. This paper reports the results a number of meta-analyses of published studies (English language only) that examined the relationship between dampness or mould in homes and respiratory infections and bronchitis. In total there were 23 studies included (4 birth cohort, 17 cross-sectional and 2 case-control). Summary estimates of odds ratios for various respiratory health outcomes ranged from 1.38 to 1.50 from random effects models with 95% confidence intervals excluding the null value (indicating no effect) in all cases. For respiratory infections in children the reported odds ratio was 1.48, (95% CI 1.34 – 1.62) indicating that children living in damp and/or mouldy homes have about 50% more respiratory infections. The authors concluded that "dampness and mould are associated with moderate but statistically significant increase in respiratory infections and bronchitis. If these associations were causal, reducing dampness and mould in buildings would reduce the occurrence of respiratory infections."
Taske Nichole, Taylor Lorraine, Mulvihill Caroline, et al. 2005. **Housing and Public Health: a review of reviews of interventions for improving health *Evidence Briefing***. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/niceMedia/pdf/housing_MAIN%20FINAL.pdf This briefing, intended for policy and decision makers, NHS providers, housing providers and all those working in public health aimed to: identify all relevant systematic and other reviews on housing-related public health interventions, highlight interventions that these reviews indicated work particularly for vulnerable and disadvantaged groups, identify cost-effectiveness data for housing-related interventions and highlight any gaps in the evidence base and provide recommendations for future research. Regarding respiratory illness in children it is reported that there is a lack of review-level evidence for the effectiveness of air filtration systems or interventions that aim to reduce exposure to house dust mite allergen in the home (unless combined with maintenance drug treatments) in improving health outcomes for people with asthma. The authors conclude that large studies investigating the wider social context of housing interventions are required and report that some of these are underway in the U.K.
Saegert SC, Klitzman S, Freudenberg N, et al. 2003. **Healthy housing: a structured review of published evaluations of US interventions to improve health by modifying housing in the United States, 1990-2001**. American Journal of Public Health, 93(9), 1471-7. http://ajph.aphapublications.org/cgi/reprint/93/9/1471 This review of 72 studies found that 92% of interventions addressed a single condition, most commonly lead poisoning, injury or asthma. Fifty-seven per cent targeted children. The most common intervention strategies were a one-time intervention to change the environment and/or attitudes, behaviour or knowledge. Most studies reported that the intervention produced a statistically significant benefit however few (14%) were judged to be very successful. The review authors identified three factors that seemed to be generally associated with successful interventions: firstly policy interventions, secondly technological interventions that were effective, cheap, durable and relatively maintenance-free, especially if these interventions were accompanied by the provision of information or counselling and, thirdly, the involvement of people in the solutions to their own health problems. The authors argued that a broad ecological approach to health and housing issues which considers the interaction of environmental and psychosocial factors is likely to be more effective than interventions which target a single health condition.
Krieger J, Higgins DL. 2002. **Housing and health: time again for public health action**. American Journal of Public Health, 92(5), 758-68. http://ajph.aphapublications.org/cgi/reprint/92/5/758.pdf This article provides a general overview of the health effects of poor housing. It reports on some of the research in this area and on some of the historical background to the issue. There is a discussion of various "Healthy Homes" projects in the U.S. and on approaches to making homes healthier via refinement of building codes. There is a comprehensive list of 154 references.

Other Government Publications and Websites
Housing New Zealand Corporation. **Healthy Housing**.http://www.hnzc.co.nz/hnzc/web/housing-improvements-&-development/property-improvement/healthy-housing.htm This webpage provides information on the Healthy Housing Programme which is a joint initiative between Housing New Zealand and DHBs. The aims are: to raise awareness of infectious diseases, to improve access to health and social services, to reduce the risk of housing-related health problems and to reduce overcrowding. It involves a public health nurse and staff from Housing New Zealand meeting with Housing New Zealand tenants in selected areas (currently parts of the Hutt Valley, Otara, Glen Innes and Mangere) to identify housing and health issues within households. A clinician from the DHB reviews the information from the interview and the DHB makes sure tenants and their families can access healthcare for any identified health problems. The DHB also links tenants with social services agencies if they require welfare services. A summary of the outcomes evaluation for this programme has been published as: Housing New Zealand Corporation. 2008. **The Healthy Housing Programme Outcomes Evaluation**. Wellington: Housing New Zealand Corporation. http://www.hnzc.co.nz/hnzc/dms/94A76C4ABCB39FED972CEF9E09DCF445.pdf The evaluation found that the programme (which started in 2001) has significantly reduced rates of housing related disease (asthma and respiratory disease, rheumatic fever, meningitis and cellulitis) as well as injury rates. More detailed evaluation reports were published by Auckland UniServices Ltd in 2005, 2006 and 2007.
Other Relevant Publications and Websites
The Housing and Health Research Programme. 2011. **Healthy Housing He Kainga Orana**. http://www.healthyhousing.org.nz/ The Housing and Health Research programme is based at the University of Otago, Wellington and it undertakes research on the links between housing and health. Information about this programme can be found on this website as can a list of numerous publications relating to its activities.
James Bev, Savilee-Smith Kay. 2010. **Children's Housing Futures**. Wellington: Centre for Housing Research Aotearoa New Zealand. http://www.chranz.co.nz/pdfs/childrens-housing-futures-report.pdf Significant numbers of children in New Zealand live in unaffordable housing, crowded housing and housing with insecure tenure. The proportion of children who live in rented housing is increasing. Rental housing tends to be older and more poorly maintained than owner occupied housing. Section 4 of this publication reviews a range of international and New Zealand Research on the links between housing experiences and poor life chances and wellbeing.
Rankine Jenny. 2005. **Housing and Health - A summary of selected research for Auckland Regional Public Health services** Auckland: Auckland Regional Public Health Service. http://www.arphs.govt.nz/Publications_reports/archive/HealthyHousing/HsgHlthinAuckland.pdf This report, commissioned by the ARPHS, summarises selected research into housing and health in Auckland. Substandard housing which is crowded, cold, damp and mouldy, with no or unsafe heating (such as unflued gas heaters) increases the likelihood of the inhabitants suffering respiratory and other illness. Poor housing also increases the risks of injury and mental health conditions. Government policy affects the supply, quality and affordability of housing for people on low incomes. Existing state housing stock is poorly suited to large Pacific families. This report includes a long list of references, many of which are New Zealand specific.
The Public Health Advisory Committee. 2002. **The Health of People and Communities: the effect of environmental factors on the health of New Zealanders**. Wellington: National Health Committee. http://www.phac.health.govt.nz/moh.nsf/pagescm/775/$File/Health+of+People.pdf This report to the Minister of Health highlights environmental issues which have links to ill health and are also likely to contribute to health inequalities. Section 3 deals with air quality. It notes that poor indoor air quality is associated with the exacerbation of respiratory conditions and also allergic and toxic reactions especially in vulnerable groups such as children, older people and Māori. Poor quality housing may be damp and mouldy. Second hand smoke and the use of unvented gas appliances for heating and cooking produce toxins that aggravate respiratory conditions. It notes that multiply-disadvantaged people are the most likely to live in poor housing and to suffer poor health and that these people should be a priority for research and action. The committee makes a number of recommendations for the Ministry of Health including supporting policies to improve housing quality, encouraging the Ministry of Consumer Affairs to investigate the use of unflued gas heaters and identify affordable, safer alternatives, examining options for promoting smokefree homes and cars, and developing a set of core human health indicators for air quality in New Zealand.

UPPER RESPIRATORY TRACT CONDITIONS

ACUTE UPPER RESPIRATORY INFECTIONS AND TONSILLECTOMY IN CHILDREN

Introduction

Upper respiratory tract infections (URTIs) are a common cause of illness in childhood and account for a large number of visits to primary care each year [104]. In New Zealand, a number of acute URTIs are considered to be ambulatory sensitive, on the basis that early and appropriate management of these conditions in primary care can significantly reduce the need for hospital admissions [97].

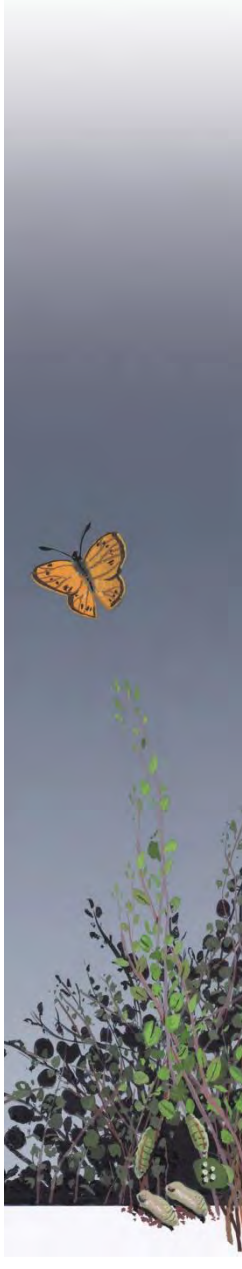
Although they are generally of short duration and limited severity, upper respiratory infection also place a significant burden on secondary care services. The conditions which are most relevant for children [97] are outlined briefly below:

Non Specific URTIs: Non-specific URTIs, including the common cold, produce a variety of symptoms including cough, sore throat, runny nose, fever and malaise. They are usually of viral origin [104]. The available evidence indicates that antibiotic treatment does not alter the course of these illnesses, which are self-limiting in the vast majority of cases, nor is it an effective strategy for preventing complications such as lower respiratory conditions like pneumonia [105].

Acute Pharyngitis and Tonsillitis: While the majority of cases of pharyngitis and tonsillitis are also due to viral infections (and are therefore self-limiting and need only symptomatic treatment), a small number are due to group A streptococcus and may, if untreated, result in acute rheumatic fever [106]. The NZ Rheumatic Fever Guideline [107] recommends assessing all patients presenting with sore throat for the presence or absence of significant risk factors (Māori or Pacific ethnicity, 3–45 years of age, resident in lower socioeconomic areas of the North Island, past history of acute rheumatic fever) and/or clinical findings (temperature >38°C, no cough, swollen tender lymph nodes, tonsillar swelling or exudate, age 3–14 years). The Guideline provides an algorithm which, on the basis of the numbers of risk factors and clinical criteria present, can be used to assign patients to one of 3 groups: high risk (indicating that a throat swab should be taken and empiric antibiotics commenced), medium risk (indicating that a throat swab should be taken and antibiotics commenced if the swab is positive) and low risk (indicating that no throat swab should be taken and that treatment should be symptomatic only).

Waiting List Admissions for Tonsillectomy: In New Zealand, a large number of waiting list admissions for tonsillectomy occur each year. While a number are performed for the management of upper airway obstruction/obstructive sleep apnoea, the majority are for the management of recurrent tonsillitis [97]. There has been considerable controversy however, concerning the benefits of tonsillectomy for recurrent throat infections, and internationally tonsillectomy is now a much less frequently performed procedure than it was in the past [108,109]. Several national guidelines and an Australasian position paper recommend the use of the "Paradise Criteria" when determining the indications for tonsillectomy [108,110,111]. These are: seven or more well-documented, adequately treated disabling sore throats due to tonsillitis in the preceding year; OR five or more such episodes in each of the previous two years; OR three or more such episodes in the previous three years [112].

A recent Cochrane review of this issue concluded that for children meeting the Paradise Criteria, having an adenotonsillectomy would result in avoiding, on average, three unpredictable episodes of any type of sore throat over the next year, at a cost of one predictable episode of significant pain, lasting on average five to seven days, in the immediate post-operative period. Less severely affected children would have only one less sore throat of any type in the next year (on average two, rather than three). Further, tonsillectomy is not without risks. The most significant complication is haemorrhage which has been reported in 2-3% of cases and has, on rare occasions, proved fatal [108,113].



The following section uses data from the National Minimum Dataset to review acute and arranged admissions for acute upper respiratory infections in children aged 0–14 years as well as waiting list admissions for tonsillectomy (+/- adenoidectomy). Guidelines and evidence-based reviews, which consider how these conditions might best be prevented or managed, are considered at the end of the section.

Data Sources and Methods

Indicator

1. *Acute and Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Acute and arranged hospital admissions for children aged 0–14 years with an ICD-10-AM primary diagnosis of Acute Upper Respiratory Tract Infection: Acute Nasopharyngitis (Common Cold) (J00); Acute Sinusitis (J01); Acute Pharyngitis (J02); Acute Tonsillitis (J03); Croup/Acute Laryngitis/Tracheitis (J04, J050); Acute URTI Multiple/Unspecified Sites (J06); Epiglottitis (J051).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Arranged and Waiting List Admissions for Tonsillectomy (+/-Adenoidectomy) in Children Aged 0-14 Years*

Numerator: National Minimum Dataset: Arranged and waiting list admissions for tonsillectomy +/− adenoidectomy (ICD-10-AM Primary Procedure Codes 4178900 or 4178901) in children (0–14 years). Indications for tonsillectomy (ICD-10-AM primary diagnosis codes) included: Chronic Tonsillitis (J350); Hypertrophy of the Tonsils/Adenoids (J351–J353); Sleep Apnoea (G473); Other/Unspecified Chronic Diseases of the Tonsils/Adenoids (J358–J359).

Notes on Interpretation

Note 1: All of the acute upper respiratory tract infections listed above are considered ambulatory sensitive, with the exception of croup/acute laryngitis/tracheitis, where early access to primary care may not prevent a hospitalisation (e.g. children with croup may require hospitalisation for the management of respiratory distress).

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission (referred to elsewhere in this report as a semi-acute admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary. Because arranged admissions comprise a mix of patients being admitted semi-acutely for the management of medical conditions, and semi-urgently for operative procedures, in this section arranged admissions have been included in both the acute upper respiratory tract infection and tonsillectomy categories. While in a small number of cases, a single child may have appeared in both analyses, in reality the majority of admissions for tonsillectomy were for chronic upper respiratory conditions (e.g. chronic tonsillitis, obstructive sleep apnoea) which were not included in the acute URTI section.

Note 3: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

Acute Upper Respiratory Tract Infections

New Zealand Distribution and Trends

New Zealand Distribution by Primary Diagnosis

In New Zealand during 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an admission with an URTI in children, followed by croup/acute laryngitis/tracheitis (**Table 47**).

New Zealand Distribution by Age

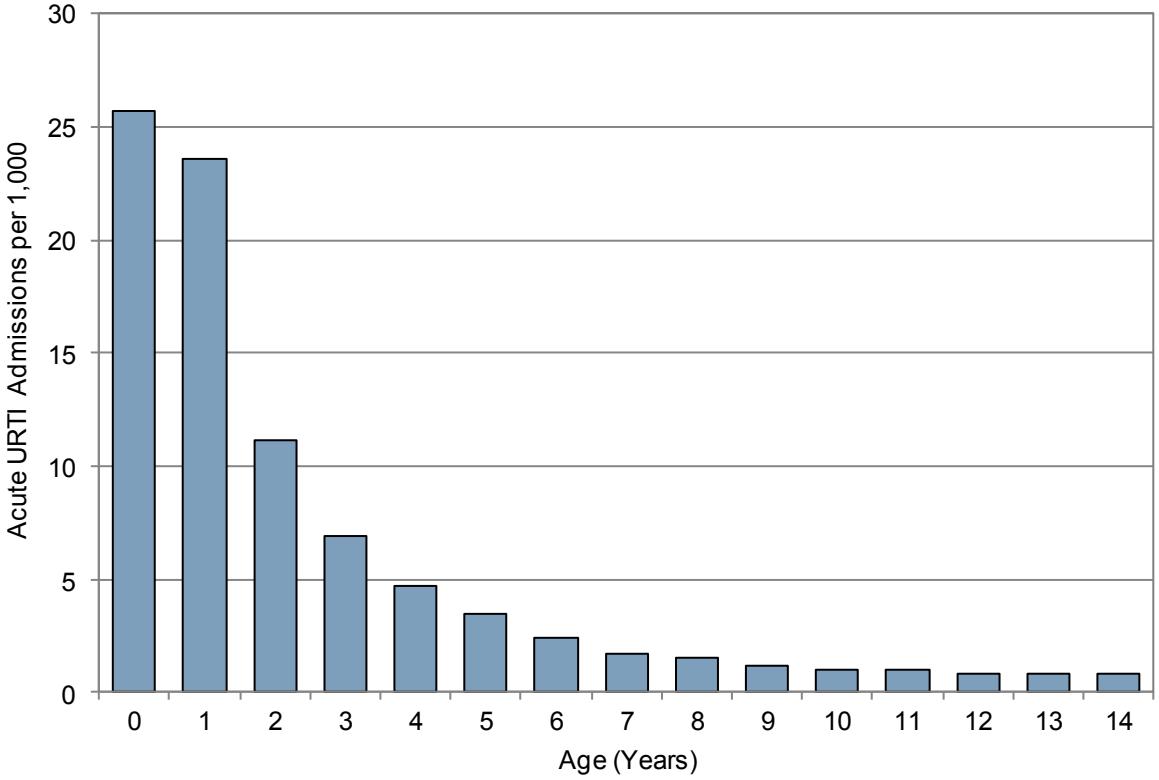
In New Zealand during 2006–2010, admissions for acute URTIs were most common in infants and one year olds, with rates tapering off rapidly thereafter (**Figure 30**).

Table 47. Acute and Arranged Hospital Admissions for Acute URTIs in Children Aged 0–14 Years by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Acute Upper Respiratory Tract Infections				
New Zealand 0–14 Years				
Acute URTI Multiple/Unspecified Sites	15,172	3,034.4	3.40	59.6
Croup / Acute Laryngitis / Tracheitis	5,735	1,147.0	1.28	22.5
Acute Tonsillitis	2,907	581.4	0.65	11.4
Acute Pharyngitis	1,332	266.4	0.30	5.2
Acute Nasopharyngitis (Common Cold)	156	31.2	0.03	0.6
Acute Sinusitis	127	25.4	0.03	0.5
Epiglottitis	17	3.4	<0.01	0.1
Total	25,446	5,089.2	5.70	100.0

Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 30. Acute and Arranged Hospital Admissions for Acute URTIs in Children 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

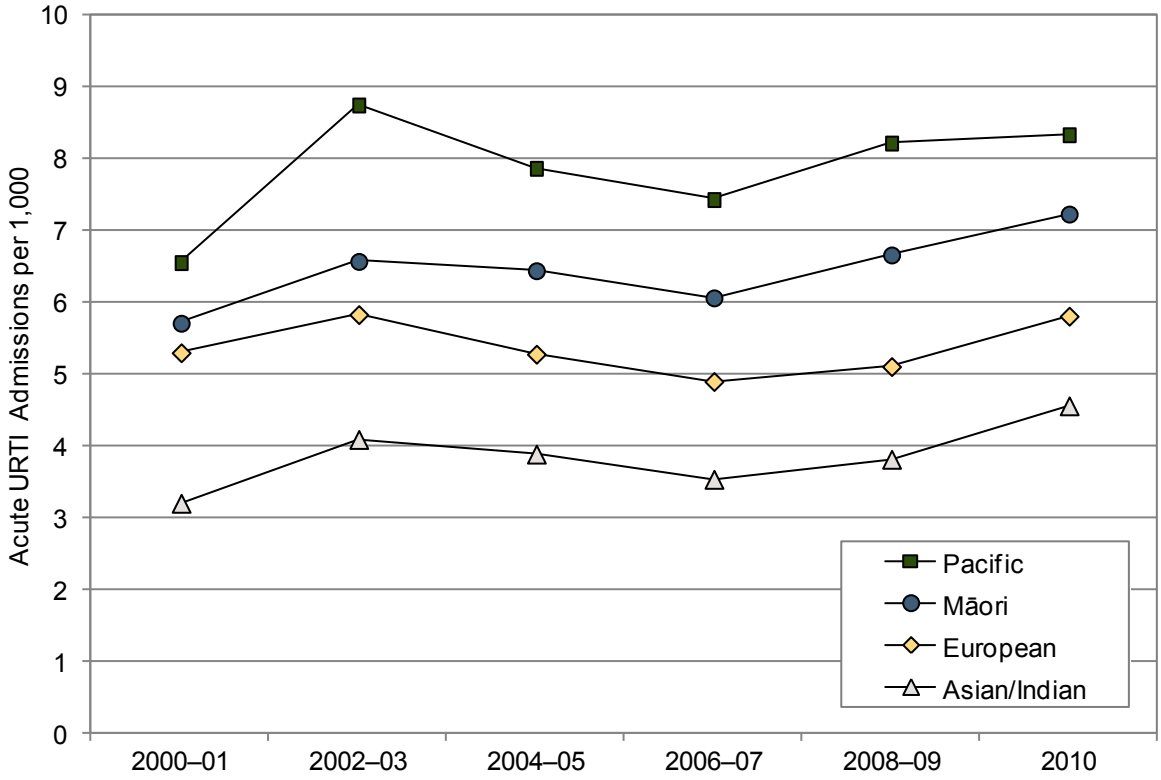
In New Zealand during 2006–2010, hospital admissions for acute URTIs were *significantly* higher for males, Pacific > Māori > European > Asian/Indian children and those living in average-to-more deprived (NZDep decile 4–10) areas (**Table 48**). Similar ethnic differences were seen during 2000–2010 (**Figure 31**).

Table 48. Acute and Arranged Hospital Admissions for Acute URTIs in Children Aged 0–14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Acute Upper Respiratory Tract Infections 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.65	1.00		Decile 1–2	3.50	1.00	
Decile 2	3.35	0.92	0.85–0.99	Decile 3–4	4.23	1.21	1.15–1.27
Decile 3	3.92	1.07	1.00–1.15	Decile 5–6	5.51	1.57	1.50–1.65
Decile 4	4.52	1.24	1.16–1.32	Decile 7–8	6.54	1.87	1.79–1.95
Decile 5	5.20	1.42	1.33–1.52	Decile 9–10	8.03	2.29	2.20–2.39
Decile 6	5.77	1.58	1.49–1.68	Prioritised Ethnicity			
Decile 7	6.07	1.66	1.56–1.77	European	5.15	1.00	
Decile 8	6.93	1.90	1.79–2.02	Māori	6.53	1.27	1.23–1.30
Decile 9	8.12	2.22	2.10–2.36	Pacific	7.92	1.54	1.48–1.60
Decile 10	7.96	2.18	2.06–2.31	Asian/Indian	3.87	0.75	0.71–0.79
Gender							
Female	4.93	1.00					
Male	6.44	1.31	1.27–1.34				

Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 31. Acute and Arranged Hospital Admissions for Acute URTIs in Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Waikato and Taranaki during 2006–2010, hospital admissions for URTI in children were *significantly* lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti admission rates were *significantly* higher (**Table 49**).

Table 49. Acute and Arranged Hospital Admissions for Acute URTI in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Acute Upper Respiratory Tract Infections 0–14 Years					
Waikato	1,739	347.8	4.43	0.78	0.74–0.82
Lakes	925	185.0	7.73	1.36	1.27–1.45
Bay of Plenty	1,892	378.4	8.51	1.49	1.42–1.56
Tairawhiti	619	123.8	10.7	1.88	1.73–2.03
Taranaki	452	90.4	4.04	0.71	0.65–0.78
New Zealand	25,446	5,089.2	5.70	1.00	

Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Distribution by Primary Diagnosis

During 2006–2010, acute upper respiratory tract infections of multiple/unspecified sites were the most frequent reasons for an URTI admission in all five Midland DHBs, followed by croup/acute laryngitis/tracheitis (**Table 50**).

Midland Region Trends

In the Midland Region during 2000–2010, there were no consistent trends in hospital admissions for URTI in children, with rates in most DHBs fluctuating during this period (**Figure 32**).

Midland Region Distribution by Ethnicity

In the Midland Region during 2000–2010, while hospital admissions for URTI in children were generally higher for Māori children than for European children, this was not consistent in all DHBs, with rates in Taranaki Māori and European children being similar during the early-mid 2000s, and rates in some other DHBs being similar for Māori and European children at some points during 2000–2010 (**Figure 33**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, hospital admissions for URTI in children were highest during winter and early spring in all five DHBs (**Figure 34**).

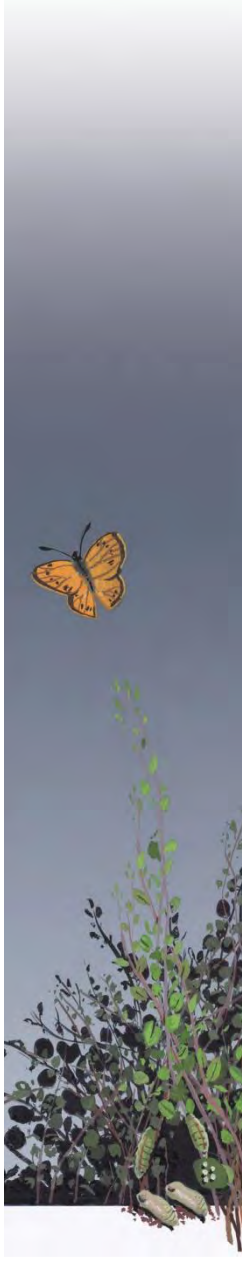
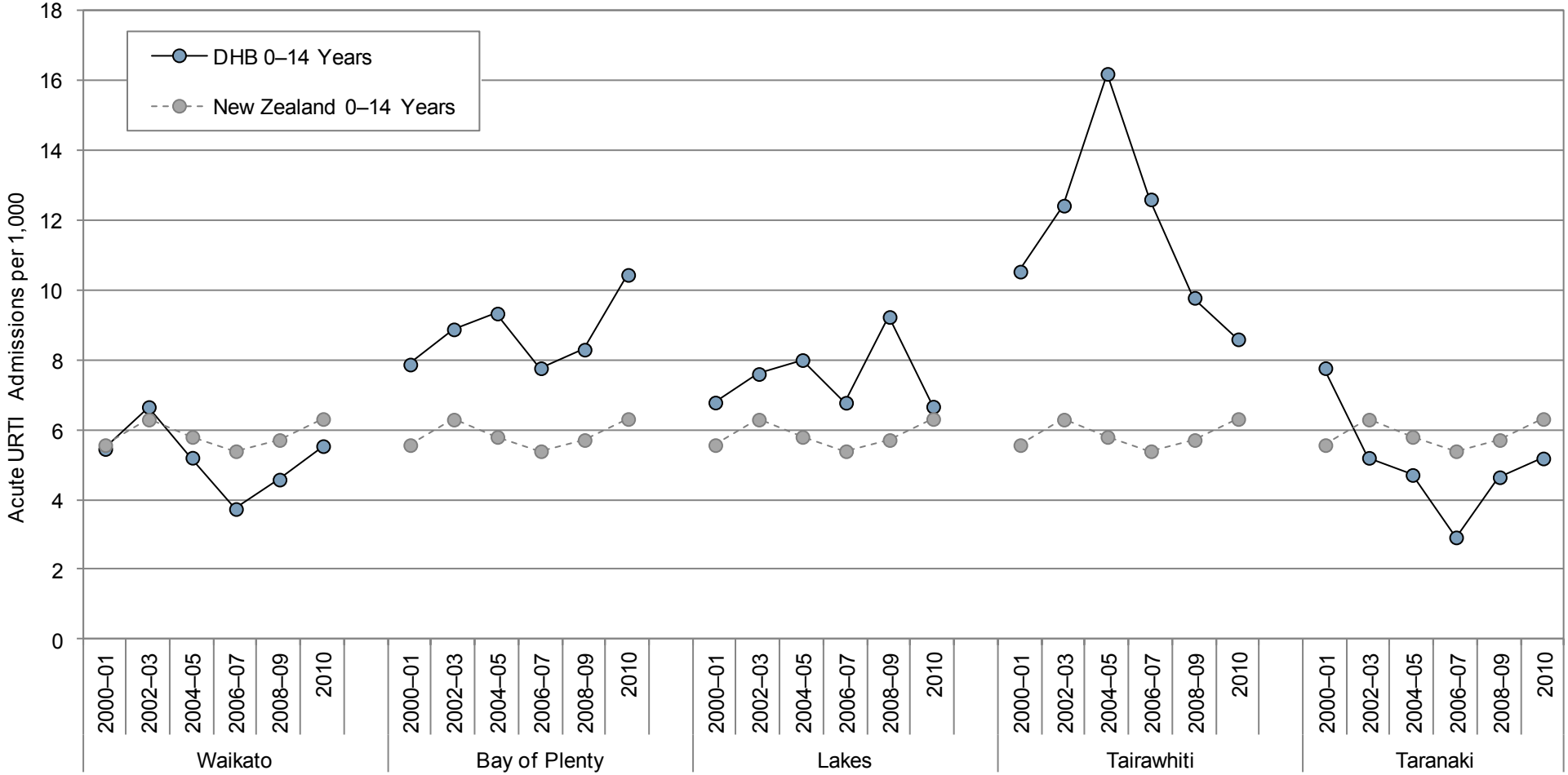


Table 50. Acute and Arranged Hospital Admissions for Acute URTI in Children Aged 0–14 Years by Primary Diagnosis, Midland DHBs 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Acute Upper Respiratory Tract Infections				
Waikato 0–14 Years				
Acute URTI Multiple/Unspecified Sites	1,016	203.2	2.59	58.4
Croup / Acute Laryngitis / Tracheitis	303	60.6	0.77	17.4
Acute Tonsillitis	244	48.8	0.62	14.0
Acute Pharyngitis	145	29.0	0.37	8.3
Acute Nasopharyngitis (Common Cold)	24	4.8	0.06	1.4
Acute Sinusitis	7	1.4	0.02	0.4
Total Waikato	1,739	347.8	4.43	100.0
Bay of Plenty 0–14 Years				
Acute URTI Multiple/Unspecified Sites	1,182	236.4	5.32	62.5
Croup / Acute Laryngitis / Tracheitis	328	65.6	1.48	17.3
Acute Tonsillitis	240	48.0	1.08	12.7
Acute Pharyngitis	107	21.4	0.48	5.7
Acute Nasopharyngitis (Common Cold)	27	5.4	0.12	1.4
Acute Sinusitis	7	1.4	0.03	0.4
Epiglottitis	<3	s	s	s
Total Bay of Plenty	1,892	378.4	8.51	100.0
Lakes DHB 0–14 Years				
Acute URTI Multiple/Unspecified Sites	530	106.0	4.43	57.3
Croup / Acute Laryngitis / Tracheitis	164	32.8	1.37	17.7
Acute Tonsillitis	113	22.6	0.94	12.2
Acute Pharyngitis	112	22.4	0.94	12.1
Acute Sinusitis	5	1.0	0.04	0.5
Acute Nasopharyngitis (Common Cold)	<3	s	s	s
Total Lakes DHB	925	185.0	7.73	100.0
Tairawhiti 0–14 Years				
Acute URTI Multiple/Unspecified Sites	381	76.2	6.58	61.6
Croup / Acute Laryngitis / Tracheitis	145	29.0	2.50	23.4
Acute Tonsillitis	66	13.2	1.14	10.7
Acute Pharyngitis	22	4.4	0.38	3.6
Acute Nasopharyngitis (Common Cold)	5	1.0	0.09	0.8
Total Tairawhiti	619	123.8	10.7	100.0
Taranaki 0–14 Years				
Acute URTI Multiple/Unspecified Sites	224	44.8	2.00	49.6
Croup / Acute Laryngitis / Tracheitis	144	28.8	1.29	31.9
Acute Tonsillitis	56	11.2	0.50	12.4
Acute Pharyngitis	23	4.6	0.21	5.1
Acute Nasopharyngitis (Common Cold)	3	0.6	0.03	0.7
Acute Sinusitis	<3	s	s	s
Total Taranaki	452	90.4	4.04	100.0

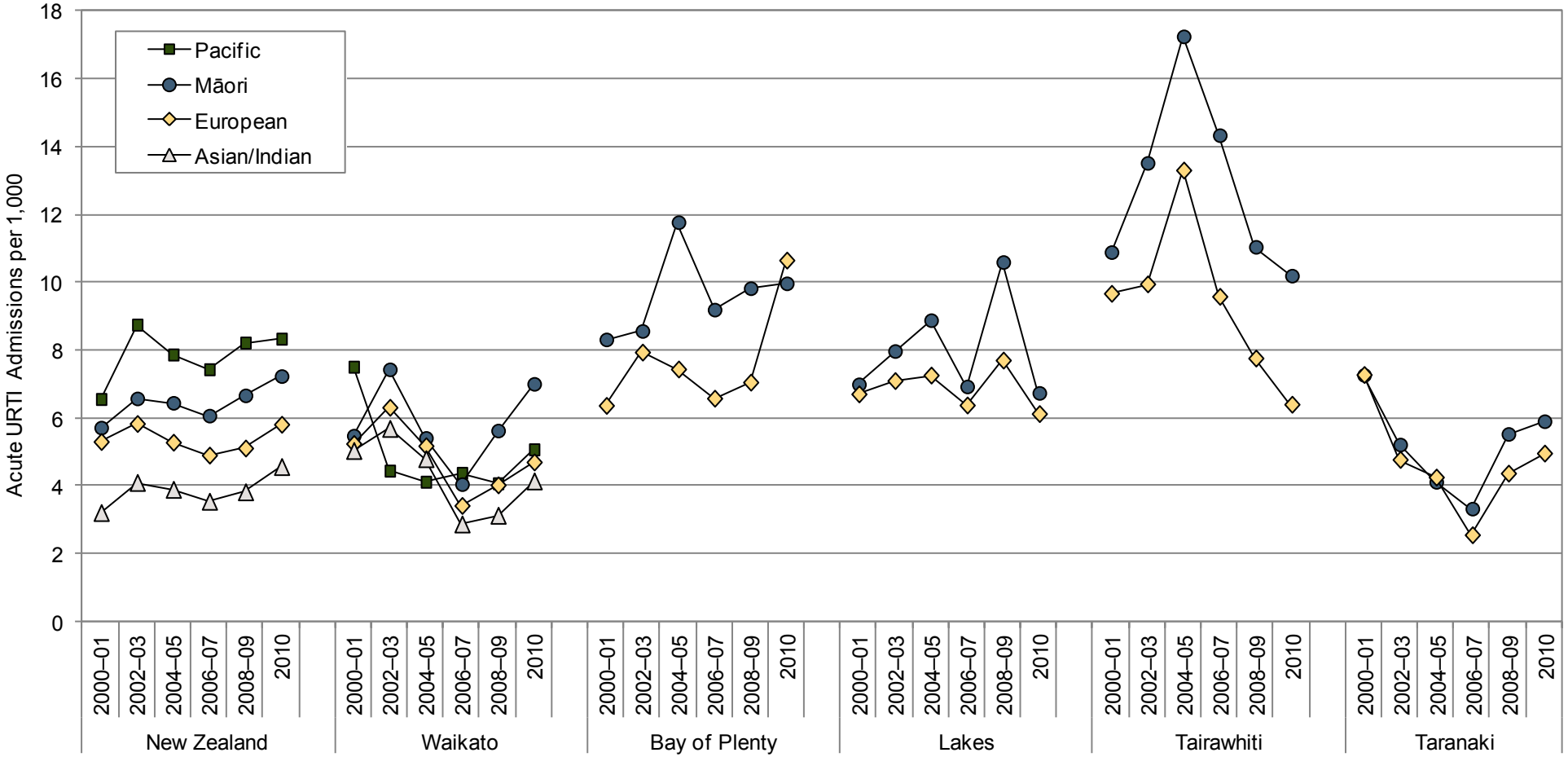
Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Figure 32. Acute and Arranged Hospital Admissions for Acute URTI in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000–2010



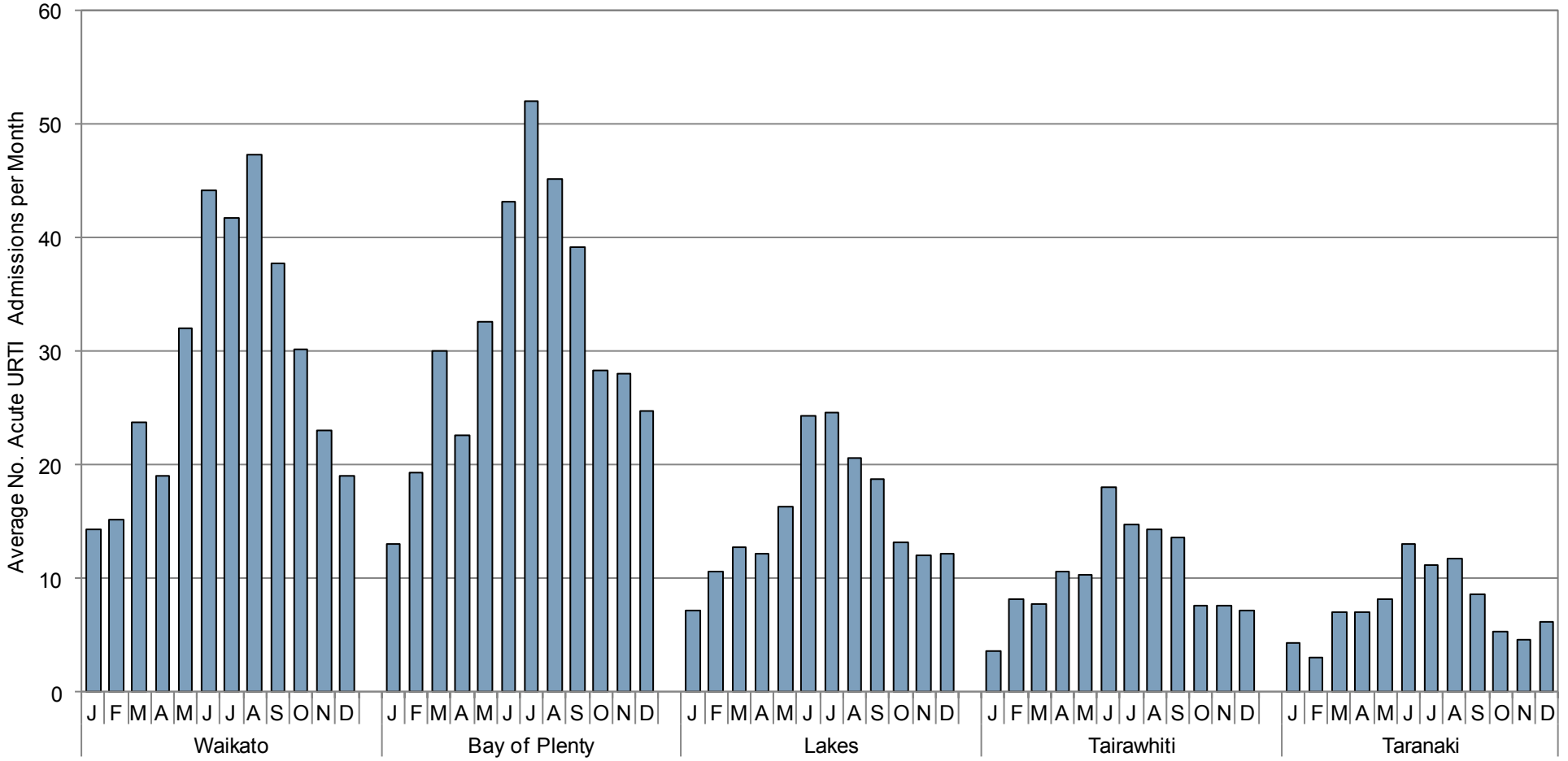
Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 33. Acute and Arranged Hospital Admissions for Acute URTI in Children Aged 0–14 Years by Ethnicity, Midland DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 34. Average Number of Acute and Arranged Hospital Admissions for Acute URTI in Children Aged 0–14 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Acute and arranged admissions only)

Tonsillectomy

New Zealand Distribution and Trends

New Zealand Distribution by Primary Diagnosis

In New Zealand during 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in children admitted to hospital for tonsillectomy +/− adenoidectomy, accounting for 60.1% of all admissions in this category. Hypertrophy of the tonsils/adenoids was the second leading diagnosis, followed by sleep apnoea (**Table 51**).

New Zealand Trends

In New Zealand, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children decreased during the early 2000s. Admission rates reached their lowest point in 2004–05, before increasing again (**Figure 35**).

New Zealand Distribution by Age and Ethnicity

In New Zealand during 2006–2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy increased during the pre-school years, to reach their highest point at four years of age in European and Asian/Indian children, at five years of age in Māori children, and at six years of age in Pacific children. During the preschool years, admission rates were generally higher for European > Asian/Indian and Māori > Pacific children, while after ten years of age, admissions were generally higher for European and Māori > Pacific > Asian/Indian children (**Figure 36**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, arranged/waiting list admissions for tonsillectomy were *significantly* higher for European > Māori > Asian/Indian and Pacific children, and were *significantly* lower for those living in the least deprived (NZDep decile 1) areas (**Table 52**). Similar ethnic differences were seen during 2000–2010 (**Figure 37**).

Table 51. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
Tonsillectomy +/− Adenoidectomy 0–14 Years				
Chronic Tonsillitis	8,102	1,620.4	1.82	60.1
Hypertrophy Tonsils/Adenoids	3,276	655.2	0.73	24.3
Sleep Apnoea	1,517	303.4	0.34	11.2
Acute Tonsillitis	128	25.6	0.03	0.9
Otitis Media	97	19.4	0.02	0.7
Other/Unspecified Chronic Diseases Tonsils/Adenoids	58	11.6	0.01	0.4
Peritonsillar Abscess	5	1.0	<0.01	<0.1
Perforation/Other Disorders Tympanic Membrane	4	0.8	<0.01	<0.1
Other Diagnoses	301	60.2	0.07	2.2
New Zealand Total	13,488	2,697.6	3.02	100.0

Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

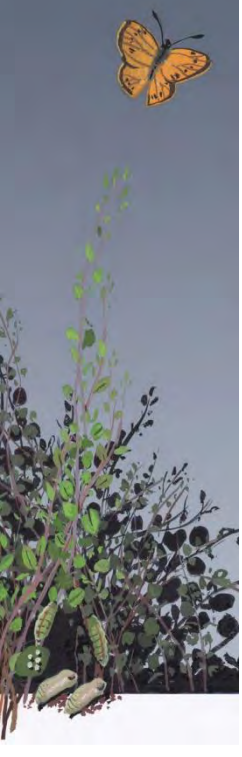
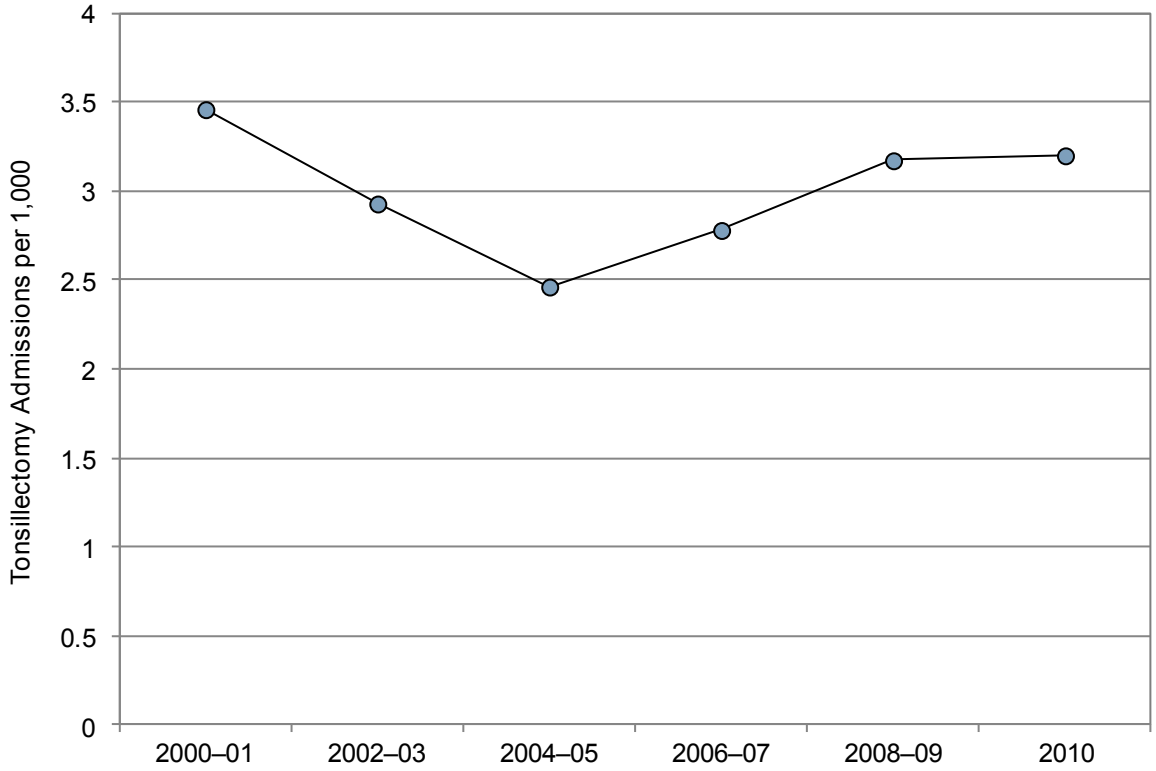
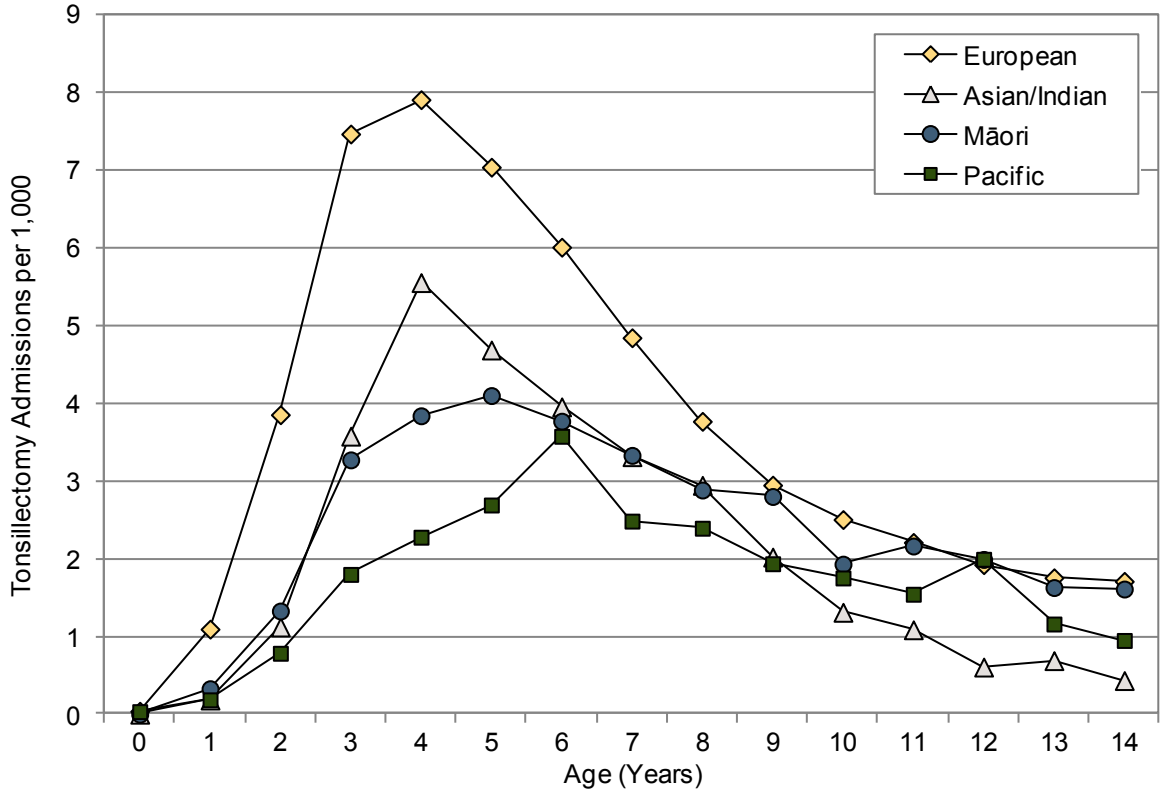


Figure 35. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 36. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children 0–14 Years by Age and Ethnicity, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised

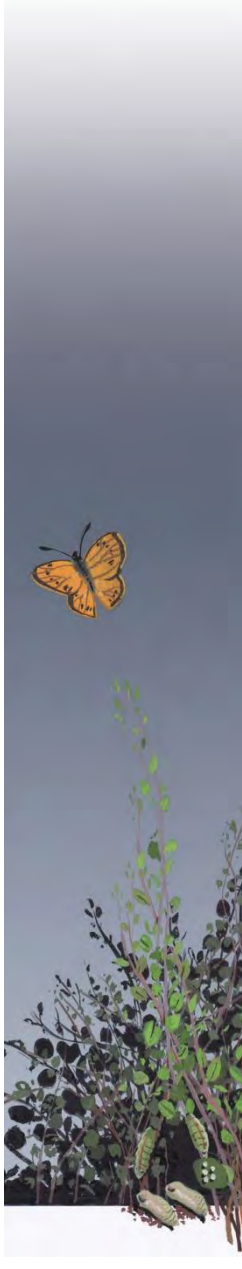
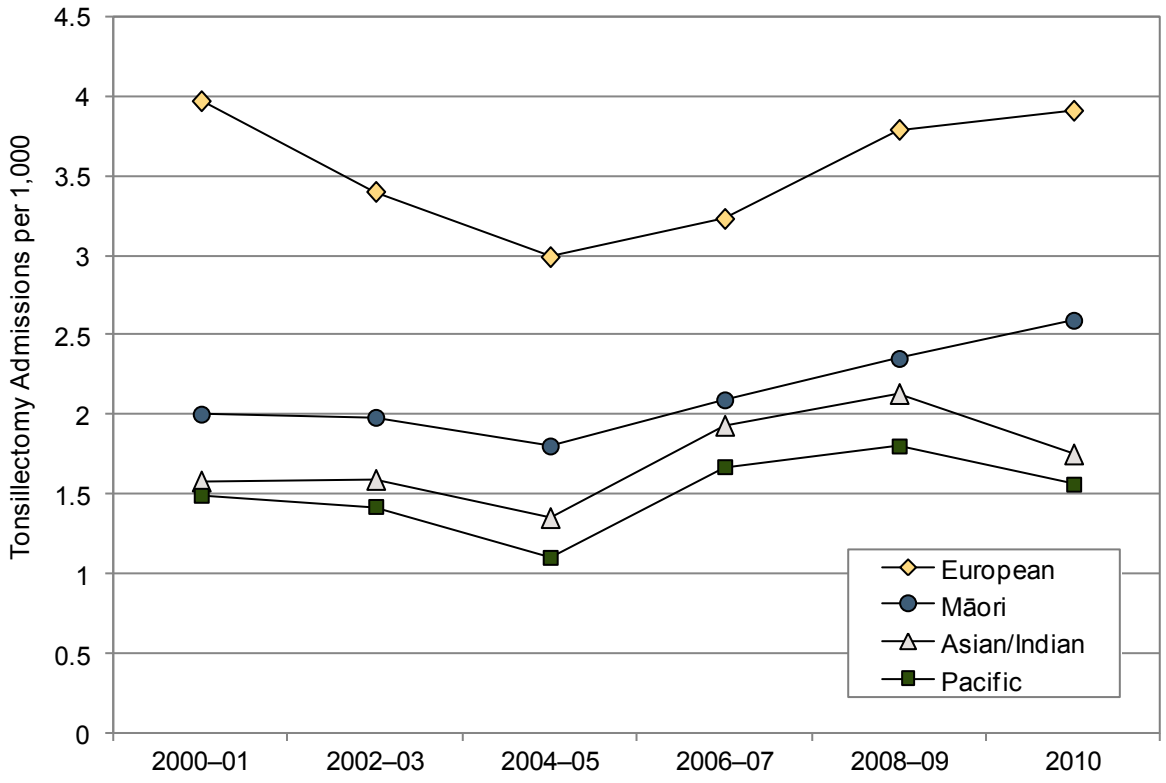


Table 52. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Tonsillectomy +/− Adenoidectomy							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	2.04	1.00		Decile 1–2	2.17	1.00	
Decile 2	2.30	1.13	1.03–1.23	Decile 3–4	2.61	1.21	1.13–1.28
Decile 3	2.47	1.21	1.11–1.33	Decile 5–6	3.59	1.65	1.56–1.75
Decile 4	2.74	1.34	1.23–1.46	Decile 7–8	3.56	1.64	1.55–1.74
Decile 5	3.56	1.74	1.60–1.89	Decile 9–10	3.12	1.44	1.36–1.52
Decile 6	3.61	1.77	1.63–1.92	Prioritised Ethnicity			
Decile 7	3.56	1.74	1.60–1.89	European	3.59	1.00	
Decile 8	3.57	1.75	1.61–1.89	Māori	2.30	0.64	0.61–0.67
Decile 9	3.78	1.85	1.71–2.01	Pacific	1.70	0.47	0.44–0.51
Decile 10	2.56	1.25	1.15–1.36	Asian/Indian	1.97	0.55	0.51–0.59
Gender							
Female	3.01	1.00					
Male	3.03	1.00	0.97–1.04				

Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 37. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years by Ethnicity, New Zealand 2000–2010



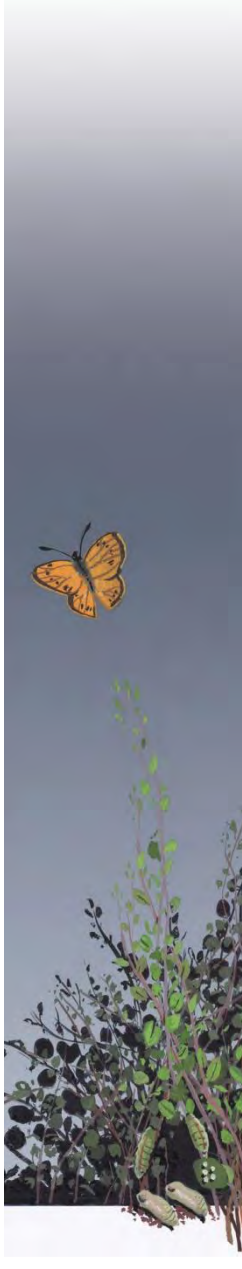
Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Midland Region Distribution and Trends

Table 53. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years by Primary Diagnosis, Midland DHBs 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tonsillectomy +/− Adenoidectomy				
Waikato				
Chronic Tonsillitis	979	195.8	2.49	69.1
Hypertrophy Tonsils/Adenoids	332	66.4	0.85	23.4
Sleep Apnoea	56	11.2	0.14	4.0
Other/Unspecified Chronic Diseases Tonsils/Adenoids	17	3.4	0.04	1.2
Otitis Media	16	3.2	0.04	1.1
Acute Tonsillitis	4	0.8	0.01	0.3
Other Diagnoses	12	2.4	0.03	0.8
Waikato Total	1,416	283.2	3.61	100.0
Bay of Plenty				
Chronic Tonsillitis	485	97.0	2.18	58.6
Hypertrophy Tonsils/Adenoids	183	36.6	0.82	22.1
Sleep Apnoea	118	23.6	0.53	14.3
Acute Tonsillitis	10	2.0	0.04	1.2
Otitis Media	10	2.0	0.04	1.2
Other Diagnoses	21	4.2	0.09	2.5
Bay of Plenty Total	827	165.4	3.72	100.0
Lakes DHB				
Chronic Tonsillitis	206	41.2	1.72	60.8
Hypertrophy Tonsils/Adenoids	108	21.6	0.90	31.9
Sleep Apnoea	5	1.0	0.04	1.5
Other/Unspecified Chronic Diseases Tonsils/Adenoids	5	1.0	0.04	1.5
Otitis Media	4	0.8	0.03	1.2
Acute Tonsillitis	3	0.6	0.03	0.9
Other Diagnoses	8	1.6	0.07	2.4
Lakes DHB Total	339	67.8	2.83	100.0
Tairawhiti				
Chronic Tonsillitis	100	20.0	1.73	76.3
Hypertrophy Tonsils/Adenoids	29	5.8	0.50	22.14
Other Diagnoses	<3	s	s	s
Tairawhiti Total	131	26.2	2.26	100.0
Taranaki				
Chronic Tonsillitis	245	49.0	2.19	66.0
Sleep Apnoea	50	10.0	0.45	13.5
Hypertrophy Tonsils/Adenoids	11	2.2	0.10	3.0
Otitis Media	3	0.6	0.03	0.8
Other Diagnoses	62	12.4	0.55	16.7
Taranaki Total	371	74.2	3.32	100.0

Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.



Midland Region Distribution by Primary Diagnosis

In the Midland Region during 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in children admitted to hospital for tonsillectomy +/− adenoidectomy in all five DHBs, with hypertrophy of the tonsils / adenoids being the second most frequent cause in all DHBs except Taranaki, where sleep apnoea was the second most frequent reason for admission (**Table 53**).

Midland DHBs vs. New Zealand

In the Waikato and Bay of Plenty during 2006–2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children were significantly higher than the New Zealand rate, while in Tairawhiti, rates were significantly lower. Rates in Lakes and Taranaki however, were not *significantly* different from the New Zealand rate (**Table 54**).

Table 54. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Tonsillectomy +/− Adenoidectomy					
Waikato	1,416	283.2	3.61	1.19	1.13–1.26
Lakes	339	67.8	2.83	0.94	0.84–1.04
Bay of Plenty	827	165.4	3.72	1.23	1.15–1.32
Tairawhiti	131	26.2	2.26	0.75	0.63–0.89
Taranaki	371	74.2	3.32	1.10	0.99–1.22
New Zealand	13,488	2,697.6	3.02	1.00	

Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

In Lakes, Taranaki and Tairawhiti, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children increased between 2002–03 and 2010, while in the Waikato rates decreased during the early-2000s, reached their lowest point during 2004–05 and then increased again. Admissions in the Bay of Plenty also decreased during the mid-2000s, reached their lowest point in 2006–07 and then increased again (**Figure 38**).

Midland Region Distribution by Ethnicity

In the Midland Region during 2000–2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy were consistently higher for European children than for Māori children in all five Midland DHBs. Admissions for Waikato European children were also higher than for Waikato Asian/Indian and Pacific children during this period (**Figure 39**).

Midland Region Distribution by Season

Amongst the Midland DHBs during 2006–2010, no consistent seasonal patterns were evident in arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children (**Figure 40**).

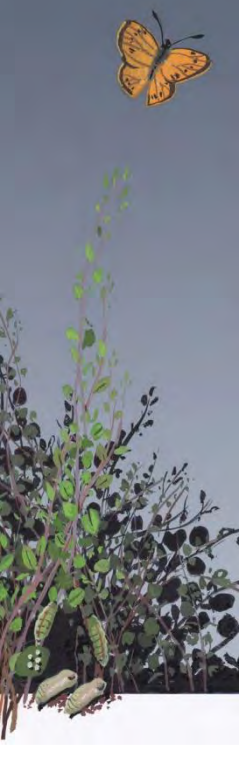
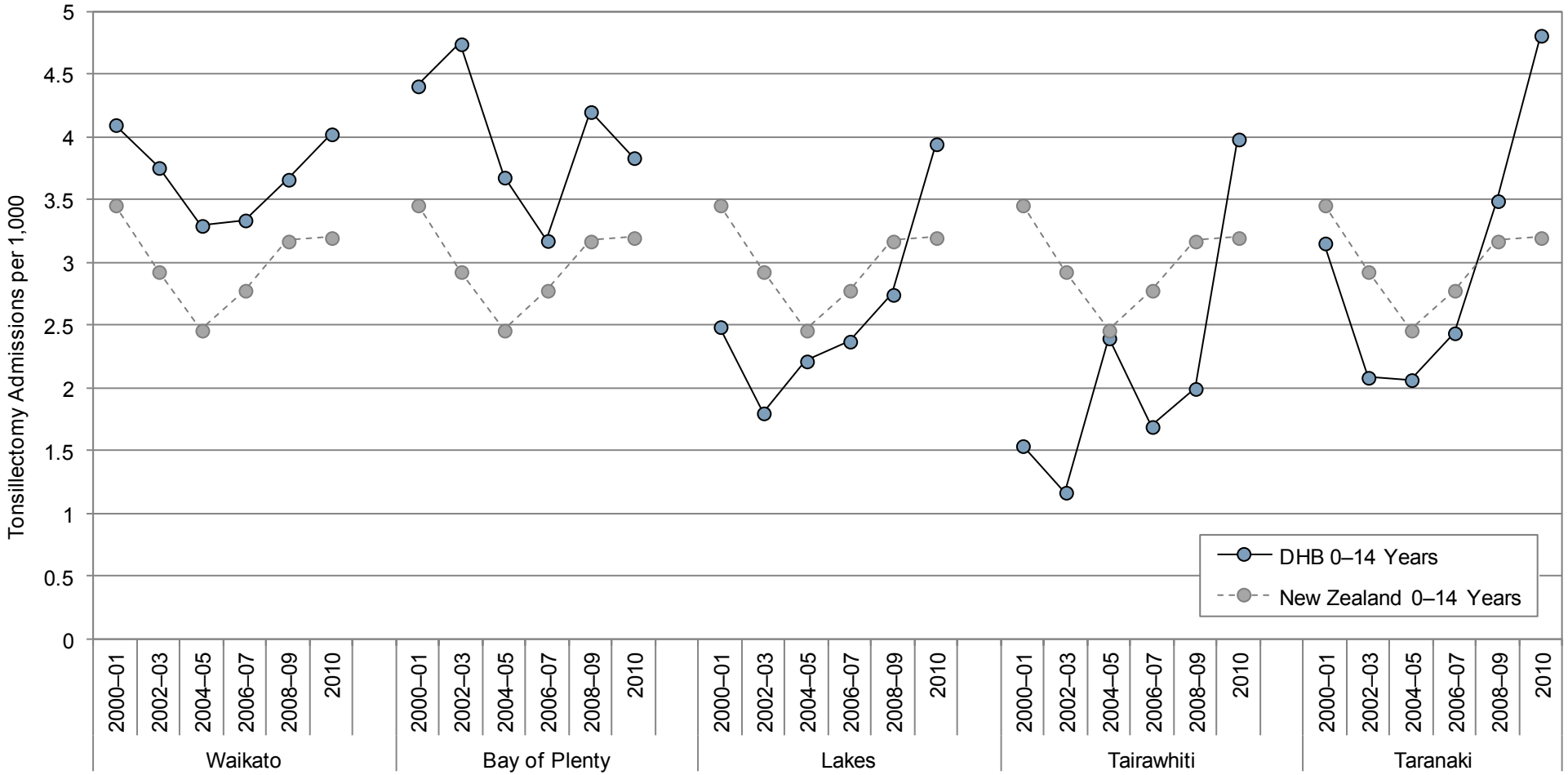
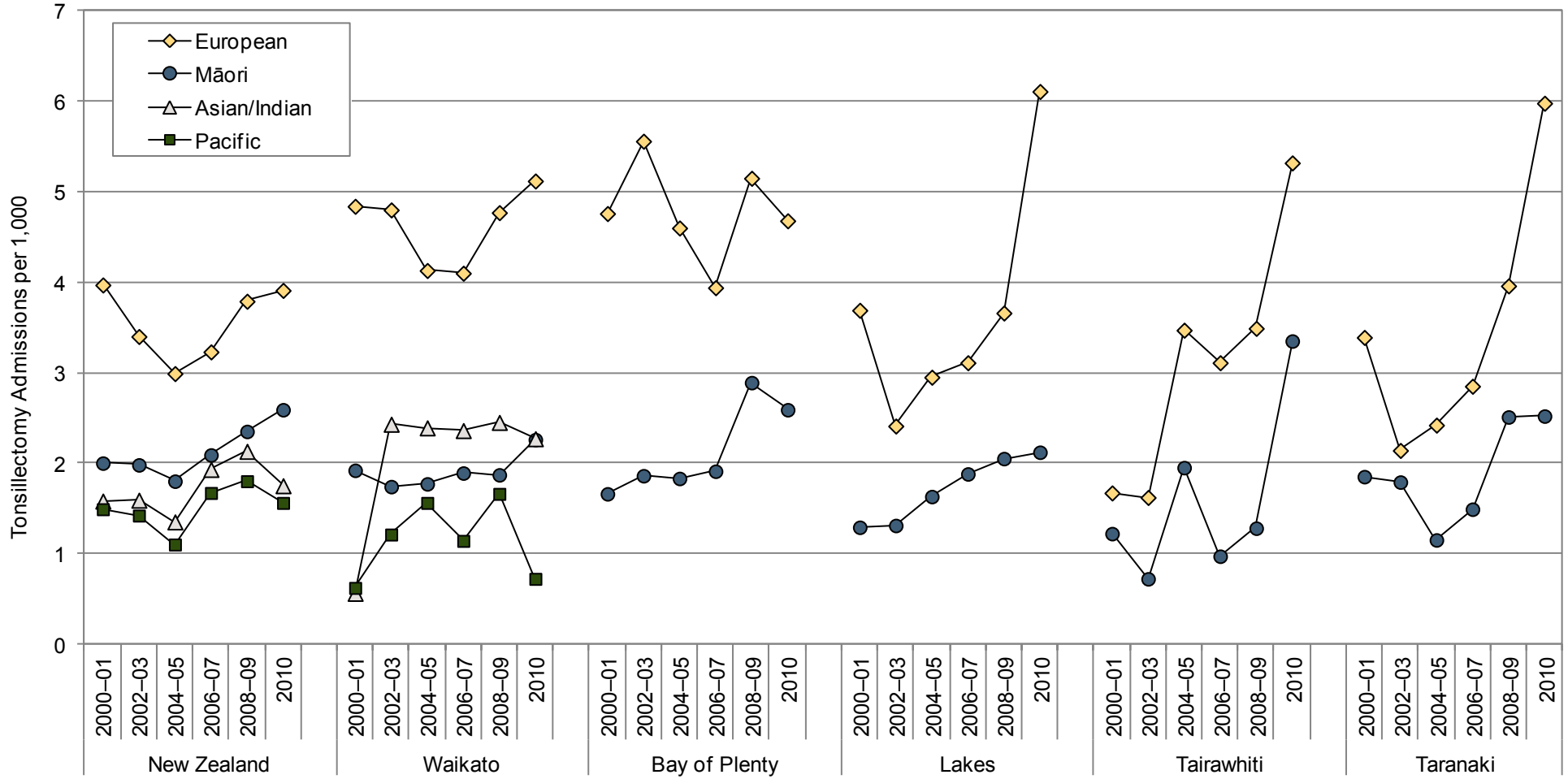


Figure 38. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000–2010



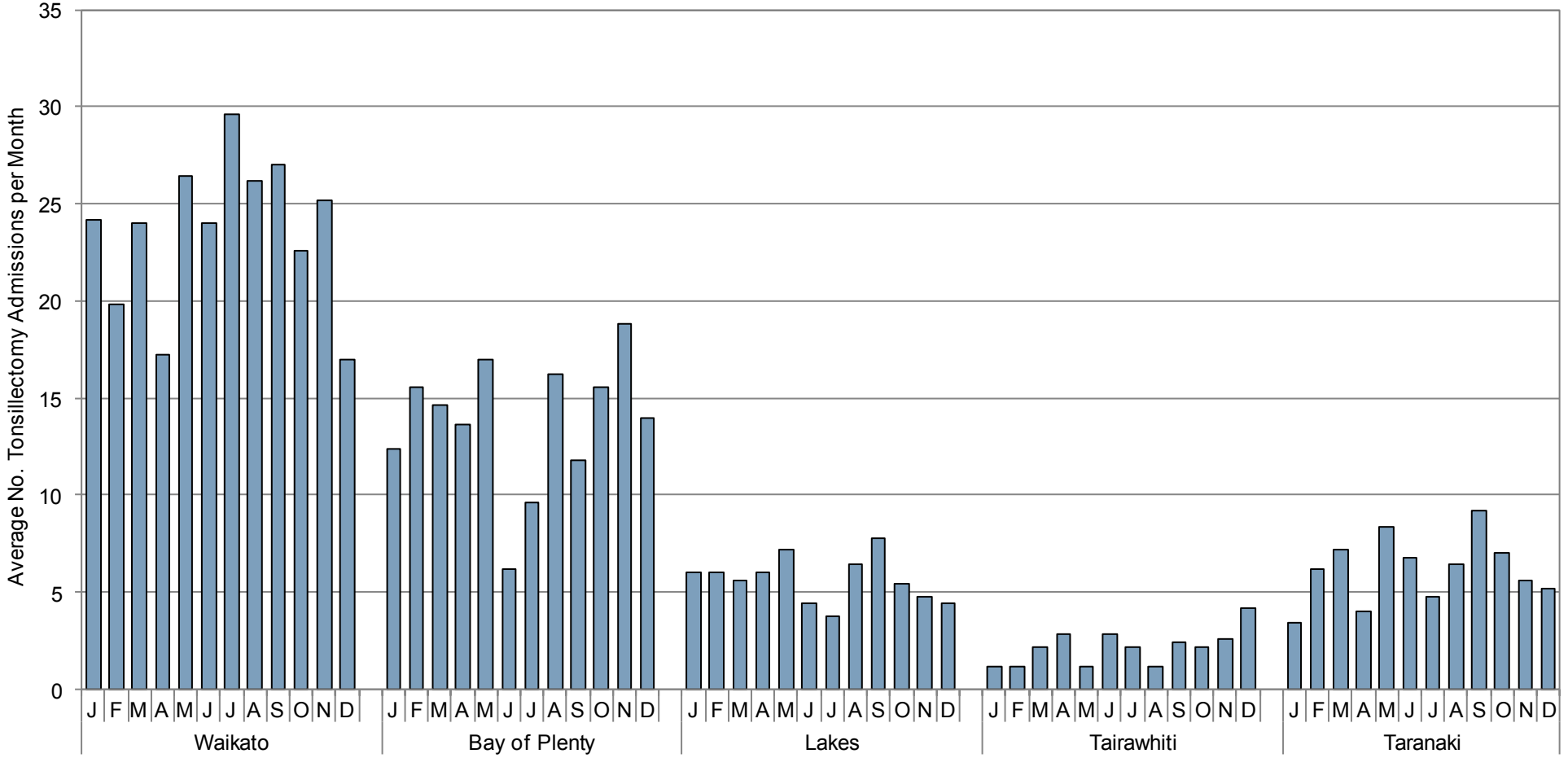
Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 39. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0−14 Years by Ethnicity, Midland DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 40. Average Number of Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children 0–14 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Arranged and waiting list admissions only)

Summary

Acute Upper Respiratory Infections

In New Zealand during 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an URTI admission in children, followed by croup/acute laryngitis/tracheitis. When broken down by age, URTI admissions were most common in infants and one year olds, with rates tapering off rapidly thereafter. Rates were also *significantly* higher for males, for Pacific > Māori > European > Asian/Indian children and those in average-to-more deprived (NZDep decile 4–10) areas.

During 2006–2010, acute upper respiratory tract infections of multiple / unspecified sites were the most frequent reasons for an URTI admission in all five Midland DHBs, followed by croup/acute laryngitis/tracheitis. During 2000–2010, there were no consistent trends in URTI admissions, with rates in most DHBs fluctuating during this period. However, in the Waikato and Taranaki during 2006–2010, admissions were *significantly* lower than the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti admissions were *significantly* higher. URTI admissions were also generally higher for Māori children than for European children, although this was not consistent across all DHBs, or in some years. Admissions however were consistently higher in winter and early spring in all five DHBs.

Tonsillectomy

In New Zealand during 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in children admitted to hospital for tonsillectomy +/− adenoidectomy, accounting for 60.1% of all admissions in this category. Hypertrophy of the tonsils/adenoids was the second leading diagnosis, followed by sleep apnoea. When broken down by age, admissions increased during the pre-school years, to reach their highest point at four years of age in European and Asian/Indian children, at five years of age in Māori children, and at six years of age in Pacific children. Admissions were *significantly* higher for European > Māori > Asian/Indian and Pacific children, and *significantly* lower for those living in the least deprived (NZDep decile 1) areas.

In the Waikato and Bay of Plenty during 2006–2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children were significantly higher than the New Zealand rate, while in Tairawhiti, rates were significantly lower. Rates in Lakes and Taranaki however, were not *significantly* different from the New Zealand rate. Admissions were consistently higher for European children than for Māori children in all five Midland DHBs, with admissions for Waikato European children also being higher than for Waikato Asian/Indian and Pacific children during this period.

Policy Documents and Evidence-Based Reviews Relevant to Upper Respiratory Infections and Tonsillectomy

In New Zealand there are no policy documents which focus solely on the prevention of upper respiratory tract infections. A range of documents however consider approaches to respiratory / infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101
5. **Guidelines for the Management of Sore Throats:** Table 88 on Page 291

A number of international evidence-based reviews however consider the most appropriate management of upper respiratory tract infections, and these are considered in **Table 55**, along with those reviews which consider the indications for tonsillectomy in children.

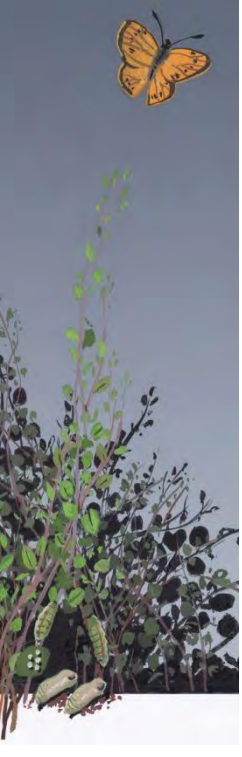


Table 55. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Upper Respiratory Tract Infections and Tonsillectomy

Government Policy Documents
Mesdsafe. 2010 June 8. **Sale restrictions on some cough and cold medicines for children under 12**. http://www.medsafe.govt.nz/hot/media/2010/CoughandColdJune2011.asp accessed 25/8/11. This media release announces that cough and cold medications for children can only be sold in pharmacies except for those containing ingredients such as lemon, honey and other natural products which can be sold in supermarkets for use in children over six years of age. Products containing dextromethorphan, phenylephrine and ipecacuanha can only be sold by pharmacies for use in children less than 12 years of age. Supermarkets can sell these products provided they are labelled as being for use only in adults and children over 12 years of age. These restrictions follow concern about the safety and efficacy of cough and cold medicines in children. Details about these medicine can be found in the minutes of the Medicines Classification Committee's 13 April 2010 meeting at: http://www.medsafe.govt.nz/profs/class/mccMin13April2010.htm
International Guidelines on the Management of Upper Respiratory Infections and Cough
National Guideline Clearinghouse (NGC). 1999 Oct 6 (revised 2011 Mar). **Guideline synthesis: Diagnosis and management of pharyngitis.** http://www.guideline.gov This web page provides a comparison of three published guidelines: 1). Institute for Clinical Systems Improvement (ICSI). **Respiratory Illness in Children and Adults, Diagnosis and Treatment of (Guideline)** Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2008 http://www.icsi.org/respiratory_illness_in_children_and_adults__guideline_/respiratory_illness_in_children_and_adults__guideline__13116.html 2). **Scottish Intercollegiate Guidelines Network (SIGN)**. Management of sore throat and indications for tonsillectomy. A national clinical guideline. Edinburgh (Scotland): Scottish Intercollegiate Guidelines Network (SIGN); 2010 3). **University of Michigan Health System (UMHS)**. Pharyngitis. Ann Arbor (MI): University of Michigan Health System; 2006 Areas of agreement and disagreement are outlined, along with the methodologies and grading schemes used for the evidence. Tables provide direct comparisons of the recommendations in all three guidelines.
National Institute for Health and Clinical Excellence. 2008. **Prescribing of Antibiotics for Self-limiting Respiratory Tract Infections in Adults and Children in Primary Care**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/12015/41323/41323.pdf Acute respiratory infections are common and usually self-limiting. Overuse of antibiotics in primary care increases rates of antibiotic resistance which could become a major public health problem. This guideline is intended to provide evidence-based best practice advice on the care of adults and children over three months of age for whom immediate prescribing of antibiotics is not warranted. The guidelines state that a no antibiotic or delayed antibiotic prescribing strategy is appropriate for patients with the following conditions: acute otitis media, acute sore throat/acute pharyngitis/acute tonsillitis, common cold, acute rhinosinusitis, acute cough/acute bronchitis but that an immediate antibiotic prescribing strategy can be considered for bilateral acute otitis media in children younger than two years, acute otitis media in children with otorrhoea and acute sore throat/acute pharyngitis/acute tonsillitis when three or more Centor criteria are present. The guidelines also cover advice to patients and identifying patients at risk of developing complications who require immediate antibiotics and/or further investigations.
Shields MD, Bush A, Everard ML, et al. 2008. **BTS guidelines: Recommendations for the assessment and management of cough in children**. Thorax, 63 Suppl 3, iii1-iii15. These British Guidelines cover the management, in both primary and secondary care, of acute, chronic and recurrent coughing in children up to 12 years of age without known lung disease,. They state that “There is currently a lack of evidence on which to make evidence-based statements for the diagnosis, investigation and treatments included in this guideline” however the recommendations in the guidelines are accompanied by references to the available literature.
Chang AB, Landau LI, Van Asperen P, et al. 2006. **Cough in children: definitions and clinical evaluation. Position statement of the Thoracic Society of Australia and New Zealand**. Medical Journal of Australia, 184(8), 394-403. This position statement provides a concise guide to the management of cough in children in the Australasian context and is aimed at physicians who treat children. The management statements are accompanied by a grade indicating the quality of the published evidence on which they are based.
Chang AB, WB G. 2006. **Guidelines for evaluating chronic cough in pediatrics: ACCP evidence-based clinical practice guidelines**. Chest, 129(1), 260S-83S. Paediatric chronic cough is defined as a daily cough lasting for four or more weeks. These guidelines mostly deal with non-specific cough i.e. dry cough in the absence of known respiratory disease and they state there have been few RCTs in this area. Table 2 summarises studies describing the yield of specific investigations for cough in children. The recommendations are accompanied by grades indicating the level of evidence and the degree of benefit.

International Guidelines on the Indications for Tonsillectomy
Baugh R, Archer S, Mitchell R, et al. 2011. **Clinical Practice Guideline: Tonsillectomy in Children**. American Academy of Otolaryngology–Head and Neck Surgery. http://www.entnet.org/HealthInformation/upload/CPG-TonsillectomyInChildren.pdf This guideline provides evidence-based guidance for identifying the children (1–18 years) who are the best candidates for tonsillectomy, optimising perioperative management, and improving communication with parents about management options. Each evidence-based statement is followed by an indication of the strength of the recommendation based on the quality of the evidence. It recommends watchful waiting for recurrent throat infections if there have been <7 episodes in the past year, <5 episodes in the past 2 years, or <3 episodes in the past 3 years. These criteria form part of the "Paradise Criteria", which are used in what the guidelines call *the most frequently cited and meticulous* RCTs investigating the efficacy of tonsillectomy. Table 9 compares three major guidelines: those of the U.S., Scotland and Italy. The Scottish and US guidelines recommend the Paradise criteria for assessing the need for tonsillectomy. The Italian guidelines state the that tonsillectomy is indicated in patients with at least one year of recurrent tonsillitis (5+ episodes per year) that is disabling and interferes with normal activities, but only after an additional six months of watchful waiting during which a diary documenting clinical symptoms is kept. The guidelines also cover indications for tonsillectomy in children with sleep disordered breathing (the common indication for tonsillectomy other than recurrent sore throat).
Scottish Intercollegiate Guidelines Network. 2010. **Management of sore throat and indications for tonsillectomy: A national clinical guideline**. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign117.pdf This Scottish Guidelines covers diagnosis, pain management, antibiotic use, indications tonsillectomy and postoperative care for acute and recurrent sore throat in children and adults. Recommendations are accompanied by a grade indication of the strength of the evidence on which they are based. Key recommendations include: Using the Centor clinical prediction score to help decide whether to prescribe an antibiotic (grade C), watchful waiting is more appropriate than tonsillectomy for children with mild sore throats (Grade A) and that the indications for considering tonsillectomy are 7+ well-documented, adequately treated disabling sore throats due to tonsillitis in the preceding year or, 5+ such episodes in each of the previous two years or, 3+ such episodes in the previous three years. (Grade D)
Bellussi L, Busoni Paolo, Camaioni A, et al. 2008. **SNLG15 Appropriateness and Safety of Tonsillectomy and/or Adenoidectomy**. Rome: Sistema Nazionale Linee Guida (SNLG). http://www.snlg-iss.it/cms/files/LG_en_tonsillectomy_2008.pdf These Italian evidence-based guidelines cover indications for tonsillectomy and/or adenoidectomy, surgical techniques, perioperative management and clinical and organisational aspects of adenotonsillectomy. They state that the main indications for tonsillectomy and/or adenoidectomy are obstructive sleep apnoea syndrome in children with adenotonsillar hypertrophy and severe recurrent tonsillitis. They state that tonsillectomy for severe recurrent sore throat is only indicated if there have been at least five incapacitating episodes during at least one year. Recommendations in the guidelines are accompanied by a grade indicating the strength of the evidence on which they are based.
Indications for Tonsillectomy and Adenotonsillectomy in Children A joint Position paper of the Paediatrics & Child Health Division of The Royal Australasian College of Physicians and The Australian Society of Otolaryngology Head and Neck Surgery. 2008 Sydney. http://www.racp.edu.au/index.cfm?objectid=B5637C7B-E823-E407-E65AB8D6F27A07BD These guidelines support the use of the Paradise criteria for tonsillectomy for frequent recurrent acute tonsillitis. The following conditions are also listed as indications for tonsillectomy: upper airway obstruction in children with obstructive sleep apnoea, peritonsillar abscess and suspected neoplasm.
Systematic and Other Reviews from the International Literature
Burton MJ, Glasziou PP. 2009. **Tonsillectomy or adeno-tonsillectomy versus non-surgical treatment for chronic/recurrent acute tonsillitis**. Cochrane Database of Systematic Reviews, 2009(1), Art. No.: CD001802. DOI: 10.1002/14651858.CD001802.pub2. This review included five RCTs, four of which involved children (719 in total) and one of which involved adults (70 in total, followed for 90 days after surgery). The reviewers considered two groups of children: those "severely affected" who met the "Paradise criteria" (see below for the original paper) and those less severely affected. The reviewers concluded that for severely affected children having adenotonsillectomy would result in avoiding, on average, three unpredictable episodes of any type of sore throat over the next year at a cost of one predictable episode of significant pain, lasting on average five to seven days, in the immediate post-operative period. Less severely affected children would have only one less sore throat of any type in the next year (on average two rather than three).
Bailey EJ, Morris PS, Kruske SG, et al. 2008. **Clinical pathways for chronic cough in children**. Cochrane Database of Systematic Reviews, 2008(2), Art. No.: CD006595. DOI: 10.1002/14651858.CD006595.pub2. Chronic cough (cough lasting 4+ weeks) is common in children. There are clinical guidelines (pathways) for this condition however there have been no RCTs comparing outcomes between children treated according to a clinical pathway and those who were not. In the absence of such trials the authors recommend that decisions on further investigations and treatment in a child with chronic cough be made on an individual basis according to the clinical symptoms and signs.

Spurling GKP, Del Mar CB, Dooley L, et al. 2007. **Delayed antibiotics for respiratory infections**. Cochrane Database of Systematic Reviews, 2007(3), Art. No.: CD004417. DOI: 10.1002/14651858.CD004417.pub3.

Antibiotics provide only modest benefits in acute otitis media, pharyngitis and acute bronchitis and have no effect on the common cold. There is interest in limiting unnecessary antibiotic prescribing, with a possible strategy being to provide a prescription but advise waiting 48 hours to see if the symptoms resolve untreated. This review considered ten RCTs which compared delayed antibiotics with either immediate antibiotics (9 trials) or no antibiotics (3 trials) for patients with acute upper respiratory tract infections. There was no difference in clinical outcomes between immediate, delayed and no antibiotics for cough and the common cold. Some studies reported that immediate antibiotics were more effective than delayed antibiotics for fever, pain and malaise in acute otitis media and in sore throat. There were no significant differences in complication rates and only slight differences in adverse effects. Patients were more satisfied with immediate rather than delayed antibiotics (92% vs.87%) and more satisfied with delayed than no antibiotics (87% vs. 83%). Re-consultation rates were the same in both the immediate and delayed antibiotic groups. The authors concluded that although delayed antibiotics reduced antibiotic use compared to immediate antibiotics, it has not been shown that delayed antibiotics are different from no antibiotics in terms of symptom control and complication rates. They suggest that where a clinician considers immediate antibiotics are not indicated, offering no antibiotics with advice to return if symptoms do not resolve is likely to result in the least antibiotic use and provide similar patient satisfaction and clinical outcomes to delayed antibiotics.

In addition to the reviews above, the **Cochrane Collection:** http://www.thecochranelibrary.com/view/0/index.html contains a large number of other reviews relevant to upper respiratory conditions. These include:

- *Croup*: Glucocorticoids, Heliox and Nebulised Epinephrine
- *Common Cold*: Acetylcysteine and carbocysteine, antibiotics, antihistamines, Chinese herbs, echinacea, garlic, heated humidified air, intranasal ipratropium bromide, nasal decongestants, non-steroidal anti-inflammatory drugs, vitamin C and zinc.
- *Cough*: Honey, over-the-counter medications.
- *Non-specific cough* (non-productive cough in the absence if identifiable respiratory disease or known aetiology): anticholinergics, antihistamines, gastro-oesophageal reflux treatment, honey and lozenges, indoor air modification, inhaled beta-2 agonists, inhaled corticosteroids, inhaled cromones, Leukotriene receptor antagonist, methylxanthines, treatment of obstructive sleep apnoea.
- *Tonsillectomy*: Antibiotics, coblation vs. other techniques, dissection vs. diathermy, oral rinses, mouthwashes and sprays post tonsillectomy, perioperative local anaesthesia, steroids, Periodic fever, aphthous stomatitis, pharyngitis, & cervical adenitis syndrome (PFAPA).
- *Sinusitis*: decongestants, antihistamines and nasal irrigation, functional endoscopic balloon dilation of sinus ostia, functional endoscopic surgery, nasal saline irrigation, systemic antibiotics, topical and systemic antifungal therapy, topical steroid, antibiotics for acute maxillary sinusitis, intranasal steroids for acute sinusitis.
- *Upper respiratory conditions in general*: pelargonium sidoides extract, saline nasal irrigation.

Other Relevant Publications

Paradise JL, Bluestone CD, Bachman RZ, et al. 1984. **Efficacy of tonsillectomy for recurrent throat infection in severely affected children. Results of parallel randomized and nonrandomized clinical trials**. New England Journal of Medicine 310(11) 674-83.

This paper reports on two studies comparing the efficacy of tonsillectomy with non-surgical treatment in children meeting strict criteria for recurrent tonsillitis in the following categories: frequency of episodes of throat infection (7+ episodes in the preceding year, or 5+ in each of the preceding 2 years, or 3+ in each of the preceding 3 years), clinical features, treatment and documentation. There was a non-randomised study of 96 children whose parents did not consent to being part of the randomised study and a RCT involving 91 children. In both studies the incidence of throat infections was significantly lower in the surgical group ($p \leq 0.05$) in the first two years of follow up but not in the third year, however many in the non-surgical group had only 1-2 if any episodes of infection and most episodes were mild. The authors say their results support choosing tonsillectomy for children meeting stringent eligibility criteria but they also support choosing non-surgical management.

Schaefer MK, Shehab N, Cohen AL, et al. 2008. **Adverse Events From Cough and Cold Medications in Children**. *Pediatrics* 121(4) 783-87.

This paper reports on the use of public health surveillance data to describe emergency department visits for adverse drug events due to cough and cold medications ingested by children in the U.S. The investigation was undertaken in response reports of unintentional overdoses and links between these medications and infant deaths which had led to calls for the U.S. Food and Drug Administration to advise that these medications not be used in children under 6 years of age. The results of the study indicated that an estimated 7091 patients under 12 years of age were treated in emergency departments for adverse drug events due to cough and cold medications and that this number equates to 5.7% of all ED visits for all medications in this age group. Unsupervised ingestion accounted for 66% of all estimated ED visits and most of these ingestions (77%) in children involved children aged between 2 and 5. Most children (93%) did not require admission or extended observation. It is suggested that engineering innovations such as incorporating adaptors onto bottles of liquid medication such that medication can only be accessed via a needle-less syringe, would prevent unsupervised preschool-aged children from drinking directly from the bottle and the wider use of child-resistant packaging could help reduce the problem of unsupervised ingestions.

MIDDLE EAR CONDITIONS: OTITIS MEDIA AND GROMMETS

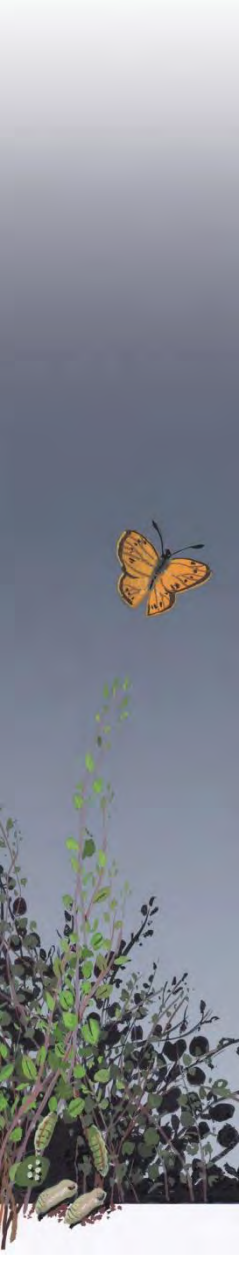
Introduction

Otitis media is one of the most common childhood infections presenting in primary care, and is also a frequent reason for antibiotic treatment and hospitalisation for surgical intervention [114]. It can be subdivided into two related categories:

Acute Otitis Media (AOM): AOM is caused by inflammation of the middle ear and is usually viral or bacterial in origin. Symptoms often follow an upper respiratory infection and include fever, irritability, ear pain and hearing loss, and on examination a red, opaque, bulging eardrum may be present +/- a purulent ear discharge [115]. Risk factors include age (peak incidence 6-11 months), a lack of breastfeeding, parental smoking and attendance at day care. In the acute phase, management includes pain relief, observation (selected mild cases) and antibiotics [114]. Complications include perforation of the eardrum, mastoiditis and labyrinthitis (infection of the inner ear). In the longer term, some children develop recurrent acute otitis media and/or chronic middle ear effusions, for which surgical management may be indicated [115].

Otitis Media with Effusion (OME): OME is defined as the presence of a middle ear effusion (fluid) without signs or symptoms of acute infection. It may arise de-novo or following an episode of acute otitis media [114]. Approximately 90% of children have an episode of OME prior to school entry [116], with the peak incidence being around 1 year of age [114]. While OME is common, most episodes resolve spontaneously (in one series 28% resolved by 3 months, 42% by 6 months and 59% by 9 months [114]), and thus if children are not at particular risk for speech, language or learning problems (e.g. children with Down Syndrome or cranio-facial abnormalities), they may be managed with watchful waiting for at least 3 months [116]. Even with effusions persisting > 3 months, intervention may be unnecessary in asymptomatic children, but follow up is still required at 3-6 month intervals until the effusion has disappeared, significant hearing loss is identified, or structural abnormalities of the eardrum or middle ear are suspected. The decision to opt for surgical intervention is usually made on the basis of the child's hearing status, associated symptoms and developmental risk, and in most cases involves the insertion of grommets [116].

For children with long-standing (>3-6 months) bilateral OME, or recurrent AOM, grommets (ventilation or tympanostomy tubes) are often considered, with a view to restoring normal hearing. The procedure (which improves ventilation and pressure regulation in the middle ear) involves making a small incision in the eardrum (with or without the aspiration of middle ear fluid) and the insertion of a small ventilation tube. On average, grommets remain in the eardrum for 6–12 months before falling out [117]. In terms of their effectiveness, a recent Cochrane review noted that a meta-analysis of three high quality trials which randomised children to receive either bilateral grommets or no grommets indicated a hearing improvement of only 4.2 dB at six to nine months (95% CI 2.39 - 6.00) and no difference at 12-18 months in the children who had received grommets compared to those who had not. The review did not identify any studies which reported an effect of grommets on speech or language development or behavioural, cognitive or quality of life outcomes however only a few studies attempted to measure these. (Note: children at high risk of speech or developmental problems were excluded from these trials.) [118] Another Cochrane review concluded that in children under three years of age with recurrent otitis media, grommets reduce the number of episodes of acute otitis media in the first six months after surgery by an average of 1.5 episodes per child (from 2.2 to 0.67 episodes) [119].



The following section uses data from the National Minimum Dataset to explore acute hospital admission for otitis media in children, as well as arranged and waiting list admissions for the insertion of grommets.

Data Sources and Methods

Indicators

1. *Acute Hospital Admissions for Otitis Media in Children Aged 0–14 Years*

2. *Acute Hospital Admissions for Other Conditions of the Middle Ear and Mastoid in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Acute hospital admissions for children aged 0–14 years with an ICD-10-AM primary diagnosis of Otitis Media (H65–H67) or Other Conditions of the Middle Ear and Mastoid: Eustachian Tube Disorders (H68, H69); Mastoiditis and Related Disorders (H70); Cholesteatoma of the Middle Ear (H71); Perforation/Other Disorders of the Tympanic Membrane (H72–73); and Other Disorders of the Middle Ear/Mastoid (H74–75).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

3. *Arranged and Waiting List Admissions for the Insertion of Grommets in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Arranged and Waiting List Admissions for the Insertion of Grommets (ICD-10-AM primary procedure codes 4163200 and 4163201).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission (referred to elsewhere in this report as a semi-acute admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary.

While the majority of children admitted acutely with a primary diagnosis of otitis media do not receive a surgical intervention, the majority of children admitted from the waiting list with the same primary diagnosis do, with the most common operative procedure being the insertion of grommets. For arranged admissions the picture is more mixed, with some patients being admitted semi-acutely for the non-surgical management of otitis media, and others for an operative intervention such as grommets. On balance however, more arranged admissions with a primary diagnosis of otitis media are for surgical interventions, and thus in this section arranged admissions have been grouped with the waiting list category (in contrast to other sections where acute and arranged admission are considered together).

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Distribution by Primary Diagnosis

Conditions of the Middle Ear and Mastoid: In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, accounting for 93.1% of admissions in this category. Mastoiditis and related disorders was the second most frequent reason for admission (**Table 56**).

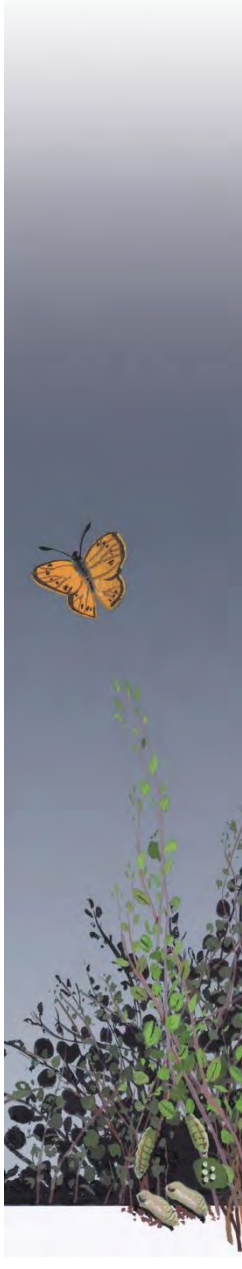
Grommets: In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in arranged/waiting list admissions for the insertion of grommets, and accounted for 95.2% of admissions in this category. Perforations/other disorders tympanic membrane was the second most frequent primary diagnosis (**Table 57**).

New Zealand Trends

In New Zealand during 2000–2010, arranged/waiting list admissions for the insertion of grommets declined, while acute admissions for otitis media declined during the early 2000s, but were more static after 2004–05 (**Figure 41**).

New Zealand Distribution by Age and Ethnicity

Otitis Media: In New Zealand during 2006–2010, acute admissions for otitis media were highest in infants and one year olds, with rates declining rapidly thereafter. When broken



down by ethnicity, admission rates were higher for Māori and Pacific > European > Asian children during the first four years, although ethnic differences were less consistent thereafter (**Figure 42**).

Grommets: In contrast, in New Zealand during 2006–2010, arranged/waiting list admissions for the insertion of grommets were relatively infrequent during the first year of life, but increased rapidly thereafter. Rates were highest in European children at one year of age, in Māori children at two years of age, in Asian/Indian children at four years of age and in Pacific children at six years of age. Overall, during the first four years admission rates were higher for European and Māori > Pacific > Asian/Indian children, while after six years of age, admissions were higher for Pacific > Māori > European > Asian/Indian children (**Figure 42**).

Table 56. Acute Hospital Admissions for Conditions of the Middle Ear and Mastoid in Children Aged 0–14 Years by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
Conditions of Middle Ear and Mastoid				
Otitis Media	2,679	535.8	0.60	93.1
Mastoiditis and Related Disorders	158	31.6	0.04	5.5
Perforation/Other Disorders Tympanic Membrane	29	5.8	0.01	1.0
Cholesteatoma Middle Ear	6	1.2	<0.01	0.2
Other Disorders Middle Ear/Mastoid	6	1.2	<0.01	0.2
Eustachian Tube Disorders	<3	s	s	s
New Zealand Total	2,879	575.8	0.64	100.0

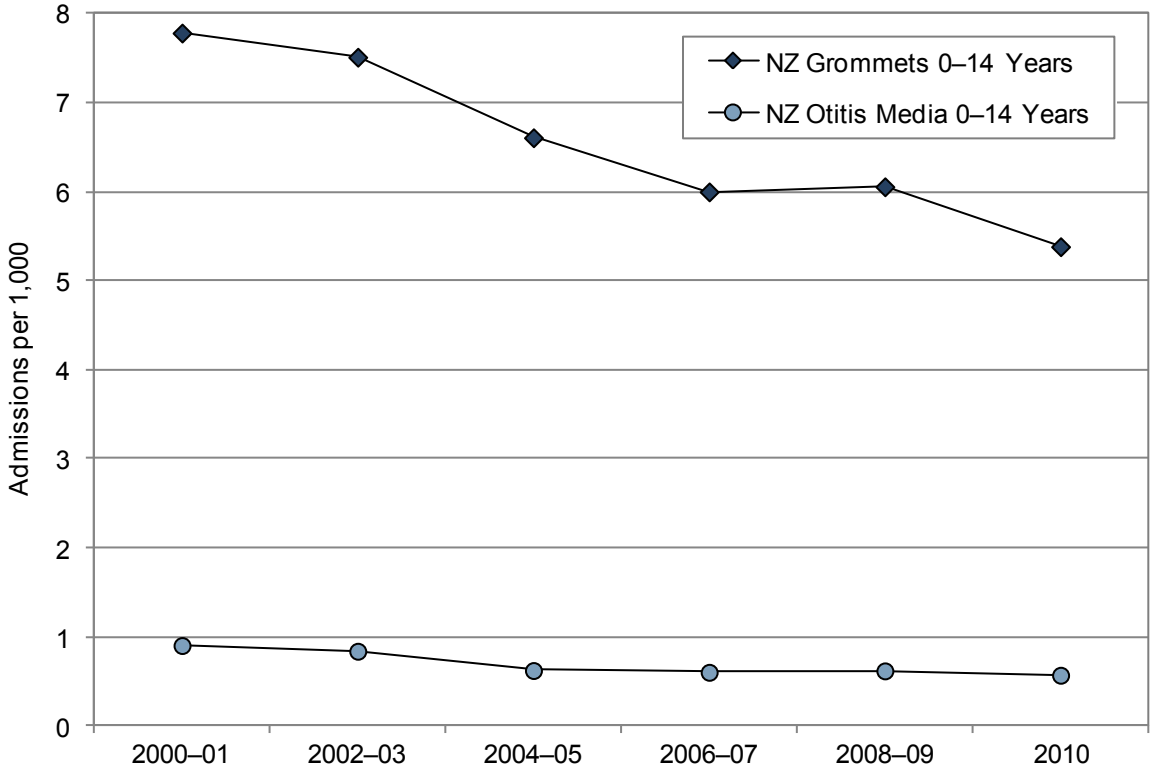
Source: Numerator: National Minimum Dataset (Acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers

Table 57. Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
Grommets				
Otitis Media	25,055	5,011	5.61	95.2
Perforation/Other Disorders Tympanic Membrane	542	108.4	0.12	2.1
Eustachian Tube Disorders	133	26.6	0.03	0.5
Hypertrophy Tonsils/Adenoids	112	22.4	0.03	0.4
Other Disorders Middle Ear/Mastoid	88	17.6	0.02	0.3
Chronic Tonsillitis	75	15.0	0.02	0.3
Sleep Apnoea	41	8.2	0.01	0.2
Cholesteatoma Middle Ear	9	1.8	<0.01	<0.1
Mastoiditis and Related Disorders	6	1.2	<0.01	<0.1
Other/Unspecified Chronic Diseases Tonsils/Adenoids	4	0.8	<0.01	<0.1
Other Diagnoses	260	52.0	0.06	1.0
New Zealand Total	26,325	5,265	5.90	100.0

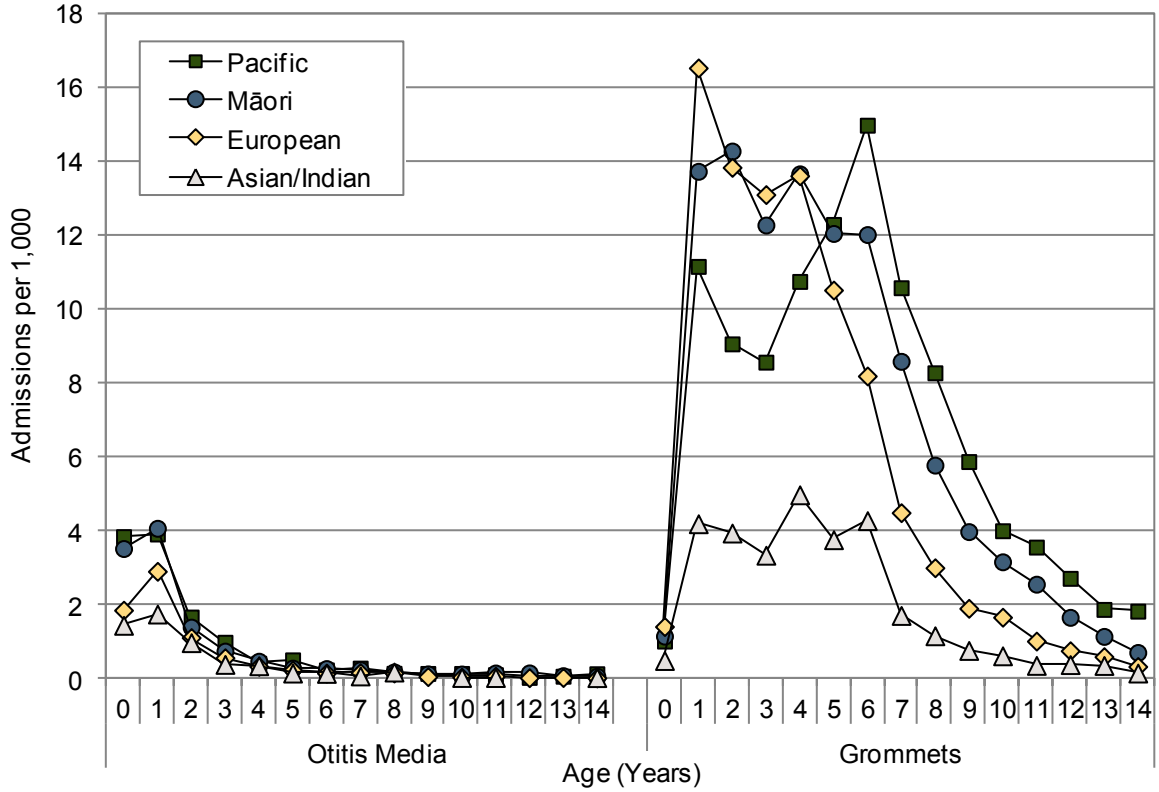
Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 41. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 42. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years by Age and Ethnicity, New Zealand 2006–2010



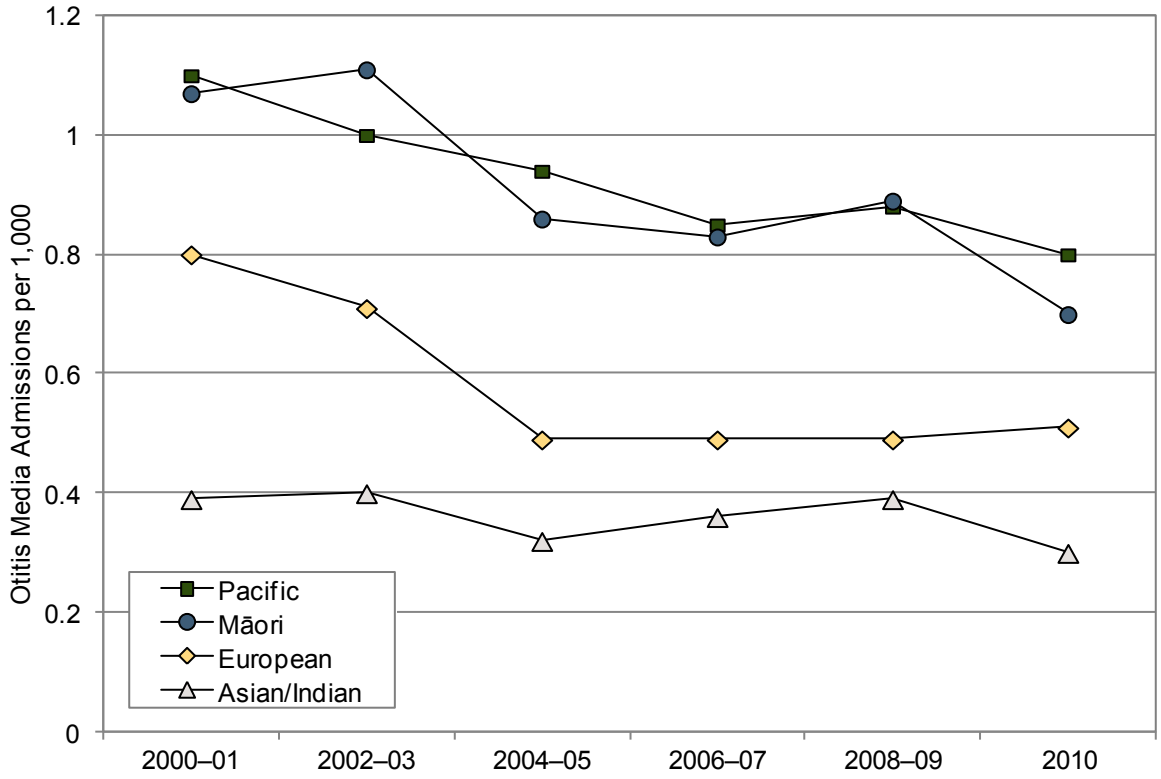
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised.

Table 58. Acute Hospital Admissions for Otitis Media in Children Aged 0–14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Otitis Media							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	0.35	1.00		Decile 1–2	0.34	1.00	
Decile 2	0.32	0.93	0.74–1.16	Decile 3–4	0.41	1.22	1.04–1.43
Decile 3	0.38	1.09	0.87–1.37	Decile 5–6	0.55	1.61	1.39–1.87
Decile 4	0.44	1.25	1.01–1.55	Decile 7–8	0.68	2.00	1.74–2.30
Decile 5	0.49	1.40	1.13–1.73	Decile 9–10	0.94	2.77	2.43–3.16
Decile 6	0.59	1.69	1.38–2.06	Prioritised Ethnicity			
Decile 7	0.64	1.83	1.50–2.23	European	0.49	1.00	
Decile 8	0.71	2.01	1.66–2.43	Māori	0.83	1.68	1.54–1.83
Decile 9	0.98	2.80	2.33–3.35	Pacific	0.85	1.73	1.54–1.95
Decile 10	0.90	2.57	2.15–3.07	Asian/Indian	0.36	0.73	0.61–0.86
Gender							
Female	0.54	1.00					
Male	0.66	1.22	1.13–1.32				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 43. Acute Hospital Admissions for Otitis Media in Children Aged 0–14 Years by Ethnicity, New Zealand 2000–2010



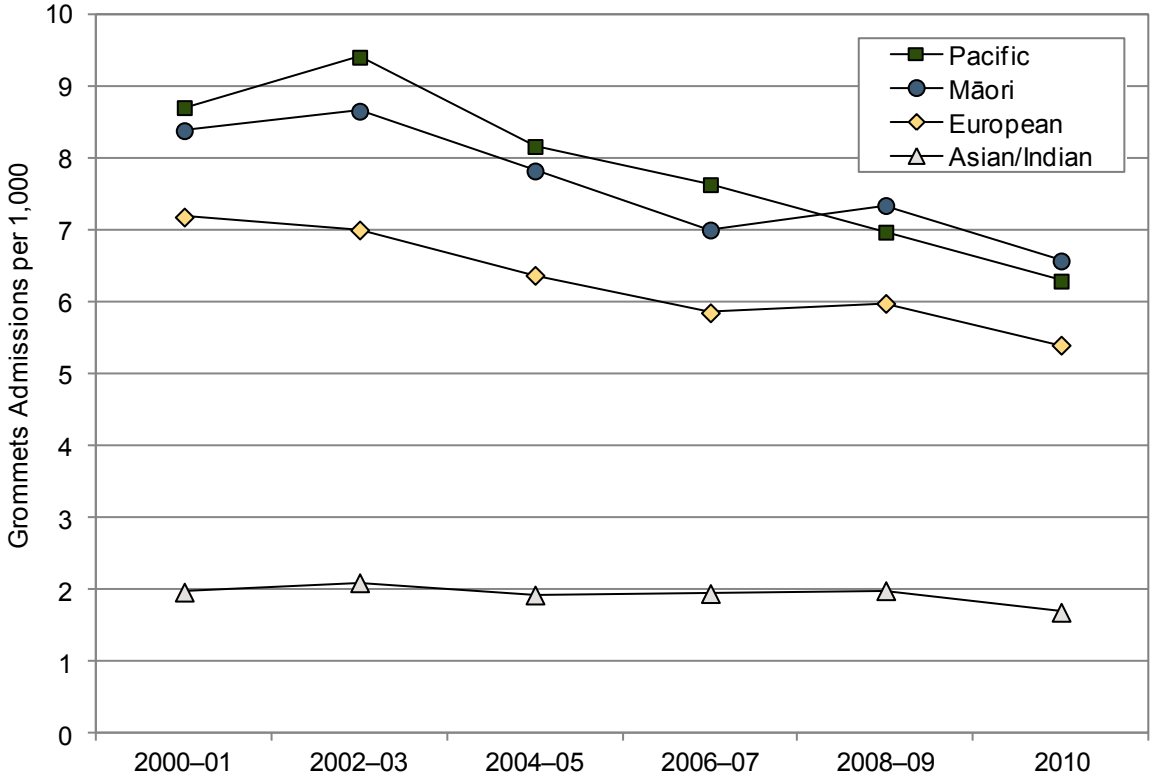
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised.

Table 59. Arranged/Waiting List Admissions for Grommets in Children Aged 0−14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Grommets							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.45	1.00		Decile 1–2	3.64	1.00	
Decile 2	3.84	1.11	1.04–1.19	Decile 3–4	4.68	1.29	1.23–1.35
Decile 3	4.60	1.33	1.25–1.43	Decile 5–6	6.23	1.71	1.64–1.79
Decile 4	4.75	1.38	1.29–1.47	Decile 7–8	7.22	1.98	1.90–2.07
Decile 5	5.99	1.74	1.63–1.86	Decile 9–10	7.32	2.01	1.93–2.10
Decile 6	6.43	1.87	1.75–1.98	Prioritised Ethnicity			
Decile 7	6.88	1.99	1.87–2.12	European	5.81	1.00	
Decile 8	7.51	2.18	2.05–2.31	Māori	7.05	1.21	1.18–1.25
Decile 9	7.73	2.24	2.11–2.38	Pacific	7.09	1.22	1.17–1.27
Decile 10	6.96	2.02	1.90–2.14	Asian/Indian	1.91	0.33	0.31–0.35
Gender							
Female	4.88	1.00					
Male	6.87	1.41	1.37–1.44				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised. Decile is NZDep2001.

Figure 44. Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

Otitis Media: In New Zealand during 2006–2010, acute admissions for otitis media were *significantly* higher for males, for Pacific and Māori > European > Asian/Indian children and those living in average-to-more deprived (NZDep decile 4–10) areas (**Table 58**). Similar ethnic differences were seen during 2000–2010 (**Figure 43**).

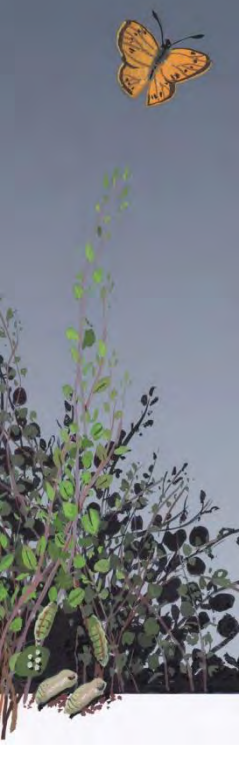
Grommets: Similarly, during 2006–2010 arranged/waiting list admissions for the insertion of grommets were *significantly* higher for males and for Pacific and Māori > European > Asian/Indian children. Admission rates were *significantly* lower for those living in the least deprived (NZDep decile 1) areas (**Table 59**). Similar ethnic differences were seen during 2000–2010 (**Figure 44**).

Midland Region Distribution and Trends

Table 60. Acute Hospital Admissions for Conditions of the Middle Ear and Mastoid in Children Aged 0–14 Years by Primary Diagnosis, Midland DHBs 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Conditions of Middle Ear and Mastoid				
Waikato				
Otitis Media	273	54.6	0.70	92.2
Mastoiditis and Related Disorders	18	3.6	0.05	6.1
Perforation/Other Disorders Tympanic Membrane	3	0.6	0.01	1.0
Cholesteatoma Middle Ear	<3	s	s	s
Other Disorders Middle Ear/Mastoid	<3	s	s	s
Waikato Total	296	59.2	0.75	100.0
Bay of Plenty				
Otitis Media	316	63.2	1.42	97.2
Mastoiditis and Related Disorders	5	1.0	0.02	1.5
Perforation/Other Disorders Tympanic Membrane	3	0.6	0.01	0.9
Other Disorders Middle Ear/Mastoid	<3	s	s	s
Bay of Plenty Total	325	65.0	1.46	100.0
Lakes DHB				
Otitis Media	138	27.6	1.15	98.6
Mastoiditis and Related Disorders	<3	s	s	s
Other Disorders Middle Ear/Mastoid	<3	s	s	s
Lakes DHB Total	140	28.0	1.17	100.0
Tairawhiti				
Otitis Media	64	12.8	1.11	98.5
Mastoiditis and Related Disorders	<3	s	s	s
Tairawhiti Total	65	13.0	1.12	100.0
Taranaki				
Otitis Media	46	9.2	0.41	95.8
Perforation/Other Disorders Tympanic Membrane	<3	s	s	s
Cholesteatoma Middle Ear	<3	s	s	s
Taranaki Total	48	9.6	0.43	100.0

Source: Numerator: National Minimum Dataset (Acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.



Midland Region Distribution by Cause

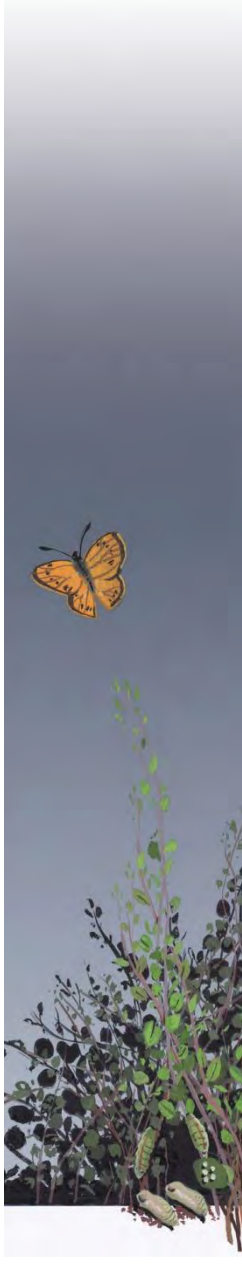
Conditions of the Middle Ear and Mastoid: In the Midland Region during 2006–2010, otitis media was the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, accounting for >90% of admissions in all five DHBs during this period (**Table 60**).

Grommets: Similarly during 2006–2010, otitis media was the most frequent primary diagnosis in arranged/waiting list admissions for the insertion of grommets, again accounting for >90% of admissions in all five DHBs (**Table 61**).

Table 61. Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years by Primary Diagnosis, Midland DHBs 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Grommets				
Waikato				
Otitis Media	2,453	490.6	6.25	93.4
Perforation/Other Disorders Tympanic Membrane	80	16.0	0.20	3.0
Eustachian Tube Disorders	26	5.2	0.07	1.0
Other Disorders Middle Ear/Mastoid	21	4.2	0.05	0.8
Hypertrophy Tonsils/Adenoids	4	0.8	0.01	0.2
Other Diagnoses	43	8.6	0.11	1.6
Waikato Total	2,627	525.4	6.69	100.0
Bay of Plenty				
Otitis Media	1,060	212.0	4.77	93.6
Perforation/Other Disorders Tympanic Membrane	28	5.6	0.13	2.5
Eustachian Tube Disorders	13	2.6	0.06	1.1
Other Disorders Middle Ear/Mastoid	10	2.0	0.04	0.9
Sleep Apnoea	5	1.0	0.02	0.4
Other Diagnoses	16	3.2	0.07	1.4
Bay of Plenty Total	1,132	226.4	5.09	100.0
Lakes DHB				
Otitis Media	717	143.4	5.99	96.0
Perforation/Other Disorders Tympanic Membrane	13	2.6	0.11	1.7
Other Diagnoses	17	3.4	0.14	2.3
Lakes DHB Total	747	149.4	6.24	100.0
Tairawhiti				
Otitis Media	341	68.2	5.89	96.6
Eustachian Tube Disorders	8	1.6	0.14	2.3
Perforation/Other Disorders Tympanic Membrane	3	0.6	0.05	0.8
Other Diagnoses	<3	s	s	s
Tairawhiti Total	353	70.6	6.10	100.0
Taranaki				
Otitis Media	775	155.0	6.93	98.1
Perforation/Other Disorders Tympanic Membrane	3	0.6	0.03	0.4
Other Diagnoses	12	2.4	0.11	1.5
Taranaki Total	790	158.0	7.06	100.0

Source: Numerator: National Minimum Dataset (Arranged/waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.



Midland DHBs vs. New Zealand

During 2006–2010, acute admissions for otitis media in children were *significantly* higher than the New Zealand rate in the Bay of Plenty, Lakes, Tairawhiti and the Waikato, but *significantly* lower than the New Zealand rate in Taranaki. In contrast, arranged/waiting list admissions for grommets were *significantly* higher than the New Zealand rate in Taranaki and the Waikato, but *significantly* lower in the Bay of Plenty. Admissions in Lakes and Tairawhiti however, were not *significantly* different from the New Zealand rate (**Table 62**).

Table 62. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Otitis Media					
Waikato	273	54.6	0.70	1.16	1.02–1.31
Lakes	138	27.6	1.15	1.92	1.62–2.28
Bay of Plenty	316	63.2	1.42	2.37	2.11–2.66
Tairawhiti	64	12.8	1.11	1.84	1.44–2.36
Taranaki	46	9.2	0.41	0.69	0.51–0.92
New Zealand	2,679	535.8	0.60	1.00	
Grommets					
Waikato	2,627	525.4	6.69	1.13	1.09–1.18
Lakes	747	149.4	6.24	1.06	0.98–1.14
Bay of Plenty	1,132	226.4	5.09	0.86	0.81–0.92
Tairawhiti	353	70.6	6.10	1.03	0.93–1.15
Taranaki	790	158.0	7.06	1.20	1.12–1.29
New Zealand	26,325	5,265.0	5.90	1.00	

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

During 2000–2010, arranged/waiting list admissions for the insertion of grommets declined in the Waikato, Lakes and Tairawhiti, while admissions in the Bay of Plenty and Taranaki were more variable. In contrast, acute admissions for otitis media declined in the Bay of Plenty, Tairawhiti and Taranaki during 2000–2010, while in the Waikato rates declined during the early 2000s but became more static from 2004–05. In Lakes, rates increased during the early-2000s, reached their highest point in 2004–05 and then declined (**Figure 45**).

Midland Region Distribution by Ethnicity

In the Midland Region during 2000–2010, arranged/waiting list admissions for the insertion of grommets were generally higher for Māori than for European children in the Bay of Plenty, Lakes and Taranaki, although differences between Māori and European children in the Waikato and Tairawhiti were less consistent. Admissions in Waikato European children however were consistently higher than for Waikato Asian/Indian children (**Figure 46**). Small numbers prevented a more detailed review of differences in acute otitis media admissions by ethnicity.

Midland Region Distribution by Season

In the Midland Region during 2006–2010, there were no consistent seasonal variations in arranged/waiting list admissions for the insertion of grommets, although acute admissions for otitis media were higher in winter and early spring in some DHBs (**Figure 47**).

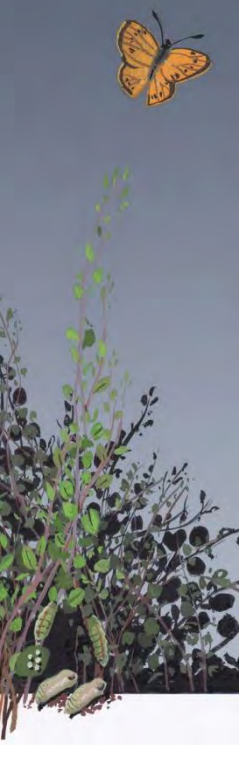
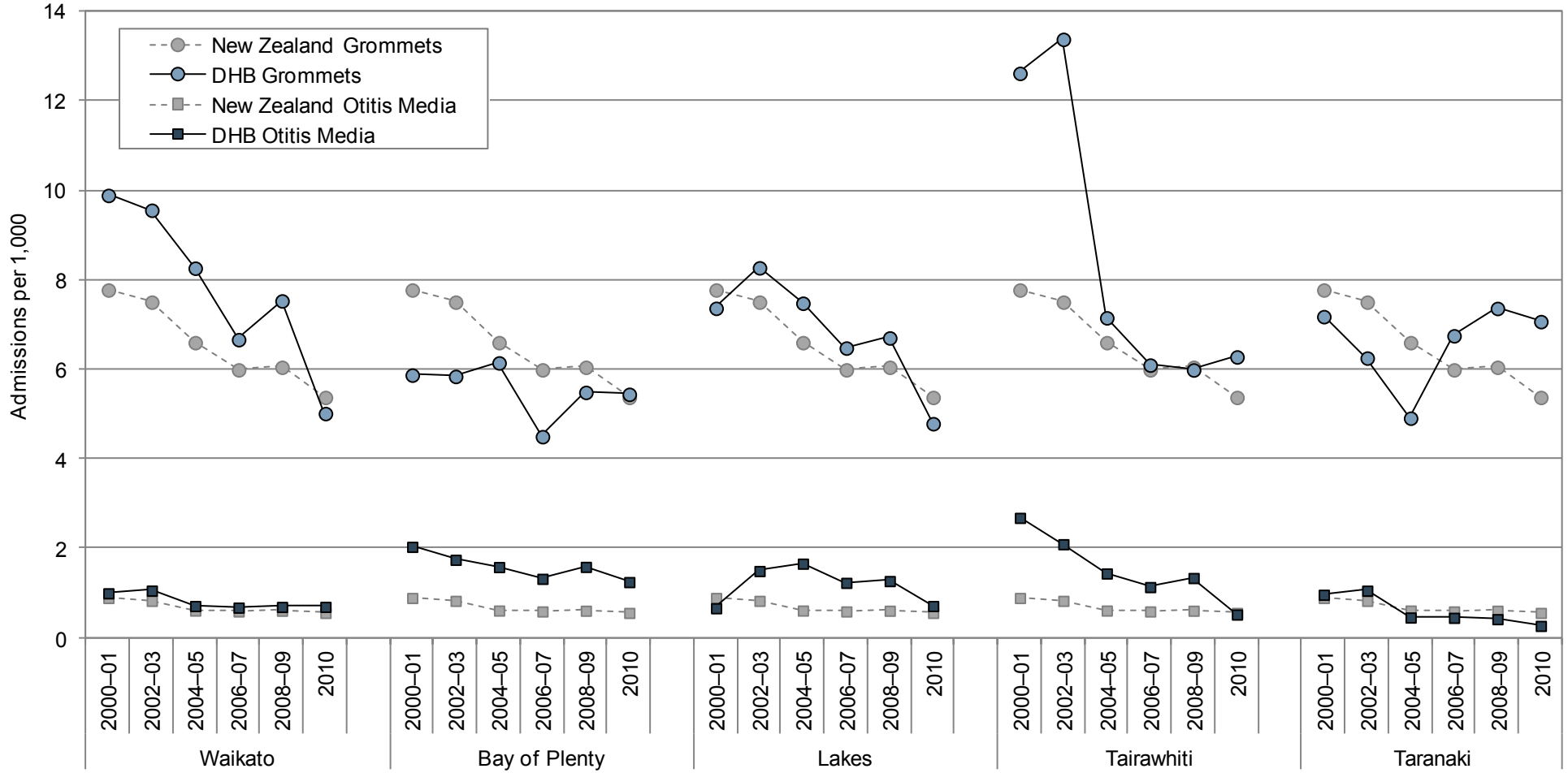
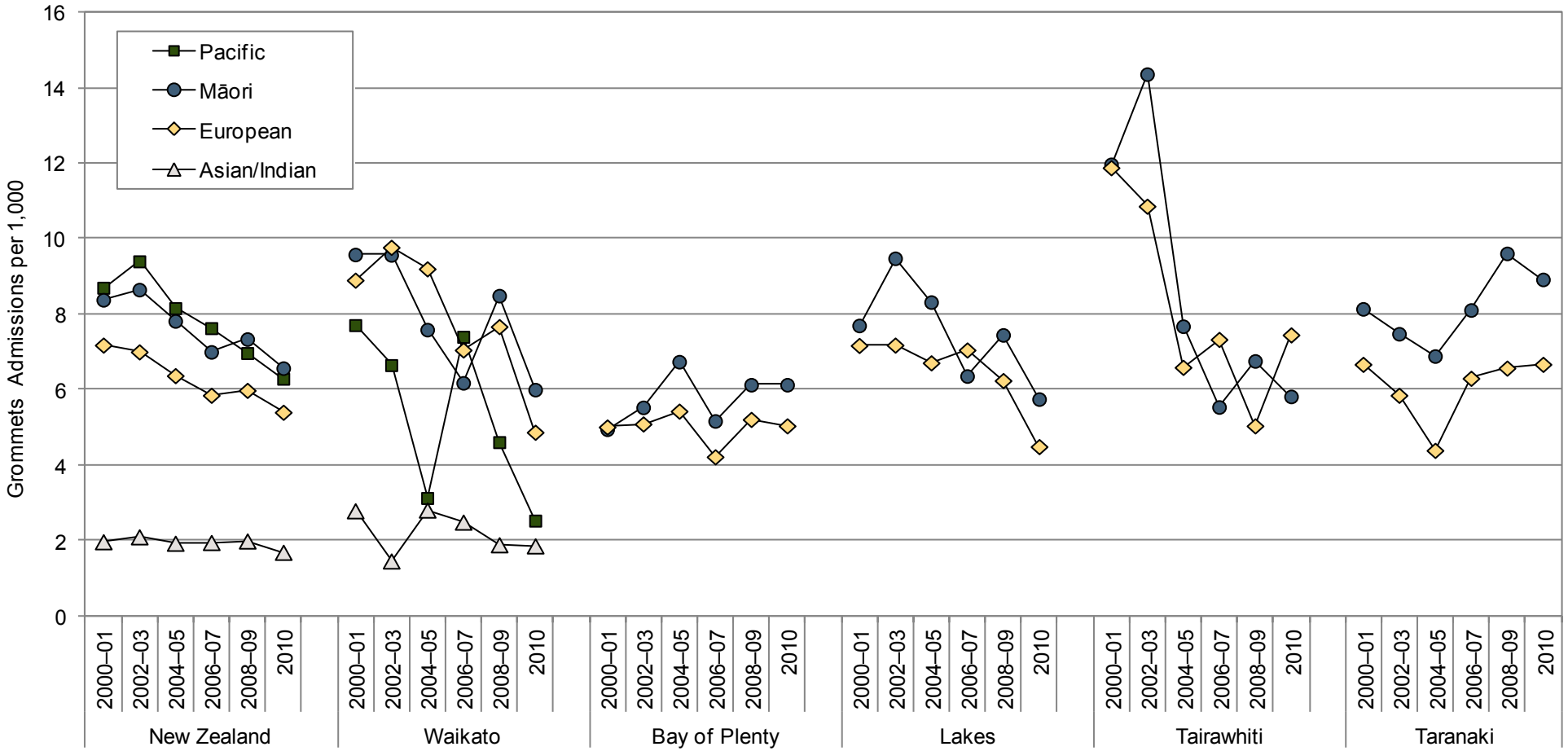


Figure 45. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000–2010



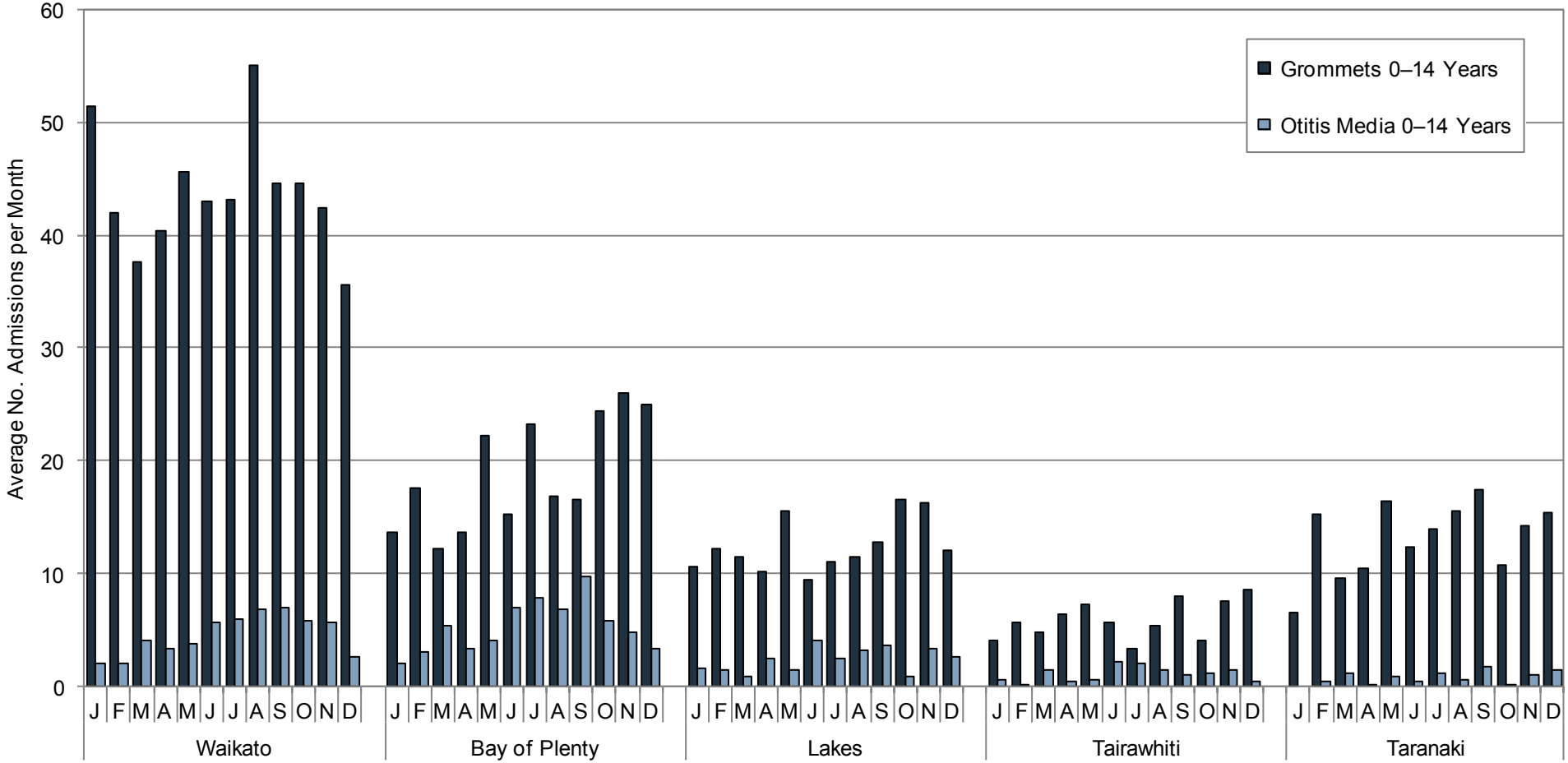
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 46. Arranged/Waiting List Admissions for Grommets in Children Aged 0–14 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 47. Average Number of Acute Hospital Admissions for Otitis Media and Arranged/ Waiting List Admissions for Grommets in Children Aged 0–14 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset

Summary

In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, as well as for those admitted semi-acutely/from the waiting list for the insertion of grommets. When broken down by age, acute admissions for otitis media were highest in infants and one year olds, with rates declining rapidly thereafter. Rates were higher for Māori and Pacific > European > Asian/Indian children during the first four years, although ethnic differences were less consistent thereafter. In contrast, arranged/waiting list admissions for the insertion of grommets were relatively infrequent during the first year of life, but increased rapidly thereafter. Rates reached their highest point in European children at one year, in Māori children at two years, in Asian/Indian children at four years and in Pacific children at six years of age. Overall, during the first four years admission rates were higher for European and Māori > Pacific > Asian/Indian children, while after six years of age, admissions were higher for Pacific > Māori > European > Asian/Indian children.

In the Midland Region during 2006–2010, otitis media was also the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, as well as for those admitted semi-acutely/from the waiting list for the insertion of grommets. Acute admissions for otitis media were *significantly* higher than the New Zealand rate in the Bay of Plenty, Lakes, Tairawhiti and the Waikato, but *significantly* lower in Taranaki. In contrast, arranged/waiting list admissions for grommets were *significantly* higher than the New Zealand rate in Taranaki and the Waikato, but *significantly* lower in the Bay of Plenty, and not *significantly* different in Lakes and Tairawhiti. Arranged/waiting list admissions for grommets were generally higher for Māori than for European children in the Bay of Plenty, Lakes and Taranaki, although differences between Māori and European children in the Waikato and Tairawhiti were less consistent. Admissions in Waikato European children however were consistently higher than for Waikato Asian/Indian children.

Local Policy Documents and Evidence-Based Reviews Relevant to Otitis Media and Grommets

In New Zealand there are no policy documents which focus solely on the prevention of otitis media. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

A number of local policy documents however consider screening for acquired hearing losses in children, and these are considered in **Table 63**, along with a range of international reviews and guidelines which consider the most appropriate management of otitis media and the indications for grommets in children.

Table 63. Local Policy Documents and Evidence-Based Reviews Relevant to the Identification of Acquired Hearing Losses, or the Management of Otitis Media (including Grommets)

Ministry of Health Policy Documents
Ministry of Health. 2009. **National Vision and Hearing Screening Protocols**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/9663/$File/national-vision-and-hearing-screening-protocols-nov09.pdf This document describes the best practice for Vision Hearing Technicians (VHTs) who deliver the National Vision and Hearing screening programme. The hearing component of the programme involves targeted tympanometry screening of three-year-olds for groups at high risk of harm from glue ear (at DHBs discretion), screening audiometry (and tympanometry if required) for four-year-olds as part of the B4 School Check, catch up screening for new entrants (audiometry +/- tympanometry) who did not have screening as part of a B4 school check, or who require follow up from a B4 School check, and screening audiometry or threshold audiometry (depending on the age/ability of the child) for children in special circumstances and migrant children.
Ministry of Health. 2008. **The B4 School Check: A handbook for practitioners**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/10080/$File/b4sc-practitionershandbook-march2010.pdf The B4 School Check includes vision and hearing screening. Section 4 of this publication provides brief information on childhood hearing impairment and provides guidance for practitioners on audiometry screening of four, five and six year old children using the sweep test and, if the sweep test is equivocal or abnormal, tympanometry.
Ministry of Health. 2004. **Child and Youth Health Toolkit**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf This toolkit is aimed at DHB staff and others wishing to improve child and youth health. Chapter 11 (pp. 59-64), while now superseded by the B4 School Check screening protocol, outlines a range of strategies DHBs might use to address the hearing-related health needs of children in their regions.
Ministry of Health. 2002. **Well Child-Tamariki Ora. National Schedule Handbook**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/1745/$File/well-child-national-schedule-handbook.pdf Information on new born baby hearing (now superseded by the new born hearing screening programme) and hearing surveillance at well child contacts is contained on pp. 79-83.Pp. 89-91 cover surveillance for otitis media with effusion.
International Guidelines
National Collaborating Centre for Women's and Children's Health. 2008. **Surgical management of children with otitis media with effusion (OME)**. London: RCOG Press. http://www.nice.org.uk/nicemedia/live/11928/39633/39633.pdf These evidence-based guidelines cover the surgical management of OME in children <12 years including specific recommendations for children with Down syndrome and cleft palate. They cover assessment, diagnosis and indications for specialist referral, indications for surgical intervention, the effectiveness of surgical and non-surgical interventions, information for parents and carers and recommendations for research. They state that children with persistent bilateral OME documented over a period of three months with a hearing level in the better ear of 25-39 dBHL should be considered for surgery. The following treatments are not recommended as non-surgical interventions: antibiotics, topical/systemic antihistamines, decongestants or steroids, homeopathy, cranial osteopathy, acupuncture, dietary modifications, probiotics, immunostimulants or massage. Hearing aids should be offered to children with persistent bilateral hearing loss for whom surgery is contraindicated or unacceptable and autoinflation (forced exhalation with closed mouth and nose to reopen the Eustachian tube) may be considered during the observation period for cooperative children. Each section in the guidelines includes a review of the evidence and an evidence summary. Appendix C provides an economic evaluation of alternative management. The evidence tables on which the guidelines were based can be found at: http://www.nice.org.uk/nicemedia/live/11928/39639/39639.pdf
American Academy of Pediatrics Subcommittee on Management of Acute Otitis Media. 2004. **Diagnosis and management of acute otitis media**. Pediatrics, 113(5), 1451-65.http://pediatrics.aappublications.org/content/113/5/1451.full.html This U.S. guideline provides evidence-based recommendations for primary care physicians for the management of uncomplicated acute otitis media (AOM) in children from two months to 12 years of age. A statement following each recommendation explains the evidence level and the risk/benefit ratio. The guideline provides criteria for choosing whether to prescribe antibiotics or to recommend observation and pain relief only. Antibiotics (Amoxicillin as a first choice) are recommended in children aged <6 months whether the diagnosis is certain or not, in children 6 months to 2 years if the diagnosis is certain or the illness is severe and in children over 2 years only if the diagnosis is certain and the illness is severe. Effective strategies for prevention are stated to be limiting attendance at childcare and breastfeeding for at least 6 months, and less well-proven preventive strategies are avoiding supine bottle feeding and the use of pacifiers after six months and eliminating exposure to tobacco smoke. Influenza and pneumococcal vaccines may have a small effect in preventing AOM. Complementary medicines are not recommended. The evidence report on which the guideline is based has been published separately as: Marcy M, Takata G, Chan LS. 2001. **Management of Acute Otitis Media. Evidence Report/Technology Assessment No. 15. AHRQ Publication No. 01-E010 : ; 2001**. Rockville, MD: Agency for Healthcare Research and Quality.

Scottish Intercollegiate Guidelines Network. 2003. **Diagnosis and management of childhood otitis media in primary care: A national clinical guideline**. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign66.pdf

This evidence-based guideline covers the clinical assessment, treatment, follow up and referral of children with acute otitis media and otitis media with effusion. It also covers the responsibilities of NHS institutions for implementation of the guideline and for audit as well as providing brief information for parents and careers. Statements summarising the research literature are accompanied by a grade indicating the quality of the evidence (Grade1 = meta-analysis of RCTs, 2 = case-control or cohort studies, 3 = case reports/case series, 4 = expert opinion). Recommendations in the guideline are accompanied by a grade (A-D) indicating the strength of the evidence on which they are based.

Systematic and Other Reviews from the International Literature

Simpson SA, Lewis R, van der Voort J, et al. 2011. **Oral or topical nasal steroids for hearing loss associated with otitis media with effusion in children**. Cochrane Database of Systematic Reviews, 2011(5), Art. No.: CD001935. DOI:10.1002/14651858.CD001935.pub3.

This review included 12 studies of medium to high quality with a total of 945 participants. Oral steroids alone were significantly more likely than placebo to lead to resolution of OME in the short term (< 1 month), (pooled data using a fixed effect model, RR 4.48, 95% CI 1.52 – 13.23). Oral steroids plus antibiotic were significantly more likely than placebo plus antibiotic to result in resolution of OME in the short term (random effects model, RR 1.99; 95% CI 1.14 to 3.49; five trials, 409 children). Over the longer term (> 1 month) oral steroids either alone or in combination with antibiotics made no difference to rates of resolution of OME and over both the short and the long term intranasal steroids, either alone or with antibiotics, also made no difference to rates of resolution of OME. Only one study documented hearing loss associated with OME before study entry. There was no evidence that either oral or topical steroid treatment was beneficial in reducing OME-associated hearing loss although only two studies, one of small size (oral steroids) and one of moderate size (oral steroids plus antibiotics) evaluated this outcome.

Browning GG, Rovers MM, Williamson I, et al. 2010. **Grommets (ventilation tubes) for hearing loss associated with otitis media with effusion in children**. Cochrane Database of Systematic Reviews, 2010(10), Art. No.: CD001801. DOI:10.1002/14651858.CD001801.pub3.

Otitis media with effusion (OME) is common in younger children and the surgical insertion of grommets is a treatment option. This review included 10 RCTs involving 1728 children aged one to 12 years with either unilateral or bilateral OME. Three studies randomised ears (i.e. each child received a grommet in only one ear) and seven randomised children to receive either bilateral grommets or no grommets. Grommets were found to have small benefits on hearing which diminished after six to nine months. No studies reported an effect on speech or language development or behavioural, cognitive or quality of life outcomes, however only a few studies attempted to measure these. A meta-analysis of three high quality trials randomising children (523 in total) showed a hearing benefit of only 4 dB (95% CI 2 to 6 dB) at six to nine months and no difference at 12 to 18 months. Similarly, three trials that randomised ears showed hearing in the grommet ear was 10db better (95% CI 5 to 16 dB) at four to six months, 6 dB better at seven to 12 months (95% CI 2 to 10 dB) and 5dB better at 18 to 24 months (95% CI 3 to 8 dB).The authors noted that natural resolution leads to hearing improvement in non-surgically treated children over a similar or shorter time period. They also stated that there have been no studies done in children with established speech, language, developmental or learning problems and therefore it is not possible to draw any conclusions about the benefits or otherwise of grommets for these children.

van den Aardweg TAM, Schilder GMA, Herkert E, et al. 2010. **Adenoidectomy for otitis media in children**. Cochrane Database of Systematic Reviews, 2010(1), Art. No.: CD007810. DOI: 10.1002/14651858.CD007810.pub2.

This review included 14 RCTs (involving a total of 2712 children) assessing the effectiveness of adenoidectomy in children with otitis media. The trials involved a variety of comparisons which limited the possibilities for pooling the results. The most important findings are those from three pooled trials comparing adenoidectomy plus a unilateral tympanostomy tube versus a unilateral tympanostomy tube alone. In these trials the unoperated ear was used as the comparator. At six months the unoperated ears in the children who had had adenoidectomy were 22% less likely to have persistent otitis media with effusion (OME), (95% CI 12% - 32%), and at 12 months there was a 29% risk reduction (95% CI 19 -39%). The authors state that it was more difficult to interpret the findings of the other trials which compared range of other treatment combinations, because the patient population was mixed: some children had recurrent acute otitis media (AOM), some had only OME and some had a combination of the two. The authors concluded that adenoidectomy had only a small and non-significant effect on acute otitis media and on hearing, with the only significant benefit of adenoidectomy in regard to otitis media being promoting the resolution of OME.

Jansen AGSC, Hak E, Veenhoven RH, et al. 2009. **Pneumococcal conjugate vaccines for preventing otitis media**. Cochrane Database of Systematic Reviews, 2009(2), Art. No.: CD001480. DOI:10.1002/14651858.CD001480.pub3.

Pneumococcus is one of the most common bacterial causes of acute otitis media. This review included eight studies reporting on seven RCTs of Pneumococcal conjugate vaccines (PCVs) on otitis media. The studies were of variable quality with three scoring the maximum of five points on the Jadad quality scale, two scoring four and three scoring two. The review authors concluded that “When administered in infancy, PCVs appear to have some protective effect against acute otitis media (AOM), depending on the type of PCV used.” They state that the only currently licensed vaccine (the 7-valent vaccine CRM197-PCV7, trade name Prevenar®) appears to produce only marginal (6% to 7%) reductions in AOM. For older children, two trials suggested that vaccination with CRM197-PCV7 had no beneficial effect. Since this review was written, newer vaccines have been licensed (Prevenar 13® and Synflorix®) which provide protection against a greater number of pneumococcal strains and are expected to be more effective at preventing otitis media (see below). From 1 July 2011 the New Zealand immunisation schedule has included Synflorix®.

McDonald S, Langton Hewer CD, Nunez DA. 2008. **Grommets (ventilation tubes) for recurrent acute otitis media in children**. Cochrane Database of Systematic Reviews, 2008(4), Art. No.: CD004741. DOI: 10.1002/14651858.CD004741.pub2.
Content updated after new search for studies (no change to conclusions), published in Issue 6, 2011.

Recurrent otitis media in this review was defined as either 3+ acute middle ear infections in a six month period or 4+ such infections in a year. The reviewers identified two RCTs in children under the age of three, one with 108 participants and one with 68 participants. Based on the results of the larger of these studies they concluded that, in children <3 years with recurrent otitis media, grommets reduce the number of episodes of acute otitis media in the first six months after surgery by an average of 1.5 episodes per child (from 2.2 to 0.67 episodes) and, based on the results of both studies, that children who received grommets are more likely to be symptom-free in the six months after surgery than control children (OR 0.18, 95% CI 0.08 – 0.42). Neither study followed up children for >6 months but the authors state that the short follow up does cover the period when the grommets might be expected to be in situ.

Simpson SA, Thomas CL, van der Linden MK, et al. 2007. **Identification of children in the first four years of life for early treatment for otitis media with effusion**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD004163. DOI: 10.1002/14651858.CD004163.pub2.

This review assessed the evidence for the effects of screening (using tympanometry) and treating (with grommets) children with clinically important otitis media with effusion (OME) in the first four years of life, on language and behavioural outcomes. The authors did not find any RCTs comparing outcomes in children randomised to be screened for OME to those in children not screened. They found three trials (668 participants) evaluating interventions in children with OME identified through screening and these indicated that there was no clinically important benefit of screening and treating OME on language development or behaviour. They noted that although the studies were of high methodological quality, the participation rates of eligible children were quite low which could have led to selection bias. For example, if parents who suspected their child had problems declined to be randomised preferring to seek investigation and treatment elsewhere, this would have reduced the likelihood of finding a significant effect of screening and treatment.

Vaile L, Williamson T, Waddell A, et al. 2006. **Interventions for ear discharge associated with grommets (ventilation tubes)**. Cochrane Database of Systematic Reviews, 2006(2), Art. No.: CD001933. DOI: 10.1002/14651858.CD001933.pub2.

Post-operative otorrhoea (discharge) is a common complication of grommet insertion with a reported incidence ranging from 10% to 50%. The authors reported that there was very little good quality evidence on the best way to treat this problem. They state that, in the U.K., many ENT surgeons treat it with topical antibiotics with or without topical steroids, but general practitioners, mainly because of fears of amino-glycoside ototoxicity, tend not to prescribe these and choose instead systemic broad-spectrum antibiotics. The authors identified one small (79 participants) RCT comparing oral amoxicillin clavulanate to placebo which found a beneficial effect of the antibiotic: RR of discharge after 8 days of antibiotic treatment compared to placebo 0.19, (95% CI 0.07 – 0.49), however in this study both arms of the trial also received daily aural toilet which limits the applicability of the results to primary care. Two studies investigated steroids (one compared oral prednisolone plus oral amoxicillin clavulanate with oral amoxicillin clavulanate alone and one compared topical dexamethasone with topical ciprofloxacin ear drops) and one study compared antibiotic-steroid combination drops (Otosporin®) versus spray (Otomize®). None of these three studies found a significant benefit of a particular treatment over another. The authors were therefore unable to identify the most effective intervention or to assess the associated risks. They state that further research is needed.

Leach AJ, Morris PS. 2006. **Antibiotics for the prevention of acute and chronic suppurative otitis media in children**. Cochrane Database of Systematic Reviews, 2006(4), Art. No.: CD004401. DOI: 10.1002/14651858.CD004401.pub2.
Republished on line with edits Issue 1, 2011.

Acute otitis media (AOM) may lead to tympanic perforation which can progress to chronic suppurative otitis media (CSOM) with constant offensive discharge from the perforated tympanic membrane(s). The associated hearing loss can affect the language development and behaviour of young children. The review included 17 RCTs, 16 of which were used in a meta-analysis. All of these 16 studies included children who were regarded as being at increased risk of otitis media, and in seven studies the children met the accepted criteria for being prone to otitis media (three episodes in the previous six months or four episodes in the previous 12 months). None of the studies reported the proportion of children with recurrent AOM or CSOM at end of treatment and only one study provided data on long-term outcomes. Long term (6+ weeks) antibiotics were found to reduce the risk of any episode of AOM (14 studies, 1461 children, RR 0.65, 95% CI 0.53 to 0.79; random-effects model) and the number of episodes of AOM (13 studies, 1327 children, incidence rate ratio (IRR) 0.51, 95% CI 0.39 to 0.66; random-effects model). Antibiotics will prevent 1.5 episodes of AOM per child-year of treatment. (On average an at-risk child taking antibiotics for a year would have 1.5 rather than 3 episodes per year).

Macfadyen CA, Acuin JM, Gamble CL. 2006. **Systemic antibiotics versus topical treatments for chronically discharging ears with underlying eardrum perforations**. Cochrane Database of Systematic Reviews, 2006(1), Art. No.: CD005608. DOI:10.1002/14651858.CD005608.
Edited (no change to conclusions), published in Issue 1, 2009.

Chronic suppurative otitis media is a chronic infection of the middle ear with perforation of the tympanic membrane and on-going discharge of pus from the ear. This review included nine RCTs (833 participants) of variable, mostly poor, methodological quality. Topical quinolone antibiotics were more effective at clearing discharge at one to two weeks than either systemic non-quinolone antibiotics (2 trials, n=116, RR=3.21, 95% CI 1.88– 5.49) or systemic quinolone antibiotics (3 trials, n=175, RR 3.18, 95% CI 1.88–5.49). Topical and systemic quinolone antibiotics together were more effective than systemic quinolones alone (2 trials, n=90, RR 2.75, 95% CI 1.38 – 5.46) but there was also no clear evidence that topical quinolone treatment plus systemic quinolone treatment was more beneficial than topical quinolone treatment alone (2 trials, n = 135, RR 1.17, 95% CI 0.48 – 2.86). There was no clear evidence that either topical non-quinolone antibiotics (without steroids) or topical antiseptics were more effective than systemic antibiotics (mostly non-quinolones). The review authors noted that evidence regarding safety was weak and stated that more research about the risks of ototoxicity for alternative treatments particularly topical aminogylcosides (which are non-quinolones) is needed.

Griffin GH, Flynn C, Bailey RE, et al. 2006. **Antihistamines and/or decongestants for otitis media with effusion (OME) in children**. Cochrane Database of Systematic Reviews, 2006(4), Art. No.: CD003423. DOI: 10.1002/14651858.CD003423.pub2.

The results of sixteen RCTs (1880 participants) indicated that none of these interventions were beneficial and that 11% of treated subjects experienced adverse effects including gastrointestinal upset, irritability, drowsiness or dizziness. Therefore the authors of this review did not recommend antihistamines, decongestants or antihistamine/decongestant combinations for the treatment of OME.

Perera R, Haynes J, Glasziou P, et al. 2006. **Autoinflation for hearing loss associated with otitis media with effusion**. Cochrane Database of Systematic Reviews, 2006(4), Art. No.: CD006285. DOI: 10.1002/14651858.CD006285.

Autoinflation is a technique for reopening the Eustachian tube (connecting the middle ear with the back of the nasal cavity) and introducing air into the middle ear by raising intranasal pressure. This may be done by forced exhalation with closed mouth and nose, by blowing up a balloon through each nostril, or using an anaesthetic mask or a Politzer device. The authors of this review identified six small RCTs, five in children aged between three and 16 years and one in adults: two used a classic Otovent®, two used a carnival blower + balloon and two used Politzer devices. None of the studies were deemed to be of high quality. All except one of the studies reported beneficial effects in the short term, most commonly measured using tympanometry and/or audiometry (the maximum follow up period was three months). The authors suggest that “Autoinflation is a lower risk intervention than grommets and may be an appropriate alternative” and that further research would be useful.

Macfadyen CA, Acuin JM, Gamble C. 2005. **Topical antibiotics without steroids for chronically discharging ears with underlying eardrum perforations**. Cochrane Database of Systematic Reviews, 2005(4), Art. No.: CD004618. DOI:10.1002/14651858.CD004618.pub2.

This review considered RCTs comparing any topical antibiotic without steroids with any of the following: no drug treatment, aural toilet, topical antiseptics or another topical antibiotic without steroid for the treatment of chronic suppurative otitis media. In total the review included 14 trials (1724 analysed participants or ears) which were generally poorly reported with short follow up periods. Topical quinolone antibiotics were more effective than no drug treatment in clearing discharge at one week (two trials, n =197, RR 0.45, 95% CI 0.34 – 0.59) and they were also more effective than antiseptics at one week (3 trials, n=263, RR 0.52, 95% CI 0.41 – 0.67) and at two to four weeks (4 trials, n = 519, RR 0.58, 95% CI 0.47 - 0.72). There was no significant difference between quinolone and non-quinolone antibiotics. Results from comparisons of non-quinolone antibiotics (without steroids) and antiseptics were mixed, changing over time. The authors state that indirect evidence suggests that a benefit of topical quinolones over non quinolone topical antibiotics cannot be ruled out. They also state that further research is required particularly to clarify the risks of ototoxicity since non-quinolone antibiotics such as aminoglycosides are known to be ototoxic when given systemically and there are concerns that ototoxicity may result from the use of topical aminoglycoside antibiotics where there is a perforated tympanic membrane.

Sanders S, Glasziou PP, Del Mar CB, et al. 2004. **Antibiotics for acute otitis media in children**. Cochrane Database of Systematic Reviews, 2004(1), Art. No.: CD000219. DOI: 10.1002/14651858.CD000219.pub2.
Republished online with edits in Issue 4, 2010

The conclusions of this review are based on 10 high quality RCTs in high income countries involving a total of 2928 children. Antibiotics made no difference to pain in the first 24 hours but slightly reduced pain in the next two to seven days. They also made no difference to the risk of perforation, recurrence or abnormal tympanometry (indicating possible hearing loss) after either one month or three months. Antibiotics appear to be most beneficial for children under two years of age with bilateral otitis media, or with both acute otitis media and discharging ears. For other children expectant observation is justified.

In addition to the reviews summarised above, Cochrane Reviews were also available on short course antibiotics, once or twice daily versus three times daily amoxicillin with or without clavulanate, topical analgesia (local anaesthetic ear drops) and zinc supplements. See the **Cochrane Database of Systematic Revie**ws for further details.

Other Relevant Publications
Milne RJ, Vander Hoorn S. 2010. **Burden and cost of hospital admissions for vaccine-preventable paediatric pneumococcal disease and non-typable Haemophilus influenzae otitis media in New Zealand**. Applied Health Economics & Health Policy, 8(5), 281-300. This study aimed to estimate both the numbers and costs (to the New Zealand Government) of potentially vaccine-preventable paediatric admissions for pneumococcal disease and non-typable Haemophilus influenzae (NTHi) otitis media prior to the inclusion of a pneumococcal vaccine into the immunization programme in 2008. Using admission data from 2000-2007 it was estimated that, prior to the introduction of the vaccine, hospital admissions for pneumococcal meningitis, bacteraemia and pneumonia and for NTHi otitis media cost about NZ$ 10 million annually. Most of these admissions were in children under the age of two and they were particularly Pacific and Māori children and those living in relative socio-economic deprivation.
Gunasekera H, Morris PS, McIntyre P, et al. 2009. **Management of children with otitis media: a summary of evidence from recent systematic reviews**. Journal of Paediatrics & Child Health, 45(10), 554-62; quiz 62-3. The Australian authors of this review provide a useful summary of the various systematic reviews on aspects of the management of acute otitis media and otitis media with effusion. They state that most children in Australia are given antibiotics at their first consultation for acute otitis media. They also state that diagnosis of either acute otitis media or otitis media with effusion requires the presence of an effusion which can only be detected reliably by tympanometry and/or pneumatic otoscopy but that they have no information on how commonly these diagnostic techniques are used in general practice or paediatric settings in Australia except that neither of these techniques is widely used in Australian Aboriginal Medical Service. (Aboriginal children have some of the world's highest rates of complicated otitis media).
Prymula R, Peeters P, Chrobok V, et al. 2006. **Pneumococcal capsular polysaccharides conjugated to protein D for prevention of acute otitis media caused by both Streptococcus pneumoniae and non-typable Haemophilus influenzae: a randomised double-blind efficacy study**. Lancet, 367(9512), 740-8. This is the report of the randomised efficacy trial of the vaccine that was the prototype of Synflorix®, the 10-valent pneumococcal non-typable Haemophilus influenza protein D conjugate vaccine recently added to the New Zealand immunisation schedule in place of the seven-valent pneumococcal vaccine Prevenar®. Overall there was a 34% reduction (95% CI 21 - 44) in cases of otitis media in the vaccine group compared to the control group in the period from the third dose at five months, until 24-27 months of age. It is stated that the results confirm that the vaccine not only provides protection against pneumococcal otitis media but also against otitis media due to non-typable *Haemophilus influenzae*.

LOWER RESPIRATORY TRACT CONDITIONS

BRONCHIOLITIS

Introduction

Bronchiolitis is the most common lower respiratory infection in infants and a leading cause of hospital admission in this age group. It is a viral infection and is most commonly due to Respiratory Syncytial Virus (RSV), although other viruses including adenovirus, rhinovirus, enterovirus, influenza, parainfluenza and human metapneumovirus have also been implicated [120,121]. Most children (around 90%) will be infected with RSV before the age of two years, however, infection does not confer immunity and re-infections are common [120]. In temperate climates such as New Zealand, RSV usually occurs in seasonal epidemics which peak in late winter [122].

Affected infants appear initially to have a simple upper respiratory infection with a mild fever, a runny nose and a cough but after a few days this progresses to wheezing, due to obstruction of the small airways (the bronchioles) and respiratory distress, with rapid breathing (tachypnoea), nasal flaring and the use of accessory muscles. Feeding and sleeping may be impaired [123], and very young infants may also have episodes of apnoea. A recent study from the U.S. reported a median duration of symptoms of fifteen days in infants presenting to the emergency department (but not necessarily admitted to hospital) with a first-time episode of bronchiolitis [124].

Severely affected infants require hospital treatment, which usually consists of supportive therapy with fluid supplementation and oxygen [125]. However, only around 2-3% of infants with bronchiolitis require hospitalisation [122], and deaths from bronchiolitis are rare, with reported rates in the U.S. and the U.K. being around two per 100,000 live births [122].

Risk factors for severe illness, such as that requiring intensive care, include young age (<6 weeks), premature birth, chronic lung disease of prematurity, congenital heart disease and immunodeficiency [121,122,125]. More common risk factors associated with hospitalisation for less severe bronchiolitis include male sex, age less than six months, birth during the first half of the RSV season, overcrowding, socio-economic disadvantage, older siblings and attendance at day care [126]. Maternal smoking and lack of breast feeding are also considered to be risk factors [120].

The following section reviews bronchiolitis in infants aged <1 year using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of evidence-based review documents and guidelines which consider interventions to prevent or manage bronchiolitis in infants.

Data Sources and Methods

Indicator

1. *Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants Aged <1 Year*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for infants aged <1 year with a primary diagnosis of Bronchiolitis (ICD-10-AM J21).

Denominator: Birth Registration Dataset

2. Mortality from Bronchiolitis in Infants Aged <1 Year

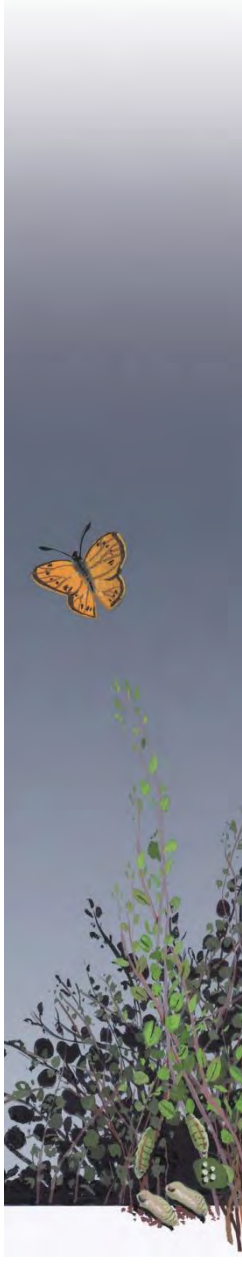
Numerator: National Mortality Collection: Deaths in Infants Aged <1 Year where the main underlying cause of death was Bronchiolitis (ICD-10-AM J21).

Denominator: Birth Registration Dataset

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.



Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, bronchiolitis admissions in infants remained fairly static during the early-mid 2000s, but then increased between 2006-07 and 2008-09. On average during 2000-2008, one infant each year died as the result of bronchiolitis (**Figure 48**).

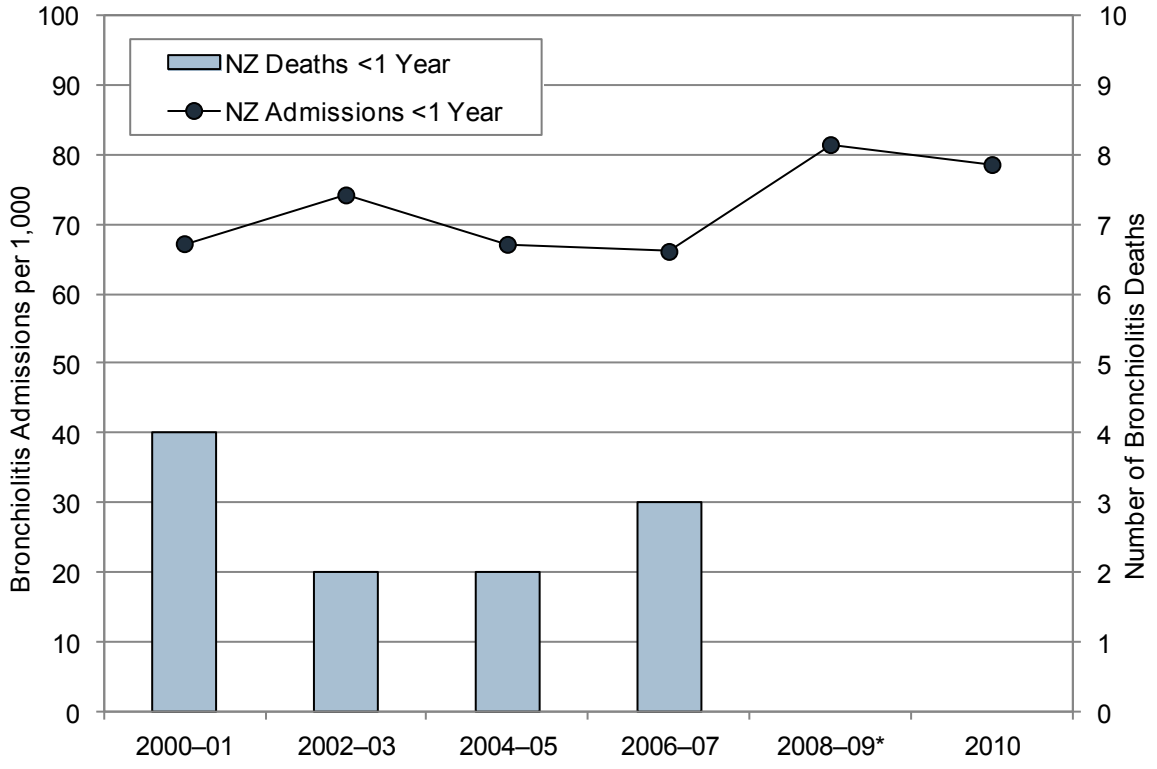
New Zealand Distribution by Age

In New Zealand during 2006–2010, bronchiolitis admissions were highest in infant <1 year, with rates declining rapidly with increasing age thereafter. In addition, during 2004-2008, all bronchiolitis deaths occurred in infants aged <1 year (**Figure 49**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

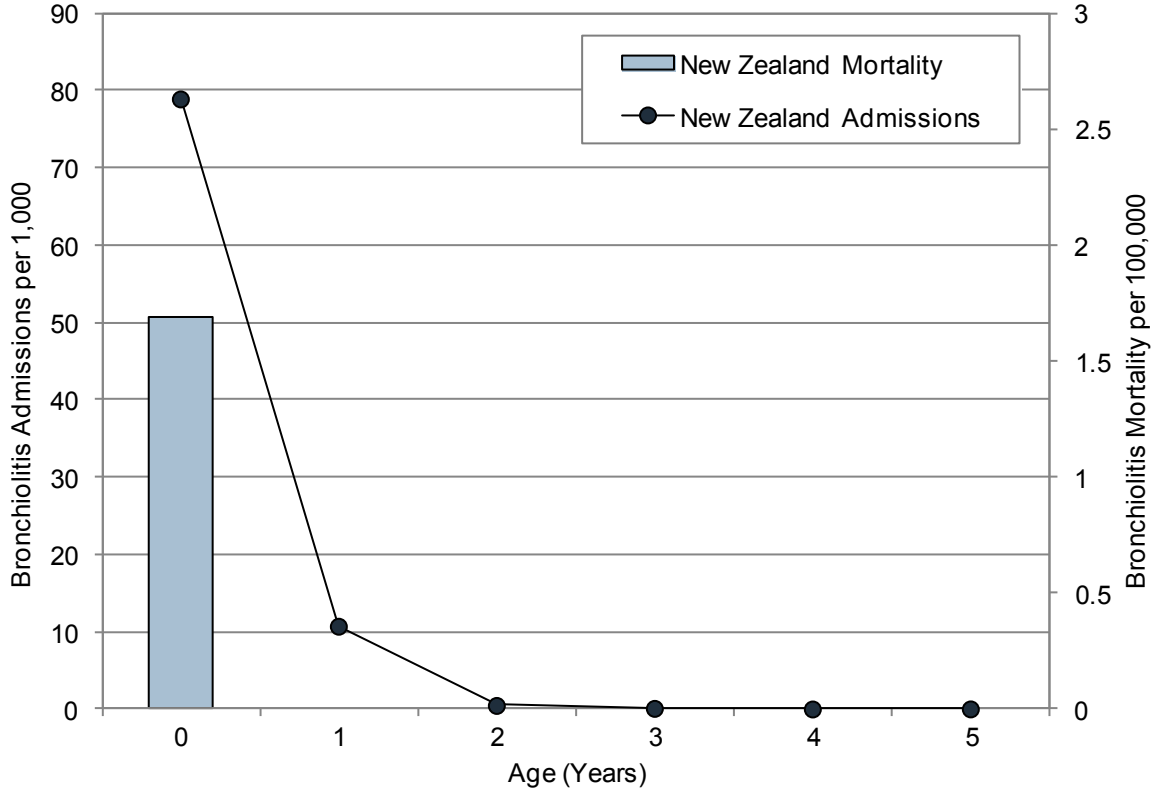
In New Zealand during 2006–2010, bronchiolitis admissions were *significantly* higher for males, Pacific > Māori > European > Asian/Indian infants and those living in average-to-more deprived (NZDep decile 3-10) areas (**Table 64**). Similar ethnic differences were seen during 2000–2010 (**Figure 50**).

Figure 48. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Bronchiolitis in New Zealand Infants <1 Year



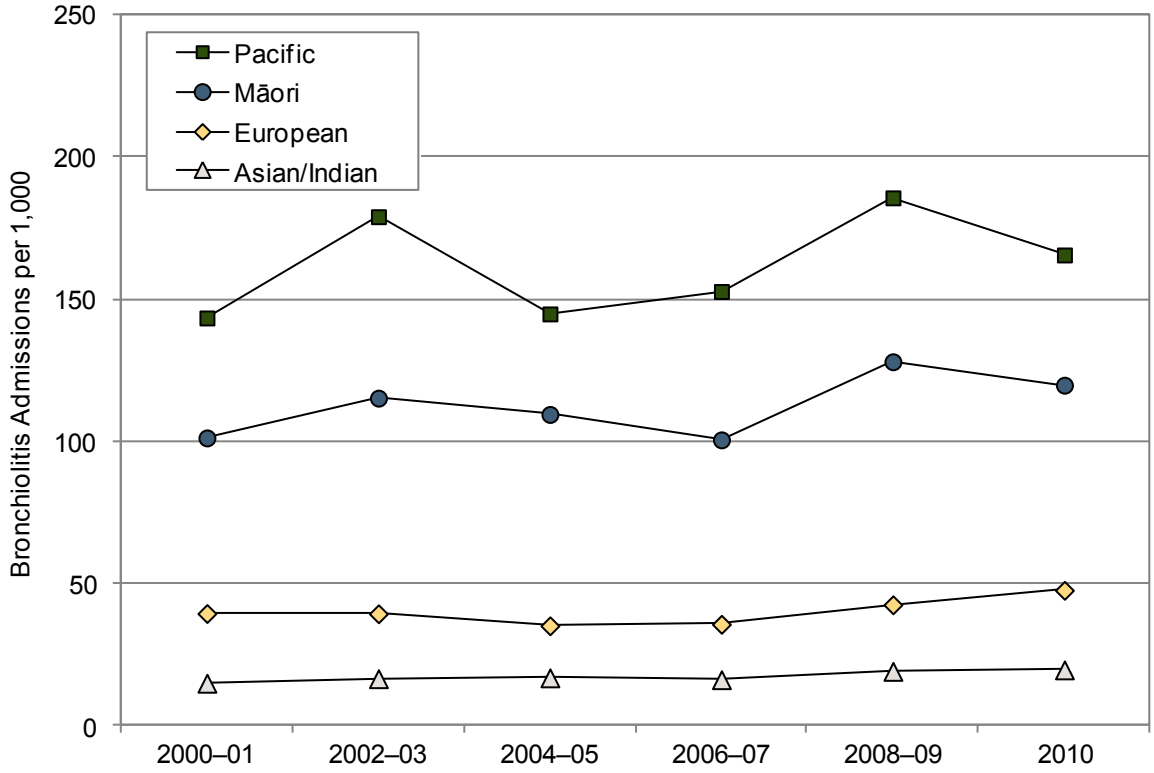
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Birth Registration Dataset; *Note: Number of deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

Figure 49. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Bronchiolitis in New Zealand Children by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 50. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised.

Table 64. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Bronchiolitis in Infants <1 Year							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	28.9	1.00		Decile 1–2	29.6	1.00	
Decile 2	30.2	1.05	0.94–1.16	Decile 3–4	38.6	1.31	1.22–1.40
Decile 3	36.8	1.27	1.16–1.40	Decile 5–6	54.9	1.86	1.75–1.97
Decile 4	40.2	1.39	1.27–1.53	Decile 7–8	76.5	2.59	2.45–2.74
Decile 5	47.9	1.66	1.52–1.82	Decile 9–10	136.9	4.63	4.39–4.89
Decile 6	60.6	2.10	1.93–2.28	Prioritised Ethnicity			
Decile 7	68.5	2.37	2.18–2.58	European	40.7	1.00	
Decile 8	83.0	2.87	2.65–3.11	Māori	115.4	2.83	2.75–2.92
Decile 9	107.4	3.72	3.44–4.02	Pacific	168.9	4.15	4.01–4.29
Decile 10	163.2	5.65	5.23–6.10	Asian/Indian	18.1	0.45	0.41–0.48
Gender							
Female	59.4	1.00					
Male	89.3	1.50	1.47–1.54				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In Lakes, Tairawhiti and the Bay of Plenty during 2006–2010, bronchiolitis admissions in infants were *significantly* higher than the New Zealand rate, while in Taranaki admissions were *significantly* lower. In contrast, admissions in the Waikato were similar to the New Zealand rate (**Table 65**).

Table 65. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Bronchiolitis in Infants <1 Year					
Waikato	2,013	402.6	72.5	0.97	0.93–1.01
Lakes	971	194.2	116.2	1.55	1.46–1.65
Bay of Plenty	1,525	305.0	103.0	1.38	1.31–1.45
Tairawhiti	461	92.2	115.4	1.54	1.41–1.68
Taranaki	448	89.6	56.5	0.75	0.69–0.83
New Zealand	23,831	4,766.2	74.8	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Midland Region Trends

In the Waikato, Bay of Plenty, Lakes and Tairawhiti during 2000–2010, while there were large year to year variations, bronchiolitis admissions in infants exhibited a general upward trend, while in Taranaki rates declined during the early-mid 2000s and then fluctuated (**Figure 51**).

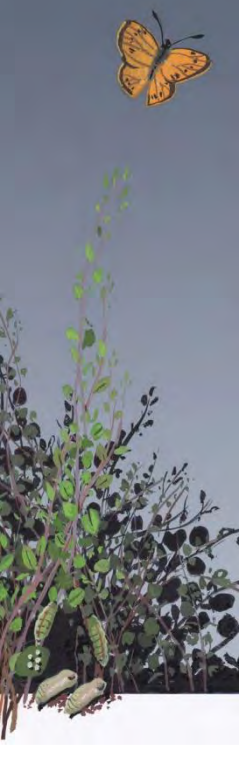
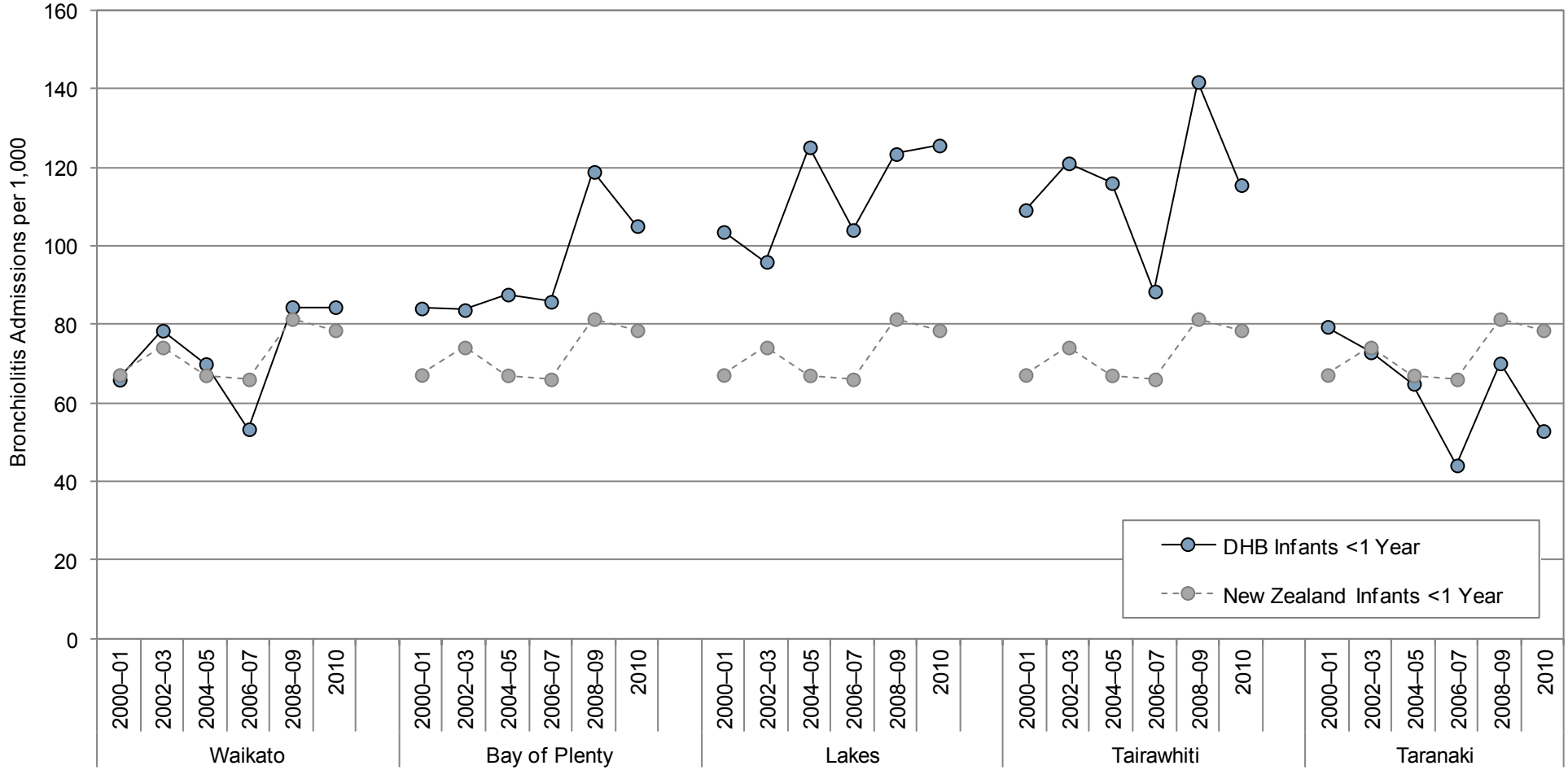
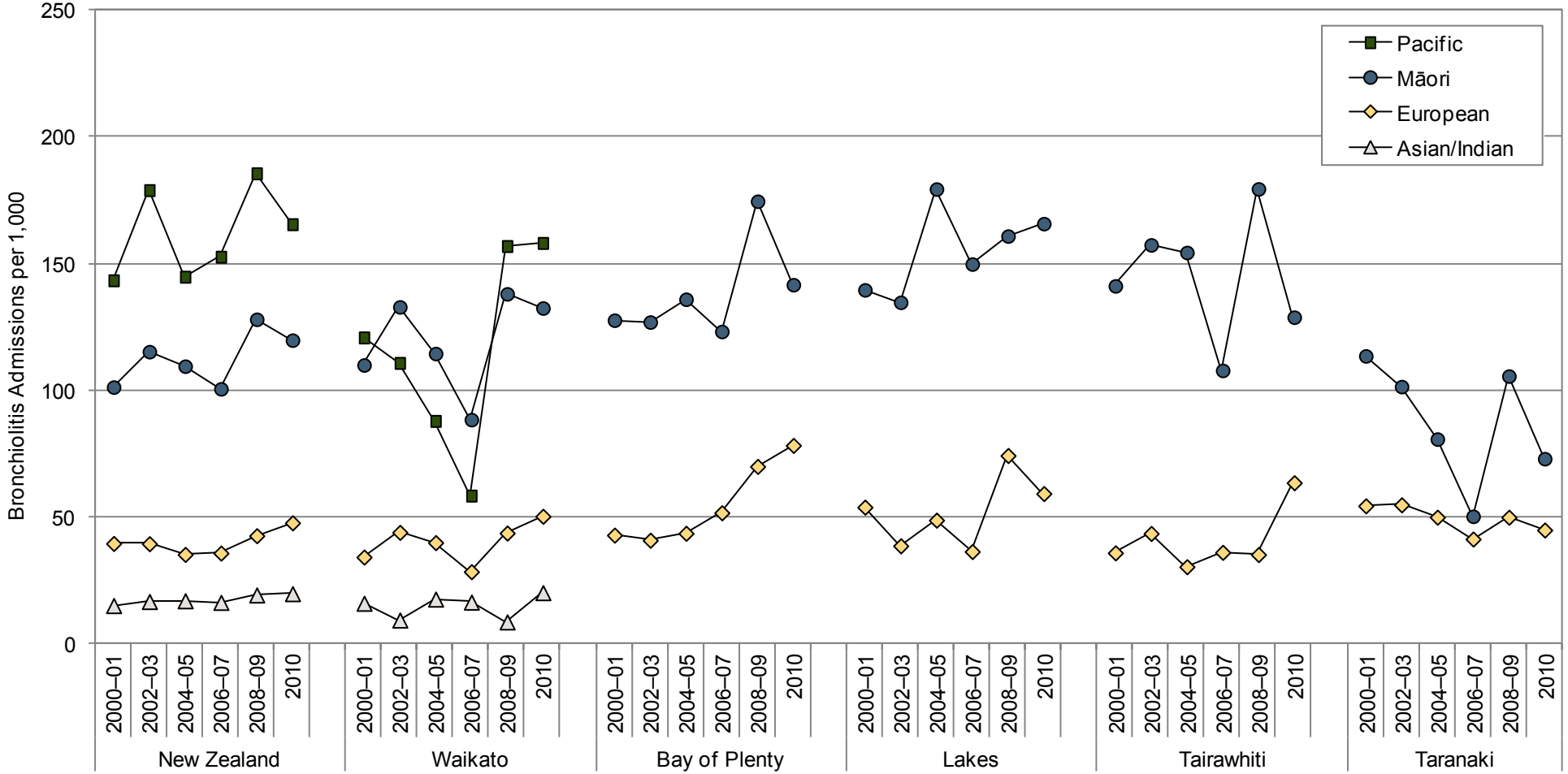


Figure 51. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year, Midland DHBs vs. New Zealand 2000–2010



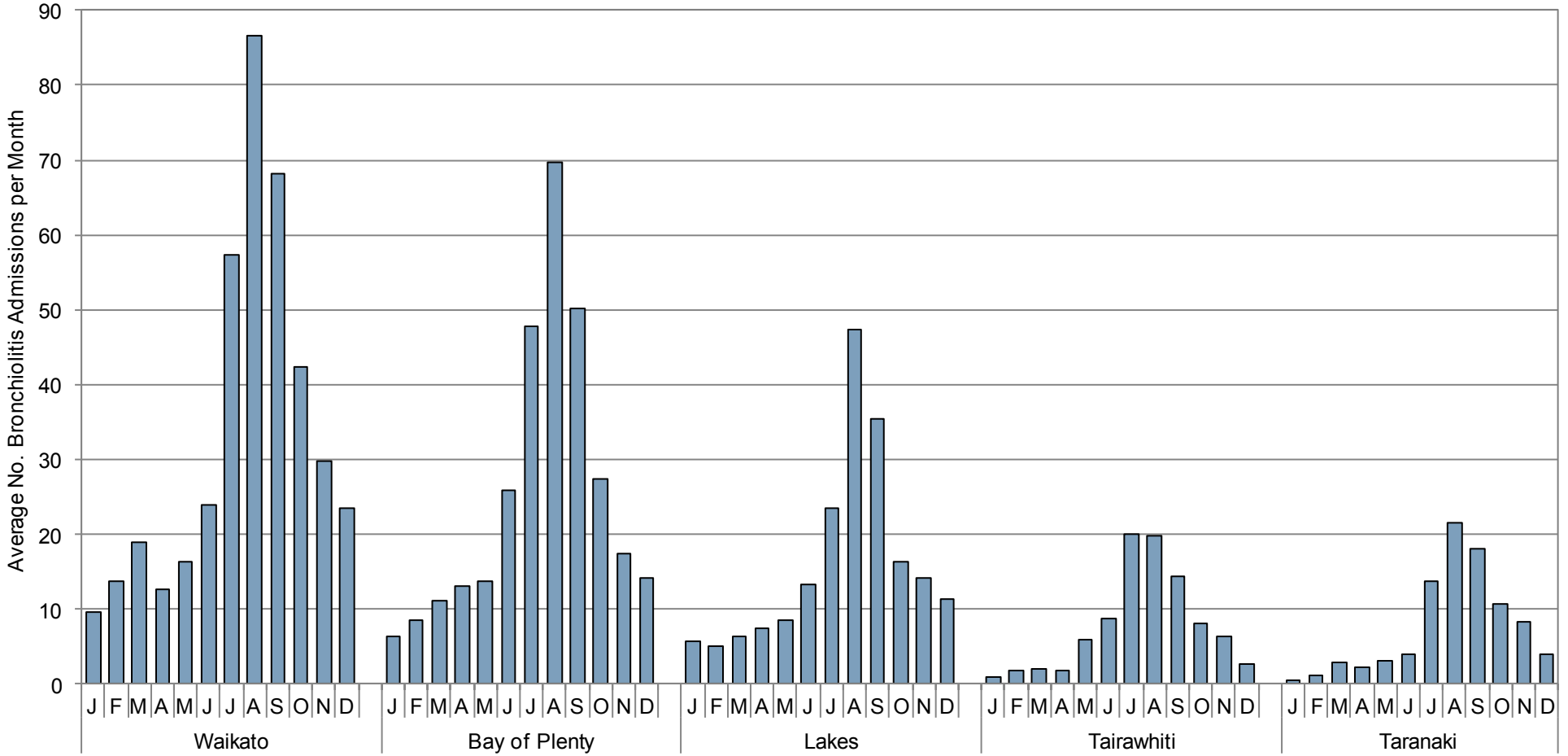
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 52. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised.

Figure 53. Average Number of Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Midland Region Distribution by Ethnicity

In the Waikato during 2000–2010, bronchiolitis admissions were generally higher for Pacific and Māori > European > Asian/Indian infants, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European infants (**Figure 52**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, bronchiolitis admissions in infants were highest during winter and early spring in all five DHBs (**Figure 53**).

Summary

In New Zealand during 2000–2010, bronchiolitis admissions remained fairly static during the early-mid 2000s, but then increased between 2006–07 and 2008–09. On average during 2000–2008, one infant each year died from bronchiolitis. During 2006–2010, bronchiolitis admissions were *significantly* higher for males, Pacific > Māori > European > Asian/Indian infants and those from average-to-more deprived (NZDep decile 3–10) areas.

In Lakes, Tairawhiti and the Bay of Plenty during 2006–2010, bronchiolitis admissions in infants were *significantly* higher than the New Zealand rate, while in Taranaki admissions were *significantly* lower. In contrast, admissions in the Waikato were similar to the New Zealand rate. In the Waikato, bronchiolitis admissions were higher for Pacific and Māori > European > Asian/Indian infants, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European infants. Admissions were higher during winter and early spring in all five DHBs.

Local Policy Documents and Evidence-Based Reviews Relevant to Bronchiolitis

In New Zealand there are no policy documents which focus solely on the prevention of bronchiolitis. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

A range of international reviews and guidelines however, consider the most appropriate management of bronchiolitis, and these are considered in **Table 66**.

Table 66. Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Bronchiolitis

International Guidelines
Bronchiolitis Guideline Team Cincinnati Children's Hospital Medical Center. 2010. **Evidence-based care guideline for management of bronchiolitis in infants 1 year of age or less with a first time episode**. http://www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/edf8f194-1a56-48f7-8419-7c5e0a168b5d.pdf These American guidelines aim to: avoid the use of unnecessary diagnostic studies (particularly chest x-rays), decrease the use of medications and respiratory therapy with no observed improvement, improve rates of appropriate admissions, decrease nosocomial infection rates, improve the use of appropriate monitoring and maintain or shorten lengths of hospital stays. Community preventive measures are stated to be: emphasising the importance of hand washing in all settings, eliminating exposure to environmental tobacco smoke, limiting exposure to contagious settings (day care, sick siblings), breastfeeding for six months or more and, for selected high-risk infants, preventive medical therapies such as palivizumab. In the hospital, it is recommended that respiratory isolation policies apply to patients with documented bronchiolitis. All of the recommendations in the guidelines are followed by references to the literature and there is discussion of the quality of the evidence but there is no formal grading of the research evidence.

Committee on Infectious Diseases. 2009. **From the American Academy of Pediatrics: Modified Recommendations for Use of Palivizumab for Prevention of Respiratory Syncytial Virus Infections**. Pediatrics, 124(6), 1694-701.

Palivizumab is a humanized murine monoclonal anti-F glycoprotein immunoglobulin G1 antibody which has both neutralizing and fusion inhibitory activity against Respiratory Syncytial Virus, the most common cause of bronchiolitis. It can be given as an intramuscular injection and requires five monthly doses from the start of the RSV season. It is effective in reducing hospitalisation rates in infants and children at high risk for severe disease but it is very expensive. This policy statement from the American Academy of Pediatrics recommends prophylaxis for infants and children aged <2 years with complicated or cyanotic congenital heart disease, or who have been treated for chronic lung disease within six months of the start of the RSV season, and certain groups of infants born prematurely. A concise summary of these indications can be found on the CDC website at: http://www.cdc.gov/rsv/clinical/prophylaxis.html

Turner T, Wilkinson F, Harris C, et al. 2008. **Evidence based guideline for the management of bronchiolitis**. Australian Family Physician, 37(6), S6-13.

This is a concise Australian clinical guideline endorsed by The Royal Australian College of General Practitioners. It does not discuss the research evidence in any detail but it does indicate whether or not the authors identified any. Statements in the guideline are accompanied by a letter grade but the grading system is not explained.

National Guideline Clearinghouse. 2007. **Guideline synthesis: Prevention, diagnosis and treatment of pediatric bronchiolitis**.http://www.guideline.gov/syntheses/synthesis.aspx?id=16418&search=asthma+children

This web page provides a direct comparison of the recommendations in the guidelines from the American Academy of Pediatrics, the Cincinnati Children's Hospital Medical Center and the Scottish Intercollegiate Guidelines Network and it states that there are no significant areas of difference between the guidelines.

Scottish Intercollegiate Guidelines Network. 2006. **Bronchiolitis in children: A national clinical guideline**. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign91.pdf

These guidelines aim to reduce unnecessary investigations and therapies especially in the acute illness and to define indications for referral from primary to secondary and sometimes tertiary care. They provide evidence-based recommendations on the prevention, diagnosis, investigation, treatment and management of bronchiolitis in infants <12 months of age and, in infants with the significant co-morbidities of congenital heart disease, or underlying respiratory disease, or who were born prematurely at ≤ 37 weeks gestation, up to 24 months of age. Statements summarising information from the research literature and also the recommendations for practice are accompanied by a grade indicating the quality of the relevant evidence.

American Academy of Pediatrics Subcommittee on D, Management of B. 2006. **Diagnosis and management of bronchiolitis**. Pediatrics, 118(4), 1774-93.

These American guidelines aim to provide an evidence-based approach to the prevention, diagnosis and management of bronchiolitis in children from one month to two years of age. Recommendations are accompanied by a letter grade indicating the quality of evidence on which they are based and are followed by a discussion of the research evidence. Regarding prevention, the guidelines state that prophylactic palivizumab may be given to selected high-risk infants including children with chronic lung disease, a history of prematurity, or congenital heart disease. In hospital frequent hand decontamination by hospital personnel and family members is important for preventing nosocomial infection and alcohol-based rubs are the preferred method. Reducing exposure to second hand smoke and the promotion of breastfeeding are important preventive measures in the community. The guidelines do not recommend any complementary or alternative medications due to lack of evidence. There is a comprehensive list of references.

Paediatric Society of New Zealand. 2005. **Best Practice Evidence-Based Guideline Wheeze and Chest Infection in Infants Under 1 Year**. Wellington: Paediatric Society of New Zealand. http://www.paediatrics.org.nz/files/guidelines/Wheezeendorsed.pdf

This publication summarises the international literature and draws on local expertise to provide information to facilitate informed decision making by parents, caregivers and health care providers about the management of lower respiratory tract infection, bronchiolitis, pneumonia and persistent and recurrent wheeze in infants aged over one month and less than one year of age. Key statements and recommendations in the guidelines are graded according to the system used by the New Zealand Guidelines Group. Promotions of breast feeding and smoke-free environments are recommended preventive strategies. Regarding bronchiolitis, oximetry is the only possibly useful investigation and no medications are stated to be effective. Management, in those ill enough to require hospital admission, consists primarily of supportive measures such as oxygen, nasogastric feeding and intravenous fluids. Support and education of parents is important. These guidelines are well referenced however they have not been updated since they were first published.

Systematic and Other Reviews from the International Literature

Bialy I, Foisy M, Smith M, et al. 2011. **The Cochrane Library and the Treatment of Bronchiolitis in Children: An Overview of Reviews**. Evidence-Based Child Health, 6(1), 258-75.

This recently updated overview of Cochrane reviews relevant to the treatment of bronchiolitis symptoms brings together evidence from eleven reviews. There was slight variation between the reviews in the clinical definitions of bronchiolitis and the age ranges of children. Seven reviews compared an active treatment to placebo (antibiotics, bronchodilators, epinephrine (adrenaline), glucocorticoids, helium oxygen mixtures (heliox), immunoglobulin, inhaled corticosteroids), two compared active treatment to standard care (extra-thoracic pressure, physiotherapy) and five compared an active treatment with another active treatment (epinephrine, glucocorticoids, hypertonic saline, oxygen, physiotherapy). Some reviews included more than one type of comparison. The authors concluded that for outpatients presenting with wheezing as the major manifestation of bronchiolitis, nebulised epinephrine can be effective in reducing the need for hospitalisation (4 trials, 920 participants, RR 0.67, 95% CI 0.50–0.89).They state that, given the current level of evidence and the potential for adverse events, systemic glucocorticoids such as dexamethasone cannot be recommended as a routine therapy. Regular nebulised hypertonic saline driven using oxygen may reduce the length of hospital stays. Due to the weak level of evidence, chest physiotherapy, nebulised epinephrine and systemic and inhaled corticosteroids cannot be recommended for inpatients. For very sick infants in intensive care, intravenous immunoglobulin, heliox and extra-thoracic pressure cannot be recommended because of lack of available evidence and/or methodological flaws of reviews.

A previous Cochrane review relating to the use of Palivizumab (a monoclonal antibody) for the prevention of infection with respiratory syncytial virus (the major cause of bronchiolitis) has been withdrawn, however a protocol for a new review has been published indicating a forthcoming review.

Wang D, Bayliss S, Meads C. 2011. **Palivizumab for immunoprophylaxis of respiratory syncitial virus (RSV) bronchiolitis in high-risk infants and young children: a systematic review and additional economic modelling of subgroup analyses**. Health Technology Assessment (Winchester, England), 15(5).http://www.hta.ac.uk/fullmono/mon1505.pdf

This report is based on an analysis of thirteen studies, most of which were small and inadequately powered for the outcomes of interest. The aim was to use evidence from a systematic review of prognostic and hospitalisation studies to estimate the cost-effectiveness of palivizumab for RSV prophylaxis in different groups of children at high risk from RSV infection including children with and without chronic lung disease (CLD) or congenital heart disease (CHD). The authors concluded that, at a willingness-to-pay threshold of £30,000 per quality-adjusted life year, prophylaxis with palivizumab may be cost-effective for some sub groups. According to this criterion children without either CLD or CHD would need at least two additional risk factors apart from gestational age and birth age to justify prophylaxis but children with CHD or CLD would not necessarily need any apart from gestational age and birth age.

Other Relevant Publications

Vogel AM, McKinlay MJ, Ashton T, et al. 2002. **Cost-effectiveness of Palivizumab in New Zealand**. Journal of Paediatrics & Child Health, 38(4), 352-7.

This cost effectiveness evaluation aimed to determine the preterm infant hospitalisation risks for respiratory syncytial virus (RSV) infection and to calculate the net cost per hospitalisation averted due to the use of palivizumab. Pre term infants are often readmitted to hospital after their initial discharge, usually as a result of respiratory infections which are most commonly due to respiratory syncytial virus (RSV). Estimates of readmission risks before one year of prematurity-corrected age in New Zealand ranged from 8% for infants discharged between 29 and 31 weeks gestation without chronic lung disease to 42% for infants less than 32 weeks gestation discharged home on oxygen. The number needed to treat with palivizumab to prevent one hospitalisation ranged from 6 to 26 across the groups of infants and the costs to prevent one hospitalisation ranged from NZ$28,600 to $166,700. The authors estimated that prophylaxis for all New Zealand infants born at ≤ 28 weeks would cost $ 1,090,000 net and prevent 29 hospitalisations for an average cost per admission averted of $37,000, with eight infants being treated to prevent one hospitalisation. For all groups of infants prophylaxis was associated with a net cost. The authors concluded that, if value was ascribed to preventing morbidity, the priority groups for prophylaxis are infants discharged home on oxygen, followed by infants born at ≤28 weeks gestation. They state that palivizumab has not been proven to reduce mortality, which is low for infections due to RSV, even in high-risk infants.

PNEUMONIA

Introduction

While most respiratory infections in children are acute upper respiratory infections, children presenting to hospital emergency departments commonly have lower tract respiratory infections, including pneumonia. Pneumonia is an inflammation of the lung tissue, which is usually the result of a viral or bacterial infection following an acute upper respiratory infection. Most cases of pneumonia are due to viruses, but bacterial pneumonias cause most pneumonia deaths [127].

The causative organisms vary with the age of the child. In neonates bacteria (group B *Streptococcus* and gram-negative enteric bacteria) are the most common cause, while in infants older than four months and young children viruses, particularly respiratory syncytial virus, are more common. Outside of the neonatal period, the most common bacterial cause is *Streptococcus pneumonia,* although in children older than five years *Mycoplasma pneumoniae*, and *Chlamydophila pneumoniae* are also common [128]. Clinical features include a high respiratory rate, respiratory distress, fever, chills, cough, chest pain, and abdominal pain and distension. Some infants with bacterial pneumonia may have vomiting, anorexia and diarrhoea [129].

In New Zealand, there are significant ethnic disparities in hospitalisations for pneumonia in children with Māori and Pacific children having higher admission rates than European children [130] and more severe disease once admitted [131]. Risk factors for pneumonia worldwide include low socio-economic status, low birth weight, lack of breastfeeding, living in crowded homes, indoor smoke and poor hygiene (particularly lack of hand washing) [132]. In New Zealand it has been suggested that factors such as poor housing (cold, damp, mould, overcrowding), a lack of access to primary healthcare and poor nutrition (e.g. iron deficiency) play significant roles [102,130].

The following section explores bacterial and viral pneumonia in children and young people using information from the National Minimum Dataset and Mortality Collection. The section concludes with a review of policy and evidence-based review documents which consider the prevention and management of pneumonia in this age group.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years*

2. *Acute and Semi Acute Hospital Admissions for Viral Pneumonia in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with a primary diagnosis of Bacterial/Non-Viral/Unspecified Pneumonia (ICD-10-AM J13–J16, J18) or Viral Pneumonia (ICD-10-AM J12, J100, J110).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

3. Mortality from Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years

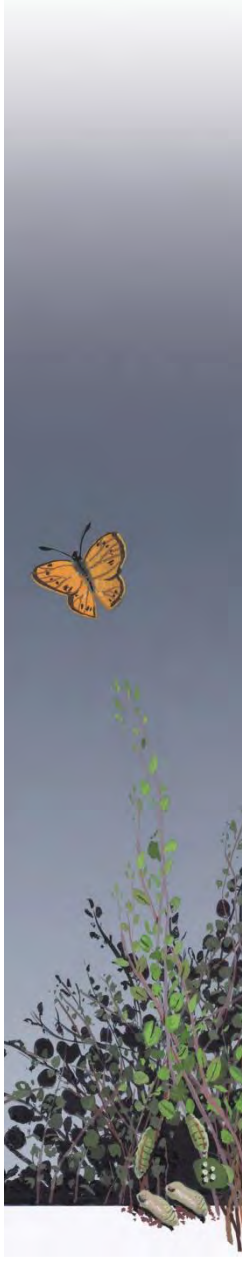
4. Mortality from Viral Pneumonia in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Bacterial/Non-Viral/Unspecified Pneumonia (ICD-10-AM J13–J16, J18) or Viral Pneumonia (ICD-10-AM J12, J100, J110).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: In this section, a separation has been maintained between bacterial/non-viral/unspecified pneumonia and viral pneumonia, because the former is considered to be ambulatory sensitive (e.g. early antibiotics in primary care may potentially prevent a hospital admission), while viral pneumonia is thought to be less amenable to such primary care interventions. In reality however, a large proportion of the former category



comprises admissions with a primary diagnosis of J18: Pneumonia organism unspecified, meaning that there is likely to be considerable overlap between the two categories. It is thus recommended that trends in these two conditions be reviewed concurrently, with the artificial separation being maintained for those wishing to explore the contribution that pneumonia makes to trends in ambulatory sensitive hospital admissions.

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 3: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 4: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

Bacterial/Non-Viral/Unspecified Pneumonia: In New Zealand, bacterial/non-viral/ unspecified pneumonia admissions in children declined during 2000–2007. A small upswing in rates was evident in 2008–09, before admissions declined again in 2010. Similar patterns were seen for young people. During 2000–2008 on average eight children or young people died each year, as the result of bacterial/non-viral/unspecified pneumonia (**Figure 54**).

Viral Pneumonia: In New Zealand during 2000–2010, viral pneumonia admissions increased in both children and young people, with the most rapid increases in children occurring between 2004–05 and 2008–09. During 2000–2008, on average two or three children or young people each year died as the result of viral pneumonia (**Figure 55**). While the number of deaths from viral pneumonia may appear high compared to those arising from bacterial/non-viral/unspecified pneumonia, given the much lower admission rates for the former category, it must be remembered that a large proportion of bacterial/non-viral/unspecified pneumonia admissions were coded J18: Pneumonia organism unspecified, meaning there may be considerable overlap between these two categories.

New Zealand Distribution by Age

In New Zealand during 2006–2010, viral and bacterial/non-viral/unspecified pneumonia admissions were both highest in one year olds, with the next highest rates being seen in infants <1 year. Admissions tapered off rapidly during the preschool years, with the lowest rates being seen in those in their teens and early twenties. During 2004–2008, mortality for both outcomes was highest in infants < 1 year (**Figure 56**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children were *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those living in average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were *significantly* higher for Pacific > Māori > European > Asian/Indian young people, and those living in average-to-more deprived (NZDep decile 5–10) areas (**Table 67**). Hospital admissions for viral pneumonia were also higher for Pacific > Māori > European and Asian/Indian children and those living in average-to-more deprived (NZDep decile 6–10) areas, although small numbers precluded a valid analysis for young people (**Table 68**). When both age groups were combined, during 2000–2010 viral and bacterial/non-viral/unspecified pneumonia admissions were both higher for Pacific > Māori > European and Asian/Indian children and young people (**Figure 57**).

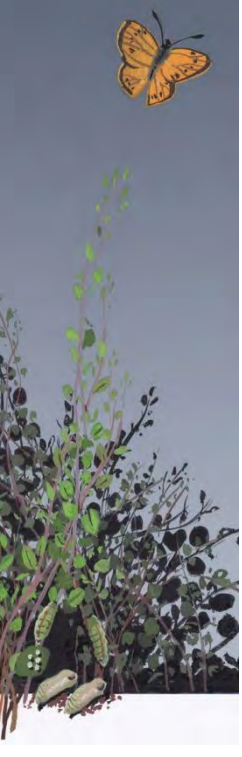
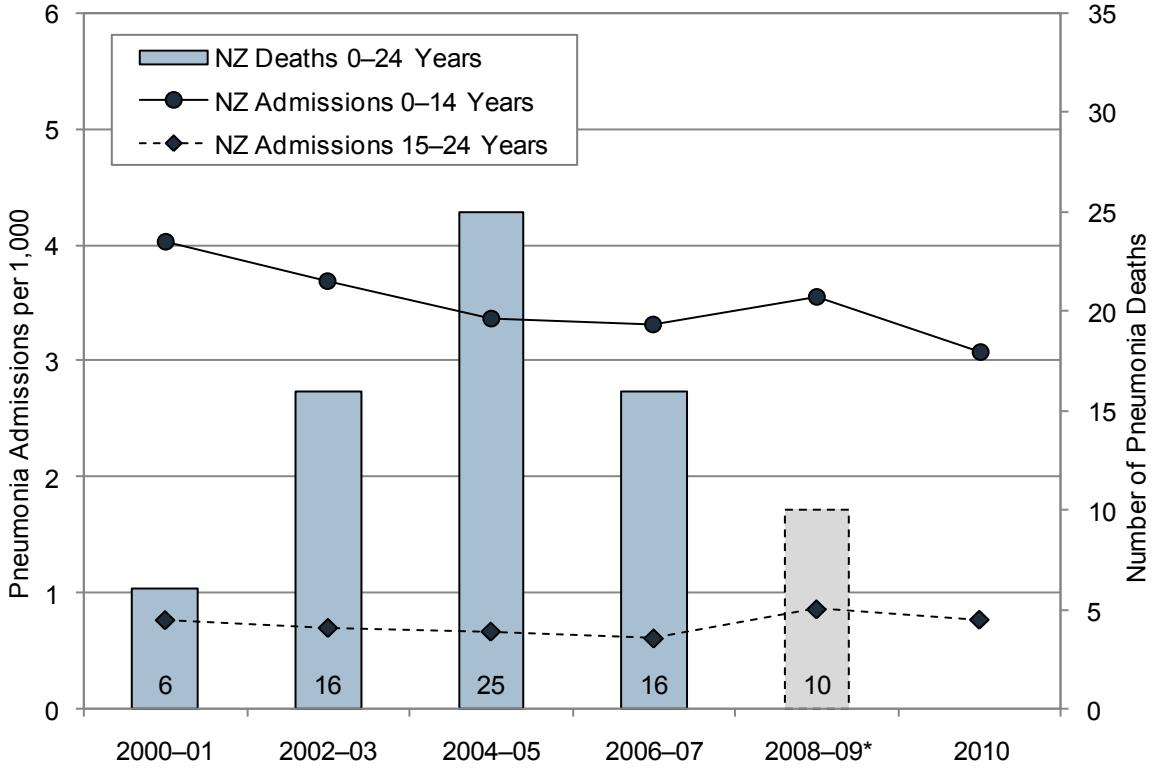
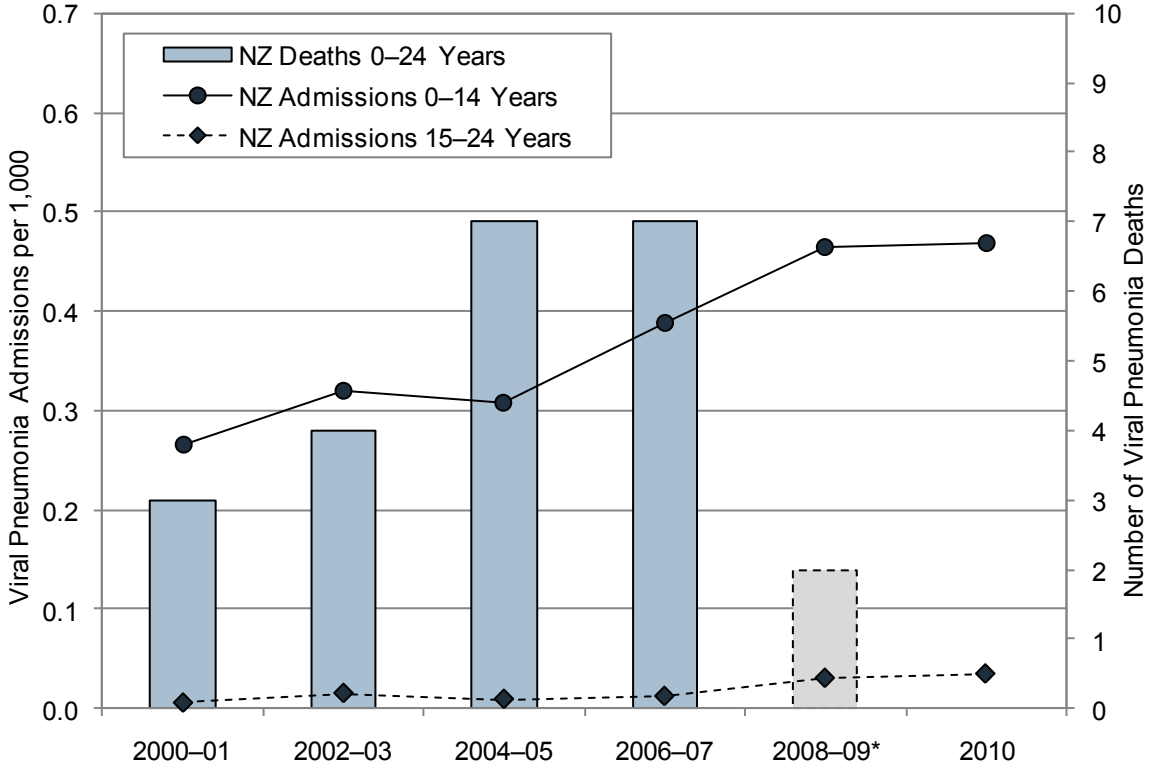


Figure 54. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Bacterial/Non-Viral/Unspecified Pneumonia in New Zealand Children and Young People Aged 0−24 Years



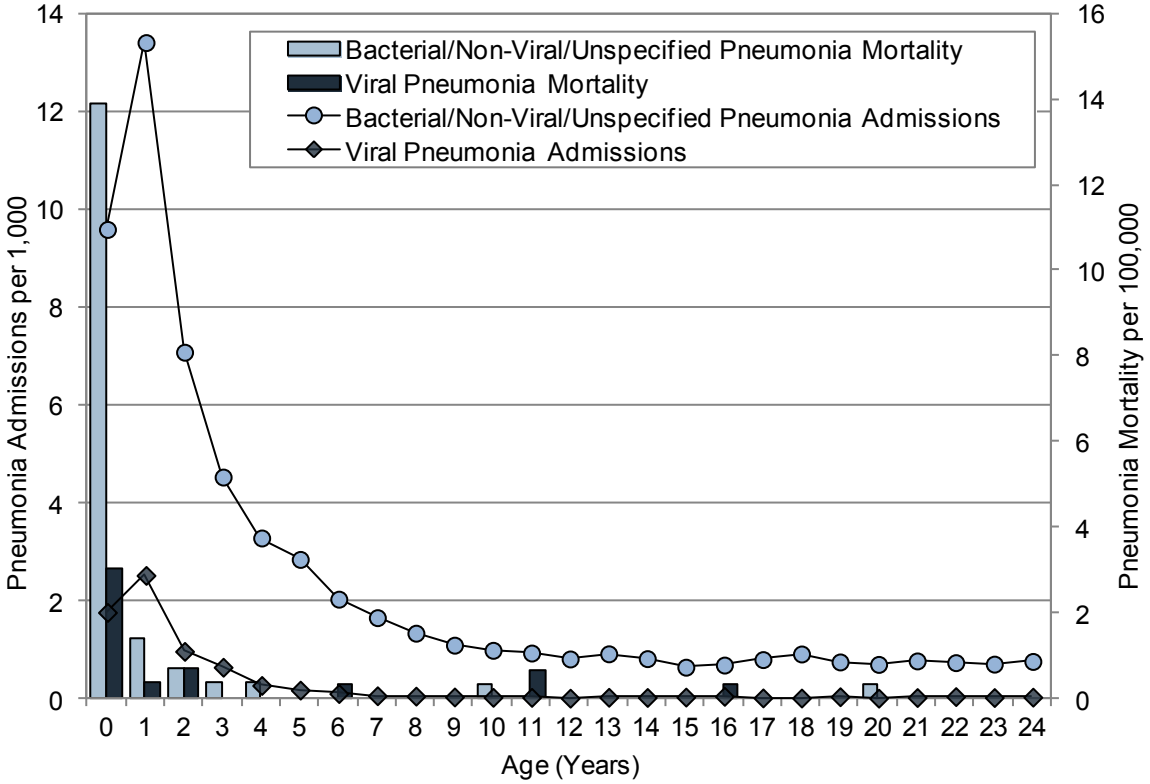
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.*Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

Figure 55. Acute and Semi-Acute Hospital Admissions (2000–2010) and Deaths (2000–2008) from Viral Pneumonia in New Zealand Children and Young People Aged 0–24 Years



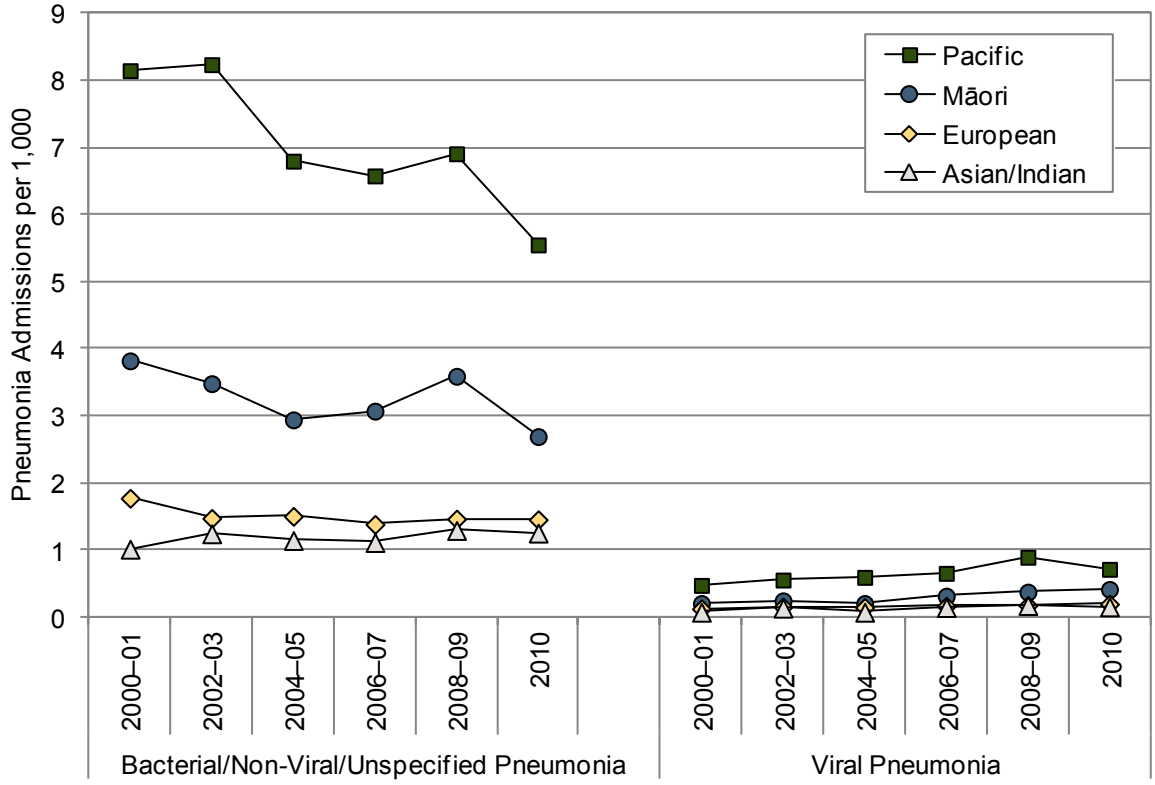
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; *Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

Figure 56. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Pneumonia in New Zealand Children and Young People by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 57. Acute and Semi-Acute Hospital Admissions for Pneumonia in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 67. Acute and Semi-Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Bacterial/Non-Viral/Unspecified Pneumonia							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	1.82	1.00		Decile 1–2	1.77	1.00	
Decile 2	1.72	0.95	0.85–1.04	Decile 3–4	2.09	1.18	1.10–1.26
Decile 3	2.08	1.14	1.04–1.26	Decile 5–6	2.74	1.55	1.45–1.65
Decile 4	2.10	1.16	1.05–1.27	Decile 7–8	3.61	2.04	1.92–2.17
Decile 5	2.58	1.42	1.29–1.56	Decile 9–10	5.95	3.37	3.18–3.56
Decile 6	2.87	1.58	1.45–1.73	Prioritised Ethnicity			
Decile 7	3.13	1.73	1.58–1.88	European	2.07	1.00	
Decile 8	4.02	2.21	2.04–2.40	Māori	4.30	2.08	2.00–2.17
Decile 9	5.13	2.82	2.61–3.06	Pacific	9.20	4.46	4.28–4.65
Decile 10	6.64	3.66	3.39–3.95	Asian/Indian	2.39	1.16	1.08–1.24
Gender							
Female	3.17	1.00					
Male	3.55	1.12	1.08–1.15				
Young People 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	0.47	1.00		Decile 1–2	0.41	1.00	
Decile 2	0.36	0.76	0.58–0.98	Decile 3–4	0.49	1.20	1.00–1.43
Decile 3	0.40	0.84	0.65–1.09	Decile 5–6	0.62	1.51	1.28–1.78
Decile 4	0.58	1.23	0.98–1.56	Decile 7–8	0.77	1.88	1.61–2.20
Decile 5	0.62	1.31	1.04–1.65	Decile 9–10	1.17	2.84	2.46–3.29
Decile 6	0.62	1.32	1.06–1.66	Prioritised Ethnicity			
Decile 7	0.82	1.73	1.40–2.15	European	0.53	1.00	
Decile 8	0.74	1.57	1.27–1.94	Māori	1.25	2.37	2.16–2.61
Decile 9	0.91	1.92	1.57–2.35	Pacific	1.94	3.68	3.30–4.11
Decile 10	1.49	3.17	2.61–3.85	Asian/Indian	0.20	0.38	0.31–0.47
Gender							
Female	0.72	1.00					
Male	0.76	1.05	0.97–1.14				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

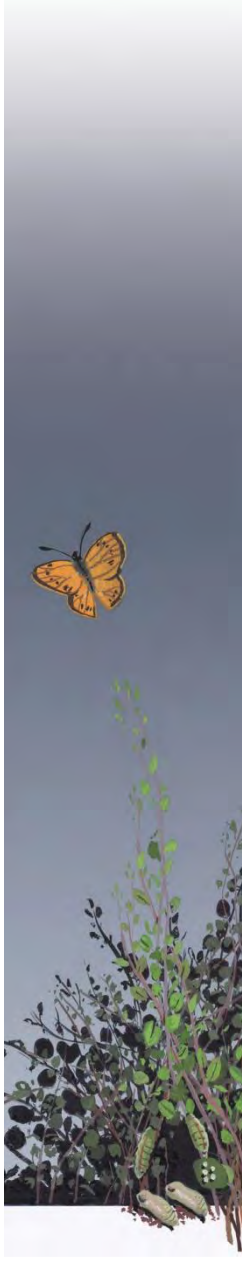


Table 68. Acute and Semi-Acute Hospital Admissions for Viral Pneumonia in Children and Young People Aged 0–14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Viral Pneumonia							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	0.25	1.00		Decile 1–2	0.24	1.00	
Decile 2	0.22	0.89	0.68–1.17	Decile 3–4	0.30	1.25	1.04–1.50
Decile 3	0.30	1.18	0.91–1.52	Decile 5–6	0.38	1.57	1.31–1.87
Decile 4	0.30	1.18	0.92–1.52	Decile 7–8	0.48	1.99	1.69–2.35
Decile 5	0.33	1.29	1.00–1.66	Decile 9–10	0.71	2.95	2.53–3.45
Decile 6	0.42	1.65	1.30–2.08	Prioritised Ethnicity			
Decile 7	0.38	1.51	1.19–1.93	European	0.27	1.00	
Decile 8	0.56	2.20	1.76–2.74	Māori	0.54	1.96	1.76–2.19
Decile 9	0.68	2.67	2.15–3.31	Pacific	1.19	4.36	3.88–4.89
Decile 10	0.73	2.90	2.35–3.57	Asian/Indian	0.32	1.19	0.99–1.43
Gender							
Female	0.42	1.00					
Male	0.45	1.05	0.96–1.15				
Young People 15–24 Years							
Small numbers precluded a valid analysis for this age group							

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

Bacterial/Non-Viral/Unspecified Pneumonia: In the Waikato during 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children and young people were *significantly* lower than the New Zealand rate, while in Lakes and Tairawhiti rates were *significantly* higher. While rates in the Bay of Plenty were similar to the New Zealand rate in both age groups, in Taranaki rates in children were *significantly* lower than the New Zealand rate, but rates in young people were similar (**Table 69**).

Viral Pneumonia: In the Waikato, Bay of Plenty, Tairawhiti, and Taranaki during 2006–2010, hospital admissions for viral pneumonia in children were *significantly* lower than the New Zealand rate, while rates in Lakes were *significantly* higher. Small numbers precluded a valid analysis for young people (**Table 69**).

Midland Region Trends

Bacterial/Non-Viral/Unspecified Pneumonia: In the Waikato, Bay of Plenty and Lakes during 2000–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children declined, while in Tairawhiti and Taranaki rates increased during the mid-late 2000s. Admissions for young people were more static, with the exceptions of the Bay of Plenty where admissions declined during the mid-late 2000s, and Taranaki, where admission rates increased (**Figure 58**).

Viral Pneumonia: In the Midland Region during 2000–2010, there were no consistent trends in hospital admissions for viral pneumonia in children, with large year to year variations in rates (possibly as a result of small numbers) being seen in a number of DHBs (**Figure 59**).

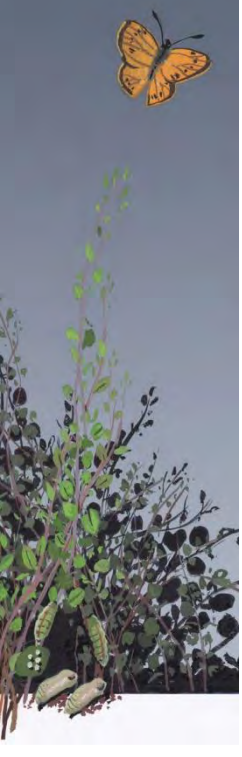


Table 69. Acute and Semi-Acute Hospital Admissions for Pneumonia in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Bacterial/Non-Viral/Unspecified Pneumonia					
Children 0–14 Years					
Waikato	734	146.8	1.87	0.56	0.52–0.60
Lakes	511	102.2	4.27	1.27	1.16–1.39
Bay of Plenty	792	158.4	3.56	1.06	0.99–1.14
Tairawhiti	299	59.8	5.16	1.54	1.37–1.72
Taranaki	316	63.2	2.83	0.84	0.75–0.94
New Zealand	15,016	3,003.2	3.36	1.00	
Young People 15–24 Years					
Waikato	134	26.8	0.50	0.68	0.57–0.80
Lakes	70	14.0	1.06	1.42	1.12–1.80
Bay of Plenty	98	19.6	0.78	1.05	0.86–1.28
Tairawhiti	41	8.2	1.30	1.75	1.28–2.38
Taranaki	55	11.0	0.79	1.06	0.81–1.38
New Zealand	2,351	470.2	0.74	1.00	
Viral Pneumonia					
Children 0–14 Years					
Waikato	118	23.6	0.30	0.69	0.57–0.83
Lakes	99	19.8	0.83	1.90	1.55–2.33
Bay of Plenty	74	14.8	0.33	0.77	0.61–0.96
Tairawhiti	3	0.6	0.05	0.12	0.04–0.37
Taranaki	18	3.6	0.16	0.37	0.23–0.59
New Zealand	1,942	388.4	0.44	1.00	
Young People 15–24 Years					
Small numbers precluded a valid analysis for this age group					

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Distribution by Ethnicity

In the Waikato during 2000–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia were higher for Pacific and Māori > European and Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were generally higher for Māori than for European children and young people (**Figure 60**). Small numbers precluded a valid analysis of ethnic differences for viral pneumonia.

Midland Region Distribution by Season

In the Midland Region during 2006–2010, hospital admissions for viral and bacterial/non-viral/unspecified pneumonia were generally higher in winter and early spring in all five DHBs (**Figure 61**).

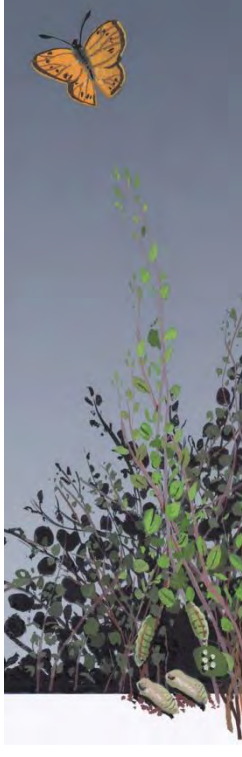
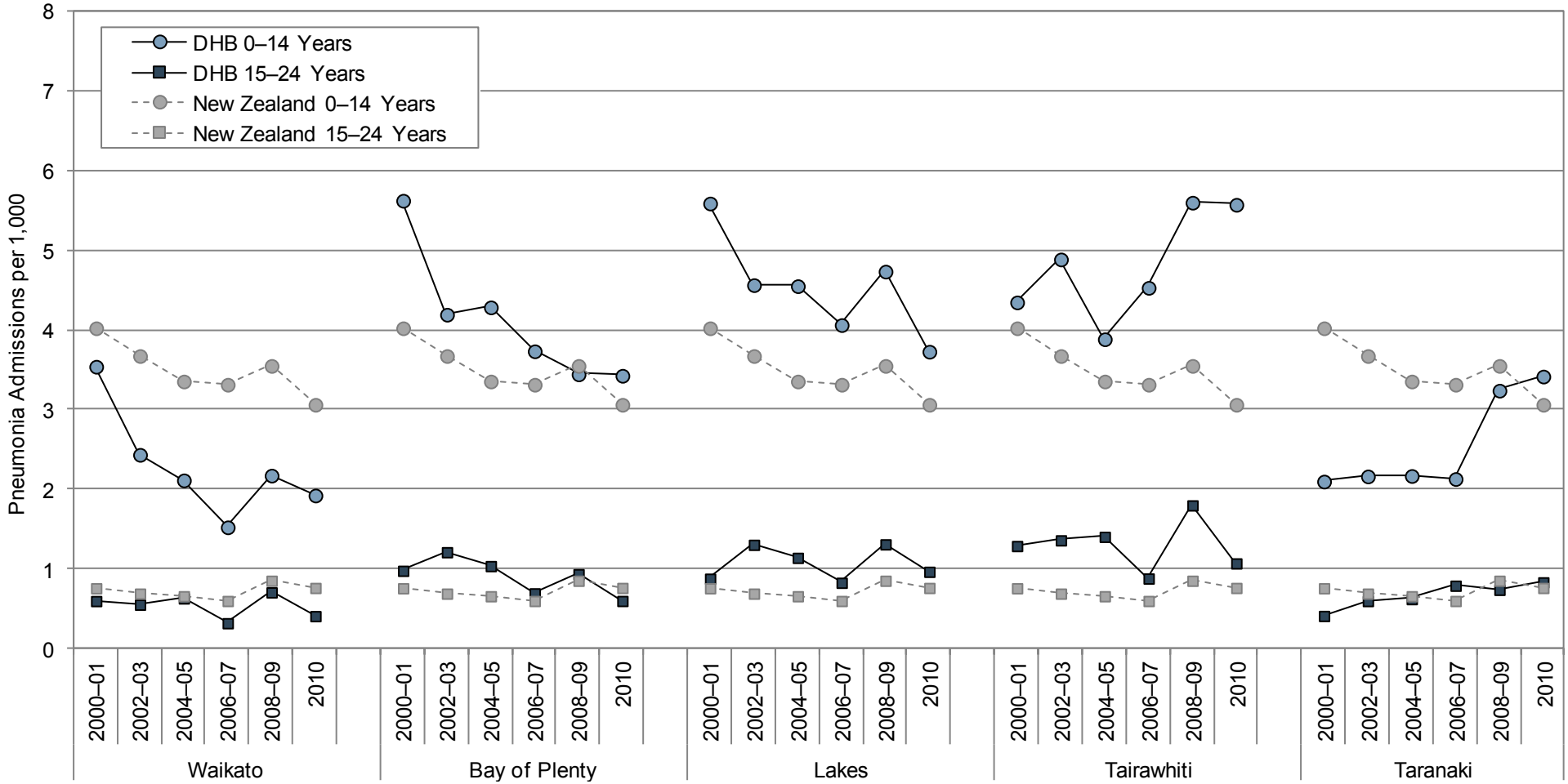
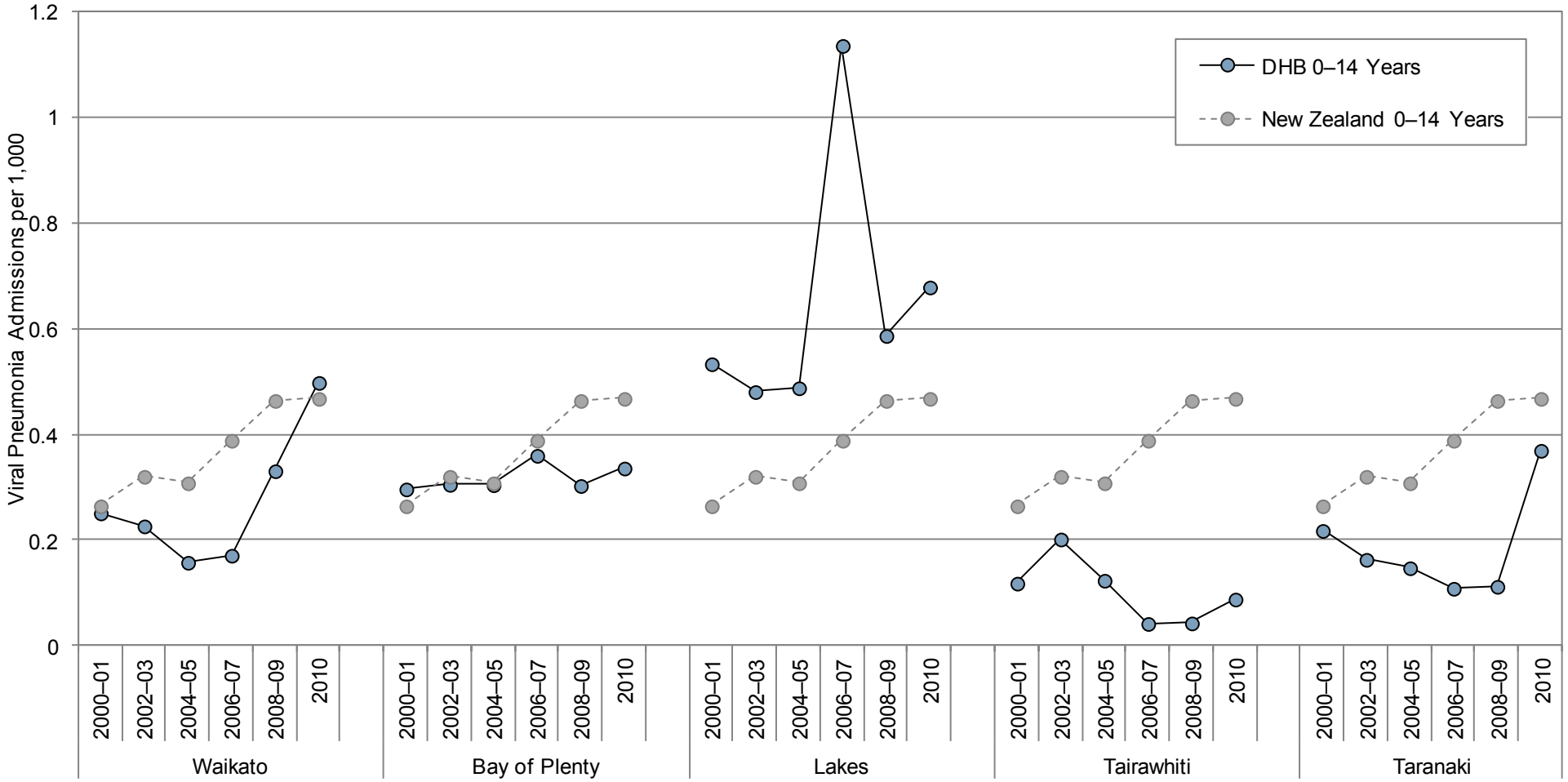


Figure 58. Acute and Semi-Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



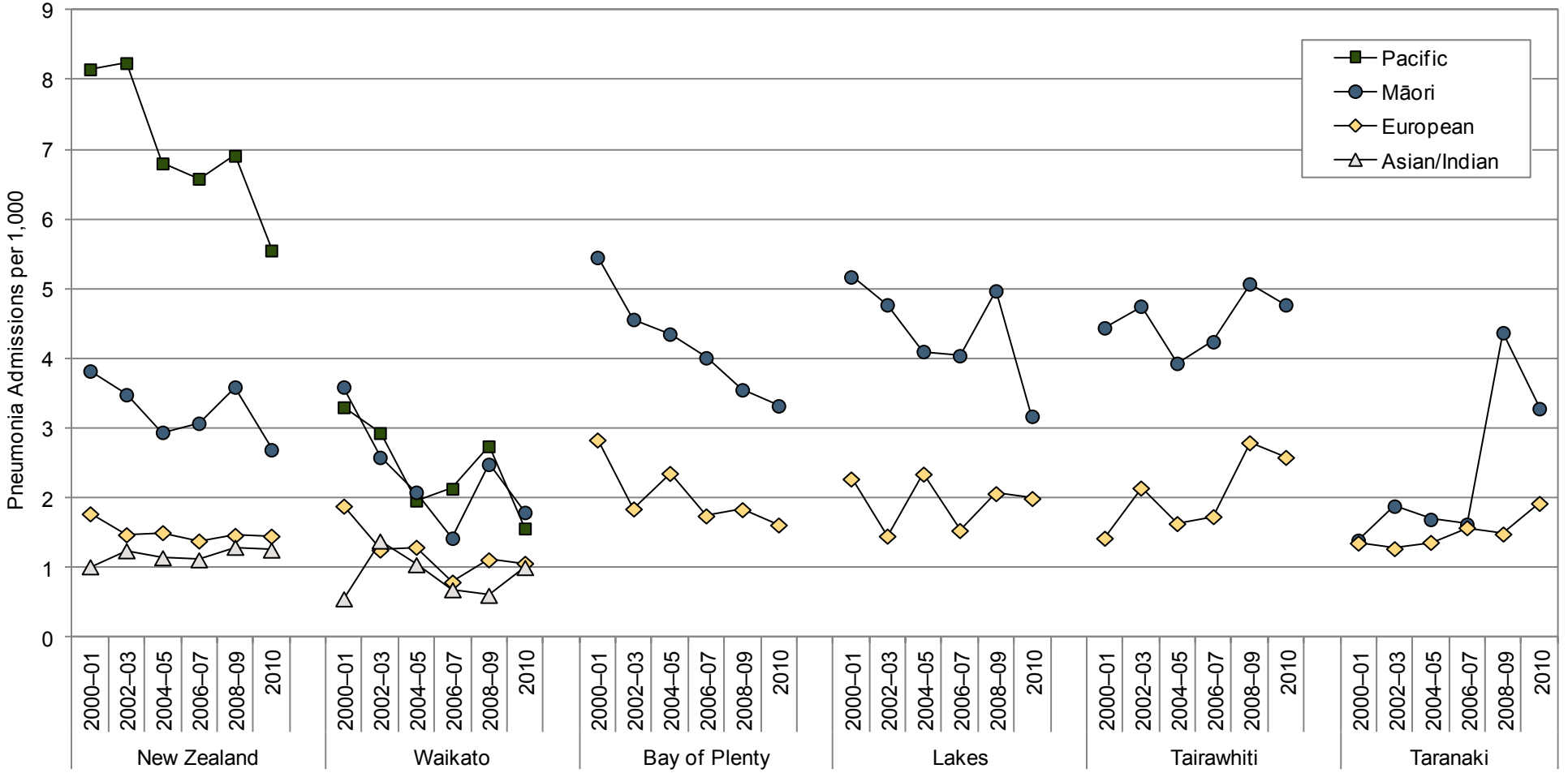
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 59. Acute and Semi-Acute Hospital Admissions for Viral Pneumonia in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000–2010



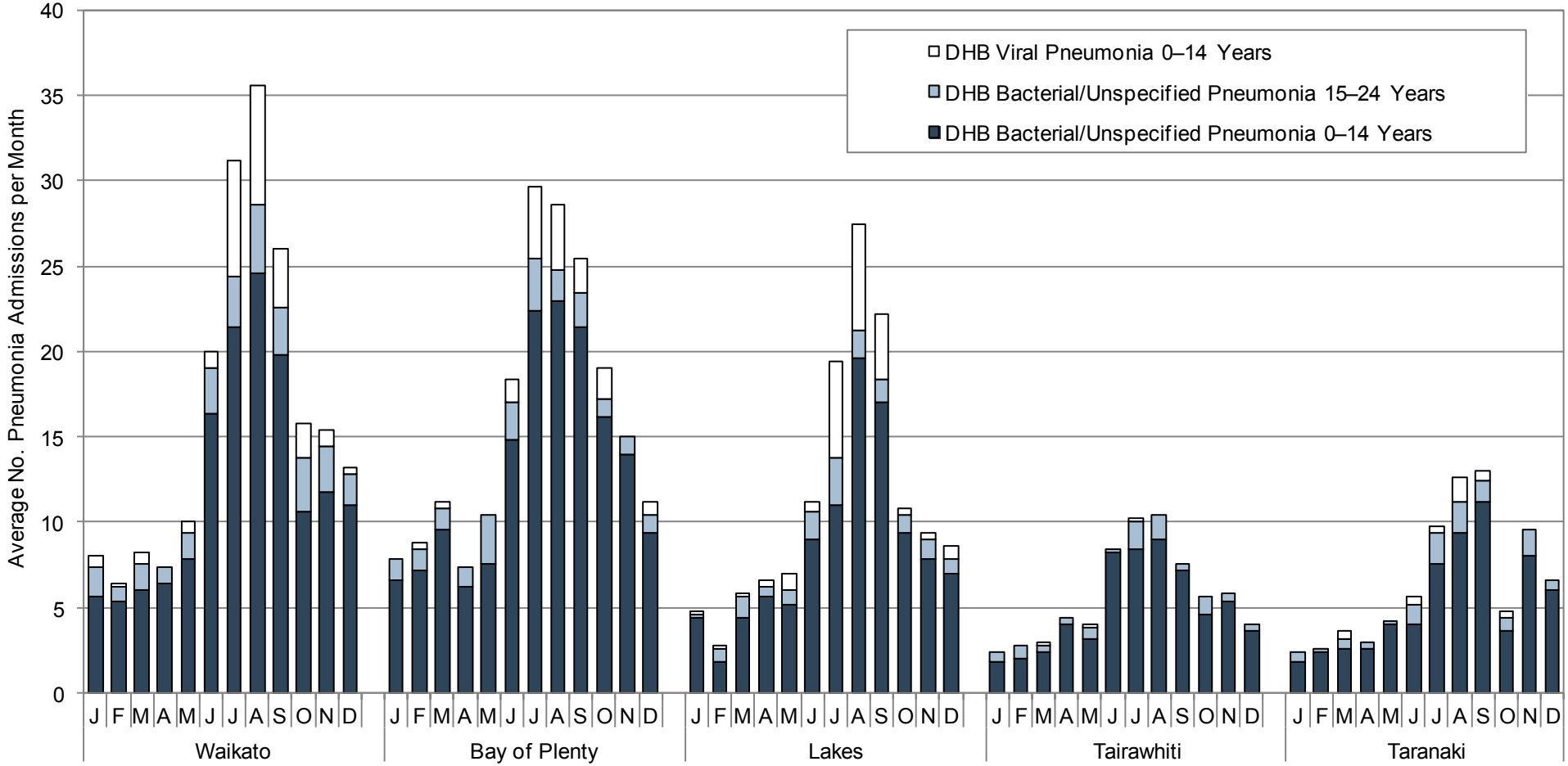
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 60. Acute and Semi-Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 61. Average Number of Acute and Semi-Acute Hospital Admissions for Pneumonia in Children and Young People Aged 0–24 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Summary

In New Zealand, bacterial/non-viral/unspecified pneumonia admissions in children declined during 2000–2007. A small upswing in rates was evident in 2008–09, before rates declined again in 2010. Similar patterns were seen for young people. In contrast, viral pneumonia admissions increased in both children and young people, with the most rapid increases in children occurring between 2004–05 and 2008–09. During 2000–2008, on average, eight children or young people died each year from bacterial/non-viral/unspecified pneumonia, and two to three died as a result of viral pneumonia.

During 2006–2010, viral and bacterial/non-viral/unspecified pneumonia admissions were highest in one year olds, with the next highest rates being in infants <1 year. Admissions tapered off rapidly during the preschool years, with the lowest rates being seen in those in their teens and early twenties. Mortality for both outcomes was highest in infants < 1 year. Admissions for bacterial/non-viral/unspecified pneumonia in children were also *significantly* higher for males, for Pacific > Māori > Asian/Indian > European children and those in average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were *significantly* higher for Pacific > Māori > European >Asian/Indian young people, and those in average-to-more deprived (NZDep decile 5–10) areas. Admissions for viral pneumonia were higher for Pacific > Māori > European and Asian/Indian children and those in average-to-more deprived (NZDep decile 6–10) areas, although small numbers precluded a valid analysis for young people.

In the Waikato, Bay of Plenty and Lakes during 2000–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children declined, while in Tairawhiti and Taranaki rates increased during the mid-late 2000s. Admissions for young people were more static, with the exceptions of the Bay of Plenty where admissions declined during the mid-late 2000s, and Taranaki, where admission rates increased. There were however, no consistent trends in hospital admissions for viral pneumonia in children, with large year to year variations in rates being seen in a number of DHBs.

In the Waikato, hospital admissions for bacterial/non-viral/unspecified pneumonia were higher for Pacific and Māori > European and Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were generally higher for Māori than for European children and young people. Admissions for viral and bacterial/non-viral/unspecified pneumonia were also higher in winter and early spring in all five DHBs.

Local Policy Documents and Evidence-Based Reviews Relevant to Pneumonia in Children and Young People

In New Zealand there are no policy documents which focus solely on the prevention of pneumonia in children and young people, although the Immunisation Handbook considers pneumococcal disease. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

A range of international reviews and guidelines also consider the most appropriate management of pneumonia in children and young people and these are considered in **Table 70**.

Table 70. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Pneumonia

Ministry of Health Policy Documents
Ministry of Health. 2011. **Immunisation Handbook 2011**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/immunise-handbook/$file/9PneumococcalDisease.pdf Chapter 9 of this Handbook covers pneumococcal disease. It provides information on the disease, its epidemiology, vaccines, recommended immunisation schedules, expected responses and adverse events post-vaccination, contraindications to vaccination, and control measures. It states that pneumococcal infection is considered to be the leading cause of pneumonia and that there are marked socio-economic and ethnic disparities in hospitalisation rates for pneumonia. Pneumococcal infection can cause meningitis and septicaemia as well as pneumonia, ear infections and sinus infections and, rarely, endocarditis and infection of other sites including joints, the peritoneal cavity and fallopian tubes. A pneumococcal conjugate vaccine, Prevenar®, was added to the immunisation schedule in 2008. This has since been replaced (2011) by Synflorix® (which provides protection against 10 serotypes) for most infants. Children eligible for the High Risk Pneumococcal Immunisation Programme (the criteria are listed in the handbook) can be given Prevenar 13® or pneumococcal polysaccharide vaccine (Pneumovax 23®, providing protection against 23 serotypes).
International Guidelines
Bradley JS, Byington CL, Shah SS, et al. 2011. **The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America**. Clinical Infectious Diseases doi:10.1093/cid/cir531 http://cid.oxfordjournals.org/content/early/2011/08/30/cid.cir531.abstract These management guidelines from the U.S. relate to otherwise healthy children. They cover indications for hospitalisation, diagnostic testing, anti-infective treatment, other therapies including drainage of parapneumonic effusion, management of the child not responding to treatment, discharge criteria and prevention. Recommendations in the guidelines are followed by an indication of both the strength of the expert panel recommendation and the quality of the evidence and also a well referenced summary of the evidence. Recommendations for prevention of pneumonia in children include: children should be immunised against *Streptococcus pneumoniae, Haemophilus influenza type b* and pertussis, all children ≥ 6 months of age should have annual influenza vaccination, parents and caretakers of infants < 6 months of age, including pregnant adolescents, should be immunised against influenza and pertussis to protect their infant, and high risk infants should be offered prophylaxis with RSV-specific monoclonal antibody (Palivizumab).
Community Acquired Pneumonia Guideline Team, Cincinnati Children's Hospital Medical Center. 2005. **Evidence based clinical practice guideline. Community acquired pneumonia in children 60 days to 17 years of age**. http://www.cincinnatichildrens.org/service/j/anderson-center/evidence-based-care/community-acquired-pneumonia/ These concise guidelines cover aetiology, assessment and diagnosis, management, and prevention of community acquired pneumonia in children. Each recommendation in the guidelines is accompanied by references to the literature with a letter grade which relates to the evidence grading scale used by the Cincinnati Children's Hospital Medical Center (explained at the end of the guidelines.) The guidelines include a management algorithm. Regarding prevention, the guidelines recommend pneumococcal vaccination for all children and annual influenza vaccination for children aged 6–23 months and for children older than 23 months with particular risk factors including (but not limited to) asthma, cardiac disease, sickle cell disease, HIV and diabetes. They also recommend discussing with families the benefits of regular hand washing, breast feeding , limiting exposure to sick children (especially in day care centres, by checking the centre's hand washing policy, delaying enrolment and choosing a smaller centre) and reducing exposure to tobacco smoke.
British Thoracic Society Standards of Care Committee. 2002. **British Thoracic Society Guidelines for the Management of Community Acquired Pneumonia in Childhood**. Thorax, 57 Suppl 1, i1-24. These British guidelines deal with the management of pneumonia in previously well infants and children, but not neonates. The recommendations are based on a thorough review of the evidence and each is graded according to the strength of the evidence and the strength of the recommendation. The grading scheme is explained at the beginning of the guidelines. The guidelines cover aetiology and epidemiology, clinical features, investigations, severity assessment (indications for hospitalisation), management (general and antibiotics), complications and prevention and primary care issues. The discussion of preventive issues suggests measures to improve housing, reduce crowding and limit smoking are beneficial and that vaccines to prevent infections due to *Haemophilus influenzae*, pertussis, influenza and pneumococci are likely to reduce the burden of childhood pneumonia.
Systematic and Other Reviews from the International Literature
Russell K, Robinson J, et al. 2009. **The Cochrane Library and Treatment for Community Acquired Pneumonia in Children: An Overview of Reviews**. Evidence-Based Child Health: A Cochrane Review Journal, 4(3), 1149-64. This is an overview of data from seven Cochrane reviews relating to the treatment of pneumonia in children. Pneumonia can be of either viral or bacterial origin. In clinical practice it is often not possible to determine whether a child has viral or bacterial pneumonia (or bronchiolitis which has a similar presentation) so treatment with antibiotics is commonly prescribed. In developed countries amoxicillin-clavulanate and azithromycin appeared to be equally effective for treating community-acquired pneumonia (CAP). One small low quality trial showed a higher cure rate with amoxicillin-clavulanate than with amoxicillin. The macrolide antibiotics azithromycin, clarithromycin, and erythromycin appeared to be equal. Azithromycin was better tolerated than was amoxicillin-clavulanate. It was not possible to reach meaningful conclusions on the effects of over-the-counter medications for cough in children with pneumonia due to insufficient number of children in the studies. The review also includes discussion of issues more relevant to developing countries.

Doan Q, Enarson P, Kissoon N, et al. 2009. **Rapid viral diagnosis for acute febrile respiratory illness in children in the Emergency Department**. Cochrane Database of Systematic Reviews, 2009(4), Art. No.: CD006452. DOI:10.1002/14651858.CD006452.pub2.

Most paediatric acute respiratory infections are due to viruses but in the emergency department (ED) investigations are usually undertaken to rule out bacterial infection and antibiotics are often ordered because of uncertainty about the diagnosis. Rapid viral testing may avoid the unnecessary use of other diagnostic testing and antibiotics since it has been reported that the risk of concurrent bacterial infection in a child with a confirmed viral infection is negligible. This review considered the effect of rapid viral testing on the use of other diagnostic investigations, the use of antibiotics and the length of emergency department stays. The review included three RCTs and one quasi-RCT, with a total of 759 children receiving viral testing and 829 control children. Rapid viral testing reduced rates of chest radiography (RR 0.77, 95% CI 0.65 to 0.91) but made no significant difference (either clinically or statistically) to antibiotic use in the ED and had no effect on length of ED visits, or rates of blood and urine testing. The authors state that the current evidence is insufficient to support rapid viral testing as a means of reducing antibiotic use in the paediatric ED. The results suggest that rapid viral testing may be beneficial but they lack the power to show statistical significance. The authors recommend a large trial to address this issue.

Jefferson T, Rivetti A, Harnden A, et al. 2008. **Vaccines for preventing influenza in healthy children**. Cochrane Database of Systematic Reviews, 2008(2), Art. No.: CD004879. DOI: 10.1002/14651858.CD004879.pub3.

This review included RCTs, cohort and case-control studies of any influenza vaccine in healthy children aged <16 years: in total 51 studies with 294,159 observations. The authors aimed to determine both the efficacy of the vaccine and its effectiveness. Efficacy is the prevention of laboratory confirmed influenza whereas effectiveness is the prevention of influenza-like illness (which may or may not be due to influenza virus). The analysis of vaccine efficacy and effectiveness included 16 RCTs and 18 cohort studies. RCTs indicated that live vaccines (nasal sprays containing weakened influenza virus) had an efficacy of 82% (95% CI 71% to 89%) and an effectiveness of 33% (95% CI 28% to 33%) in children older than two years. Inactivated vaccines (injections containing killed virus) had lower efficacy than live vaccines: 59% (95% CI 41% to 71%) but similar effectiveness: 36% (95% CI 24% to 46%). In children younger than two the efficacy of inactivated vaccine was similar to placebo. The authors were unable to perform meta-analysis of safety outcome data due to the variability in study designs and the ways data were presented and they stated there was extensive evidence of reporting bias for safety outcomes in the trials of live attenuated vaccines. The authors concluded that influenza vaccines are efficacious in children over two but that there is little evidence for children under two. They noted: “It was surprising to find only one study of inactivated vaccine in children <2years, given current recommendations to vaccinate healthy children from six months in the USA and Canada. If immunisation in children is to be recommended as a public health policy, large-scale studies assessing important outcomes and directly comparing vaccine types are urgently required.”

Matheson NJ, Harnden AR, Perera R, et al. 2007. **Neuraminidase inhibitors for preventing and treating influenza in children**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD002744. DOI:10.1002/14651858.CD002744.pub2.

Pneumonia is one of the commonest complications of influenza. This review assessed the efficacy, safety and tolerability of neuraminidase inhibitors (zanamivir and oseltamivir, trade names Relenza® and Tamiflu®) in the prevention and treatment of influenza in children. Based on the results of 3 double-blind RCTs involving 1500 children under 12 years of age with a clinical diagnosis of influenza (977 of whom had laboratory-confirmed influenza) the authors concluded that neuraminidase inhibitors are effective in shortening the duration of illness in previously healthy children with influenza but that it is unproven whether or not they help “at-risk” children with chronic medical conditions. In addition, oseltamivir is effective in reducing secondary complications and, based on one trial in 222 contacts of influenza cases, may be effective for prophylaxis. Details of how effective oseltamivir is in reducing influenza-related pneumonia are not provided.

Hemila H, Louhiala P. 2007. **Vitamin C for preventing and treating pneumonia**. Cochrane Database of Systematic Reviews, 2007(1), Art. No.: CD005532. DOI: 10.1002/14651858.CD005532.pub2.

This review considered three prophylactic trials involving a total of 2335 people. Only one of these trials was deemed to be satisfactorily randomised, double-blind and placebo controlled. Two trials involved military recruits and the third, conducted in the U.K. during World War II, involved boys from “lower wage-earning classes” attending a boarding school. All three trials found a statistically significant reduction (≥ 80%) in the incidence of pneumonia in the vitamin C group. Two therapeutic trials in adults with pneumonia, one in the U.K. which included only elderly patients and one in the former Soviet Union, found that vitamin C was beneficial but in the U.K. trial the benefit was restricted to the most severely ill patients. The review authors concluded that the current evidence is too weak to recommend prophylactic use of vitamin C to prevent pneumonia in the general population (but that this issue should be further investigated) and that therapeutic vitamin C for patients with pneumonia may be reasonable given that the costs and risks are low.

Alves Galvao MG, Rocha Crispino Santos MA, Alves da Cunha AJL. 2008. **Amantadine and rimantadine for influenza A in children and the elderly**. Cochrane Database of Systematic Reviews, 2008(1), Art. No.: CD002745. DOI:10.1002/14651858.CD002745.pub2.

There are currently two classes of anti-viral drugs for influenza: neuraminidase inhibitors (zanamivir and oseltamivir) and M2 ion channel inhibitors (Amantidine (AMT) and rimantadine (RMT)). Both classes of drugs are somewhat effective for the prevention and treatment of influenza A infections but only neuraminidase inhibitors are effective against influenza A and B. This review focussed on children and the elderly and aimed to assess the efficacy of both AMT and RMT in preventing influenza A and in shortening the duration of influenza A manifestations. It also aimed to compare the adverse effects from AMT and RMT in these age groups. The review included eight randomised trials involving children which considered treatment with AMT (2 studies), treatment with RMT (1 study), prophylaxis with AMT (1 study), prophylaxis with RMT (3 studies), adverse effects from AMT (2 studies) and adverse effects from RMT (3 studies).

The authors note that for the majority of comparisons reviewed, their ability to draw conclusions was limited by the small numbers of studies and the small numbers of participants. They concluded that, based on the available data, AMT is effective for influenza prophylaxis in children. They started that its safety was not well established but given the important role of children in transmitting infection it should be tried (in the context of pandemic situations, although this is not stated explicitly). They stated "Currently, RMT cannot be recommended as a prophylactic drug for either age group Nevertheless, if we consider: 1) it is a safe drug; 2) the results of the combined age groups, and 3) the possibility that the next pandemic virus is susceptible to this class of drug, we can still consider this 'old' drug as a less costly alternative to neuraminidase inhibitors." They concluded that the only proven benefit of either AMT or RMT was that RMT led to the abatement of fever by day three of treatment (based on the findings of 1 trial only) and that this benefit did not justify using RMT to treat all children with influenza but only those for whom fever may cause undesirable consequences. (It was unspecified who these children were.) The studies looking at possible adverse effects of AMT were all carried out in ill children and the review authors considered that this meant that there was confounding between the effects of illness and the effects of the medication and therefore it was not possible to compare side effects between AMT and RMT.

Other Relevant Publications

National Influenza Strategy Group. 2011. **Influenza Medical Website**. Auckland: Immunisation Advisory Centre. http://www.influenza.org.nz/?t=884 accessed 12/10/11.

This website provides regular updates on influenza in New Zealand and explains who is eligible for free or subsidised vaccination. It states that "Due to the reactions experienced in 2010 by some children, Fluvax® is not indicated for use in children under 5 years of age and should be used with caution in children aged 5-8 years. As an extra precaution the Ministry of Health recommends that Fluvax should not be given to children under 9 years of age in 2011." The other available vaccine, Fluarix® is approved for use in individuals 6 months and over. Some children with chronic conditions are eligible for free influenza immunisation and a list of the criteria can be found here:

http://www.influenza.org.nz/site_resources/Influenza/Influenza%202011/Eligibility_Criteria.pdf

Centers for Disease Control and Prevention. 2009. **Pneumonia hospitalizations among young children before and after introduction of pneumococcal conjugate vaccine – United States, 1997–2006**. Morbidity & Mortality Weekly Report, 58(1), 1–4. http://www.cdc.gov/mmwr/pdf/wk/mm5801.pdf

A seven-valent Pneumococcal vaccine was introduced in the U.S. in 2000. After this population and laboratory based surveillance showed that there had been substantial reductions in invasive pneumococcal disease in both children and adults. This report discusses hospitalisations for all-cause pneumonia in children. Following the introduction of the vaccine hospitalisations for pneumonia in children under two fell and in 2006 rates were about 35% lower than in 1997-99. Most of the decrease occurred soon after the vaccine was introduced and rates have remained relatively stable since then. There was no change in all-cause pneumonia hospitalisation rates in older children (2-4 years old) after the vaccine was introduced and rates have remained steady since then. The report states that it appears that pneumococci contribute to a wider range of childhood upper respiratory illnesses than was previously thought (including otitis media) and that *Streptococcus pneumoniae* may be a co-pathogen in illnesses diagnosed as influenza. This conclusion is based on the decrease in non-pneumonia acute respiratory infection hospitalisation rates. Numbers of ambulatory care visits for pneumonia in the under-twos have also decreased since the vaccine was introduced. The reports states that new vaccines which provide protection against a greater number of serotypes may further reduce hospitalisation rates.

The Asthma and Respiratory Foundation of New Zealand, Innes Asher and Cass Byrnes, editors. 2006. **Trying to Catch our Breath: The burden of preventable breathing disorders in children and young people**. Wellington: The Asthma and Respiratory Foundation of New Zealand. http://www.asthmanz.co.nz/files/PDF-files/Burden_FullDocument.pdf

Chapter 8 of this publication deals specifically with pneumonia. It states that pneumonia is more common in New Zealand than in other developed countries and that there are significant ethnic disparities. More effective primary care services are stated to be the most effective way of reducing the significant numbers of avoidable hospital admissions for pneumonia. Some children are left with lung damage after pneumonia which can lead to life-long chronic lung disease such as bronchiectasis.

ASTHMA

Introduction

Asthma is a chronic inflammatory disorder of the airways of the lower respiratory tract. The inflammation is associated with airflow obstruction and bronchial hyper-responsiveness, which leads to episodes of bronchospasm (where smooth muscle in the airway walls contracts and the airways become narrowed), and symptoms such as wheezing, chest tightness, shortness of breath and coughing [133].

Asthma typically begins in early childhood and a family history of asthma and/or atopy is an important risk factor. The most common triggers of asthma attacks in children are viral infections and aero-allergens such as pollen, mould, house dust mites, animal dander and cigarette smoke. However, asthma may also be triggered by exposure to cold air, exercise or psychological stress [133].

New Zealand is one of the countries with the highest prevalence of asthma in the world [134]. Results from Phase Three of the International Study of Asthma and Allergies in Childhood (ISAAC) conducted in Auckland, the Bay of Plenty, Christchurch, Nelson, and Wellington during 2001-2003 found that 30% of children aged 6-7 years and 32% of adolescents reported having 'ever had' asthma [135]. Phase One of the ISAAC Study also suggested that asthma was more prevalent in Māori > European > Pacific children, but that symptom severity was worst for Pacific > Māori > European children with asthma [136]. Māori children have also been reported as having higher rates of hospital admission for asthma than non-Māori children and this disparity is greatest for children from rural areas [137].

From a public health perspective, addressing issues such as parental smoking, access to primary healthcare and the appropriate use of preventer medication may assist in reducing ethnic disparities in asthma symptoms and hospital admission rates [136]. However, the extent to which population level interventions may be of value in reducing the overall prevalence of asthma among New Zealand's children and young people remains unclear.

The following section explores asthma in children and young people using information from the National Minimum Dataset and the National Mortality Collection. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing asthma in children and young people.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0–24 years with a primary diagnosis of Asthma (ICD-10-AM J45–46).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Asthma in Children and Young People Aged 0–24 Years

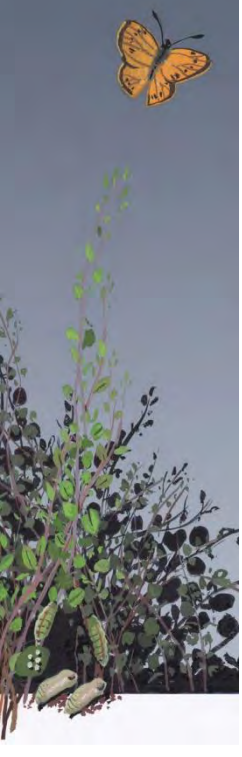
Numerator: National Mortality Collection: Deaths in children and young people aged 0–24 years where the main underlying cause of death was Asthma (ICD-10-AM J45–46).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.



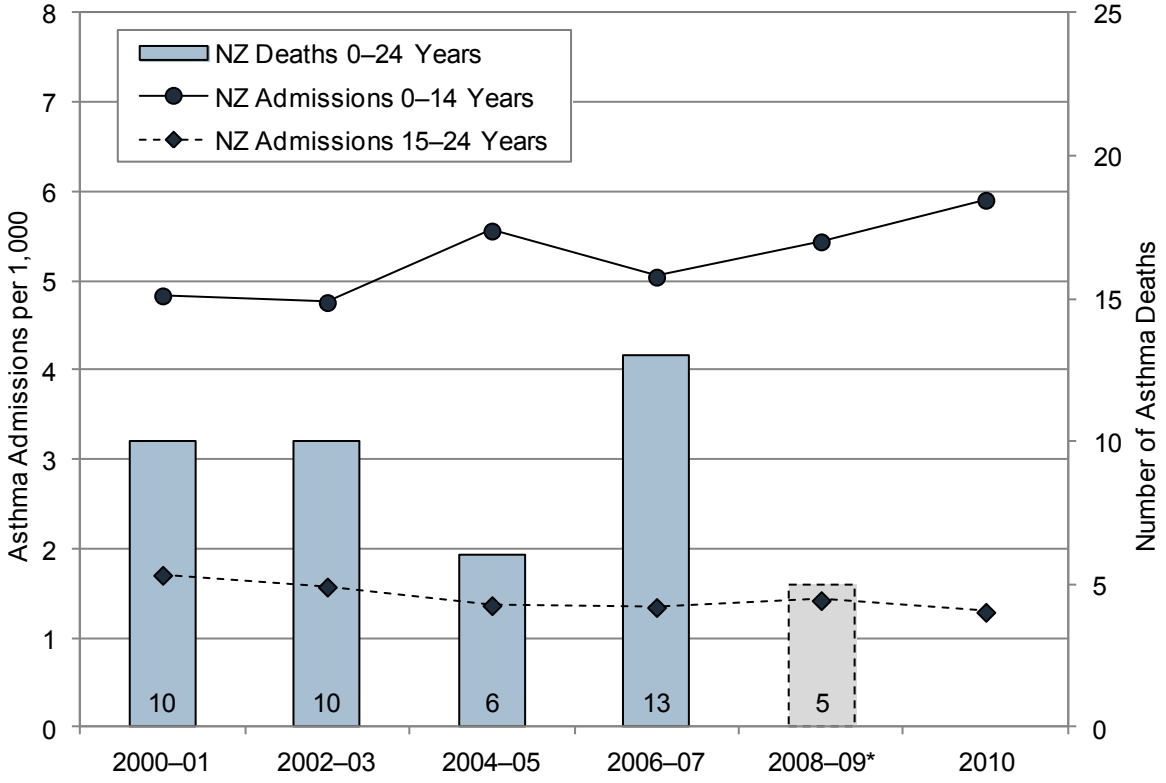
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, asthma admissions in children gradually increased, while admissions in young people were more static after 2004–2005. On average during 2000–2008, five New Zealand children or young people each year, died as the result of asthma (**Figure 62**).

Figure 62. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Asthma in New Zealand Children and Young People Aged 0−24 Years

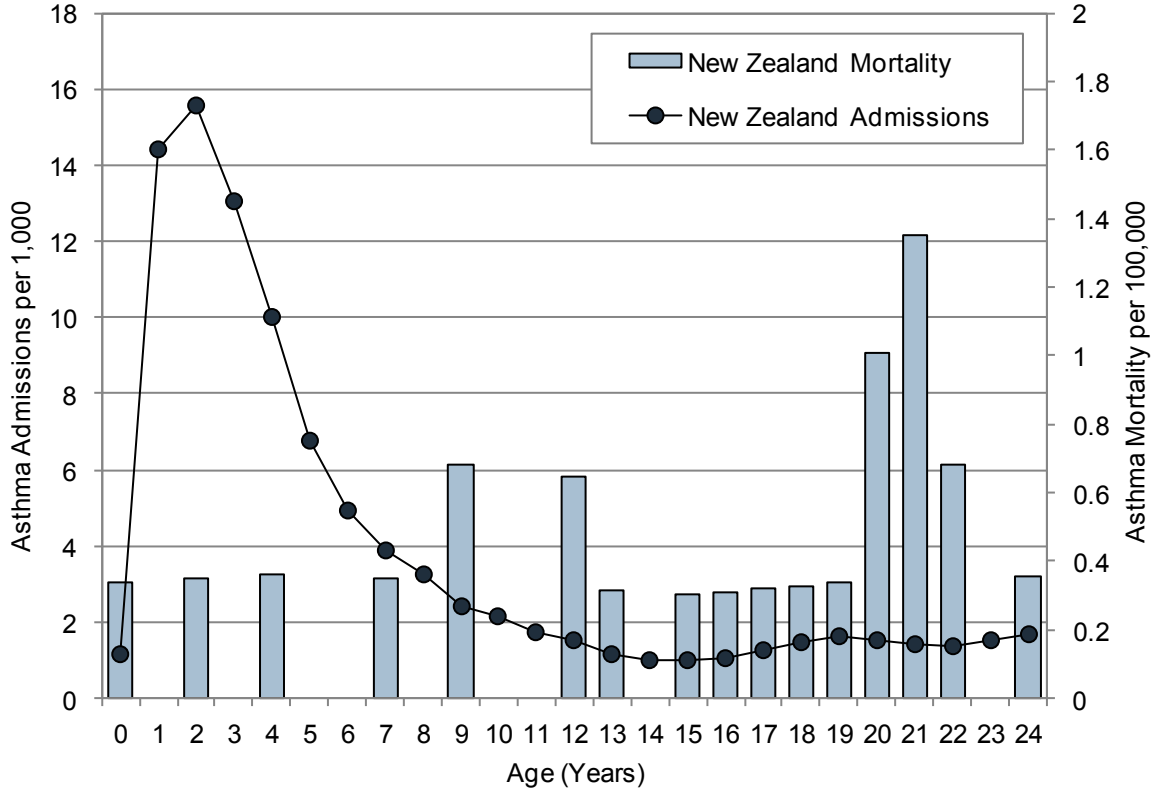


Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. *Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

New Zealand Distribution by Age

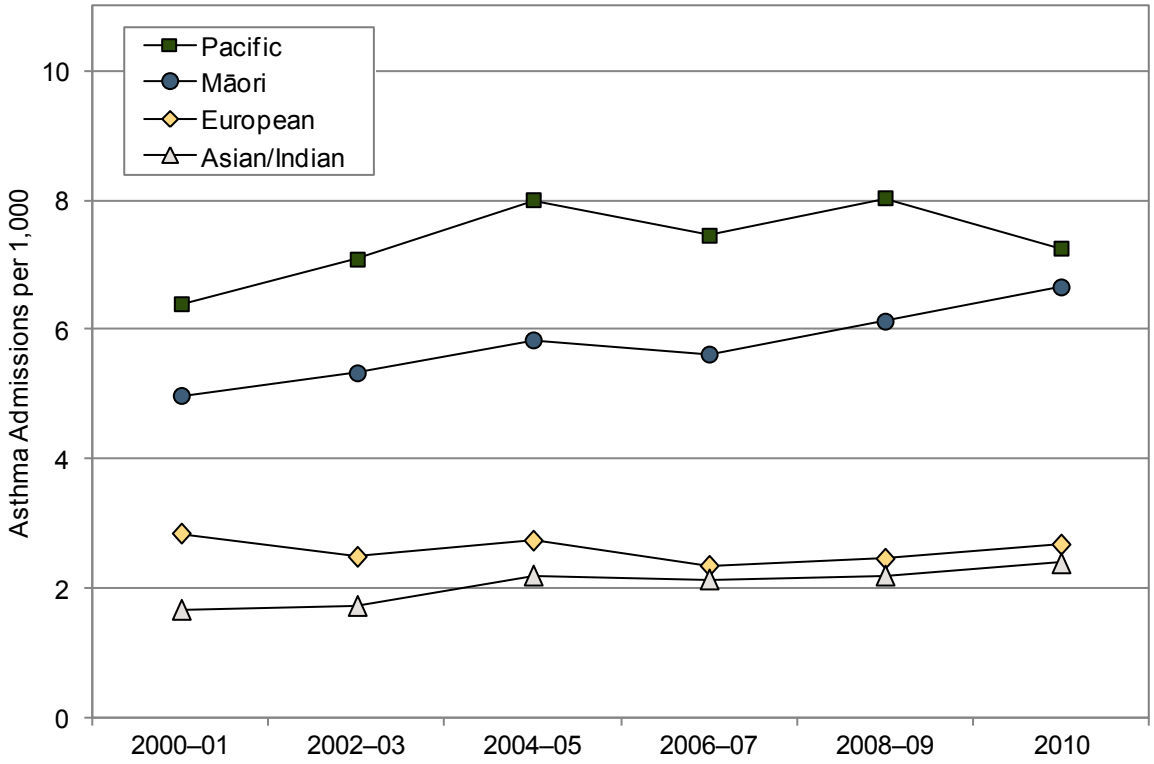
In New Zealand during 2006–2010, hospital admissions for asthma were relatively infrequent during infancy but increased rapidly thereafter to reach a peak at 2 years of age. Admissions then declined during early-middle childhood with the lowest rates being seen amongst those in their teens and early twenties. In contrast, asthma deaths were most frequent amongst those in their teens and early twenties (**Figure 63**).

Figure 63. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Asthma in New Zealand Children and Young People by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 64. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

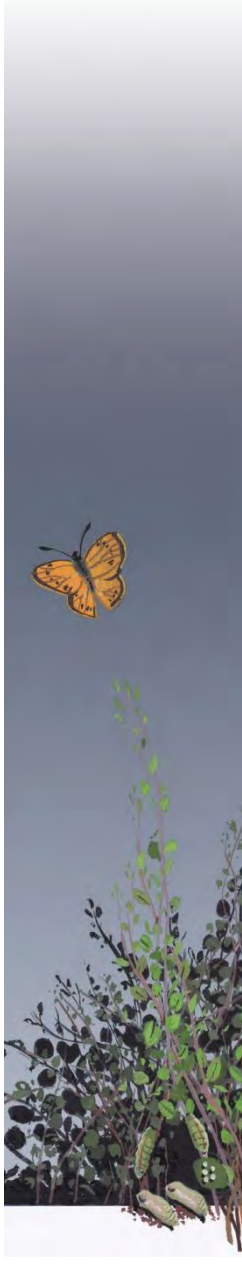
New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for asthma in children were *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those living in average-to-more deprived (NZDep decile 3–10) areas. In contrast, asthma admissions in young people were *significantly* higher for females, Pacific and Māori > European > Asian/Indian young people and those living in average-to-more deprived (NZDep decile 4–10) areas (**Table 71**). When both age groups were combined, asthma admissions during 2000–2010 were higher for Pacific > Māori > European > Asian/Indian children and young people. The differences seen between Pacific and Māori children and young people narrowed during this period as did the differences between European and Asian/Indian children and young people (**Figure 64**).

Table 71. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Asthma							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	2.92	1.00		Decile 1–2	2.87	1.00	
Decile 2	2.82	0.96	0.89–1.04	Decile 3–4	3.61	1.26	1.19–1.33
Decile 3	3.49	1.20	1.11–1.29	Decile 5–6	4.97	1.73	1.65–1.82
Decile 4	3.72	1.27	1.18–1.37	Decile 7–8	6.46	2.25	2.15–2.36
Decile 5	4.75	1.63	1.52–1.75	Decile 9–10	8.19	2.85	2.73–2.98
Decile 6	5.16	1.77	1.65–1.89	Prioritised Ethnicity			
Decile 7	5.91	2.02	1.89–2.16	European	3.46	1.00	
Decile 8	6.94	2.38	2.23–2.53	Māori	8.05	2.33	2.26–2.40
Decile 9	7.88	2.70	2.53–2.87	Pacific	10.6	3.05	2.95–3.16
Decile 10	8.45	2.89	2.72–3.08	Asian/Indian	4.32	1.25	1.19–1.32
Gender							
Female	4.39	1.00					
Male	6.33	1.44	1.41–1.48				
Young People 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	0.68	1.00		Decile 1–2	0.69	1.00	
Decile 2	0.69	1.01	0.83–1.24	Decile 3–4	0.86	1.26	1.10–1.44
Decile 3	0.74	1.08	0.88–1.32	Decile 5–6	1.21	1.76	1.55–2.00
Decile 4	0.98	1.43	1.19–1.73	Decile 7–8	1.61	2.34	2.08–2.63
Decile 5	1.16	1.70	1.42–2.05	Decile 9–10	2.07	3.01	2.69–3.37
Decile 6	1.25	1.84	1.54–2.19	Prioritised Ethnicity			
Decile 7	1.57	2.31	1.95–2.74	European	1.04	1.00	
Decile 8	1.63	2.40	2.03–2.83	Māori	2.44	2.34	2.18–2.50
Decile 9	1.89	2.78	2.36–3.26	Pacific	2.73	2.61	2.39–2.85
Decile 10	2.28	3.34	2.85–3.93	Asian/Indian	0.39	0.37	0.32–0.43
Gender							
Female	1.76	1.00					
Male	0.98	0.56	0.53–0.59				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.



Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Waikato during 2006–2010, asthma admissions in children were *significantly* lower than the New Zealand rate, while rates in Lakes, Bay of Plenty and Tairawhiti were *significantly* higher. Asthma admissions in Taranaki children were similar to the New Zealand rate. For young people, asthma admissions in Lakes were *significantly* higher than the New Zealand rate, while admissions in the Waikato, Bay of Plenty, Tairawhiti and Taranaki were not *significantly* different from the New Zealand rate (**Table 72**).

Table 72. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Asthma					
Children 0–14 Years					
Waikato	1,299	259.8	3.31	0.61	0.58–0.65
Lakes	896	179.2	7.49	1.39	1.30–1.49
Bay of Plenty	1,503	300.6	6.76	1.26	1.19–1.32
Tairawhiti	400	80.0	6.91	1.28	1.16–1.42
Taranaki	583	116.6	5.21	0.97	0.89–1.05
New Zealand	24,030	4,806.0	5.38	1.00	
Young People 15–24 Years					
Waikato	337	67.4	1.26	0.92	0.82–1.03
Lakes	125	25.0	1.88	1.38	1.15–1.64
Bay of Plenty	190	38.0	1.51	1.10	0.95–1.27
Tairawhiti	39	7.8	1.23	0.90	0.66–1.23
Taranaki	93	18.6	1.33	0.97	0.79–1.19
New Zealand	4,338	867.6	1.37	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

In the Bay of Plenty and Lakes during 2000–2010, asthma admissions in children increased. In the Waikato, Taranaki and Tairawhiti rates were more variable, although rates in the Waikato and Taranaki increased after 2006–07. In contrast, asthma admissions in young people were more static in most DHBs (**Figure 65**).

Midland Region Distribution by Ethnicity

In the Waikato during 2000–2010, hospital admissions for asthma were higher for Pacific and Māori > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki asthma admissions were higher for Māori than for European children and young people (**Figure 66**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, while no consistent seasonal patterns were evident, asthma admissions in children and young people were generally lower in January (**Figure 67**).

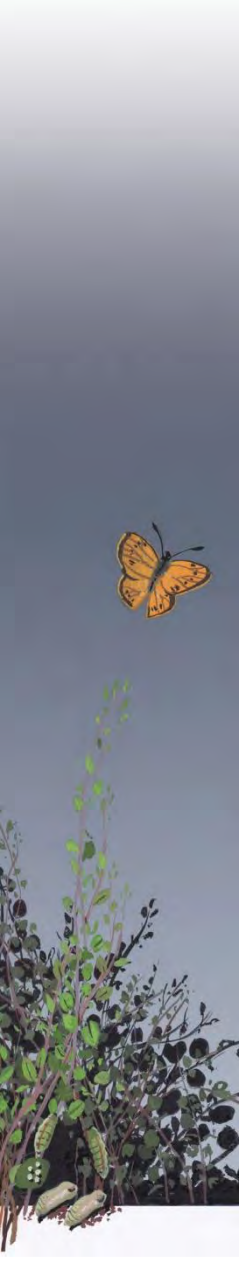
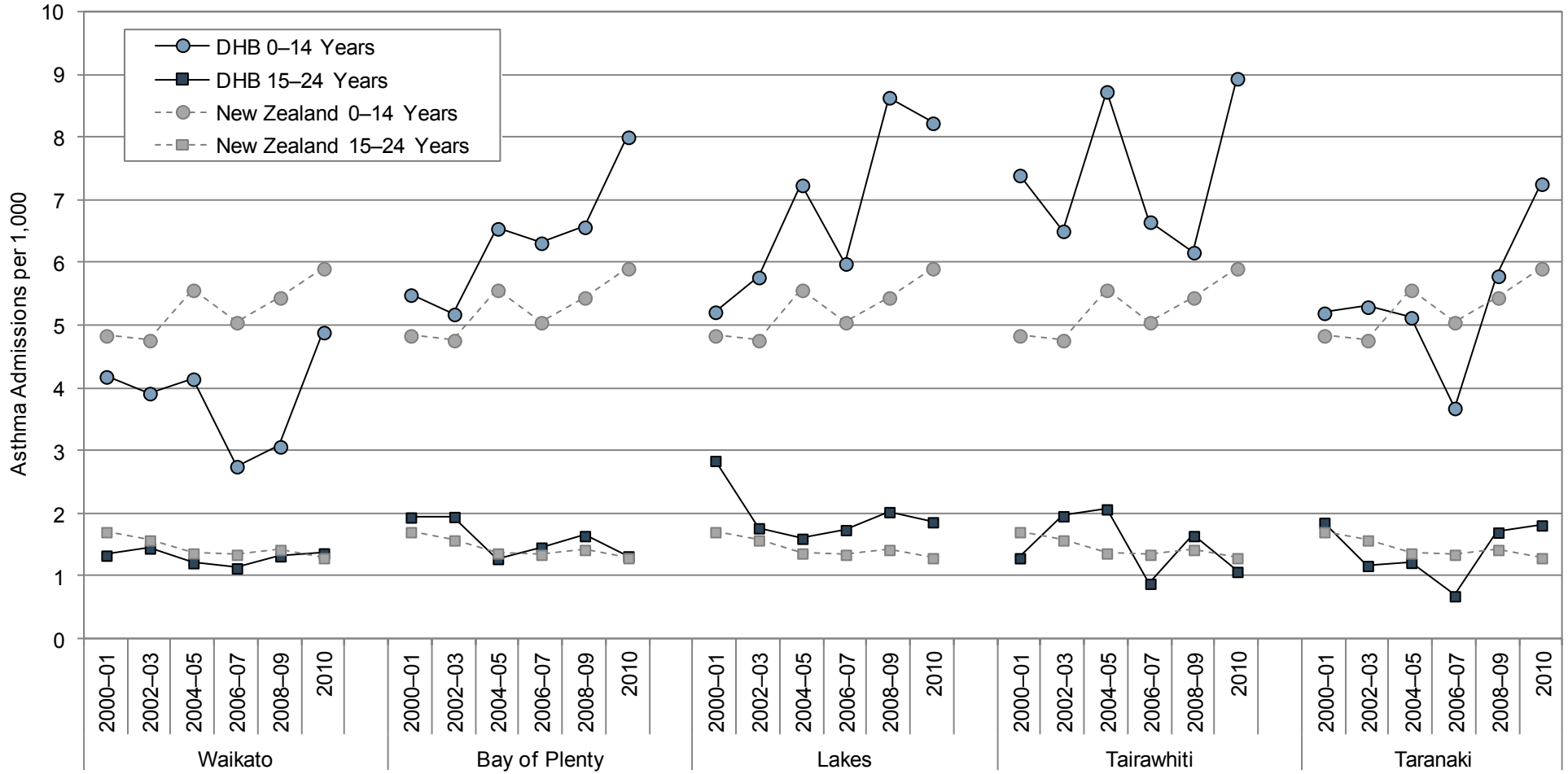
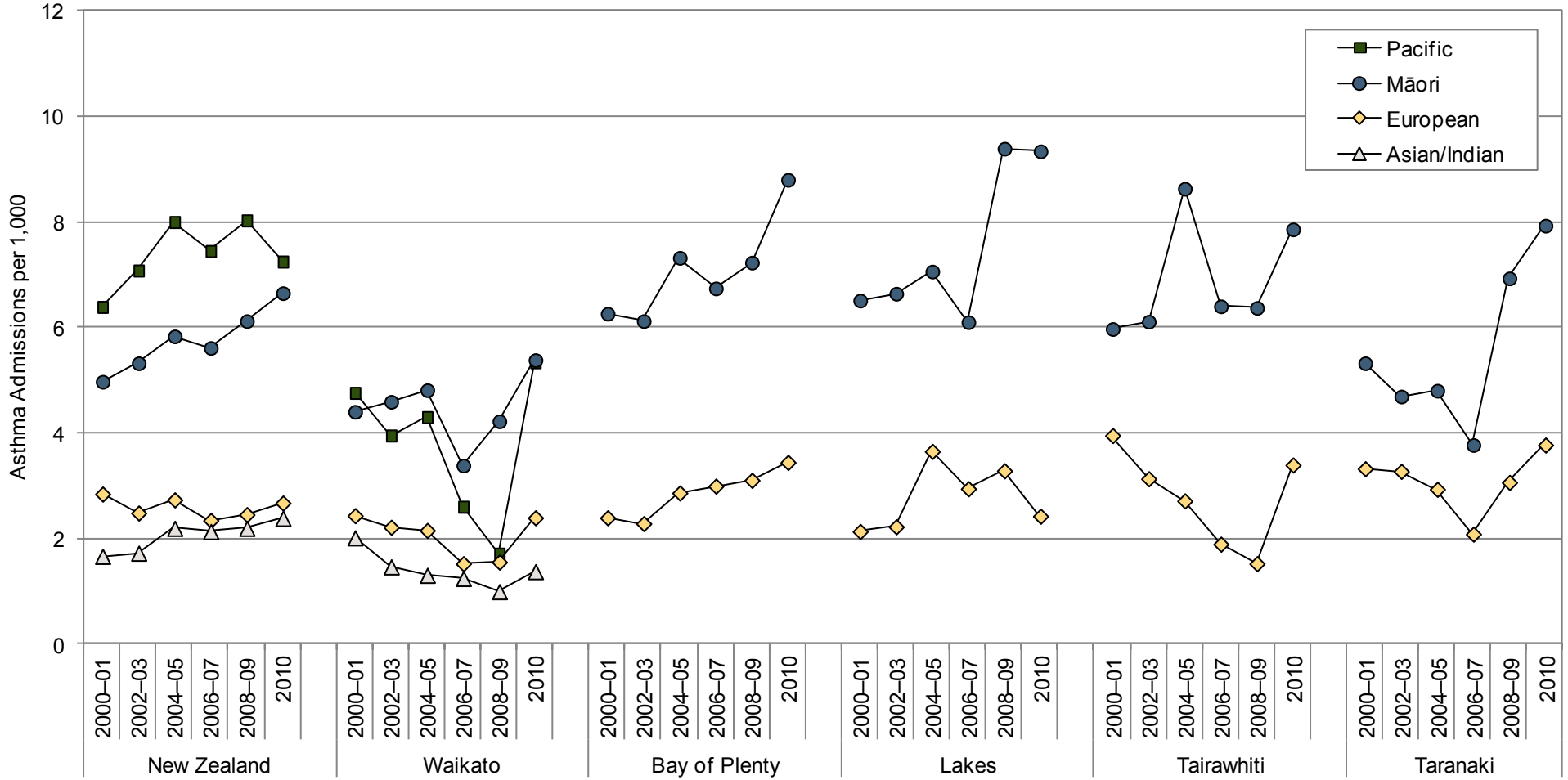


Figure 65. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



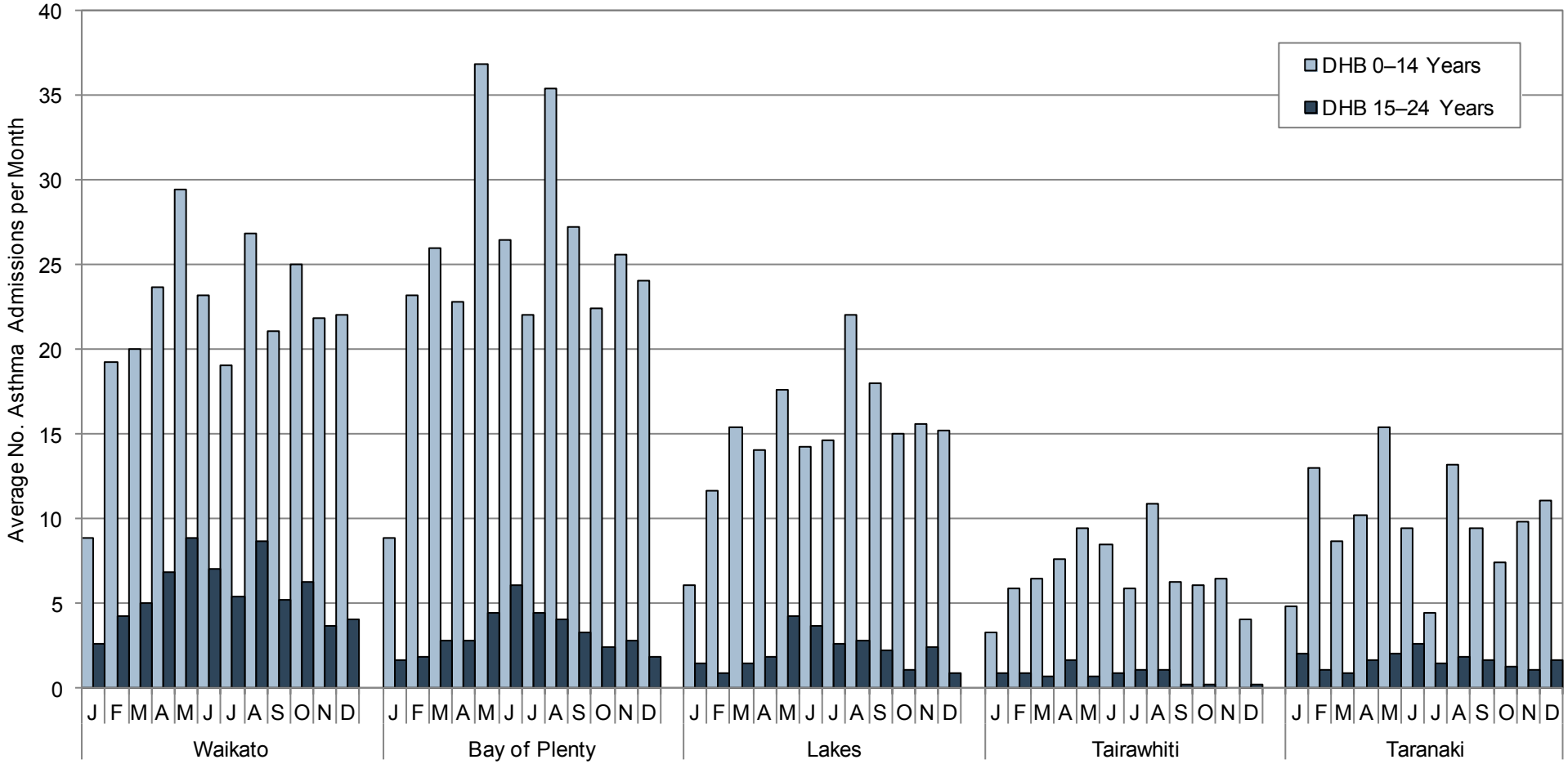
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 66. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People 0−24 Years by Ethnicity, Midland DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Ethnicity is Level 1 Prioritised.

Figure 67. Average Number of Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People 0−24 Years by Month, Midland DHBs 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Summary

In New Zealand during 2000–2010, asthma admissions in children gradually increased, while admissions in young people were more static after 2004–2005. On average during 2000–2008, five children or young people each year, died as the result of asthma. During 2006–2010, admissions were relatively infrequent during infancy but increased rapidly thereafter, reaching a peak at 2 years of age. In contrast, asthma deaths were most frequent amongst those in their late teens and early twenties. Asthma admissions in children were also *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those living in average-to-more deprived (NZDep decile 3–10) areas. In contrast, asthma admissions in young people were *significantly* higher for females, Pacific and Māori > European > Asian/Indian young people, and those in average-to-more deprived (NZDep decile 4–10) areas.

In the Bay of Plenty and Lakes during 2000–2010, asthma admissions in children increased. In the Waikato, Taranaki and Tairawhiti rates were more variable, although rates in the Waikato and Taranaki increased after 2006–07. In contrast, asthma admissions in young people were more static in most DHBs. In the Waikato, asthma admissions were higher for Pacific and Māori > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki asthma admissions were higher for Māori than for European children and young people. While no consistent seasonal patterns were evident, admissions in children and young people were generally lower in January.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Asthma

In New Zealand there are no policy documents which focus solely on the prevention of asthma in children and young people. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

A range of international publications also consider the most appropriate management of asthma in children and young people and these are considered in **Table 73**.

Table 73. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Asthma in Children and Young People

Ministry of Health Policy Documents
In New Zealand there are no Government policy documents which focus solely on the prevention of asthma, although population approaches to asthma are discussed on pages 86-93 of the **Child and Youth Health Toolkit**: http://www.moh.govt.nz/moh.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf .
International Guidelines
Cincinnati Children's Hospital Medical Center. 2010. **Evidence-based care guideline for management of acute asthma exacerbation in children**. Cincinnati Children's Hospital Medical Center. http://www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/6318985e-a921-4d93-95b7-33b6a827f9a5.pdf These guidelines focus primarily on the management of an acute exacerbation of asthma in emergency department and inpatient settings. All of the recommendations in the guidelines are accompanied by references to the literature but there is no grading of the evidence.

Global Initiative for Asthma (GINA). 2009. **Global Strategy for the Diagnosis and Management of Asthma in Children 5 Years and Younger**. Global Initiative for Asthma (GINA). http://www.ginasthma.org/uploads/users/files/GINA_Under5_2009_CorxAug11.pdf

This is a relatively brief and prescriptive evidence-based guideline from the Global Initiative for Asthma (GINA). Statements in the guideline are accompanied references to the relevant literature and by a letter grade indicating the quality of the evidence on which they are based however the research evidence is not discussed.

British Thoracic Society, Scottish Intercollegiate Guidelines Network. 2008, revised 2011. **British Guideline on the Management of Asthma: A national clinical guideline**. London, Edinburgh: British Thoracic Society, Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign101.pdf

These comprehensive, evidence-based guidelines cover diagnosis, non-pharmacological and pharmacological management, inhaler devices, management of acute asthma in people of various ages including children under and over the age of two, special situations, organisation and delivery of care and audit, and patient education and self-management. Statements summarising the literature are accompanied by a grade indicating the quality of the evidence (Grade1 = meta-analysis of RCTs, 2 = case-control or cohort studies, 3 = case reports/case series, 4 = expert opinion.) Recommendations in the guideline are accompanied by a grade (A-D) indicating the strength of the evidence on which they are based.

National Heart Lung and Blood Institute, National Asthma Education and Prevention Program. 2007. **Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma**. U.S. Department of Health and Human Services, National Institutes of Health, National Heart, Lung and Blood Institute. http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

These very comprehensive guidelines are endorsed by the American Academy of Pediatrics. The guidelines are organised around the four components that the expert panel considered essential for effective asthma management: measures of assessment and monitoring, education for a patient-clinician partnership, control of the environmental factors and comorbid conditions that affect asthma, and pharmacologic therapy. Section four deals with asthma in particular age groups. Recommendations in the guidelines are accompanied by a letter grade indicating the strength of the evidence on which they are based and an indication of how strongly the expert panel recommended (or not) the intervention in question (recommended, should be considered, may be considered, not recommended).The level of evidence is indicated according to the Jadad Scale (A= large, high quality RCTs, B= few, small RCTs, non-typical population, C = non randomised trials and observational studies, D= expert opinion).

National Asthma Council Australia. 2006. **Asthma Management Handbook 2006** Melbourne: National Asthma Council Australia. http://www.nationalasthma.org.au/uploads/handbook/370-amh2006_web_5.pdf

This Australian handbook is primarily for the use of GPs but also can be used by asthma educators, community pharmacists, nurses, ambulance officers and others. It is based on the GINA, British Thoracic Society and New Zealand guidelines and uses the Australian NHMRC levels of evidence classification.

Paediatric Society of New Zealand. 2005. **Best Practice Evidence-Based Guideline: Management of Asthma in Children aged 1-15 years**. Paediatric Society of New Zealand. http://www.paediatrics.org.nz/files/guidelines/Asthmaendorsed.pdf

These guidelines were adapted from the paediatric sections of the 2002 asthma guideline produced by the British Thoracic Society and Scottish Intercollegiate Guidelines Network. They take account of the particular needs of Māori and Pacific children and the availability and funding of pharmaceutical products here.

Systematic and Other Reviews From the International Literature

There are now hundreds of Cochrane reviews relating to asthma in children and therefore it is not possible to summarise them all in this report. The Cochrane reviews that are included here meet the following criteria:

1. They relate to a non-pharmaceutical intervention for which there is evidence of effectiveness from RCTs, and
2. They consider an intervention that has potential at a population level to either prevent asthma or reduce asthma exacerbations and hospital admissions.

At the end of this section is a list some of the (mostly) non-pharmaceutical interventions that have been the subject of Cochrane reviews and have been found to be either ineffective or lacking evidence for their effectiveness or otherwise.

National Institute for Health and Clinical Excellence. 2010. **Omalizumab for the treatment of severe persistent allergic asthma in children aged 6 to 11 years**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/13256/51345/51345.pdf

Omalizumab (Xolair®) is a monoclonal antibody that binds to immunoglobulin E (IgE) used in the treatment of severe and persistent allergic asthma. The appraisal committee concluded that, in children aged 6 to 11 years with severe persistent allergic asthma, Omalizumab in addition to optimised standard care is more clinically effective than optimised standard care alone in terms of reducing clinically significant exacerbations only if a child has experienced three or more clinically significant exacerbations in the previous year. In these cases the committee considered that the most plausible incremental cost effectiveness ratio was £82,600 per QALY gained, which the committee noted was substantially higher than is normally considered to be a cost-effective use of NHS resources. For this reason the committee concluded that Omalizumab could not be recommended for the treatment of severe persistent allergic asthma in children aged 6 to 11 years.

Abramson MJ, Puy RM, Weiner JM. 2010. **Injection allergen immunotherapy for asthma**. Cochrane Database of Systematic Reviews, 2010(8), Art. No.: CD001186. DOI: 10.1002/14651858.CD001186.pub2.

The use of allergen specific immunotherapy is a controversial treatment for asthma because although RCTs have demonstrated that it can be beneficial there is a slight risk of severe anaphylaxis which may be fatal. In recent years new methods of allergen delivery and new allergen preparations have become available. This updated review included 88 RCTs (13 of which were new since the previous Cochrane review on this topic). Numbers of trials for the various allergens were: house dust mite 42, pollen 27, animal dander 10, *Cladosporium* mould 2, latex 6 and multiple allergens 6. Overall, immunotherapy produced significant improvement in asthma symptom scores (standardised mean difference* -0.59, 95% CI -0.83 to -0.35) with a number needed to treat (NNT) to prevent one person experiencing deterioration in asthma symptoms of 4 (95% CI 3–5). Overall Immunotherapy also produced a significant reduction in medication scores (SMD -0.53, 95% CI -0.80 to -0.27) with a NNT to prevent one person requiring increased medication of 5 (95% CI 4–7). It produced a significant reduction in allergen-specific bronchial hyper-reactivity and some reduction in non-specific bronchial hyper-reactivity. It had no consistent effect on lung function. For every nine patients treated with immunotherapy one would be expected to develop a systemic reaction (usually wheezing or rash but rarely anaphylaxis) and for every 16 patients treated with immunotherapy one would be expected to develop a local adverse reaction (e.g. swelling at the injection site). *Note: the standardised mean difference (SMD) is a technical term with a somewhat complicated definition but, in very general terms, larger (more negative) values of SMD usually indicate more effective interventions. SMDs allow comparisons between interventions whose outcomes that have been measured in different ways or in different units.

Bailey EJ, Cates CJ, Kruske SG, et al. 2009. **Culture-specific programs for children and adults from minority groups who have asthma**. Cochrane Database of Systematic Reviews, 2009(2), Issue 2. Art. No.: CD006580. DOI:10.1002/14651858.CD006580.pub4.

This review aimed to determine whether culture-specific asthma programmes produced better outcomes than regular asthma programmes for children and adults with asthma who belong to minority groups. The review included four RCTs: two in the U.S. with Hispanic and/or African American children, one with Indian children in the U.K. and one with island Puerto Rican children. In total results for 617 participants aged from five to 59 years were pooled in a meta-analysis. Compared to regular asthma programmes, culturally specific programmes improved asthma-related quality of life in adults, improved asthma knowledge scores in children, and in a single study, reduced asthma exacerbations in children (risk ratio for hospitalisations 0.32, 95%CI 0.15–0.70). The authors concluded that the current limited data show that culturally specific asthma programs improve some, but not all asthma outcomes.

Boyd M, Lasserson TJ, McKean MC, et al. 2009. **Interventions for educating children who are at risk of asthma-related emergency department attendance**. Cochrane Database of Systematic Reviews, 2009(2), Art. No.: CD001290.DOI: 10.1002/14651858.CD001290.pub2.

This review considered 38 RCTs or quasi-RCTs (7843 children in total) of asthma education interventions for children who had attended the emergency department for exacerbations of asthma. Compared to control situations educational interventions aimed at the children, their parents, or both significantly reduced the risk of future emergency department visits (RR 0.73, 95% CI 0.65 to 0.81, n = 3008) and the risk of hospital admissions (RR 0.79, 95% CI 0.69 to 0.92, n = 4019) and also the numbers of unscheduled doctor visits (RR 0.68, 95% CI 0.57 to 0.81, n = 1009). There was little data on other outcomes such as FEV_1, use of “rescue” medication, symptoms or quality of life. The review authors state that it is unclear what types of educational interventions are best for reducing use of acute medical care services.

Bhogal KS, Zemek RL, Ducharme F. 2006. **Written action plans for asthma in children**. Cochrane Database of Systematic Reviews, 2006(3), Art. No.: CD005306. DOI: 10.1002/14651858.CD005306.pub2.

Asthma guidelines all recommend written asthma plans (WAPs) which consist of instructions for the management of chronic symptoms and also for the prevention and management of exacerbations. This review included four trials (3 RCTs and one quasi-RCT, 355 children in total) which compared symptom-based WAPs and peak flow-based WAPs. Children using symptom-based WAPs had a lower risk of exacerbation requiring an acute care visit (5 comparisons, RR 0.73, 95% CI 0.55–0.99). Five children would need to use a symptom based plan rather than a peak flow plan to prevent one acute care visit (NNT = 5, 95% CI 5–138). Children preferred symptom monitoring to using a peak flow meter (2 comparisons, RR 1.21, 95% CI 1.00 to 1.46), but parents did not have a preference (2 comparisons, RR 0.96, 95% CI 0.18 to 2.11). Children assigned to symptom based plans had 50% fewer symptomatic days per week (2 comparisons, mean difference 0.45 days/week, 95% CI 0.04–0.26). There were no significant differences between children using symptom based and those using peak flow based plans in rates of exacerbations requiring oral steroids or hospital admission, or in lung function, symptom score, school absenteeism, quality of life or withdrawals from the study. The review authors concluded that symptom based WAPs were superior to peak flow based WAPs for preventing acute care visits but they were unable to say whether this was due to greater adherence to symptom monitoring, earlier identification of deteriorations, higher thresholds for presenting to acute care, or the specific treatment recommendations in the plan.

National Institute for Health and Clinical Excellence. 2007. **Inhaled corticosteroids for the treatment of chronic asthma in children under the age of 12 years**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/11892/38421/38421.pdf

This technology appraisal provides guidance on the options for inhaled corticosteroid treatment in children with asthma. It discusses the various pharmaceutical products available, their costs and the available evidence on their effectiveness and cost-effectiveness. It states that when a child under the age of 12 years requires treatment with both inhaled corticosteroids and a long-acting beta-2 agonist the use of a combination inhaler is a recommended as an option, with the decision as to whether to use a combination inhaler or two separate inhalers being made on an individual basis taking into account therapeutic need and likely patient compliance.

Maas T, Kaper J, Sheikh A, et al. 2009. **Mono and multifaceted inhalant and/or food allergen reduction interventions for preventing asthma in children at high risk of developing asthma**. Cochrane Database of Systematic Reviews, 2009(3), Art. No.: CD006480. DOI: 10.1002/14651858.CD006480.pub2.
Content updated after new search for studies, republished with no change to conclusions in issue 4, 2011.

Monofaceted interventions consist of reducing exposure to either food or inhalant allergens and multifaceted interventions consist of reducing exposure to both food and inhalant allergens. This review included three multifaceted and six monofaceted intervention studies with a total of 3271 child participants. Children were recruited into the studies at or before birth. Allergen reduction measures started either prenatally or at birth and continued through postnatal life for at least four months. The children were followed up later in life to see whether or not they had developed asthma. Compared to usual care, multifaceted interventions reduced the number of children who were diagnosed with asthma by a physician at less than five years of age (OR 0.72, 95% CI 0.54 – 0.96) and the number of children older than five years who were diagnosed with asthma as defined by respiratory symptoms and lung function criteria (OR 0.52, 95% CI 0.32 – 0.85). There were no significant differences in the proportions of children who developed asthma between the monofaceted intervention groups and the control groups in under-five or over five year old children.

Indirect comparison between multifaceted and monofaceted interventions did not indicate a significant difference between the two in either age group in reducing the frequency of asthma diagnoses or the likelihood of nocturnal coughing at follow up. There was a difference between the multifaceted and the monofaceted interventions in parent-reported wheezing however this difference disappeared in the sensitivity analysis when data on study participants on-treatment only was analysed (instead of data on study participants who it was intended to treat). The most significant of the authors' conclusions was "In children who are at risk of developing childhood asthma, multifaceted interventions, characterised by dietary allergen reduction and environmental remediation, reduce the odds of a physician diagnosis of asthma later in childhood by half. This translates to a number needed to treat (NNT) of 17."

National Institute for Clinical Excellence. 2002. **Inhaler devices for routine treatment of chronic asthma in older children (aged 5–15 years)**. London: National Institute for Clinical Excellence.
http://www.nice.org.uk/nicemedia/live/11450/32338/32338.pdf

This technology appraisal provides guidance on the use of inhalers in children between five and twelve who have chronic asthma. It recommends a press-and-breathe pressurised metered dose inhaler with a suitable spacer device as the first choice for the delivery of inhaled corticosteroids. There is a discussion of important issues relating to inhaler use such as inhaler technique, adherence to treatment and individual capabilities, lifestyles and preferences. There is also a report of the findings of a systematic review which considered the evidence on clinical effectiveness, ease of use, preference, compliance, and cost effectiveness of the various drugs and delivery systems.

Wolf F, Guevara JP, Grum CM, et al. 2002. **Educational interventions for asthma in children**. Cochrane Database of Systematic Reviews, 2002(4), Issue 4. Art. No.: CD000326. DOI: 10.1002/14651858.CD000326.

This review included 32 studies (RCTs and CCTs, 3706 participants) assessing educational self-management programmes for children and adolescents aged two to18 years. Such programmes produced a modest improvement in measures of airflow and modest improvements in days absent from school, days of restricted activity and emergency room visits and possibly asthma-disturbed sleep nights. Education was most beneficial (for most outcomes) for children with more severe asthma. The authors were not able to say which type of educational intervention is best because of the difficulty of making direct comparisons between the studies.

National Institute for Clinical Excellence. 2000. **Guidance on the use of inhaler systems (devices) in children under the age of 5 years with chronic asthma**. London: National Institute for Clinical Excellence.
http://www.nice.org.uk/nicemedia/live/11400/32073/32073.pdf

This technology appraisal provides guidance on the use of inhalers in children under the age of five who have chronic asthma. It states that the first choice option should be a pressurised metered dose inhaler and spacer system, with a facemask if necessary. If this is not effective then nebulised therapy or, in children aged 3 to five years, a dry powder inhaler may be considered depending on the child's condition. There is a discussion of the available evidence on the relative effectiveness of the various devices.

Interventions that have been the subject of **Cochrane Reviews** but have been found to be either ineffective, marginally effective, or lacking evidence for their effectiveness or otherwise include: Written individualised management plans, Tele-healthcare, Acupuncture, Indigenous healthcare workers, Influenza vaccines, Family therapy, Pneumococcal vaccine, Vitamin C, Alexander technique, Ionisers, Psychological interventions, Parent-initiated corticosteroid therapy, Humidity control, Physical training, Tailored interventions based on sputum eosinophils or exhaled nitric oxide, Homeopathy, Pet allergen control measures, Primary care based clinics, House dust mite control measures, Feather vs. non-feather bedding, Herbal remedies, Tartrazine avoidance and Selenium supplementation.

Other Relevant Publications

TMG Associates. 2009. **Literature Review Respiratory Health for Māori**. Wellington: The Asthma and Respiratory Foundation of New Zealand (Inc.). http://www.asthmafoundation.org.nz/files/PDF-files/Combined_Literarture_Review_Asthma__Respiratory_Foundation_2009_TMG_associates_Ltd.pdf

Chapter 1 of this publication deals with asthma. It covers the epidemiology of asthma in Māori and discusses the research that has been done to understand and change the disproportionate burden of asthma experienced by Māori. Disparities exist in exposure to tobacco smoke, use of preventer medication and access to primary health care and, although there is little evidence of successful interventions to reduce the burden of asthma in Māori, reducing these disparities are likely to be of considerable benefit. Partnership with Māori is crucial for health care providers achieving better outcomes.

The Asthma and Respiratory Foundation of New Zealand, Innes Asher and Cass Byrnes, editors. 2006. **Trying to Catch our Breath: The burden of preventable breathing disorders in children and young people**. Wellington: The Asthma and Respiratory Foundation of New Zealand. http://www.asthmanz.co.nz/files/PDF-files/Burden_FullDocument.pdf

Chapter 13 of this publication deals specifically with asthma. It discusses ISAAC (The International Study of Asthma and Allergies in Childhood) which New Zealand is part of, hospital admission rates, medication use, and the economic costs associated with asthma. Recommendations for improving care for children with asthma include: reducing financial and geographic barriers to accessing health care, reducing financial barriers to accessing pharmaceuticals, improving housing, reducing exposure to smoking and air pollution, specific DHB strategies for Māori and Pacific children and children in rural and remote areas, and implementing the Paediatric Society's best practice guideline.

Holt Shaun, Beasley Richard. 2002. **The Burden of Asthma in New Zealand**. Wellington: Asthma and Respiratory Foundation of New Zealand (Inc.) and Medical Research Institute of New Zealand. http://www.asthmafoundation.org.nz/files/PDF-files/burdenfull.pdf

This report provides a comprehensive picture of asthma in New Zealand under the headings of prevalence, morbidity, mortality and economic burden. The Asthma and Respiratory Foundation recommends removing financial and other barriers to accessing primary care and asthma medications and an integrated approach to asthma management which includes diagnosis, assessment of severity, provision of asthma education and written asthma management plans and regular reviews of asthma control and medications.

BRONCHIECTASIS

Introduction

The term bronchiectasis is derived from two Greek words literally meaning 'stretching of the windpipe'. Bronchiectasis is characterised by abnormal dilation and distortion of the bronchial tree and is the end result of a number of conditions which lead to difficulty clearing secretions, recurrent infections and a vicious circle of infection and inflammation producing airway injury and remodelling [138].

Bronchiectasis is usually a progressive disease, and typically results in a persistent wet cough with purulent sputum (in older children, as younger children tend not to expectorate the sputum) and recurrent infectious exacerbations. Children with extensive bronchiectasis often have reduced exercise capacity, chest wall deformity, finger clubbing and persistent coarse crackles on examination and they may have slower growth. The disease results in significant morbidity, lost schooldays and parental absences from work [139]. Extensive disease may also produce effects beyond the respiratory system, including cardiac and psychological effects, and may lead to respiratory failure and premature death [140].

The incidence of bronchiectasis in New Zealand children is considerably higher than that reported for Finland or the United Kingdom [141,142,143]. By their 15th birthday 1 in 1700 New Zealand children will have been diagnosed with bronchiectasis. Compared to European children, the incidence in Māori children is three times higher and the incidence in Pacific children is 12 times higher [144]. Bronchiectasis also shows a marked socio-economic gradient, with one Auckland study finding that 67% of affected children were living in NZDep deciles 8–10 (the most deprived 30% of areas) and that this percentage had not changed significantly over time [141]. The same study also found that in Auckland between 2000 and 2008, the number of children with bronchiectasis under active review had increased 280%, although it was unclear whether this was due to increased recognition (e.g. as a result of the increased use of high resolution CT) or a true increase in the burden of disease. Further, despite recent advances in diagnosis, the study found that the aetiology of bronchiectasis was often unclear, with 45% of cases in this study being of unknown aetiology, 23% being post-infectious, 9% being due to primary immunodeficiency and 11% being due to post-oncology disease [141].

The following section explores bronchiectasis rates in children and young people using information from the National Minimum Dataset and Mortality Collection. It concludes with a brief overview of evidence-based review documents and guidelines which consider the prevention or management of bronchiectasis in children and young people.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Children and Young People Aged 0–24 Years with (non-Cystic Fibrosis) Bronchiectasis listed in any of their first 15 diagnoses.*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with Bronchiectasis (ICD-10-AM J47) in any of the first 15 diagnoses. Admissions with Cystic Fibrosis (ICD-10 E84) in any of the first 15 diagnoses were excluded.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

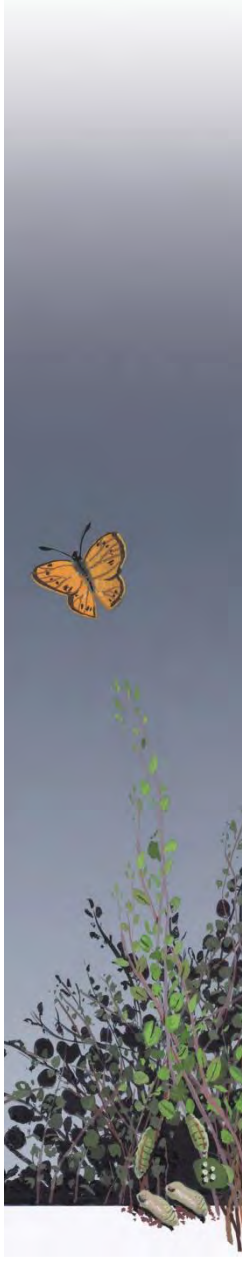
2. Mortality from (non-Cystic Fibrosis) Bronchiectasis in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Bronchiectasis (ICD-10-AM J47) and where Cystic Fibrosis (ICD-10-AM E84) was not listed as a contributory cause.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Unless otherwise specified, this analysis focuses on hospital admissions for children and young people with bronchiectasis listed in any of the first 15 diagnoses (rather than on the subset of admissions where bronchiectasis was listed only as the primary diagnosis). The rationale for this wider focus was the fact that



many children and young people with bronchiectasis will not be hospitalised for their bronchiectasis per se, but rather for one of its predisposing conditions or resulting complications. For example, during 2005–2009, only 55.4% of hospitalisations for children and young people with bronchiectasis had bronchiectasis listed as the primary diagnosis, with 11.5% having agranulocytosis or immune deficiencies listed as the primary diagnosis, and a further 19.8% having pneumonia and/or other diseases of the respiratory system listed as the primary reason for admission [145].

Note 2: Because children and young people with cystic fibrosis usually develop bronchiectasis over time, and because the epidemiology of cystic fibrosis and non-cystic fibrosis bronchiectasis differ, admissions where cystic fibrosis was mentioned in any of the first 15 diagnoses have been excluded from this analysis.

Note 3: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 4: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

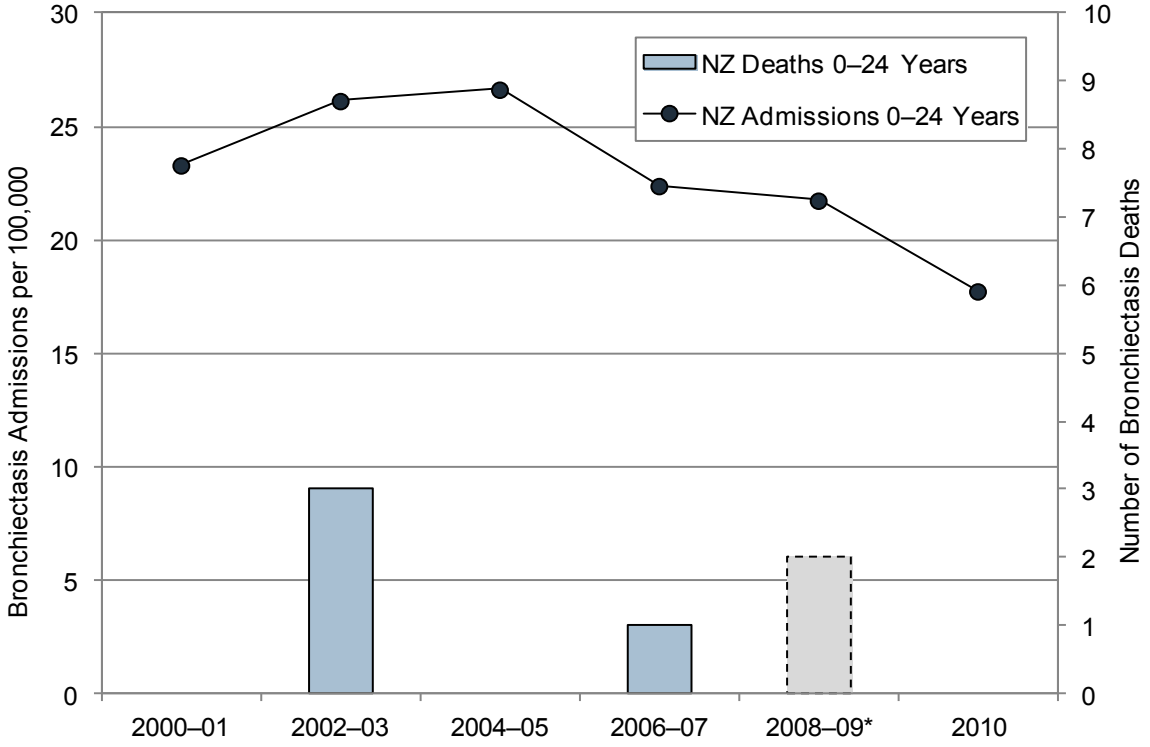
Note 5: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for children and young people with bronchiectasis increased during the early 2000s, reached a peak in 2004–05 and then declined. During 2000–2008, a total of six New Zealand children or young people had bronchiectasis listed as their main underlying cause of death (**Figure 68**).

Figure 68. Acute and Semi-Acute Hospital Admissions (2000–2010) and Deaths (2000–2008) for New Zealand Children and Young People Aged 0–24 Years with Bronchiectasis

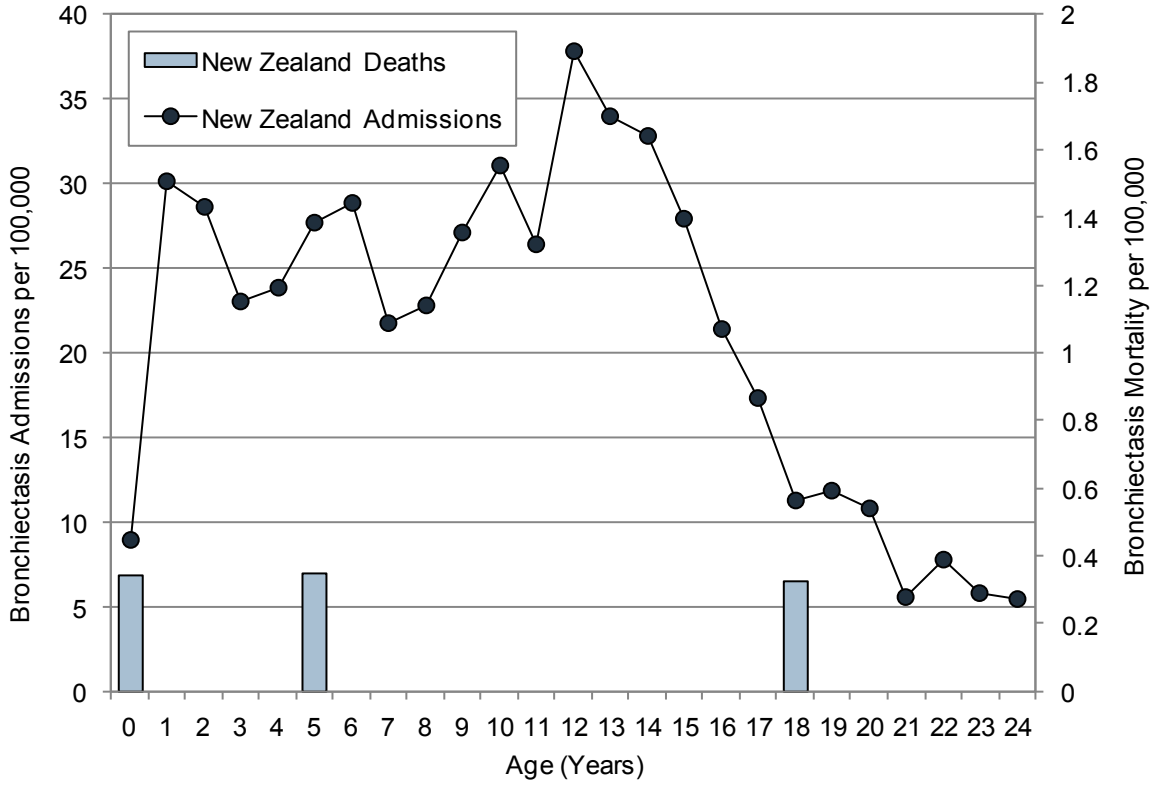


Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection (bronchiectasis listed in any of first 15 diagnoses, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population. *Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

New Zealand Distribution by Age

In New Zealand during 2006–2010, hospital admissions for children and young people with bronchiectasis increased rapidly after the first year of life, with rates remaining elevated during childhood, but dropping away amongst those in their teens and early twenties. No consistent age related patterns were evident however, for bronchiectasis deaths during 2004–2008 (**Figure 69**).

Figure 69. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) for New Zealand Children and Young People with Bronchiectasis by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection (bronchiectasis listed in any of first 15 diagnoses, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for children and young people with bronchiectasis were *significantly* higher for Pacific > Māori > Asian/Indian > European children and young people and those in average-to-more deprived (NZDep decile 3–10) areas (**Table 74**). Similarly, during 2000–2010 hospital admissions were higher for Pacific > Māori > Asian/Indian and European children and young people, although admissions for Pacific children and young people declined rapidly during the mid-late 2000s (**Figure 70**).

New Zealand Distribution by Season

In New Zealand during 2006–2010, hospital admissions for children and young people with bronchiectasis were generally lower over the summer months (**Figure 71**).

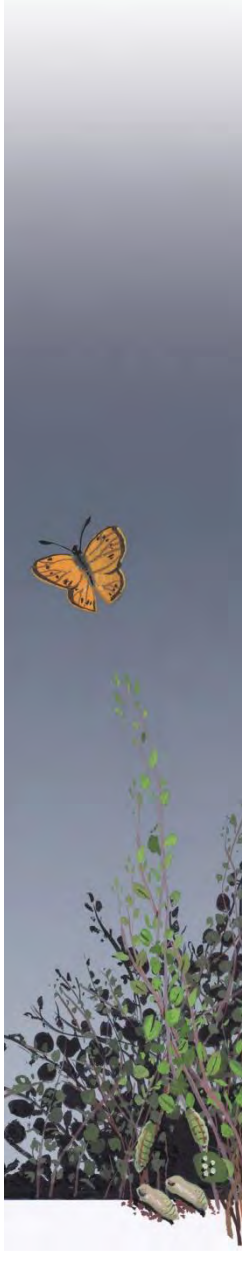
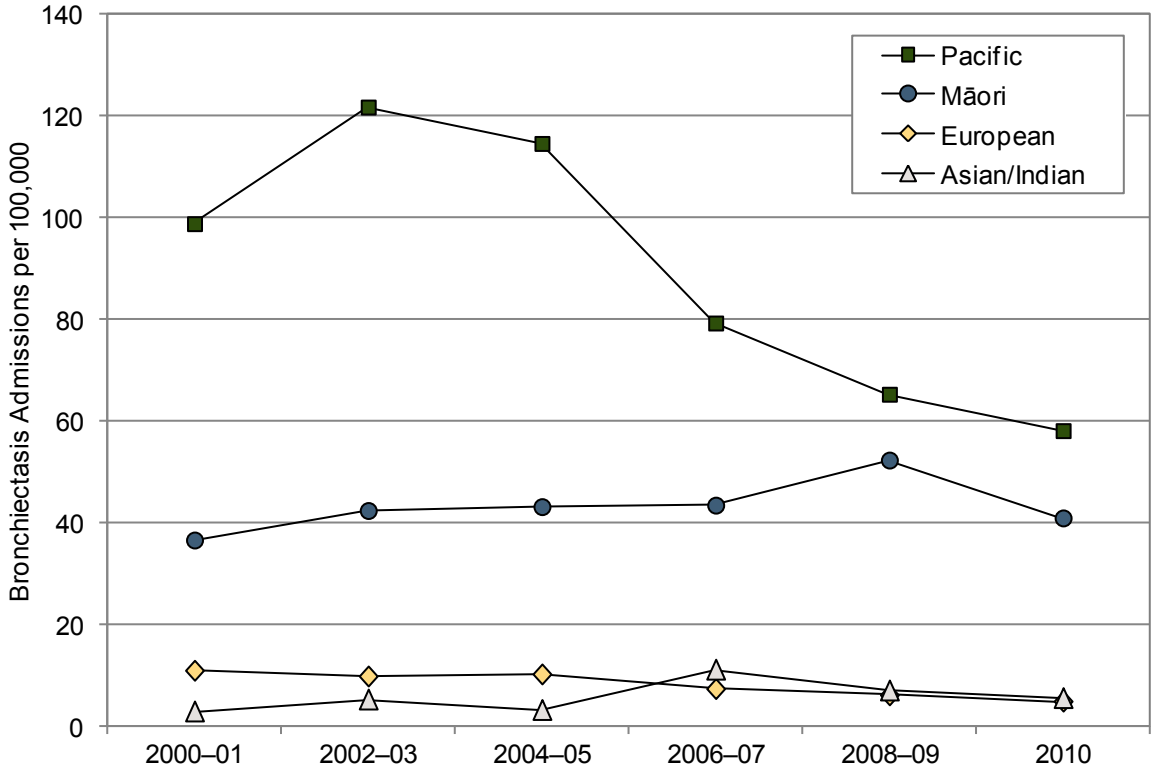


Figure 70. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0−24 Years with Bronchiectasis by Ethnicity, New Zealand 2000−2010



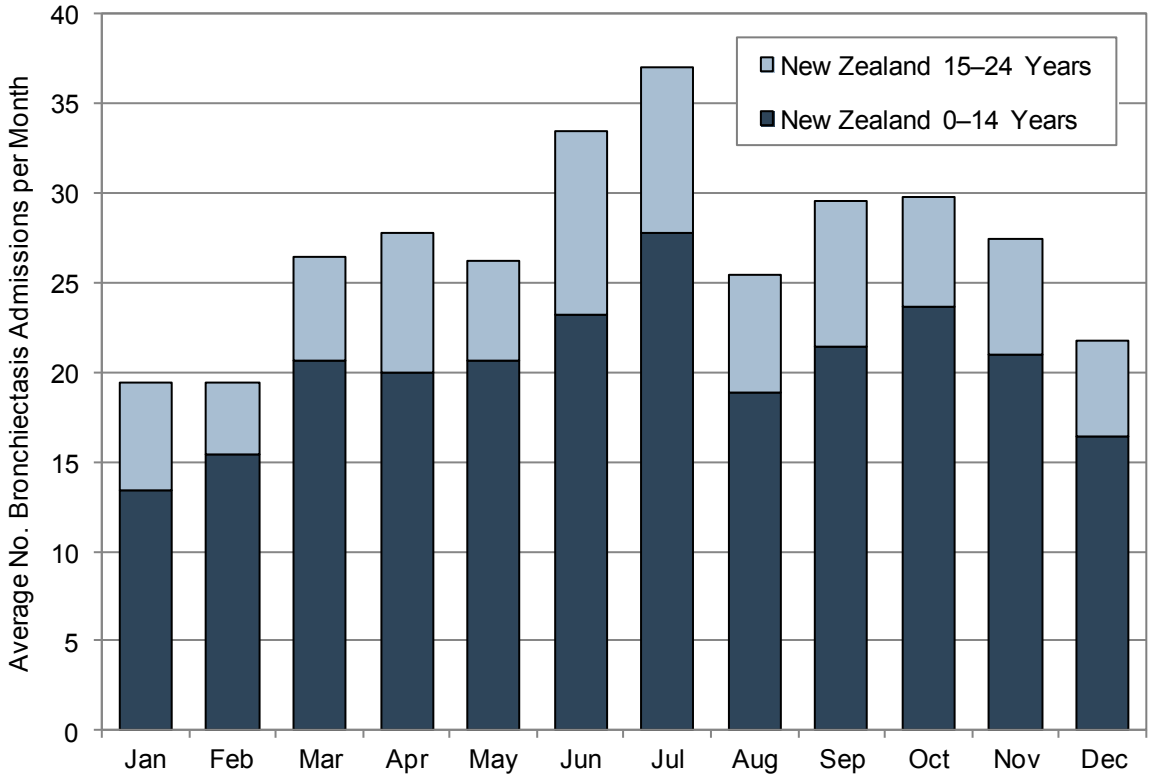
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised

Table 74. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0–24 Years with Bronchiectasis by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Bronchiectasis 0–24 Years							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	4.63	1.00		European	6.17	1.00	
Decile 3–4	6.46	1.40	1.02–1.92	Māori	46.4	7.51	6.53–8.63
Decile 5–6	15.3	3.30	2.50–4.36	Pacific	69.1	11.2	9.63–13.0
Decile 7–8	20.6	4.46	3.41–5.82	Asian/Indian	8.06	1.30	1.01–1.69
Decile 9–10	49.7	10.7	8.35–13.8				
Gender							
Female	20.7	1.00		Male	21.7	1.05	0.95–1.15

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 71. Average Number of Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0−24 Years with Bronchiectasis by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded))

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In Lakes during 2006–2010, hospital admissions for children and young people with bronchiectasis were *significantly* higher than the New Zealand rate, while in Taranaki and the Bay of Plenty admissions were *significantly* lower. Admission rates in the Waikato and Tairawhiti were not *significantly* different from the New Zealand rate (**Table 75**).

Table 75. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0–24 Years with Bronchiectasis, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Bronchiectasis 0–24 Years					
Waikato	127	25.4	19.2	0.91	0.76–1.09
Lakes	97	19.4	52.2	2.46	2.00–3.02
Bay of Plenty	47	9.4	13.5	0.64	0.48–0.85
Tairawhiti	16	3.2	17.9	0.84	0.52–1.38
Taranaki	18	3.6	9.90	0.47	0.29–0.74
New Zealand	1,618	323.6	21.2	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population

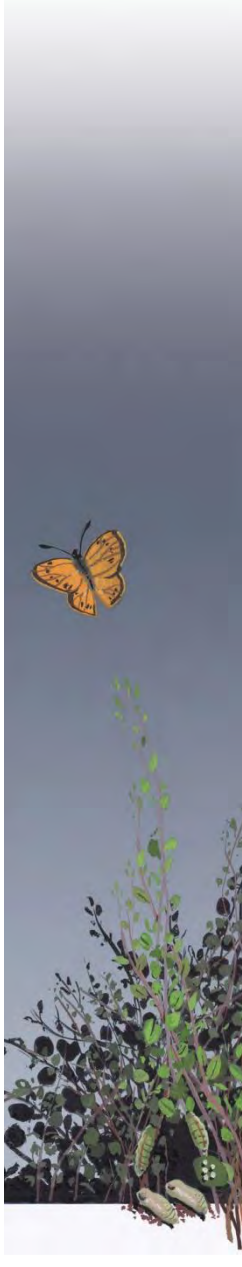
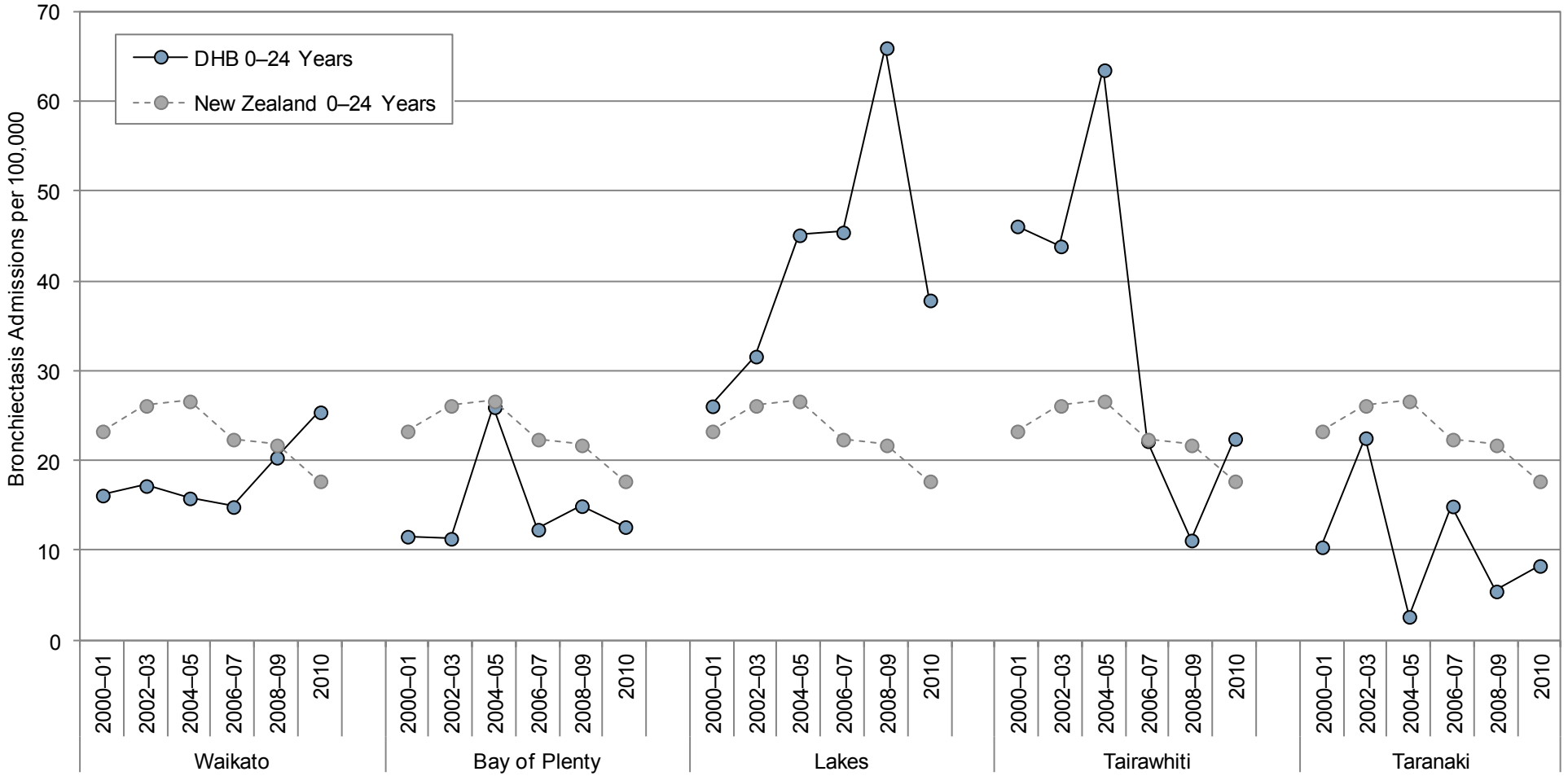


Figure 72. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0–24 Years with Bronchiectasis, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

In the Waikato during 2000–2010, hospital admissions for children and young people with bronchiectasis were relatively static during the early-mid 2000s, but increased after 2006–07. Large year to year variations in the other Midland DHBs (possibly as a result of small numbers) made trends more difficult to interpret, although rates in Lakes increased and rates in Tairawhiti decreased during the mid-2000s (**Figure 72**).

Summary

In New Zealand, hospital admissions for children and young people with bronchiectasis increased during the early 2000s, reached a peak in 2004–05 and then declined, with six children or young people having bronchiectasis listed as their main underlying cause of death during 2000–2008. During 2006–2010, admission rates increased rapidly after the first year of life, with rates remaining elevated during childhood, but dropping away amongst those in their teens and early twenties. Admissions were also *significantly* higher for Pacific > Māori > Asian/Indian > European children and young people and those in average-to-more deprived (NZDep decile 3–10) areas.

In the Waikato during 2000–2010, hospital admissions for children and young people with bronchiectasis were relatively static during the early-mid 2000s, but increased after 2006–07. Large year to year variations in the other Midland DHBs (possibly as a result of small numbers) made trends more difficult to interpret, although rates in Lakes increased and rates in Tairawhiti decreased during the mid-2000s. In Lakes during 2006–2010, admission rates were *significantly* higher than the New Zealand rate, while in Taranaki and the Bay of Plenty admissions were *significantly* lower. Admission rates in the Waikato and Tairawhiti were not *significantly* different from the New Zealand rate.

Evidence-Based Reviews Relevant to the Prevention and Management of Bronchiectasis

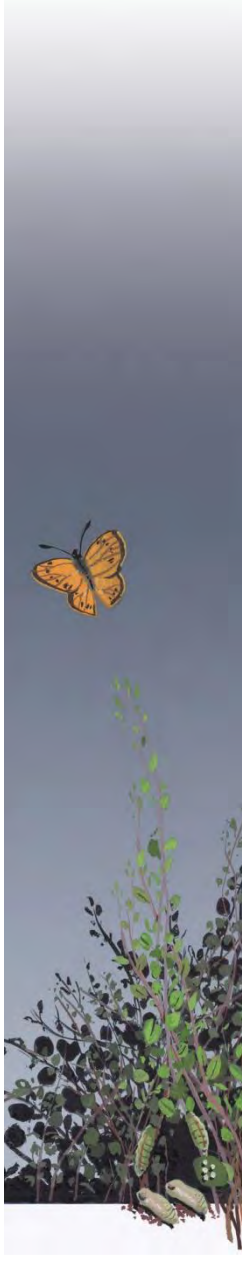
In New Zealand there are no policy documents which focus solely on the prevention of bronchiectasis in children and young people. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

A range of international reviews and guidelines also consider the prevention and management of bronchiectasis in children and young people and these are considered in **Table 76**.

Table 76. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Bronchiectasis

International Guidelines
Pasteur MC, Bilton D, Hill AT, et al. 2010. **British Thoracic Society guideline for non-CF bronchiectasis**. *Thorax* 65 Suppl 1 i1-58. http://thorax.bmj.com/content/65/Suppl_1/i1.full.pdf The aims of these British guidelines were 1) to identify relevant studies in non-cystic fibrosis bronchiectasis; 2) to provide management guidelines based on published studies where possible or a consensus view otherwise and 3) to identify gaps in the knowledge base and identify areas for future research. They cover causes, assessment and investigations, management and complications. The evidence levels for the papers cited and the grading system for recommendations follow the system developed by the Scottish Intercollegiate Guidelines Network (SIGN) and used in the British Thoracic Society (BTS)/SIGN British guideline on the management of asthma.



Chang AB, Bell SC, Byrnes CA, et al. 2010. **Chronic suppurative lung disease and bronchiectasis in children and adults in Australia and New Zealand A position statement from the Thoracic Society of Australia and New Zealand and the Australian Lung Foundation**. *Medical Journal of Australia* 193(6) 356-65. https://www.mja.com.au/public/issues/193_06_200910/cha10303_fm.pdf

These Australasian guidelines were produced as a result of a multidisciplinary workshop with the aims of 1) increasing awareness of chronic suppurative lung disease (CSLD) and bronchiectasis in adults and children, 2) promoting earlier diagnosis and improved management of these conditions and 3) presenting an Australian and New Zealand consensus on the management of these conditions. Recommendations are followed by an indication of the level of evidence and the strength of the recommendation (using the GRADE approach).The guidelines cover aetiology and investigations, management, and public health issues. The guidelines state that immunisations that prevent acute respiratory infections are recommended despite the lack of specific evidence for benefit with regard to bronchiectasis. The guidelines include a useful table summarising the evidence for the various possible interventions.

Rosen MJ. 2006. **Chronic cough due to bronchiectasis: ACCP evidence-based clinical practice guidelines**. *Chest* 129(1 Suppl) 122S-31S.

These concise American guidelines are based on a systematic review of the literature. Recommendations are followed by an indication of the evidence level, the degree of benefit and the grade of recommendation. They cover diagnosis, specific causes, and treatment.

Systematic and Other Reviews from the International Literature

Irons JY, Kenny DT, Chang AB. 2010. **Singing for children and adults with bronchiectasis**. Cochrane Database of Systematic Reviews 2010(2) Art. No.: CD007729. DOI: 10.1002/14651858.CD007729.pub2.

In their introduction, the authors state that a holistic approach is needed in the management of bronchiectasis and its negative effect on quality of life and that therapies involving breathing manoeuvres such as singing may improve both respiratory function and psychological well being. The authors were unable identify any RCTs assessing singing as a therapy for bronchiectasis and so were unable to draw any conclusions about its benefits or otherwise.

Chang CC, Singleton RJ, Morris PS, et al. 2009. **Pneumococcal vaccines for children and adults with bronchiectasis**. Cochrane Database of Systematic Reviews 2009(2) Art. No.: CD006316. DOI: 10.1002/14651858.CD006316.pub3.

The authors of this review identified one randomised controlled open label study in adults (167 participants) with chronic lung disease (bronchiectasis and other associated diseases) which compared 23-valent pneumococcal vaccine (PV) plus influenza vaccine with influenza vaccine alone. There was a significant reduction in acute respiratory exacerbations in the PV group compared to the control group, OR 0.48, 95% CI 0.26-0.88, number needed to treat for benefit=6, 95% CI 4-32, over two years. There was, however, no difference in episodes of pneumonia between the two groups and there was no data on pulmonary decline. One non-randomised Russian study reported that in 25 children with chronic lung disease (including bronchiectasis) who were vaccinated with PPV-23, a year after vaccination *Streptococcus pneumoniae* was isolated in monoculture from only 3 children. This suggests vaccination was beneficial but no clinical effect was described. The review authors concluded that there was limited evidence that the use of 23-valent pneumococcal vaccination was beneficial for adults with bronchiectasis and circumstantial evidence that it was beneficial for children. Due to the absence of evidence they recommend health providers adhere to national guidelines regarding how often the vaccine should be given.

French J, Bilton D, Campbell F. 2003. **Nurse specialist care for bronchiectasis**. Cochrane Database of Systematic Reviews 2003(1) Art. No.: CD004359. DOI: 10.1002/14651858.CD004359. Content updated after new search for studies (no change to conclusions), published in Issue 4, 2008.

This review assessed the effectiveness of nurse-led care in the management of bronchiectasis. The review included one randomised cross over trial (80 patients) which found no significant differences in clinical outcomes between nurse-led and doctor-led care in a specialist clinic setting but did find that nurse-treated participants used more healthcare resources (hospital admissions and intravenous antibiotics) in the first arm of the study. The review authors, who also conducted the study, concluded that long term studies are needed to determine whether changes in cost-effectiveness observed over time are due to learning by the nurses, changes in physician behaviour or a carry-over effect and that further studies in other settings including primary care are also needed.

Chang CC, Morris PS, Chang AB. 2007. **Influenza vaccine for children and adults with bronchiectasis.** Cochrane Database of Systematic Reviews 2007(3) Art. No.: CD006218. DOI: 10.1002/14651858.CD006218.pub2.

The authors of this review evaluated the effectiveness of routine influenza vaccination for adults and children with bronchiectasis in reducing the reducing the frequency and severity of respiratory exacerbations and in reducing pulmonary decline. They found that there was no evidence from RCTs for or against vaccination for these purposes but they state that a Cochrane review found that there was evidence that influenza vaccination for people with COPD was beneficial and, given the significant overlap between COPD and bronchiectasis, there is justification for recommending annual influenza vaccination for people with bronchiectasis whilst taking into account individual responses and the potential for adverse effects.

Bradley J, Moran F, Greenstone M. 2002. **Physical training for bronchiectasis**. Cochrane Database of Systematic Reviews 2002(2) Art. No.: CD002166. DOI: 10.1002/14651858.CD002166.

This review considered the effectiveness of a prescribed regime of physical training (compared to no physical training) for either producing improvements or reducing deterioration in physiological and clinical outcomes in people with bronchiectasis. Results from two randomised controlled studies (with a total of 52 participants) published in abstract form only showed that inspiratory muscle training (compared to sham or no training) improved endurance exercise capacity, maximum inspiratory pressure and quality of life. The authors concluded that the only type of physical training for which there was evidence of benefit was inspiratory muscle training.

In terms of the medical management of bronchiectasis, the following interventions have been the subject of **Cochrane Reviews**: Inhaled non-steroidal anti-inflammatories, short acting beta2-agonists, inhaled steroids, oral non-steroidal anti-inflammatories, mucolytics, short courses of antibiotics, anticholinergic therapy, inhaled hyperosmolar agents, long acting beta2 agonists, oral corticosteroids, oral methylxanthines, prolonged antibiotics, surgical treatment, leukotriene receptor antagonists and bronchial hygiene physical therapy.

Other Relevant Publications

The Asthma and Respiratory Foundation of New Zealand, Innes Asher and Cass Byrnes, editors. 2006. **Trying to Catch our Breath: The burden of preventable breathing disorders in children and young people**. Wellington: The Asthma and Respiratory Foundation of New Zealand. http://www.asthmanz.co.nz/files/PDF-files/Burden_FullDocument.pdf

Chapter 11 of this publication considers bronchiectasis. It notes that most children with bronchiectasis (80%) are Māori or Pacific children. Recommendations for prevention are: improvement in socio-economic conditions for the most deprived, reductions in overcrowding and smoking, and improvement in vaccination coverage. Recommendations for management are: increasing awareness among the public and general medical staff, early investigation of children with persistent (>6 weeks) productive or wet cough and improved management based on research.

INFECTIOUS DISEASES

PERTUSSIS

Introduction

Pertussis (whooping cough) is a highly contagious acute respiratory tract infection caused by the bacterium *Bordetella pertussis*. It is spread by aerosol droplets. Neither vaccination nor natural disease provides complete or lifelong immunity. "Classic" pertussis follows an incubation period of a few days to a few weeks and is recognised as having three stages: a catarrhal stage with a runny nose and sneezing (1-2 weeks), a paroxysmal stage (2-6 weeks) in which prolonged bursts of uninterrupted coughing are followed by a characteristic inspiratory whoop, and a convalescent stage (≥ 2 weeks). Young infants, who make up > 90% of the fatalities from pertussis, do not display the classic stages and apnoea and cyanosis may be the only signs of the disease initially. Young infants suspected of having pertussis need hospitalisation and the most severely affected can require intubation, drug-induced paralysis and ventilation [146]. In New Zealand morbidity from pertussis remains significant with hospitalisation rates being considerably higher than in other developed countries [147].

Routine pertussis vaccination began in New Zealand in 1960 and the current schedule recommends vaccination at 6 weeks, 3 months, and 5 months of age with booster doses at 4 years and 11 years [148]. The extra booster at 11 years was added to the schedule in 2006. Despite improvements in immunisation coverage epidemics of pertussis continue to occur, on average, every four years. This pattern is not significantly different from the pre-immunisation era, although rates of disease are less. Since pertussis became a notifiable disease in 1996, the proportion of notified cases aged ≥ 30 years has increased from 23% in 1997 to 54% in 2008. While this reflects what has occurred in other countries and is probably due to increased awareness and surveillance, it also indicates that infected adults are an important source of disease for infants.

In terms of reducing the burden of disease, besides improving coverage and timeliness of infant vaccination, which is the most important strategy, the Global Pertussis Initiative recommends universal preschool booster doses, universal adolescent immunisation, universal adult immunisation, selective immunisation of new mothers, family, and close contacts of newborns (the "cocoon strategy"), selective immunisation of healthcare workers, and selective immunisation of childcare workers [149,150].

The following section reviews pertussis rates in infants aged <1 year using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of policy and evidence-based review documents which consider interventions to reduce pertussis at the population level.

Data Sources and Methods

Indicator

1. *Acute and Semi-Acute Hospital Admissions for Pertussis in Infants Aged <1 Year*

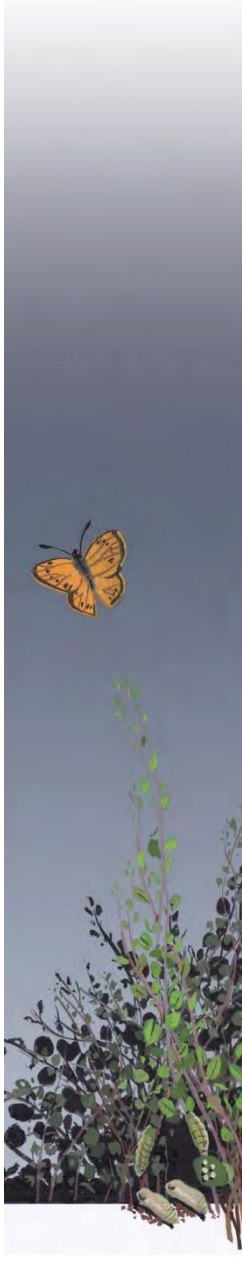
Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for infants aged <1 year with an ICD-10-AM primary diagnosis of Pertussis/Whooping Cough: Whooping cough due to *Bordetella pertussis* (A37.0); Whooping cough due to *Bordetella parapertussis* (A37.1); Whooping cough due to other *Bordetella* species (A37.8); Whooping cough, unspecified (A37.9).

Denominator: Birth Registration Dataset

2. Mortality from Pertussis in Infants Aged <1 Year

Numerator: National Mortality Collection: Deaths in Infants Aged <1 Year where the main underlying cause of death was Pertussis/Whooping Cough: Whooping cough due to *Bordetella pertussis* (A37.0); Whooping cough due to *Bordetella parapertussis* (A37.1); Whooping cough due to other *Bordetella* species (A37.8); Whooping cough, unspecified (A37.9).

Denominator: Birth Registration Dataset



Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

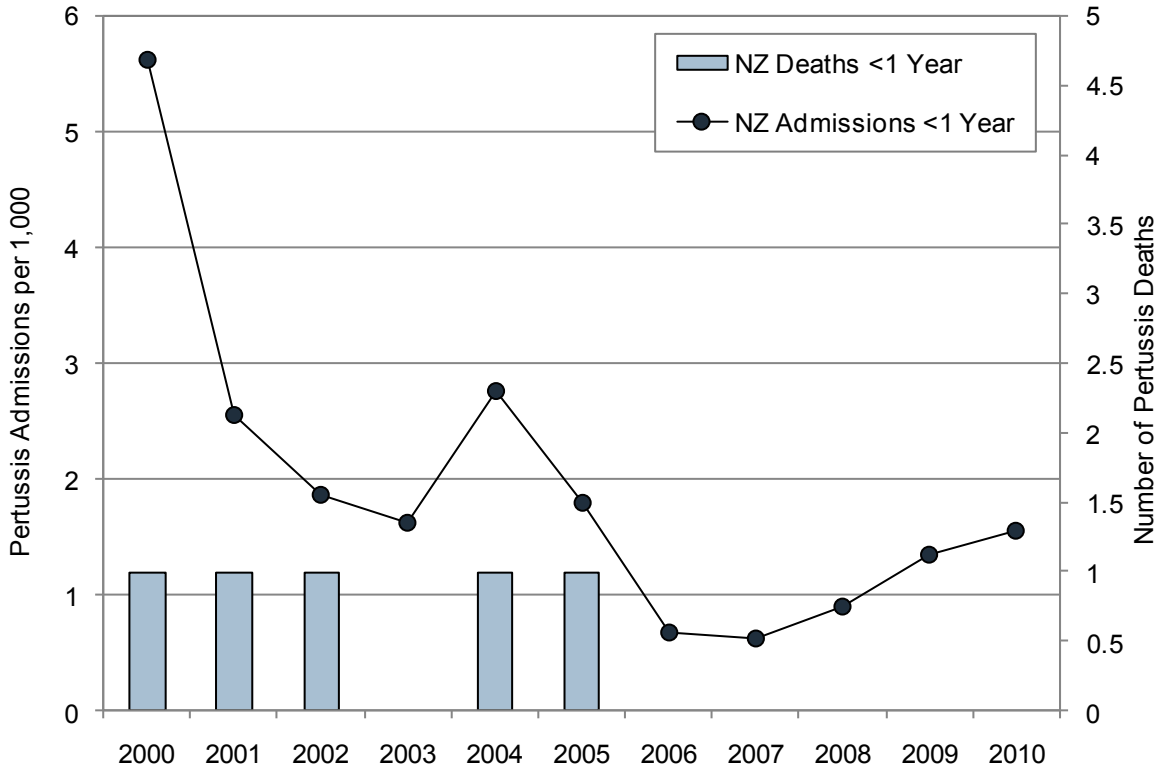
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for pertussis in infants fluctuated, with peaks occurring in 2000 and 2004. Admission rates reached their lowest point in 2007, with rates increasing gradually thereafter. In addition, during the early-mid 2000s one infant each year died from pertussis, although no pertussis deaths occurred during 2006–2008 (**Figure 73**). (Note: The rates seen in 2000 represent the tip of a peak, with the rates immediately prior to this being much lower. Thus rates during this period reflect a series of episodic peaks, rather than an overall downward trend.)

Figure 73. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Pertussis in New Zealand Infants <1 Year

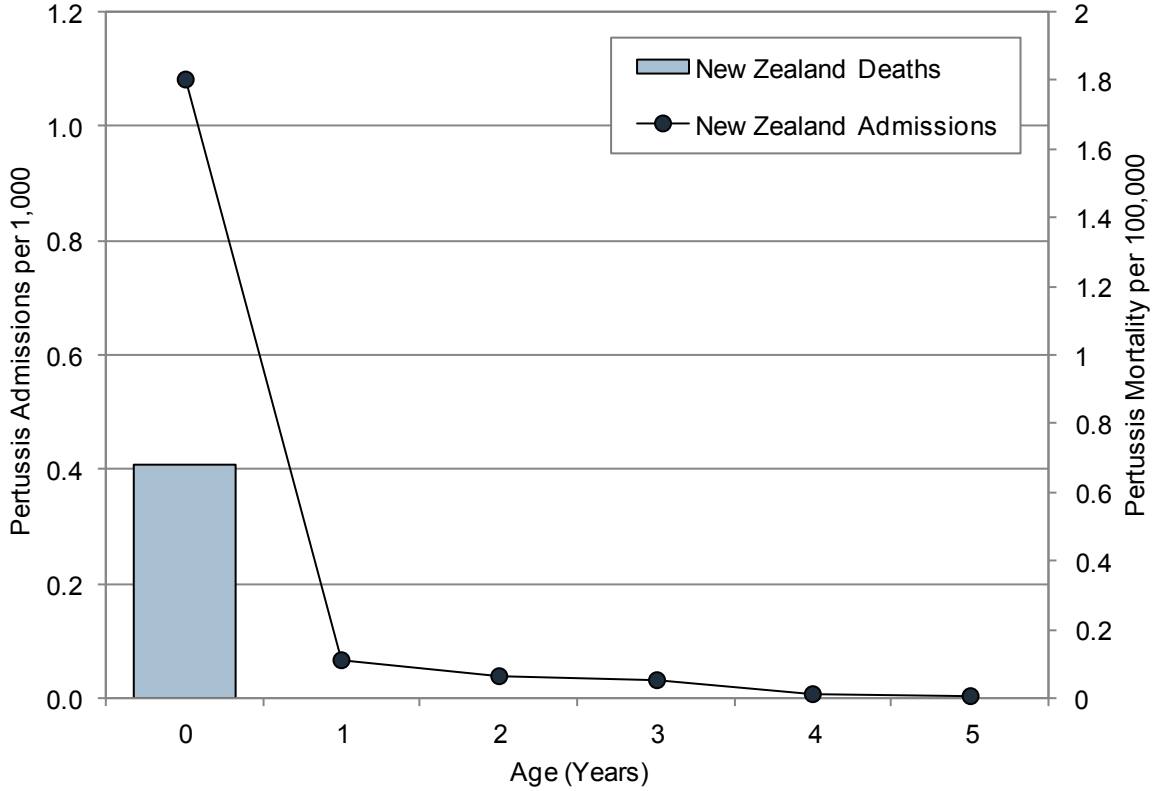


Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Birth Registration Dataset

New Zealand Distribution by Age

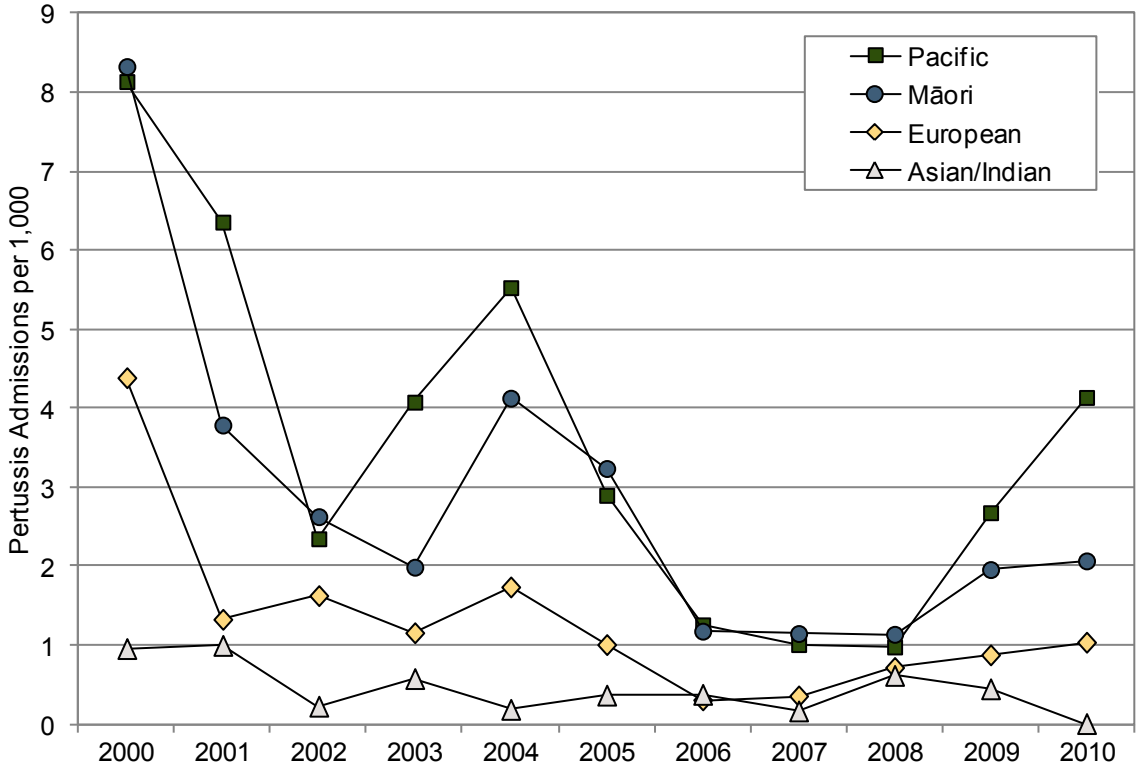
In New Zealand during 2006–2010, hospital admissions for pertussis were highest in infants <1 year, with rates declining rapidly with increasing age thereafter. Similarly, during 2004–2008, all pertussis deaths in children and young people occurred in infants <1 year of age (**Figure 74**).

Figure 74. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Pertussis in New Zealand Children by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 75. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for pertussis were *significantly* higher for Pacific and Māori > European > Asian/Indian infants and those from more deprived (NZDep decile 5–10) areas (**Table 77**). Similar ethnic differences were seen during 2000–2010 (**Figure 75**).

Table 77. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

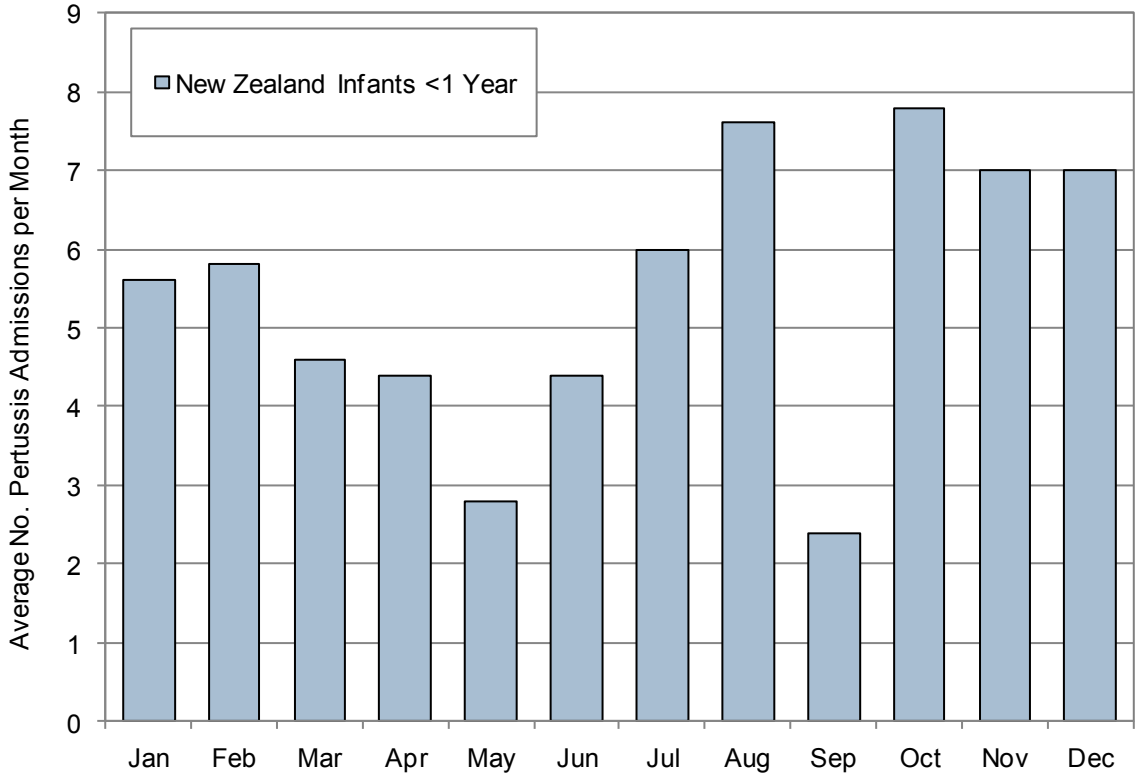
Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Pertussis in Infants <1 Year							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	0.39	1.00		European	0.65	1.00	
Decile 3–4	0.52	1.33	0.74–2.38	Māori	1.49	2.29	1.77–2.96
Decile 5–6	0.69	1.76	1.02–3.03	Pacific	2.03	3.11	2.30–4.22
Decile 7–8	1.10	2.80	1.69–4.62	Asian/Indian	0.31	0.47	0.25–0.90
Decile 9–10	1.89	4.81	2.99–7.75				
Gender							
Female	1.05	1.00		Male	1.00	0.95	0.77–1.18

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

New Zealand Distribution by Season

In New Zealand during 2006–2010 there were no consistent seasonal differences in hospital admissions for pertussis in infants aged <1 year (**Figure 76**).

Figure 76. Average Number of Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year by Month, New Zealand 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In Lakes during 2006–2010, hospital admissions for pertussis in infants <1 year were *significantly* higher than the New Zealand rate. While admissions in the Bay of Plenty and Tairawhiti were also higher and admissions in Taranaki were lower than the New Zealand rate, in none of these DHBs did these differences reach statistical significance (**Table 78**).

Table 78. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Pertussis in Infants <1 Year					
Waikato	30	6.0	1.08	1.05	0.72–1.53
Lakes	19	3.8	2.27	2.22	1.40–3.52
Bay of Plenty	23	4.6	1.55	1.51	0.99–2.31
Tairawhiti	6	1.2	1.50	1.46	0.65–3.28
Taranaki	4	0.8	0.50	0.49	0.18–1.32
New Zealand	327	65.4	1.03	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset.

Midland Region Trends

In the Midland Region during 2000–2010, there were large year to year fluctuations in hospital admissions for pertussis in infants aged <1 year in all five DHBs (**Figure 77**).

Summary

In New Zealand during 2000–2010, hospital admissions for pertussis in infants fluctuated, with peaks occurring in 2000 and 2004. Admissions reached their lowest point in 2007, with rates increasing gradually thereafter. During the early-mid 2000s one infant each year died from pertussis, although no deaths occurred during 2006–2008. During 2006–2010, pertussis admissions were highest in infants <1 year, with rates declining rapidly thereafter. Similarly, during 2004–2008, all pertussis deaths occurred in infants <1 year. Admission rates were also *significantly* higher for Pacific and Māori > European > Asian/Indian infants and those from more deprived (NZDep decile 5–10) areas.

In the Midland Region during 2000–2010, there were large year to year fluctuations in hospital admissions for pertussis in infants aged <1 year in all five DHBs. In Lakes during 2006–2010, admissions were *significantly* higher than the New Zealand rate. While admissions in the Bay of Plenty and Tairawhiti were also higher and admissions in Taranaki were lower than the New Zealand rate, in none of these DHBs did these differences reach statistical significance.

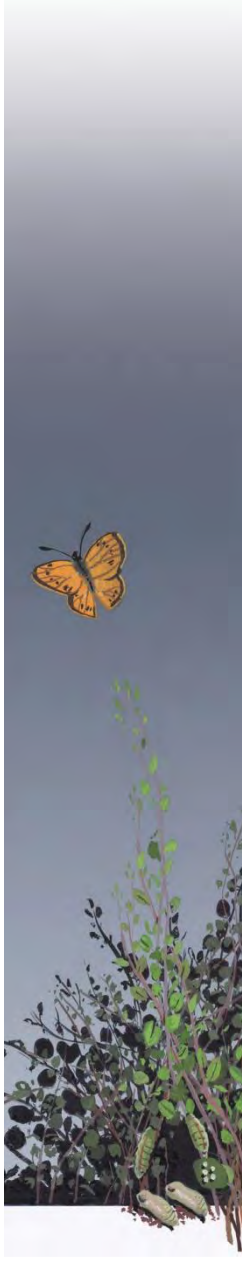
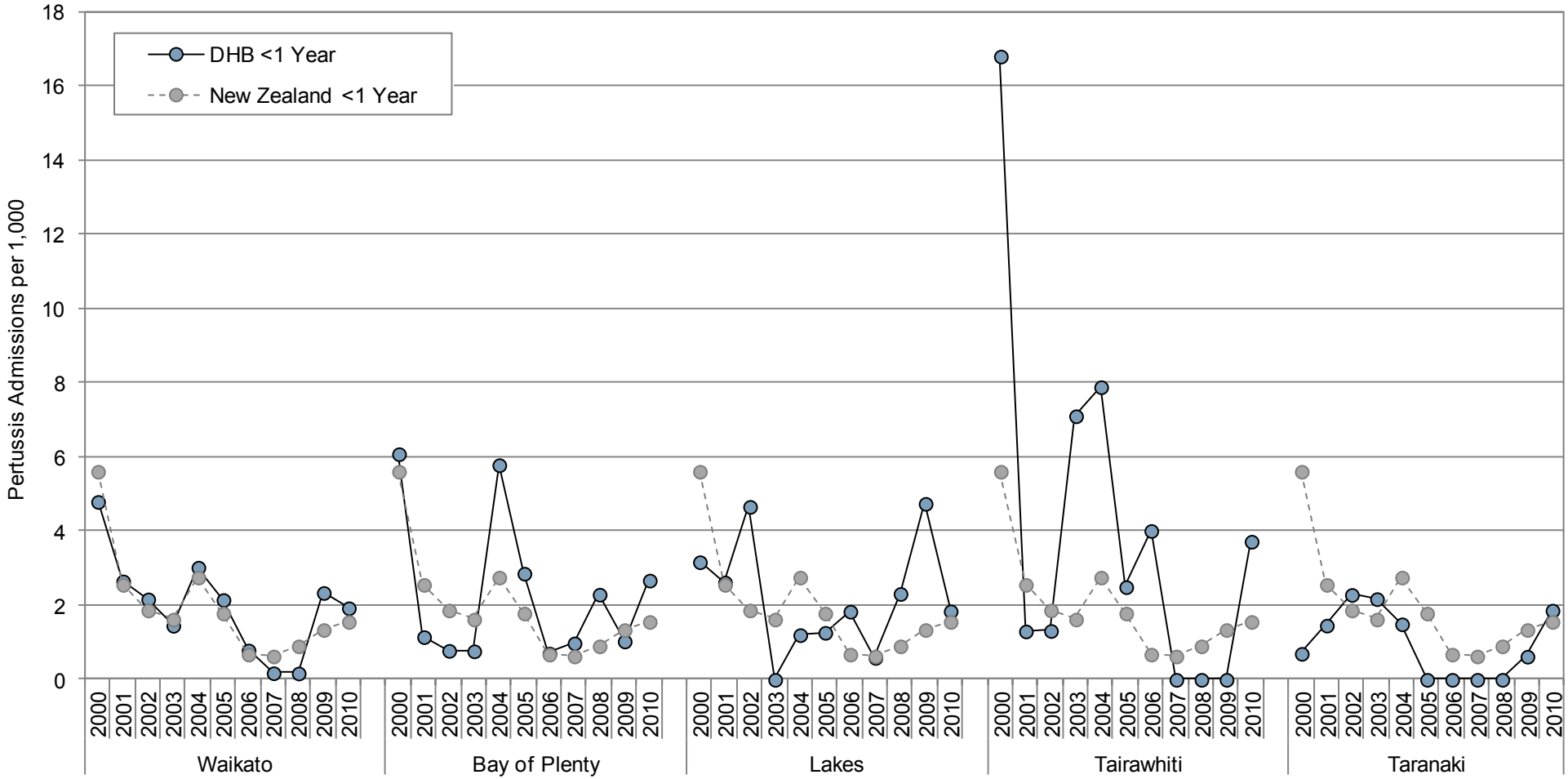


Figure 77. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Pertussis

In New Zealand a number of policy documents are relevant to the prevention of pertussis, and these are considered in **Table 79**, along with a range of reviews which consider these issues in the overseas context. In addition, a number of documents consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101
5. **Interventions to Improve Immunisation Coverage Rates** will be reviewed in more detail in next year's report.

Table 79. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Pertussis

Ministry of Health Policy Documents
Ministry of Health. 2011. **Immunisation Handbook 2011**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/immunise-handbook/$file/6Pertussis.pdf Chapter 6 of this handbook provides information on pertussis, its epidemiology, immunisation both currently and historically, the benefits of improved immunisation coverage, the available vaccines, the immunisation schedule, expected responses, adverse reactions, contraindications and precautions, antimicrobial treatment and prophylaxis. Combined Tetanus, diphtheria and pertussis immunisation is recommended, but not funded for lead maternity carers and other health care workers who work in neonatal units or are exposed to infants, household contacts of newborns including older siblings (for whom update vaccines are funded) and mothers shortly after delivery, and early childhood workers. A ten yearly booster dose is recommended for those with on-going contact with infants.
Ministry of Health. 1998. **Communicable Disease Control Manual.** Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/ea6005dc347e7bd44c2566a40079ae6f/019e54d1de5e73534c25666e00835b79/$FILE/cdcm.pdf Pages 1-21 to 1-23 of this manual contain concise information on the control of pertussis which is a notifiable disease.
Systematic and Other Reviews from the International Literature
Zhang L, Prietsch Sílvio OM, Axelsson I, et al. 2011. **Acellular vaccines for preventing whooping cough in children**. Cochrane Database of Systematic Reviews 2011(1) Art. No.: CD001478. DOI: 10.1002/14651858.CD001478.pub4. The first pertussis vaccines were made from killed whole pertussis bacteria. Concerns about the possible association of these vaccines with neurological disorders led to the development of acellular vaccines which contain up to five *Bordetella* pertussis antigens. These vaccines were developed in the 1970s and widely used and tested in Japan in the 1980s.This review included six efficacy trials and 52 safety trials of acellular pertussis vaccines. Multi-component vaccines (≥ 3 antigens) had efficacy ranging from 84% to 85% in preventing typical whooping cough and 71% to 78% in preventing mild pertussis disease. One and two-component vaccines had efficacy ranging from 59% to 75% against typical whooping cough and 13% to 54% against mild pertussis disease. Multi-component acellular vaccines are more effective than low-efficacy whole cell vaccines but may be less effective than high efficacy whole cell vaccines however acellular vaccines were followed by significantly fewer local and systemic adverse events than whole cell vaccines both for the primary series and the booster doses.
Bar-On Edna S, Goldberg E, Fraser A, et al. 2009. **Combined DTP-HBV-HIB vaccine versus separately administered DTP-HBV and HIB vaccines for primary prevention of diphtheria, tetanus, pertussis, hepatitis B and Haemophilus influenzae B (HIB)**. Cochrane Database of Systematic Reviews 2009(3) Art.No.: CD005530. DOI: 10.1002/14651858.CD005530.pub2. This review compared the effectiveness of combined DTP-HBV-HIV vaccines with separate DTP-HBV and HIB vaccinations. The reviewers were unable to find any studies providing data on the prevention of disease i.e. the incidence of diphtheria, tetanus, pertussis and *H. influenzae* type B after vaccination. The review included 18 RCTs or quasi randomised clinical trials comparing vaccination with any combined DTP-HBV-HIB vaccine (with or without a variety of polio vaccines) with either separate DTP-HBV and HIB vaccinations or placebo. There were no significant differences found in immunogenicity for pertussis, diphtheria, polio and tetanus but two studies found less immunologic response for HBV and HIB after the combined vaccines and minor adverse events were more common after the combined vaccine. The authors state the studies' results were inconclusive and they were unable to conclude that the responses elicited by the combined vaccines were either different from, or equivalent to, those elicited by the separate vaccines.

McIntyre P, Wood N. 2009. **Pertussis in early infancy: disease burden and preventive strategies**. Current Opinion in Infectious Diseases 22(3) 215-23.

This review summarises the current knowledge on the epidemiology and disease burden of pertussis in developed countries and discusses prevention strategies particularly those applicable to very young infants who are the group most vulnerable to severe pertussis and who are not protected by current immunisation schedules. Such strategies may either be direct (they aim to boost the infant's immunity) or indirect (they aim to reduce the infant's disease risk by boosting the immunity of those around the infant so that they will not catch the disease and transmit it to the infant).The direct strategies include maternal immunisation in pregnancy and immunisation at birth but the evidence for these is currently insufficient. Indirect strategies include ensuring universal and timely vaccination of infants and young children, boosters for older children and adolescents, and universal or targeted ("cocoon") adult immunisation. Of the indirect strategies, the review authors state that cocooning is probably the most effective but uptake has been low or unknown in countries where national immunisation advisory bodies currently recommend this.

Other Relevant Publications

Grant CC, Reid S. 2010. **Pertussis continues to put New Zealand's immunisation strategy to the test**. New Zealand Medical Journal 123(1313) 46-61. http://journal.nzma.org.nz/journal/123-1313/4080/content.pdf

This article reviews the epidemiology of pertussis in New Zealand and the history of pertussis immunisation in New Zealand. It discusses the pertussis control strategies recommended by the Global Pertussis Initiative and their relevance to New Zealand. These strategies, in order of priority, are: reinforcing and/or improving current infant and toddler immunisation strategies, universal preschool booster doses at 4 to 6 years of age, universal adolescent immunisation, selective immunisation of healthcare workers, selective immunisation of new mothers, family and close contacts of newborns (the "cocoon" strategy), universal adult immunisation and selective immunisation of childcare workers.

Forsyth KD, Wirsing von Konig C-H, Tan T, et al. 2007. **Prevention of pertussis: Recommendations derived from the second Global Pertussis Initiative roundtable meeting**. Vaccine 25(14) 2634-42.

This paper summarises the key points from the second roundtable meeting of the Global Pertussis Initiative (GPI) which is an international group of 37 experts in the field of pertussis (from 17 countries) whose work is supported by an unrestricted educational grant from Sanofi Pasteur. The GPI had previously recommended increased and improved surveillance, improved detection and greater awareness of pertussis as an important public health problem in order to ascertain both the true incidence of the disease and the effectiveness of immunisation, and it had also recommended the addition of an acellular pertussis vaccine into the adolescent diphtheria and tetanus booster. At their second meeting, the GPI addressed specifically the problem of neonatal and infant pertussis. After reviewing the available evidence the GPI has further endorsed the cocoon strategy (see above) and also the selective immunisation of health- and child-care workers. The GPI consider that universal adult vaccination may be justified by the epidemiological data but that the feasibility of this strategy is currently questionable. They say that as further data continues to support the immunogenicity and safety of combined diphtheria, tetanus and pertussis vaccines in adults it will become worthwhile to substitute these vaccines for the adult tetanus-diphtheria boosters currently recommended in many countries. (The U.S. Advisory Committee on Immunisation Practices recommends a single dose of tetanus toxoid, reduced diphtheria toxoid + acellular pertussis vaccine (Tdap) for adults, see http://www.cdc.gov/mmwr/pdf/wk/mm6001.pdf pp. 13-15.)

MENINGOCOCCAL DISEASE

Introduction

Neisseria meningitidis is a gram-negative diplococcus and the only known natural reservoir of this bacterium is the human nasopharyngeal mucosa [151]. Asymptomatic carriage of the bacterium is common. Most cases of the disease are acquired through contact with the respiratory droplets of asymptomatic carriers [152]. The onset of symptoms of meningitis is often sudden and death can follow within hours, therefore prompt treatment with appropriate antibiotics is vital. Survivors of the disease may be left with severe disabilities including deafness, loss of limbs, mental retardation and paralysis. The initial symptoms are often non-specific and may be difficult to distinguish from those of common viral infections. They include fever, nausea and vomiting, irritability, refusing food or drink, headache and muscle or joint aches. More specific symptoms include a non-blanching petechial rash, neck stiffness, a bulging fontanelle in babies, altered mental state and photophobia [153].

There are a number of different pathogenic strains of *Neisseria meningitidis*. An epidemic of meningococcal disease due to a specific Group B strain began in New Zealand in 1991. A strain-specific vaccine was developed and introduced into the immunisation schedule in 2004. While the epidemic was already waning by this time, the number of cases due to the epidemic strain fell significantly after the vaccine was introduced [154]. The vaccine was withdrawn in 2008 [155].

Currently there are two types of meningococcal vaccine available in New Zealand. Quadrivalent polysaccharide vaccines are effective against strains A, C, Y and W135 and are approved for use in adults and children over the age of two, funded for those who have had or are about to have a splenectomy, and recommended, but not funded, for other high risk groups such as young adults in their first year of hostel accommodation, close contacts of disease cases and laboratory workers. Meningococcal C conjugate vaccines can be used in infants as well as in other age groups. Both types of vaccine may be funded to control an outbreak [148].

The following section explores meningococcal disease rates in children and young people using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of policy and evidence-based review documents which consider interventions to address meningococcal disease at the population level.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Meningococcal Disease, including meningococcal meningitis (A39).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Meningococcal Disease in Children and Young People Aged 0–24 Years

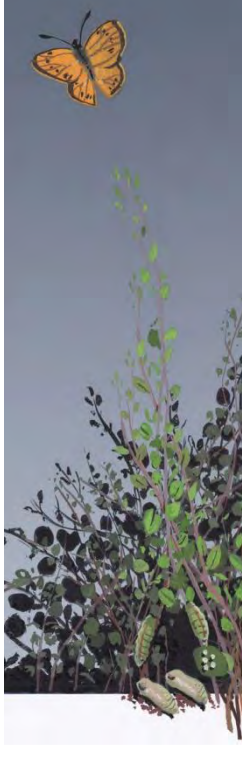
Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Meningococcal Disease, including meningococcal meningitis (A39).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.



Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for meningococcal disease in children and young people declined rapidly during the early-mid 2000s, but became more static after 2006–07. Similar patterns were seen for mortality during 2000–2008, although the number of deaths in 2008 (n=7) was higher than in the previous four years (average n=3.5) (**Figure 78**).

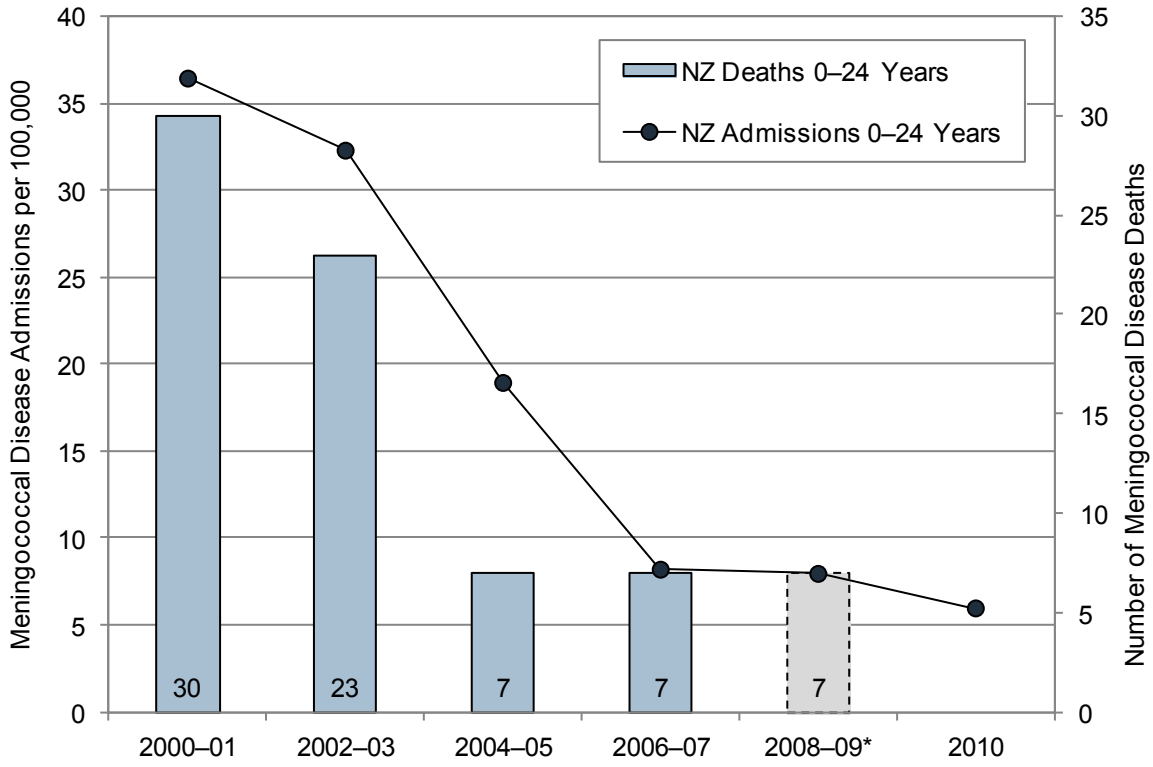
New Zealand Distribution by Age

In New Zealand during 2006–2010, hospital admissions for meningococcal disease were highest in infants <1 year, followed by those <5 years of age. Mortality during 2004–2008 was also highest in infants, followed by those <3 years of age, although a small number of deaths also occurred amongst those in their late teens and early twenties (**Figure 79**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

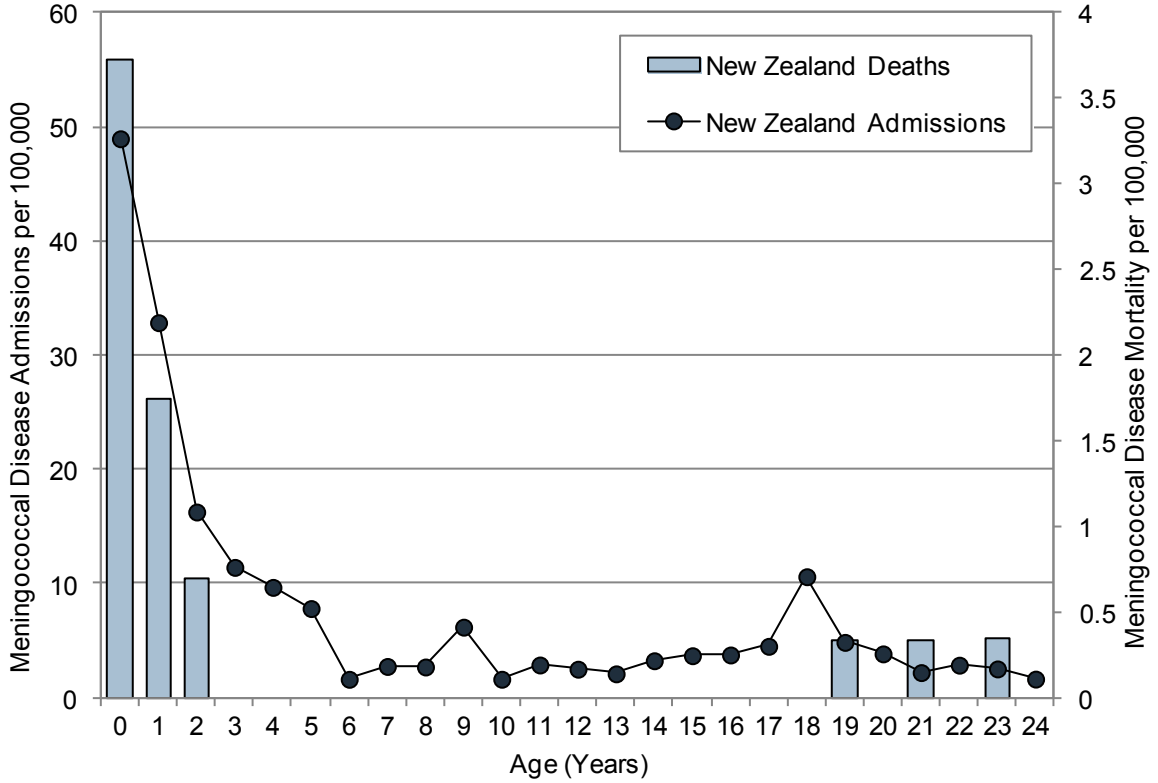
In New Zealand during 2006–2010, hospital admissions for meningococcal disease were *significantly* higher for males, Pacific and Māori > European > Asian/Indian children and young people and those living in more deprived (NZDep decile 5–10) areas (**Table 80**). Similar ethnic differences were seen during 2000–2010, with the largest absolute decreases in admissions during this period being amongst Pacific and Māori children and young people (**Figure 80**).

Figure 78. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Meningococcal Disease in New Zealand Children and Young People Aged 0−24 Years



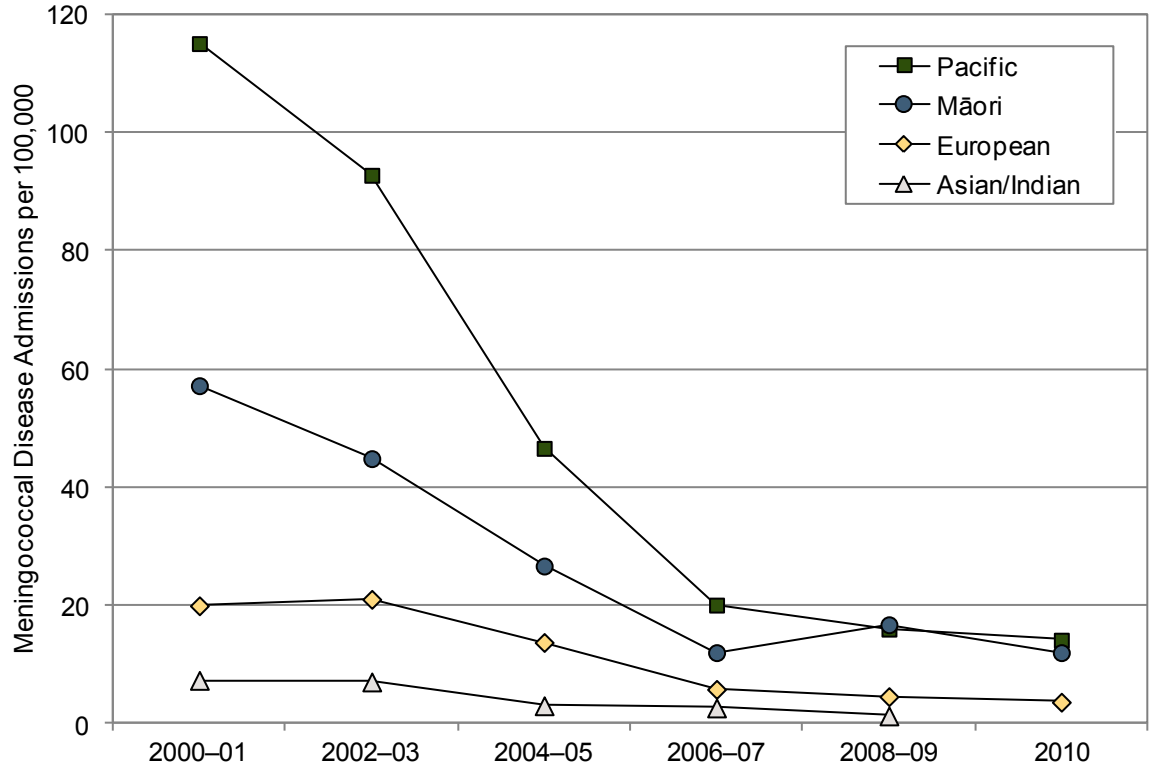
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. *Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

Figure 79. Acute and Semi-Acute Hospital Admissions (2006–2010) and Deaths (2004–2008) from Meningococcal Disease in New Zealand Children and Young People by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 80. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



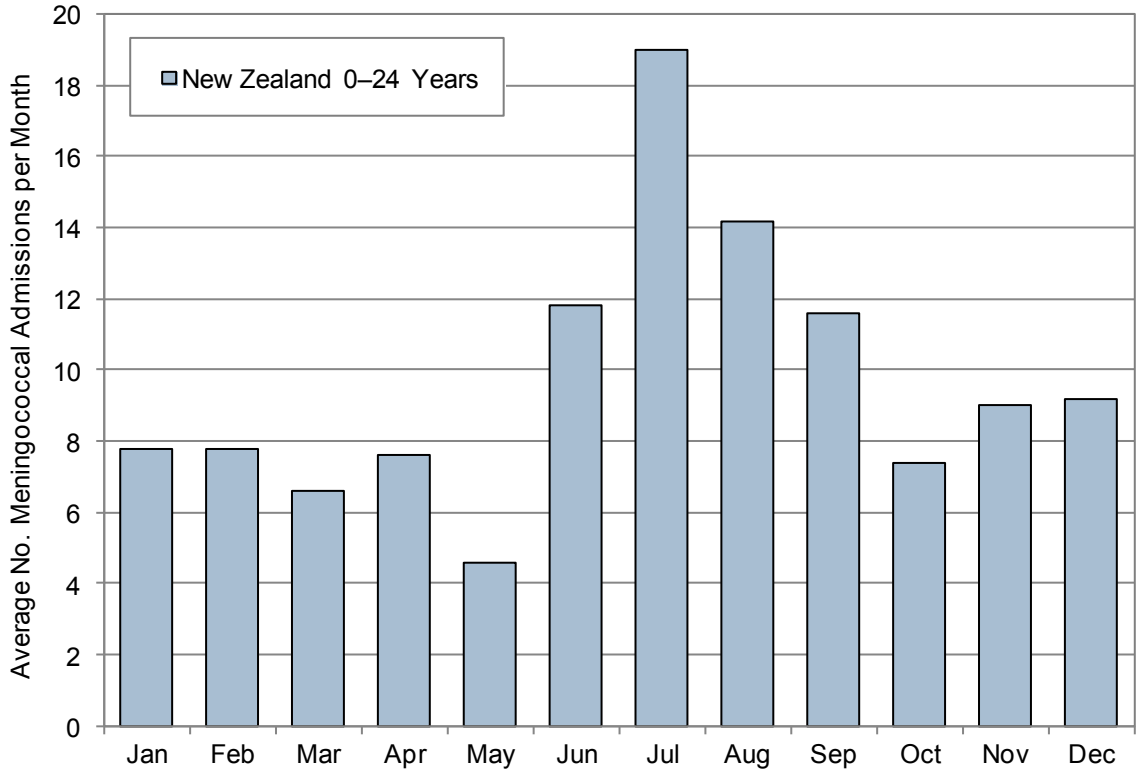
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 80. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Meningococcal Disease 0–24 Years							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	2.92	1.00		European	4.88	1.00	
Decile 3–4	3.59	1.23	0.81–1.86	Māori	13.9	2.85	2.37–3.44
Decile 5–6	5.52	1.89	1.29–2.76	Pacific	17.2	3.52	2.81–4.42
Decile 7–8	8.41	2.88	2.03–4.09	Asian/Indian	1.52	0.31	0.18–0.54
Decile 9–10	14.9	5.09	3.67–7.07				
Gender							
Female	6.94	1.00		Male	8.32	1.20	1.02–1.41

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001

Figure 81. Average Number of Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0–24 Years by Month, New Zealand 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

New Zealand Distribution by Season

In New Zealand during 2006–2010, hospital admissions for meningococcal disease were highest during the winter months **(Figure 81**).

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In Tairawhiti during 2006–2010, hospital admissions for meningococcal disease were *significantly* higher than the New Zealand rate, while rates in the remaining Midland DHBs were not *significantly* different from the New Zealand rate (**Table 81**).

Table 81. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People 0−24 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Meningococcal Disease 0–24 Years					
Waikato	44	8.8	6.67	0.87	0.64–1.19
Lakes	15	3.0	8.06	1.06	0.63–1.76
Bay of Plenty	28	5.6	8.04	1.05	0.72–1.54
Tairawhiti	15	3.0	16.8	2.19	1.31–3.66
Taranaki	13	2.6	7.15	0.94	0.54–1.62
New Zealand	583	116.6	7.64	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

In the Midland Region during 2000–2010, hospital admissions for meningococcal disease in children and young people declined in all five Midland DHBs (**Figure 82**).

Summary

In New Zealand, hospital admissions for meningococcal disease in children and young people declined rapidly during the early-mid 2000s, but became more static after 2006–07. Similar patterns were seen for mortality during 2000–2008, although the number of deaths in 2008 was higher than in the previous four years. Admissions and mortality were both highest for infants <1 year, followed by those <5 years. During 2006–2010, admissions were also *significantly* higher for males, Pacific and Māori > European > Asian/Indian children and young people and those from more deprived (NZDep decile 5–10) areas.

In the Midland Region during 2000–2010, hospital admissions for meningococcal disease in children and young people declined in all five Midland DHBs. During 2006–2010, hospital admissions for meningococcal disease were *significantly* higher than the New Zealand rate in Tairawhiti, but not *significantly* different from the New Zealand rate in the remaining four Midland DHBs were.

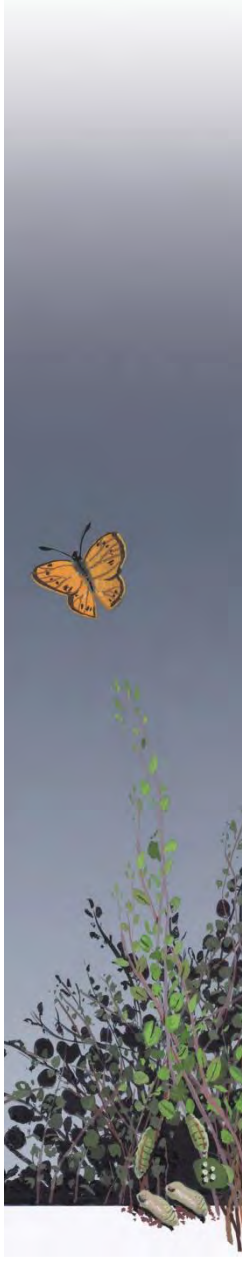
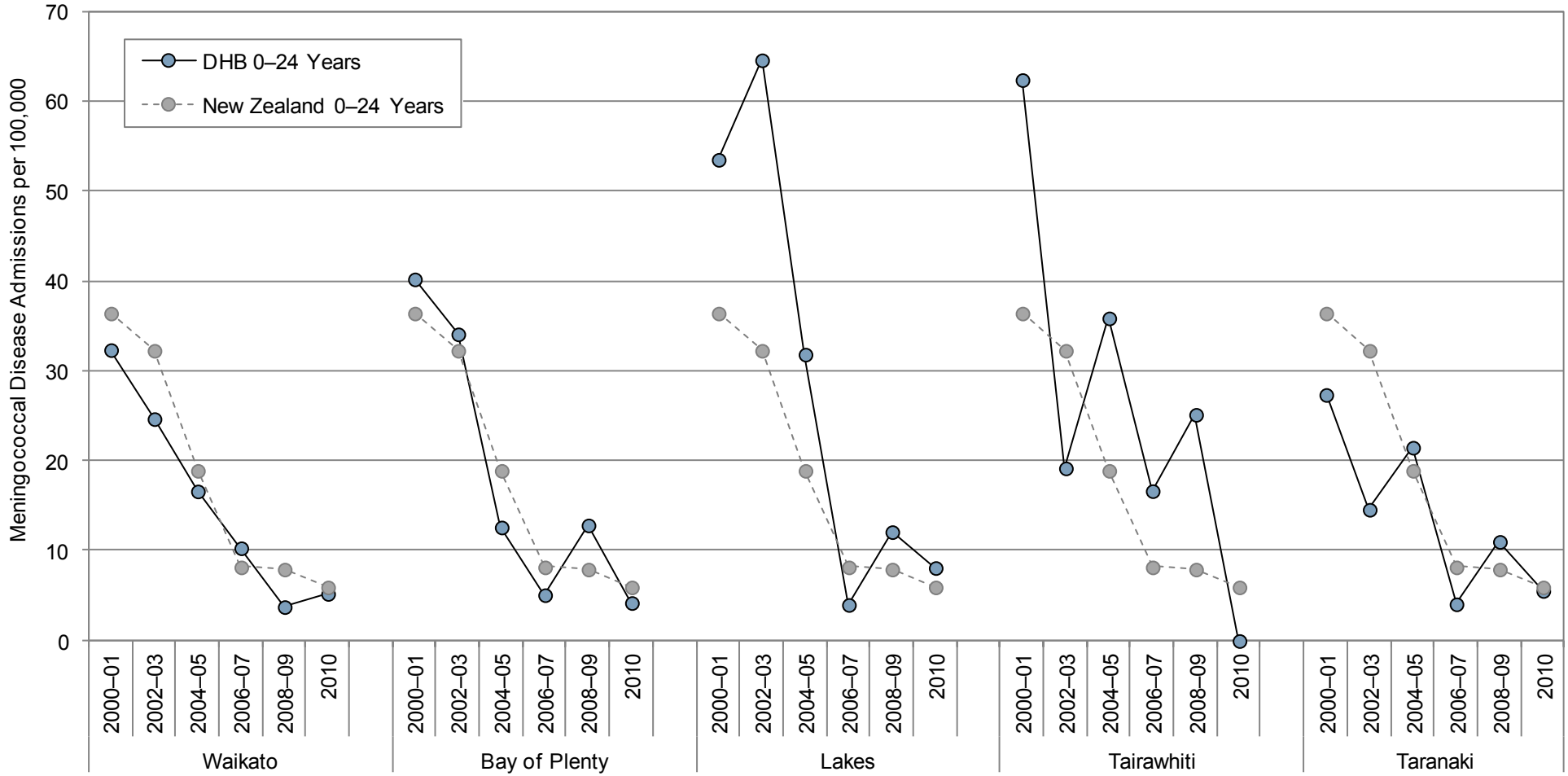


Figure 82. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Meningococcal Disease

In New Zealand a number of policy documents consider the prevention and management of meningococcal disease, and these are considered in **Table 82**, along with a number of international reviews and guidelines which also consider these issues. In addition, a number of publications consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

Table 82. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Meningococcal Disease

Ministry of Health Policy Documents
Ministry of Health. 2011. **Immunisation Handbook 2011**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/immunise-handbook/$file/16MeningococcalInvDisease.pdf Chapter 16 of this handbook covers invasive meningococcal disease. It provides information on the available vaccines and the groups for which vaccination is funded (adults and children pre-and post-splenectomy, those living in areas where there is a community programme to control an outbreak) and recommended but not funded (young adults in their first year of hostel accommodation, close contacts of disease cases, and some other high risk groups).
Ministry of Health. 2011. **Targeted vaccinations: Meningococcal Disease**. http://www.moh.govt.nz/moh.nsf/indexmh/immunisation-diseasesandvaccines-meningococcaldisease This web page provides brief information on the two main types of meningococcal vaccine available in New Zealand, the quadrivalent polysaccharide vaccines, which protect against groups A, C, Y, and W135 and are approved for use in people over the age of two, and the separate conjugate meningococcal C vaccines which protect against group C meningococcal disease only and can be used in children under the age of two. Immunity from the quadrivalent vaccine lasts for about three years and the duration of immunity produced by the conjugate vaccines is currently unknown.
The Ministry of Health meningococcal disease web page http://www.moh.govt.nz/moh.nsf/wpg_index/Publications-Meningococcal+Disease+-+Publications contains links to a number of publications relating to the meningococcal B immunisation programme. These are not summarised in this table because they are now largely of historical interest.
International Guidelines
National Collaborating Centre for Women's and Children's Health. 2010. **Bacterial Meningitis and Meningococcal Septicaemia in Children**. London: Royal College of Obstetricians and Gynaecologists. **http://www.nice.org.uk/nicemedia/live/13027/49437/49437.pdf** These detailed evidence-based guidelines cover diagnosis of bacterial meningitis and meningococcal septicaemia, management of these conditions in primary and pre-hospital care settings and in secondary and tertiary care, investigations, long term management and giving information to parents and carers. It is intended that these guidelines be used in conjunction with NICE clinical guideline 84: "Diarrhoea and vomiting in children under 5" and NICE clinical guideline 47: "Feverish illness in children". Each section in the guideline includes a review of the published evidence and concludes with recommendations for clinical practice and for research. The appendices, some of which are not included in the guideline but can be downloaded from the NICE website: http://guidance.nice.org.uk/CG102/Guidance include the literature search strategies, the clinical questions which the research aimed to answer and details of the relevant studies and meta-analyses on which the guidelines are based, as well as cost-effectiveness analyses on various diagnostic and therapeutic options.
Scottish Intercollegiate Guidelines Network. 2008. **Management of invasive meningococcal disease in children and young people: A national clinical guideline**. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign102.pdf This guideline provides evidence-based best practice recommendations on the recognition and management of meningococcal disease in children and young people. It covers the patient journey from pre-hospital care through referral, diagnostic testing, management in hospital, follow up care and rehabilitation and it also covers public health issues. Statements in the guideline which summarise the research literature are accompanied by a grade indicating the quality of the evidence. Recommendations in the guideline are accompanied by a grade (A–D) indicating the strength of the evidence on which they are based. Section 8 covers prevention of secondary transmission via prophylactic antibiotics, vaccination and infection control measures.

Systematic and Other Reviews from the International Literature
Fraser A, Gafter-Gvili A, Paul M, et al. 2011. **Antibiotics for preventing meningococcal infections**. Cochrane Database of Systematic Reviews 2011(8) Art. No.: CD004785. DOI: 10.1002/14651858.CD004785.pub4. Household contacts of people with meningococcal infection are at high risk of contracting the disease. This review of 24 studies (19 RCTs including 2531 participants and 5 cluster RCTs including 4354 participants) aimed to determine the effectiveness of different prophylactic antibiotics for a) preventing cases of meningococcal disease and b) eradicating naso-pharyngeal carriage of *Neisseria meningitides.* No trials reported any cases of meningococcal disease during the trials so it was not possible to assess directly the effectiveness of antibiotics in preventing disease. Regarding eradication of *N. meningitidis,* ciprofloxacin (RR 0.04, 95% CI 0.01 to 0.12), rifampin (rifampicin) (RR 0.17, 95% CI 0.13 to 0.24), minocycline (RR 0.28, 95% CI 0.21 to 0.37) and penicillin (RR 0.47, 95% CI 0.24 to 0.94) were all more effective than placebo up to one week after treatment and, after one to two weeks, rifampin (RR 0.20; 95% CI 0.14 to 0.29), ciprofloxacin (RR 0.03; 95% CI 0.00 to 0.42) and penicillin (RR 0.63; 95% CI 0.51 to 0.79) were more effective than placebo. Rifampin was more effective than placebo up to four weeks after treatment but resistant isolates were detected following treatment. No trials compared ceftriaxone with placebo but ceftriaxone was more effective than rifampin after one to two weeks of follow up in one study. Therefore the use of ciprofloxacin, ceftriaxone or penicillin should be considered however the use of rifampin during an outbreak may lead to the circulation of resistant isolates.
Khatami A, Pollard AJ. 2010. **The epidemiology of meningococcal disease and the impact of vaccines**. *Expert Review of Vaccines* 9(3) 285-98. This review provides an overview of meningococcal disease, its various serogroups and how vaccines have been developed over time. The success of particular vaccines in a number of different countries is also discussed. The review notes that conjugate vaccines were developed for meningococcal disease in the 1990s. They have been shown to be safe and effective in all age groups but there is still concern that antibody persistence is poor when vaccines are given in infancy. These vaccines also reduce naso-pharyngeal carriage of *N. meningitidis* which means that there are benefits from herd immunity and reduced transmission. A number of countries including the U.K., the Netherlands and Greece have introduced MenC conjugate vaccines and seen dramatic declines in incidence of disease. In January 2005, a MenACWY conjugate vaccine was licensed in the USA and was recommended for 11 to 18-year-olds, beginning with 12-year-old children, and supplemented by a catch-up program at high school entry. Since the vaccine became available, there have been 26 cases of Guillain–Barré syndrome reported as occurring within six weeks of vaccination. As a result a heightened surveillance system has been implemented but there has been no change in the recommendation for immunization. Epidemics of disease due to MenB have occurred in Norway and New Zealand and strain-specific outer membrane vesicle vaccines have been developed. The New Zealand MenB immunisation campaign ceased in 2008. Over time there are natural changes in the epidemiology of meningococcal antigens whereby a particular strain emerges and then declines to be replaced by a new strain, possibly due to herd immune responses. This makes vaccine prevention challenging.
Patel M, Lee CK. 2005. **Polysaccharide vaccines for preventing serogroup A meningococcal meningitis**. Cochrane Database of Systematic Reviews 2005(1) Art. No.: CD001093. DOI: 10.1002/14651858.CD001093.pub2. Updated after new search for studies with no change to conclusions and published in Issue 8, 2010. This review considered the effectiveness of polysaccharide serogroup A vaccine against serogroup A meningococcal meningitis, the age-specific effectiveness of the vaccine, the effectiveness of booster doses in children under five years of age, and the duration of protection in adults and children. Based on a review of eight RCTs (6 in Africa and 2 in Finland, 480,068 participants) the authors concluded that, in children over the age of five and adults the vaccine was strongly protective for the first year (summary vaccine efficacy 95%, 95% CI 87% - 99%). Data from two trials suggested that there was a protective effect in the second year and two trials suggested that the vaccine was protective in younger children but these results were not statistically significant. Only one study assessed the effect of a booster dose and it lacked the power to identify a statistically significant effect.
Sudarsanam T, Rupali P, Tharyan P, et al. 2008. **Pre-admission antibiotics for suspected cases of meningococcal disease**. Cochrane Database of Systematic Reviews 2008(1) Art. No.: CD005437. DOI: 10.1002/14651858.CD005437.pub2. Meningococcal disease can progress rapidly and lead to death or disability within hours of onset. Starting therapy with pre-admission antibiotics before confirmation of diagnosis aims to reduce the risk of death and disability. The authors of this review found no reliable evidence from RCTs for the benefit or otherwise of pre-admission antibiotics for suspected cases of non-severe meningococcal disease. For ethical reasons it is not likely such trials will be undertaken. One RCT of moderate quality indicated that single intramuscular injections of either ceftriaxone or long-acting chloramphenicol were equally effective, safe and economical in reducing serious outcomes. Local affordability, availability and patterns of antibiotic resistance should guide the choice between these antibiotics. The review authors state that “further RCTs comparing different pre-admission antibiotics, accompanied by intensive supportive measures, are ethically justifiable in participants with severe illness, and are needed to provide reliable evidence in different clinical settings”.

Other Relevant Publications
Lopez L, Sexton K, Carter P. 2011. **The Epidemiology of Meningococcal Disease in New Zealand in 2010**. Wellington: Institute of Environmental Science and Research Ltd (ESR). http://www.surv.esr.cri.nz/PDF_surveillance/MeningococcalDisease/2010/2010AnnualRpt.pdf This publication reports on the incidence and distribution of cases of meningococcal disease in New Zealand in 2010 and reviews the trends in disease patterns since the beginning of the epidemic in 1991 and since the MeNZB™ vaccination campaign began in 2004. In 2001, at the height of the epidemic, 80% of confirmed cases that could be strain typed were due to the epidemic strain (B:4:P1.7-2,4). In 2010, 31% were due to this strain indicating that the epidemic strain is still in circulation in the population. Almost 26% of cases in 2010 were due to other B strains and 27.2% to group C strains. In 2010, as in previous years, the highest age specific rates were in children aged less than one year and this was particularly noticeable for Māori and Pacific children who had rates five to six times higher than European children in this age group. Over the last ten years there has been a marked reduction in disparities in disease incidence by socio-economic status and by ethnicity. In 1991 disease rate differences in Māori and Pacific peoples compared to Europeans were 15.3 and 58.7 per 100,000 while in 2010 they were 3.5 and 4.1 per 100,000 respectively. Although the number of deaths was low the case fatality rate in 2010 was higher than in most years. Almost half of all hospitalised cases were seen in primary care before admission but only 30% of these received antibiotics in primary care. The report states that "Although it is difficult to determine the impact of pre-hospital antibiotics on disease severity and death due to small numbers and confounding factors, it would be prudent to increase this practice."
Galloway Y, Stehr-Green P, McNicholas A, et al. 2009. **Use of an observational cohort study to estimate the effectiveness of the New Zealand group B meningococcal vaccine in children aged under 5 years**. International Journal of Epidemiology 38(2) 413-8. This study was a cohort analysis of all children who were aged six months to <five years at the time the MeNZB™ vaccine became available in their DHB. It was found that, in the 24 months after they became eligible to receive a full vaccination series, fully vaccinated children were five to six times less likely than unvaccinated children to contract epidemic strain meningococcal disease. This corresponds to a vaccine effectiveness of 80.0% (95% CI 52.5–91.6) for children aged six months to <five years and 84.8% (95% CI 59.4–94.3) for children aged six months to <three years.
Kelly C, Arnold R, Galloway Y, et al. 2007. **A prospective study of the effectiveness of the New Zealand meningococcal B vaccine**. *American Journal of Epidemiology* 166(7) 817-23. This study used data from January 2001 to June 2006 to assess the effectiveness of the New Zealand meningococcal B vaccine, a strain-specific vaccine developed by Chiron vaccines (Siena, Italy) in collaboration with the Norwegian Institute of Public Health. It was estimated (using a generalised estimating equation rates model) that disease rates were 3.7 times higher in unvaccinated people (95% CI 2.1 - 6.8) and that the vaccine effectiveness was 73% (95% CI 52% - 85%). The model included allowances for region-specific disease rates, age, ethnicity, socioeconomic status, disease progression over time, and seasonality. The study authors found no statistically significant interactions between any demographic variable and the vaccine effect despite the crude rates suggesting that the vaccine was possibly less effective for children under the age of one year (2005 risk ratio for 0-1 years 0.9, risk ratio for children1-4 years 11.3 and risk ratio for children and youth 5-19 years 2.9). It was estimated that 54 epidemic strain cases had been prevented in the two years since the programme began (95% CI assuming a fixed population size 22-115).

TUBERCULOSIS

Introduction

Tuberculosis is caused by *Mycobacterium tuberculosis,* with infection usually occurring as the result of inhaling infected droplets produced by someone who has pulmonary TB. Primary infections in children are often asymptomatic, self-healing and can remain completely unnoticed unless discovered by Mantoux testing. In a minority of cases, latent infection progresses to active TB, with the risk of progression being greater in the very young, or those who are immunocompromised (e.g. persons with HIV). Symptoms of active pulmonary TB include a chronic cough, fever and weight loss, or failure to thrive. Tuberculosis can also spread from the lungs to other sites including the lymph nodes, the meninges, the pleura, the peritoneum, the joints, and the pericardium [156].

In New Zealand, as in other developed countries, annual notifications for TB declined steadily after World War Two [157]. Between 1980 and 2010 annual notifications fell further, from 15.1 per 100,000 to 7.0 per 100,000, although there was little change from 2005 to 2010 [158]. A 2006 review of TB in New Zealand children however reported a resurgence in TB cases between 1992 and 2001, with childhood TB rates being highest in those under five years of age. The report also noted significant ethnic disparities, with disease rates per 100,000 being 575.2 for African, 15.2 for Pacific, 6.4 for Māori, 5.6 for Asian and 0.6 for European children. Most cases were identified through contact tracing or immigrant screening and almost half were part of outbreaks [159].

From a public health perspective, the mainstays of controlling TB infection remain the BCG vaccination of high risk neonates, case finding with treatment of active and latent infections, contact tracing and the selective screening of high risk groups [148,160]. In this context, the most common risk factors for TB are having been born outside of New Zealand (80% of cases) and current or recent residence with a person born outside of New Zealand (76.2% of cases), with the highest rates occurring in people born in Asia, followed by those born in Sub-Saharan Africa and in the Pacific Islands [158]. Further, two relatively recently reported outbreaks in Palmerston North and in Auckland, were each able to be traced back to a single source case [161,162].

The following section explores TB rates in children and young people using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of local policy documents and evidence-based reviews which consider interventions to address TB at the population level.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Tuberculosis in Children and Young People 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Tuberculosis (A15–A19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Tuberculosis in Children and Young People 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Tuberculosis (A15–A19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

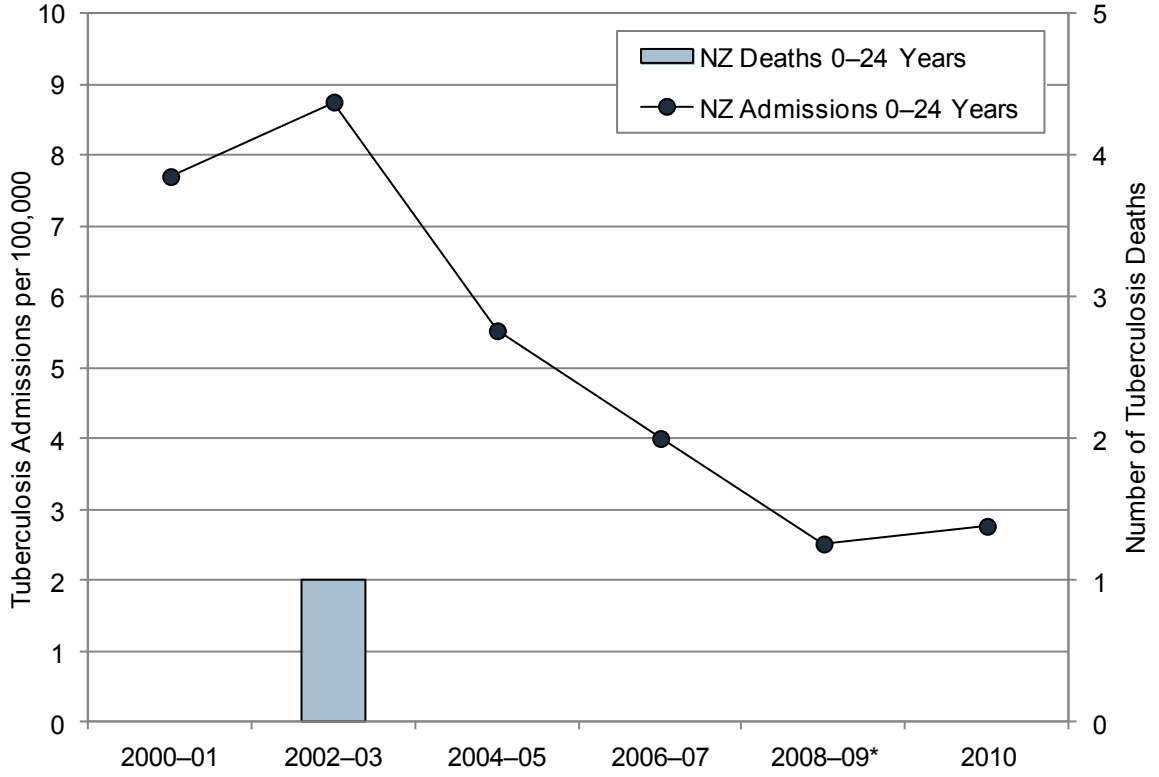
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for tuberculosis in children and young people declined after 2002–03, although a small upswing in rates was evident in 2010. During 2000–2008, one child or young person died as the result of tuberculosis (**Figure 83**).

Figure 83. Acute and Semi-Acute Hospital Admissions (2000–2010) and Deaths (2000−2008) from Tuberculosis in New Zealand Children and Young People Aged 0–24 Years



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.*Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

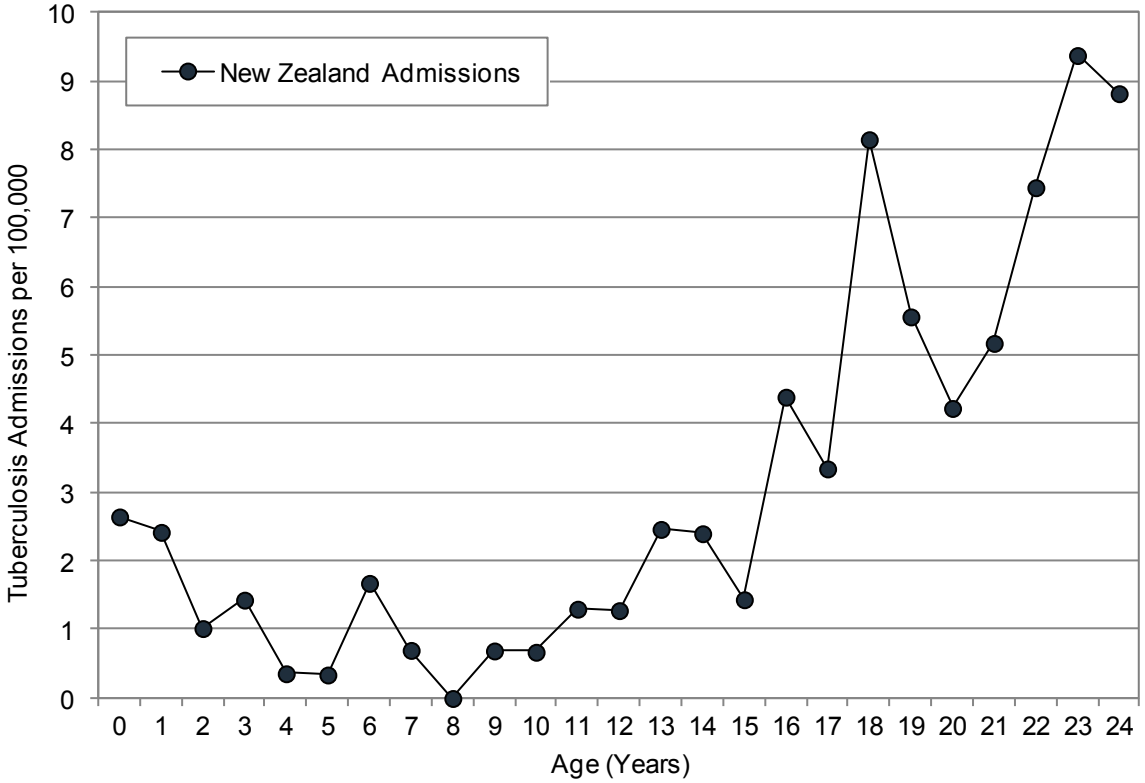
New Zealand Distribution by Age

In New Zealand during 2006–2010, hospital admissions for tuberculosis were highest amongst those in their late teens and early twenties. During 2004–2008, no children or young people died as a result of tuberculosis (**Figure 84**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

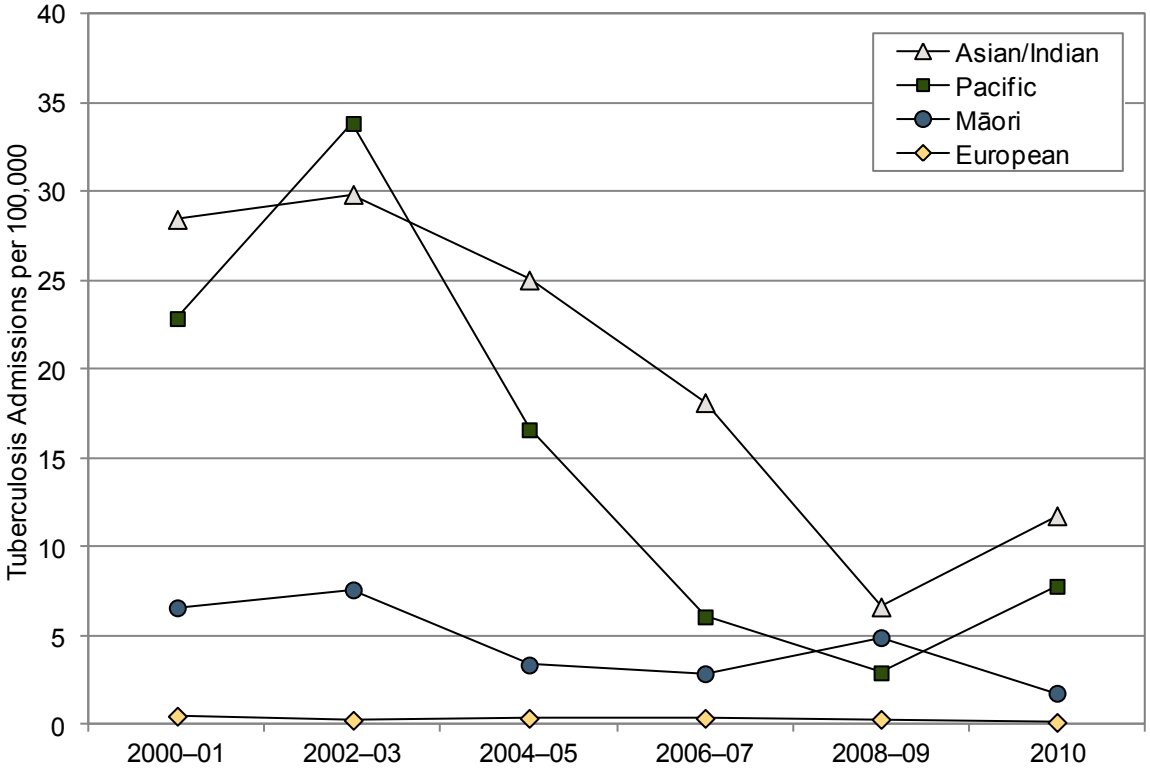
In New Zealand during 2006–2010, hospital admissions for tuberculosis were *significantly* higher for Asian/Indian, Pacific and Māori children and young people than for European children and young people. Admission rates were also *significantly* higher for those from more deprived (NZDep decile 5–10) areas (**Table 83**). Similar ethnic differences were seen during 2000–2010, although admission rates for Pacific and Asian/Indian children and young people declined during this period (**Figure 85**).

Figure 84. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People by Age, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 85. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 83. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

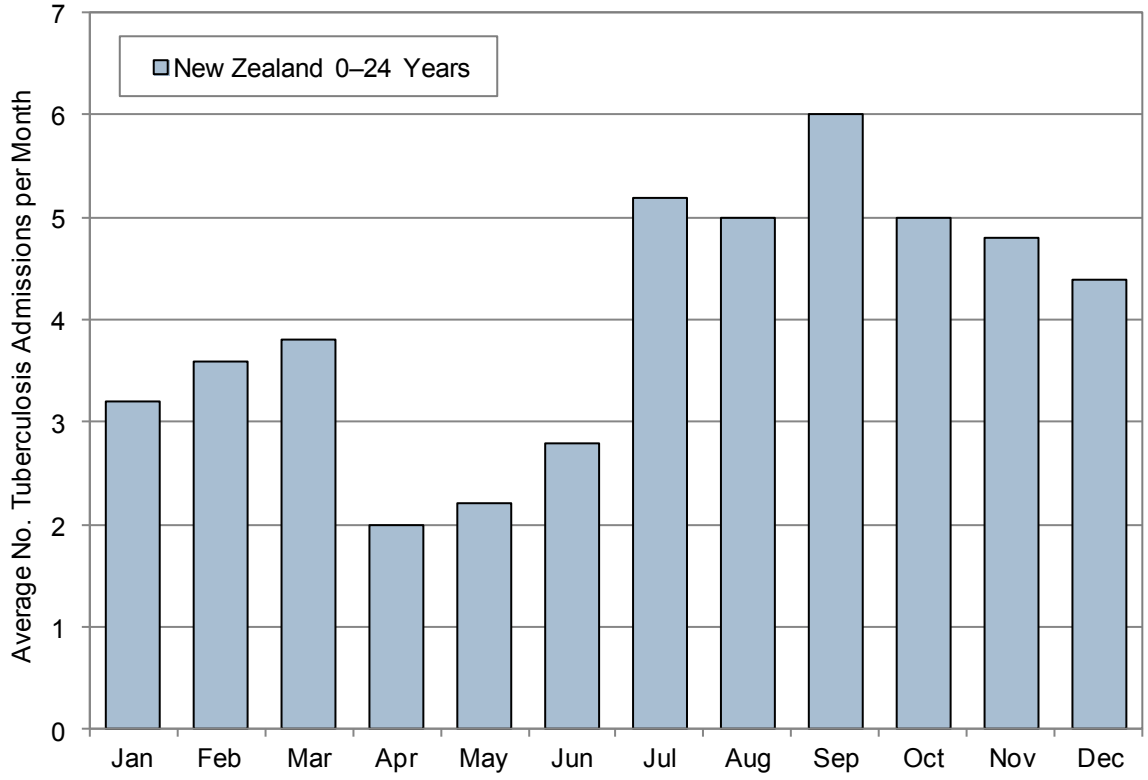
Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Tuberculosis 0–24 Years							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	1.14	1.00		European	0.28	1.00	
Decile 3–4	1.65	1.45	0.77–2.74	Māori	3.45	12.3	6.58–22.8
Decile 5–6	2.79	2.45	1.37–4.39	Pacific	5.15	18.3	9.48–35.2
Decile 7–8	2.21	1.94	1.08–3.51	Asian/Indian	12.0	42.5	23.4–77.1
Decile 9–10	6.75	5.93	3.52–9.98				
Gender							
Female	2.96	1.00		Male	3.3	1.12	0.87–1.45

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

New Zealand Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for tuberculosis in children and young people, although admissions were lowest in April–June (**Figure 86**).

Figure 86. Average Number of Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0–24 Years by Month, New Zealand 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Waikato and Bay of Plenty during 2006–2010, hospital admissions for tuberculosis were *significantly* lower than the New Zealand rate. In Lakes, while rates were also lower, they were not *significantly* different from the New Zealand rate. In Tairawhiti small numbers precluded a valid analysis, while in Taranaki no TB admissions occurred during this period (**Table 84**).

Table 84. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0−24 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Tuberculosis 0–24 Years					
Waikato	7	1.4	1.06	0.34	0.16–0.71
Lakes	4	0.8	2.15	0.68	0.25–1.84
Bay of Plenty	3	0.6	0.86	0.27	0.09–0.86
Tairawhiti	<3	s	s	s	s
Taranaki	0	–	–	–	–
New Zealand	240	48.0	3.15	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Midland Region Trends

In the Midland Region during 2000–2010, large year to year variations (likely as the result of small numbers) made trends in hospital admissions for tuberculosis in individual DHBs difficult to interpret (**Figure 87**).

Summary

In New Zealand, hospital admissions for tuberculosis in children and young people declined after 2002–03, although a small upswing in rates was evident in 2010. During 2006–2010, admissions were highest amongst those in their late teens and early twenties. Rates were also *significantly* higher for Asian/Indian, Pacific and Māori children and young people than for European children and young people and for those from more deprived (NZDep decile 5–10) areas.

In the Midland Region during 2000–2010, large year to year variations (likely as the result of small numbers) made trends in hospital admissions for tuberculosis in individual DHBs difficult to interpret. During 2006–2010, hospital admissions for tuberculosis were *significantly* lower than the New Zealand rate in the Waikato and Bay of Plenty. In Lakes, while rates were also lower, they were not *significantly* different from the New Zealand rate. In Tairawhiti small numbers precluded a valid analysis, while in Taranaki no TB admissions occurred during this period.

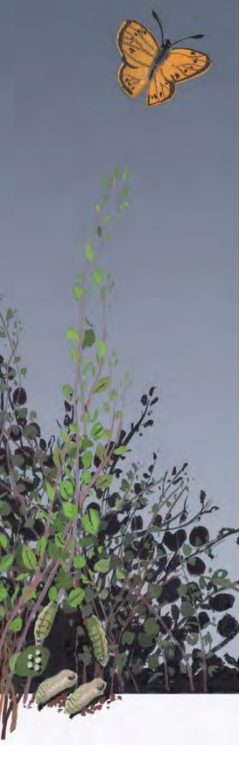
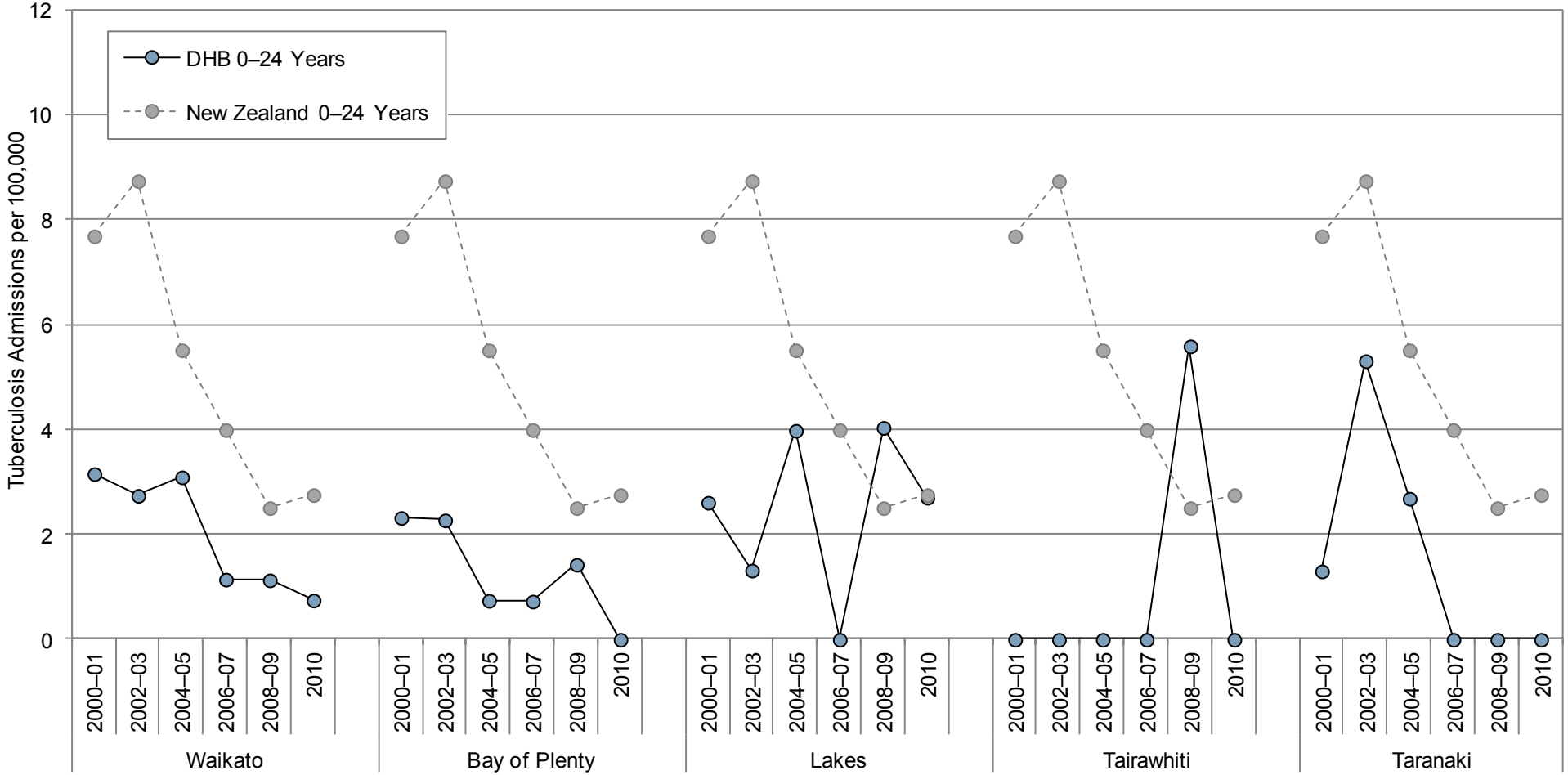


Figure 87. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Local Policy Documents and Evidence-Based Reviews Relevant to the Control of Tuberculosis

In New Zealand a number of policy documents consider the control of TB, and these are considered in **Table 85**, along with a range of international reviews and guidelines which also consider these issues. In addition, a number of publications consider approaches to infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious and Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

Table 85. Local Policy Documents and Evidence-Based Reviews Relevant to the Control of Tuberculosis

Ministry of Health Policy Documents
Ministry of Health. 2011. **Immunisation Handbook 2011**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/immunisation2011/$file/14-Tuberculosis-v2.pdf Chapter 14 of this publication details who should be offered neonatal Bacillus Calmette-Guérin (BCG) vaccine: infants living in a house or family/whanau with a person with a past or current history of TB, household members or carers who have lived for a period of six months or more in a high risk country during the past five years, and infants who during their first five years will be living for three months or more in a high risk country and are likely to be exposed to people with TB. Information on neonatal immunisation should be collected for the NIR unless the parent/guardian has opted off. Older at-risk children who missed vaccination as neonates should be vaccinated at any time up to 5 years, with children older than six months having a pre-vaccination Mantoux to see if they have already been infected.
Ministry of Health. 2010. **Guidelines for Tuberculosis Control in New Zealand 2010**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/indexmh/tuberculosis-control-nz-guidelines-2010 These comprehensive guidelines cover the epidemiology of tuberculosis in New Zealand, diagnosis, treatment and management of people with tuberculosis, special population groups, laboratory matters, and infection control and occupational health. Chapter five deals specifically with TB in children.
Ministry of Health. 2007. **Review of Neonatal BCG Immunisation in New Zealand**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/7247/$File/review-of-neonatal-bcg-immunisation-services-2006.pdf In New Zealand selective neonatal immunisation with BCG vaccination is used to prevent severe disseminated disease in high risk young children including children of migrants or refugees from high risk Asian and African countries and recent arrivals from Pacific countries. There have been concerns that not all high risk infants are being identified. This review aimed to describe the neonatal BCG immunisation services offered, review TB notification and hospitalisation data, identify any imbalance between current policy and services, and review monitoring and make recommendations on future monitoring. The review found considerable variation between DHBs in neonatal BCG vaccination and a lack of monitoring data. The review concludes with recommendations for contracts, monitoring, resources and surveillance.
International Guidelines
National Institute for Health and Clinical Excellence. 2011**. Tuberculosis: Clinical diagnosis and management of tuberculosis, and measures for its prevention and control**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/13422/53642/53642.pdf This U.K. evidence-based guideline provides advice on the care of people with, or at risk of contracting, TB and, where the scientific evidence supports this, on service organisation. It covers diagnosis, management and infection control, TB of non-respiratory sites, disseminated TB, improving adherence to therapy, risk assessment and infection control, drug-resistant TB, latent TB, groups who should be offered BCG vaccination, TB in HIV-infected individuals, case finding and contact tracing, and prevention of infection in healthcare environments and prisons. It does not explain the treatments for TB in detail, nor does it discuss the evidence on which the recommendations are based however details on the methodology used to create the guideline and the studies and models used can be found in the appendices which can be obtained from: http://www.nice.org.uk/nicemedia/live/13422/53639/53639.pdf. The key priorities for implementation are identified as: Management of patients with active TB, Improving adherence to therapy, screening of people who have recently arrived or returned from high incidence countries, and BCG vaccination for babies and others at increased risk of contracting TB.

World Health Organization. 2006. **Guidance for national tuberculosis programmes on the management of tuberculosis in children**. Geneva: World Health Organization. http://whqlibdoc.who.int/hq/2006/WHO_HTM_TB_2006.371_eng.pdf

These WHO guidelines aim to fill gaps in existing materials and provide current recommendations based on the best available evidence. Key recommendations are that children who are close contacts of smear-positive TB cases should have contact investigations and BCG vaccination should be given to all neonates in countries with high TB prevalence.

Systematic and Other Reviews from the International Literature

Ridge A, Whyte P, Grzemska M, et al. 2010. **Beyond Randomized Trials—TB treatment in Children**. Evidence-Based Child Health: A Cochrane Review Journal 5(4) 1566-77.

This review by WHO staff provides a summary of the reviews and key issues encountered when using available data to develop treatment recommendations for inclusion in the WHO guidelines for the treatment of tuberculosis in children, in particular the lack of high quality randomised controlled trials and the difficulty of retrieving observational studies through systematic search strategies. It includes evidence reviews for key clinical questions in the management of TB in children.

Ritz N, Connell TG, Curtis N. 2008. **To BCG or not to BCG? Preventing travel-associated tuberculosis in children**. *Vaccine* 26(47) 5905-10.

The Australian authors of this review note that global tourism is increasing rapidly and that recommendations for pre-travel BCG vaccination are inconsistent reflecting a paucity of data on the effectiveness of BCG vaccination and other preventive strategies in this situation. They review relevant studies and guidelines and conclude that the safest strategy, particularly in those under five years old, is to maintain a low threshold for recommending BCG immunisation.

Teo SSS, Shingadia DV. 2006. **Does BCG have a role in tuberculosis control and prevention in the United Kingdom?** Archives of Disease in Childhood 91(6) 529-31.

This brief article discusses changes to the BCG vaccination policy in the U.K. The schools' BCG vaccination programme has been discontinued in favour of targeting infants and children at increased risk including those living in high risk areas, and those who were born (or whose parents or grandparents were born) in high risk areas. The authors note that there are difficulties in identifying at risk infants including language barriers and the difficulty of obtaining reliable information on ethnicity and on the prevalence of TB in particular areas and that the new policy does not address who is to identify high risk children and how. They also state that better documentation is needed for effective monitoring of the programme and that other aspects of TB control need to be in place particularly the early diagnosis and treatment of infectious individuals and also better surveillance, contact tracing and new entrant screening.

Binkin NJ, Vernon AA, Simone PM, et al. 1999. **Tuberculosis prevention and control activities in the United States: an overview of the organization of tuberculosis services**. The International Journal of Tuberculosis and Lung Disease 3(8) 663-74.

This paper reviews the epidemiology of TB in the U.S. and presents a brief history of its TB control efforts. It describes the organisational structure of TB services in the U.S., the role of the private sector in TB control and how TB control is funded. The U.S. combines a centralised role of the national government in policy development, funding and the maintenance of national surveillance with a decentralised role of state and local jurisdictions in the adaptation / implementation of national guidelines and day to day programme activities. The authors note "Given the relative success of this combined approach, other countries facing the challenge of maintaining an effective TB control program in the face of increased decentralization of health services may find this description useful."

Colditz GA, Brewer TF, Berkey CS, et al. 1994. **Efficacy of BCG vaccine in the prevention of tuberculosis: Meta-analysis of the published literature**. Journal of the American Medical Association 271(9) 698-702.

This paper reports on a meta-analysis of 14 prospective trials (7 of which were RCTs) and 12 case-control studies. From the trials it was estimated (using a random effects model) that the relative risk of TB in the vaccine recipients compared with the non-recipients was 0.49 (95% CI 0.34-0.74). From the case-control studies the odds ratio was estimated to be 0.50 (95% CI 0.39-0.64). The authors concluded "On average, BCG vaccine significantly reduces the risk of TB by 50%. Protection is observed across many populations, study designs and forms of TB. Age at vaccination did not enhance predictiveness of BCG efficacy. Protection against TB death, meningitis, and disseminated disease is higher than for total TB cases, although this result may reflect reduced error in disease classification rather than greater BCG efficacy."

Other Relevant Publications

Bissielo A, Lim E, Heffernan H. 2011. **Tuberculosis in New Zealand: Annual Report 2010**. Wellington: Institute of Environmental Science and Research Ltd (ESR). http://www.surv.esr.cri.nz/PDF_surveillance/AnnTBReports/TBAnnualReport2010.pdf

This report summarises the epidemiology of TB notifications in New Zealand in 2010 and the trends from 2006 to 2010. In total during 2010 there were 661 notified cases, 29 of which were under the age of 20.

The Asthma and Respiratory Foundation of New Zealand, Innes Asher and Cass Byrnes, editors. 2006. **Trying to Catch our Breath: The burden of preventable breathing disorders in children and young people**. Wellington: The Asthma and Respiratory Foundation of New Zealand. http://www.asthmanz.co.nz/files/PDF-files/Burden_FullDocument.pdf

Chapter 10 deals with TB. It notes that most children with TB acquire the disease from an infectious adult as TB in young children is rarely infectious. Thus BCG vaccination is recommended for young children who live with people who have a past or present history of TB or who have come from a high risk country. It recommends continuing commitment to TB treatment and surveillance programs, cooperation with other agencies (e.g. immigration, housing) to improve screening and to help reduce the spread of disease, and the development of community y education programmes in at risk groups.

RHEUMATIC FEVER AND HEART DISEASE

Introduction

Acute rheumatic fever is due to a delayed immune response which develops in response to a group A streptococcal throat infection (typically about 3 weeks after the sore throat). It usually occurs in school-age children and may affect the brain, heart, joints, skin or subcutaneous tissue [106]. Recurrent episodes of rheumatic fever may result in the development of rheumatic heart disease, a progressive condition leading to damage, scarring and deformities of the heart valves. Surgery to repair or replace damaged valves may be required [163].

While New Zealand's rheumatic fever rates have declined significantly during the past 30 years, they still remain higher than those of many other developed countries. Risk factors include age (school age children), ethnicity (Pacific>Māori>European), socioeconomic disadvantage and overcrowding [164]. Primary prevention focuses on the adequate treatment of streptococcal throat infections, while secondary prevention aims to ensure that those previously diagnosed with rheumatic fever receive monthly antibiotic prophylaxis, either for 10 years from their first diagnosis or until 21 years of age (whichever is longer), to prevent recurrent rheumatic fever [165].

The following section explores rheumatic fever and heart disease rates in children and young people using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of policy and evidence-based review documents which consider interventions to prevent rheumatic fever and rheumatic heart disease at the population level.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Children and Young People Aged 0–24 Years with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of their first 15 diagnoses.*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with Acute Rheumatic Fever (ICD-10-AM I00–I02) or Chronic Rheumatic Heart Disease (I05–I09) listed in any of the first 15 diagnoses.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Acute Rheumatic Fever or Rheumatic Heart Disease in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Acute Rheumatic Fever or Rheumatic Heart Disease (I00–I09).

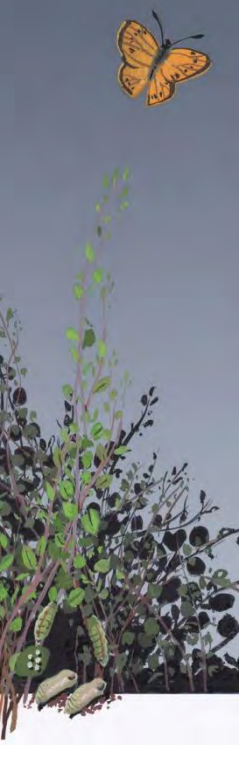
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Unless otherwise specified, this analysis focuses on hospital admissions for children and young people with either acute rheumatic fever or chronic rheumatic heart disease listed in any of the first 15 diagnoses (rather than on the subset of admissions where these diagnoses were listed only as the primary diagnosis). The rationale for this wider focus was the fact that many children and young people with chronic rheumatic heart disease will not be hospitalised for their heart disease per se, but rather for one of its resulting complications. For example, during 2005–2009 only 39.0% of hospitalisations for children and young people with rheumatic heart disease had this listed as the primary diagnosis, with 11.8% being admitted for pregnancy and childbirth, and 11.0% for other cardiovascular diagnoses [145].

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 3: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.



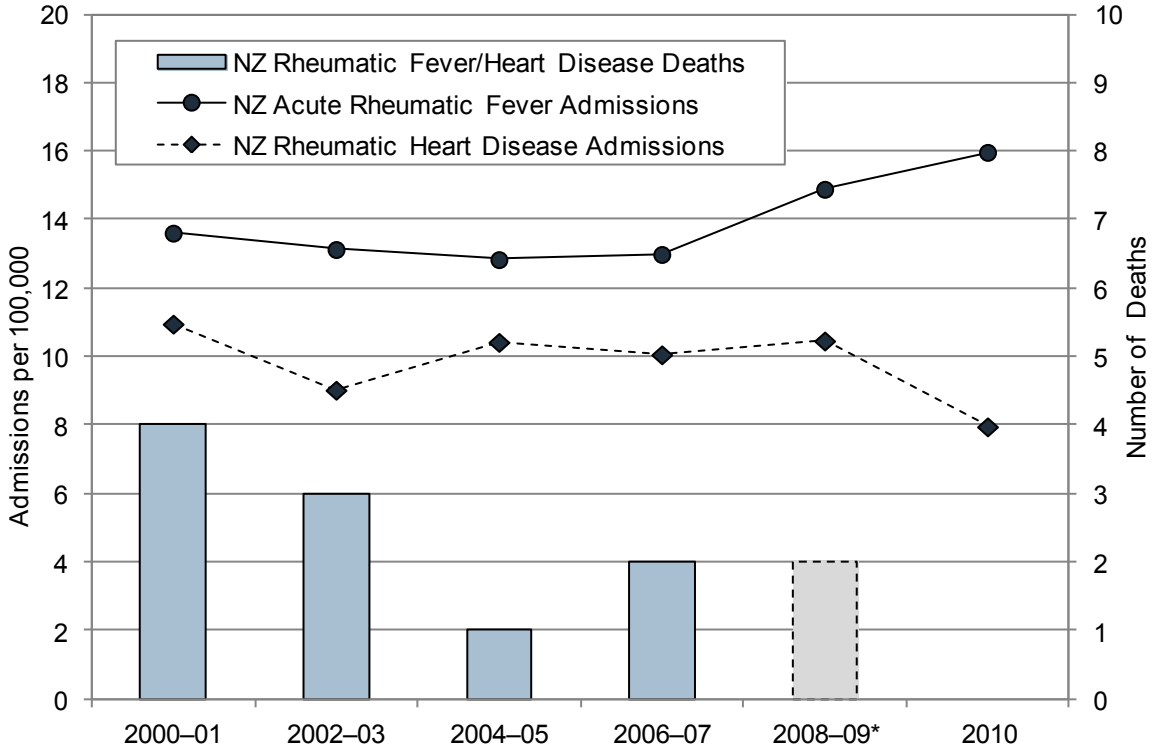
Note 4: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for children and young people with acute rheumatic fever declined gradually during the early-mid 2000s, but then increased again after 2006–07. In contrast, admissions for those with rheumatic heart disease were relatively static during the mid 2000s, although a downswing in rates was evident in 2010. During 2000–2008, on average one child or young person each year died as the result of Acute Rheumatic Fever or Rheumatic Heart Disease (**Figure 88**).

Figure 88. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000−2008) from Acute Rheumatic Fever and Rheumatic Heart Disease in New Zealand Children and Young People Aged 0−24 Years

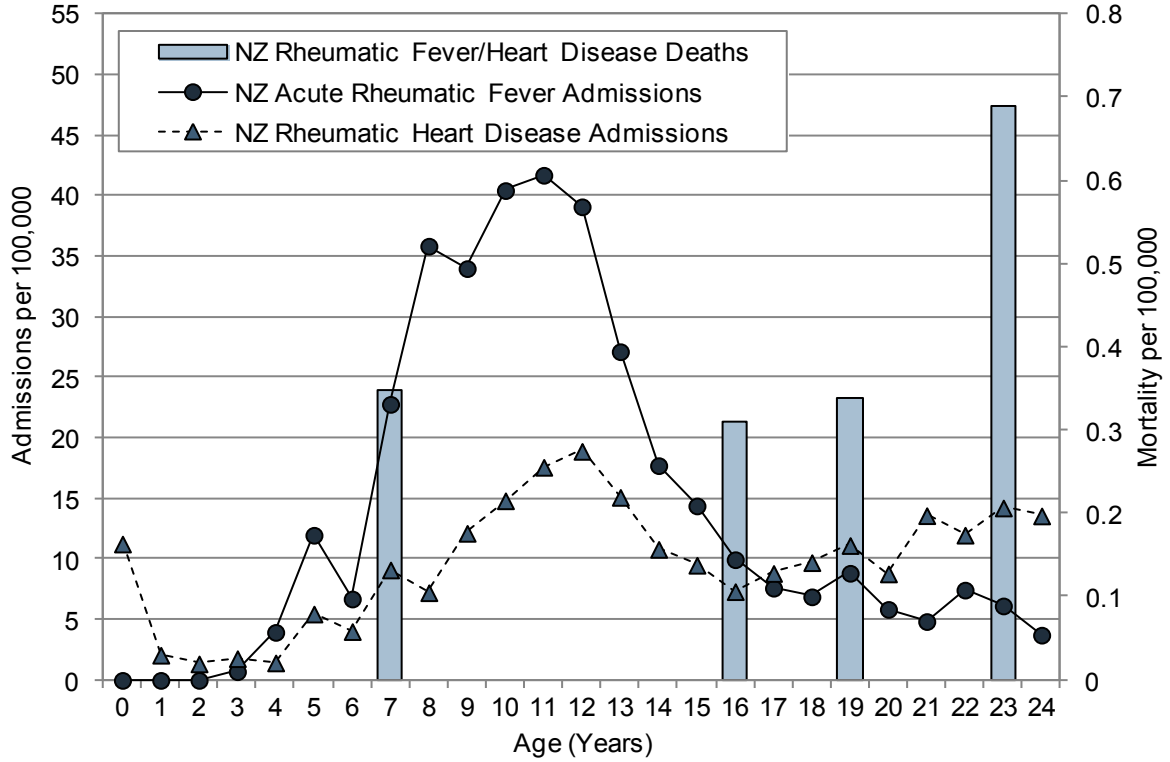


Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.*Note: Number of deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

New Zealand Distribution by Age

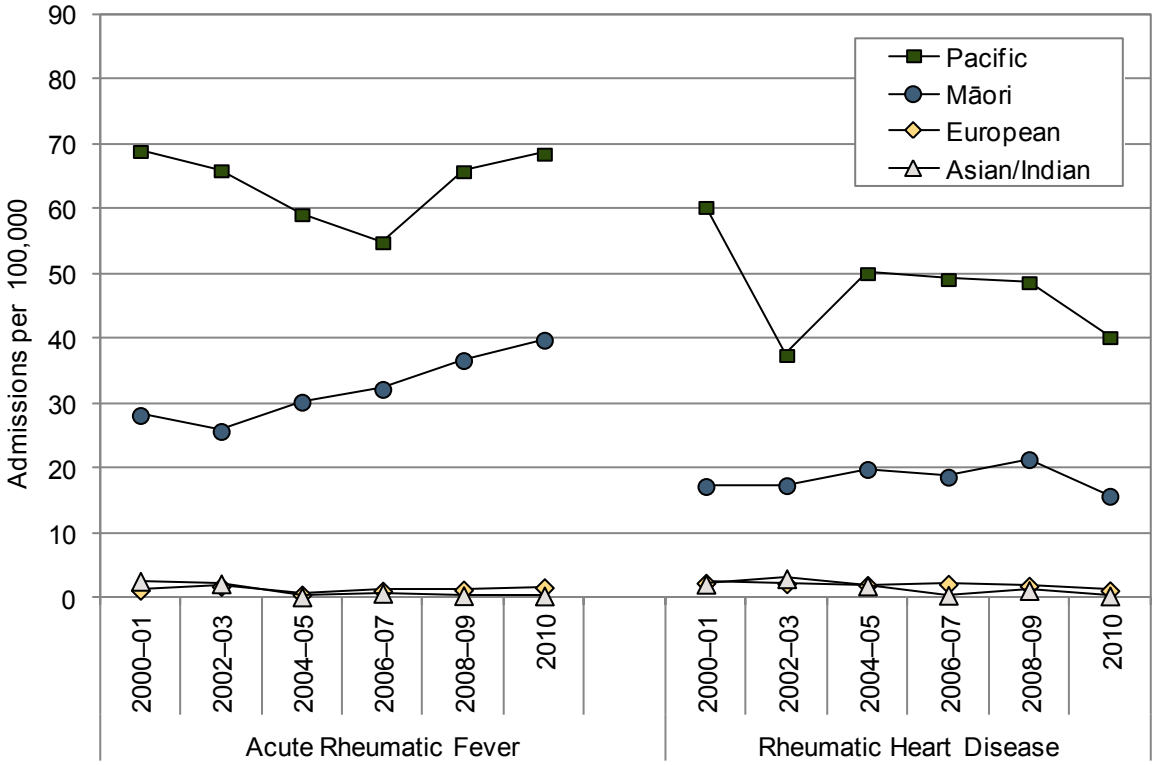
In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever were relatively infrequent during infancy, but increased rapidly during childhood, to reach a peak at 11 years of age. Hospital admissions for rheumatic heart disease also increased during childhood, to reach a peak at 12 years of age. In contrast, during 2004–2008 mortality from acute rheumatic fever or rheumatic heart disease was more common amongst those in their late teens and early twenties (**Figure 89**).

Figure 89. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Acute Rheumatic Fever and Rheumatic Heart Disease in New Zealand Children and Young People by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 90. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2000–2010



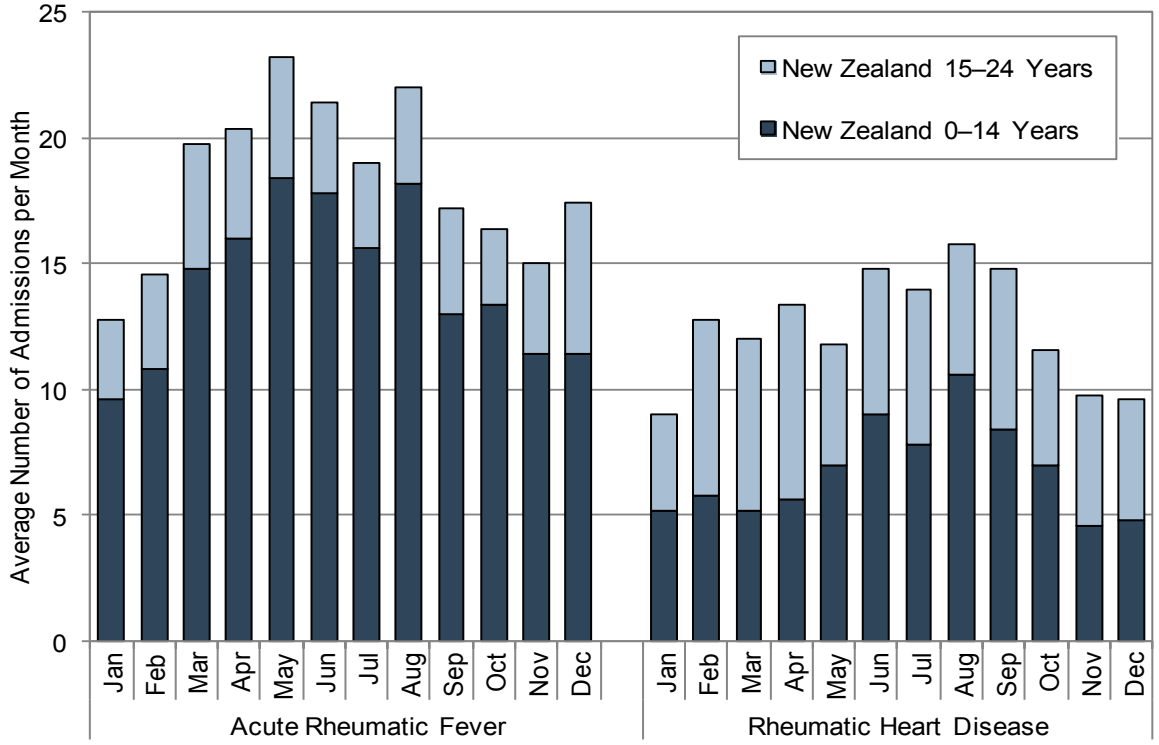
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 86. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Acute Rheumatic Fever 0–24 Years							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	1.64	1.00		European	1.41	1.00	
Decile 3–4	3.52	2.15	1.31–3.53	Māori	35.6	25.3	19.4–33.0
Decile 5–6	4.73	2.89	1.80–4.64	Pacific	62.2	44.2	33.7–57.8
Decile 7–8	11.6	7.07	4.58–10.9	Asian/Indian	0.65	0.46	0.20–1.07
Decile 9–10	41.6	25.4	16.8–38.5				
Gender							
Female	12.3	1.00		Male	16.4	1.34	1.18–1.51
Rheumatic Heart Disease 0–24 Years							
NZ Deprivation Index Quintile				Prioritised Ethnicity			
Decile 1–2	1.14	1.00		European	1.97	1.00	
Decile 3–4	3.44	3.03	1.72–5.33	Māori	19.3	9.78	7.69–12.4
Decile 5–6	3.73	3.27	1.87–5.73	Pacific	47.2	23.9	18.8–30.4
Decile 7–8	7.84	6.89	4.09–11.6	Asian/Indian	0.87	0.44	0.21–0.91
Decile 9–10	26.0	22.8	13.9–37.5				
Gender							
Female	10.7	1.00		Male	8.89	0.83	0.72–0.96

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 91. Average Number of Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0–24 Years by Month, New Zealand 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas. Hospital admissions for rheumatic heart disease were *significantly* higher for females, Pacific > Māori > European > Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 86**). Similar ethnic differences were seen during 2000–2010 (**Figure 90**).

New Zealand Distribution by Season

In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever and rheumatic heart disease were generally higher during the cooler months (**Figure 91**).

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease were *significantly* higher than the New Zealand rate, while in Lakes rates were not *significantly* different from the New Zealand rate. In the Waikato, admissions for acute rheumatic fever were similar to the New Zealand rate, while admissions for rheumatic heart disease were *significantly* lower. In Taranaki, while admissions for acute rheumatic fever and rheumatic heart disease were both lower than the New Zealand rate, only in the case of acute rheumatic fever did these differences reach statistical significance (**Table 87**).

Table 87. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0−24 Years, Midland DHBs vs. New Zealand 2006−2010

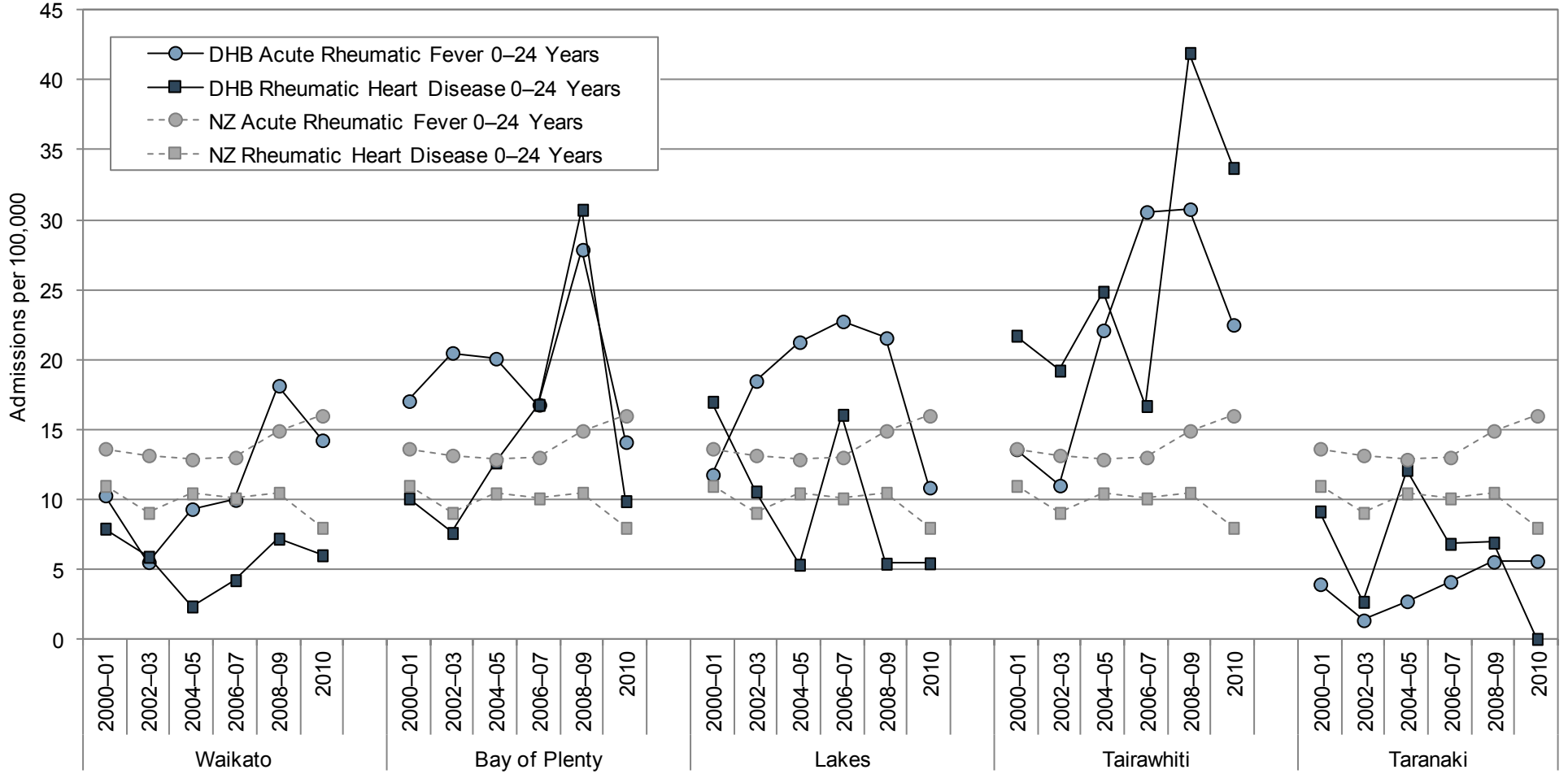
DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Acute Rheumatic Fever 0–24 Years					
Waikato	93	18.6	14.1	0.98	0.79–1.21
Lakes	37	7.4	19.9	1.38	1.00–1.92
Bay of Plenty	72	14.4	20.7	1.44	1.13–1.83
Tairawhiti	26	5.2	29.0	2.02	1.37–2.98
Taranaki	9	1.8	4.95	0.34	0.18–0.66
New Zealand	1,096	219.2	14.4	1.00	
Rheumatic Heart Disease 0–24 Years					
Waikato	38	7.6	5.76	0.59	0.42–0.81
Lakes	18	3.6	9.68	0.99	0.62–1.58
Bay of Plenty	73	14.6	21.0	2.14	1.68–2.72
Tairawhiti	27	5.4	30.2	3.08	2.10–4.52
Taranaki	10	2.0	5.50	0.56	0.30–1.05
New Zealand	747	149.4	9.79	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

In the Midland Region during 2000–2010, large year to year variations in rates (likely as the result of small numbers) made trends in hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease difficult to interpret (**Figure 92**).

Figure 92. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Summary

In New Zealand, hospital admissions for children and young people with acute rheumatic fever declined gradually during the early-mid 2000s, but increased again after 2006–07. In contrast, admissions for those with rheumatic heart disease were relatively static during the mid 2000s, although a downswing in rates was evident in 2010. During 2006–2010, acute rheumatic fever and heart disease admissions were both relatively infrequent during infancy, but increased rapidly during childhood, to reach a peak at 11-12 years of age. Acute rheumatic fever admissions were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas, while rheumatic heart disease admissions were *significantly* higher for females, Pacific > Māori > European > Asian/Indian children and young people and those from average-to-more deprived (NZDep decile 3–10) areas.

In the Midland Region during 2000–2010, large year to year variations in rates (likely as the result of small numbers) made trends in hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease difficult to interpret. During 2006–2010, hospital admissions for children and young people with acute rheumatic fever and rheumatic heart disease in the Bay of Plenty and Tairawhiti were *significantly* higher than the New Zealand rate, while in Lakes rates were not *significantly* different from the New Zealand rate. In the Waikato, admissions for acute rheumatic fever were similar to the New Zealand rate, while admissions for rheumatic heart disease were *significantly* lower. In Taranaki, while admissions for both outcomes were lower than the New Zealand rate, only in the case of acute rheumatic fever did these differences reach statistical significance.

Local Guidelines and Evidence-Based Reviews Relevant to the Prevention and Management of Rheumatic Fever

The primary prevention of rheumatic fever focuses on the adequate treatment of streptococcal throat infections, while secondary prevention aims to ensure that all children and young people previously diagnosed with rheumatic fever receive monthly antibiotic prophylaxis. In New Zealand, while there are no Government policy documents which focus solely on rheumatic fever, the National Heart Foundation has developed a set of guidelines for the primary and secondary prevention of rheumatic fever. These are reviewed in **Table 88**, along with a range of other reviews and guidelines which consider these issues in the overseas context.

In addition, many of the measures reviewed in the context of respiratory and infectious diseases are likely to have a significant impact on rheumatic fever. These include:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 44 on Page 158
2. **The Prevention of Second Hand Smoke Exposure:** Table 45 on Page 160
3. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 101

Table 88. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Acute Rheumatic Fever and Rheumatic Heart Disease

New Zealand Guidelines
The National Heart Foundation of New Zealand. 2006. **New Zealand Guidelines for Rheumatic Fever 1. Diagnosis, Management and Secondary Prevention**. Auckland: The National Heart Foundation of New Zealand. http://www.heartfoundation.org.nz/files/Rheumatic%20fever%20guideline%201.pdf These guidelines provide evidence-based guidance on the best practice for the diagnosis and management of acute rheumatic fever, for secondary prophylaxis (prevention of repeat attacks), and also for the standard of care that should be available to all people in New Zealand including those who are members of high-risk populations. Evidence is graded according to the system used in the National Heart Foundation of Australia Rheumatic Fever Guidelines (level 1 evidence is that obtained from a systematic review of a number of RCTs) and recommendations are graded based on the quality of the evidence on which they are based. A summary of the N.Z. guidelines has been published as: Atatoa-Carr P, Lennon D, Wilson N, et al. 2008. **Rheumatic fever diagnosis, management, and secondary prevention: a New Zealand guideline**. New Zealand Medical Journal, 121(1271), 59-69.
The National Heart Foundation of New Zealand. 2008. **New Zealand Guidelines for Rheumatic Fever 2. Group A Streptococcal Sore Throat Management**. Auckland: The National Heart Foundation of New Zealand. http://www.heartfoundation.org.nz/files/Rheumatic%20Fever%20Guideline%202.pdf The purpose of these guidelines is to provide evidence-based guidance for the diagnosis and treatment of Group A streptococcal sore throats in people aged 3 to 45 years to help ensure that those at highest risk of developing rheumatic fever receive the correct diagnosis and treatment while at the same time minimising unnecessary investigations and antibiotic use in those who are at the lowest risk. The levels of evidence and grades of recommendations used are adapted from the National Health and Medical Research Council levels of evidence and the U.S. National Institute of Health clinical guidelines. A summary of the N.Z. guidelines has been published as: Kerdemelidis M, Lennon D, Arroll B, et al. 2009. **Guidelines for sore throat management in New Zealand**. New Zealand Medical Journal, 122(1301), 10-8.
The New Zealand Heart Foundation. 2009. **New Zealand Guidelines for Rheumatic Fever 3. Proposed Rheumatic Fever Primary Prevention Programme**. Auckland: The National Heart Foundation of New Zealand. http://www.heartfoundation.org.nz/files/Rheumatic%20Fever%20Guideline%203.pdf These guidelines state that treating Group A Streptococcal sore throats reduces the rate of subsequent rheumatic fever and that school and community based programmes for detection and treatment are effective. There is a role for Māori and Pacific health care providers, school-based sore throat programmes and for primary health care reforms to improve access to health care for the people at highest risk of developing rheumatic fever. Household crowding is associated with an increased risk of developing rheumatic fever and some, but not all studies show a link with poverty. There is no convincing evidence of a genetic susceptibility to rheumatic fever or an association with skin infections (which can also be caused by Group A streptococcal infection). These guidelines use the same evidence grading system as the earlier National Heart Foundation guidelines.
The National Heart Foundation of New Zealand. 2008. **New Zealand Guideline for Prevention of Infective Endocarditis Associated with Dental and Other Medical Interventions**. Auckland: The National Heart Foundation of New Zealand. http://www.toiteorapublichealth.govt.nz/vdb/document/312 The introduction to these guidelines states that “There has never been a prospective clinical placebo-controlled trial of antibacterial prophylaxis in individuals with cardiac risk undergoing a potentially bacteraemia-producing procedure.” It is noted the 2007 American Heart Association recommendations advise prophylaxis only for those having dental procedures while the U.K. National Institute for Clinical Excellence recommendations advise no prophylaxis for anyone, for any procedure. The New Zealand guidelines recommend prophylaxis for people with rheumatic valvular heart disease and emphasise the importance of good oral health for all people at risk of endocarditis.
Systematic and Other Reviews from the International Literature
Kerdemelidis M, Lennon DR, Arroll B, et al. 2010. **The primary prevention of rheumatic fever**. Journal of Paediatrics & Child Health, 46(9), 534-48. This comprehensive review of the literature presents recommendations for prevention under the headings of Socio-economic factors, Biological factors, Lifestyle factors and Healthcare systems and services. The authors were members of the writing group responsible for the New Zealand guidelines and much of the material in this review is also in the third of the guidelines.

van Driel M L, De Sutter A I M, Keber N, et al. 2010. **Different antibiotic treatments for group A streptococcal pharyngitis**. Cochrane Database of Systematic Reviews, 2010(10), Art.No.:CD004406. DOI: 10.1002/14651858.CD004406.pub2.

Antibiotics are of limited benefit in treating sore throat unless patients have positive throat swabs for group A beta-hemolytic streptococci (GABHS). Seventeen RCTs (5352 participants) were included in this review. Sixteen compared penicillin with another antibiotic and one compared clindamycin with ampicillin. All of the trials were conducted in high income countries where the risk of rheumatic fever is low and they do not provide information on the effectiveness of different antibiotics for the prevention of complications (rheumatic fever and post-streptococcal glomerulonephritis). The authors found that there was insufficient evidence for clinically meaningful differences between antibiotics used to treat GABHS. They conclude that considering these results together with the low cost of penicillin and the lack of penicillin resistance by GABHS, penicillin can still be recommended as a first choice antibiotic. They state that there is a need for studies in specific communities at high risk for complications.

Lennon D, Kerdemelidis M, Arroll B. 2009. **Meta-analysis of trials of streptococcal throat treatment programs to prevent rheumatic fever**. Pediatric Infectious Disease Journal, 28(7), e259-64.

This study assessed prevention of rheumatic fever through treatment of streptococcal pharyngitis in school- and/or community- based programmes by doing a meta-analysis of relevant RCTs or before-and-after studies. Data from 6 studies which met the inclusion criteria were pooled in a meta-analysis to give a relative risk of 0.41 (95% CI 0.23 – 0.70) for the interventions. The authors state that this result indicates that a school and/or community based programmes could be expected to decrease the number of cases of acute rheumatic fever by about 60%.

Altamimi S, Khalil A, Khalaiwi KA, et al. 2009. **Short versus standard duration antibiotic therapy for acute streptococcal pharyngitis in children**. Cochrane Database of Systematic Reviews, 2009(1), Art. No.: CD004872. DOI: 10.1002/14651858.CD004872.pub2.

This review considered evidence for the efficacy of treatment of acute group A beta haemolytic streptococcus (GABHS) pharyngitis with two to six days of newer oral antibiotics compared to the standard treatment of 10 days of oral penicillin. The review included 20 RCTs with a total of 13102 cases. The authors concluded that three to six days of oral antibiotics had comparable efficacy to 10 days of penicillin however they noted that the primary reason for 10 days of penicillin is for prevention of rheumatic fever and they state “in areas where the prevalence of rheumatic fever is still high our results must be interpreted with caution.”

Lennon D, Al Tamimi SA. 2011. **Commentary on ‘Short versus standard duration antibiotic therapy for acute streptococcal pharyngitis in children**’. Evidence-Based Child Health: A Cochrane Review Journal, 6(2), 803-05.

In this commentary the authors outline their concerns about the above review particularly the criteria chosen to indicate successful treatment and the heterogeneity of the trials included. They state that group A Streptococcus is the only common cause of acute pharyngitis requiring antibiotic treatment, it is highly sensitive to penicillin and that 10 days of treatment remains the gold standard.

Spinks A, Glasziou P, Del Mar C. 2006. **Antibiotics for Sore Throat**. Cochrane Database of Systematic Reviews, 2006(4), Art. No.: CD000023. DOI: 10.1002/14651858.CD000023.pub3.

This review assessed the benefits of antibiotics for sore throat. Sixteen of the 27 trials included (10101 participants) assessed the benefits of antibiotics in reducing the incidence of rheumatic fever within two months. A meta-analysis of these 16 studies gave a rheumatic fever risk ratio of 0.27 (95% CI 0.12 -0.60) for antibiotics vs. placebo. Meta-analyses looking at penicillin and pre-1975 studies separately gave similar results to the meta-analysis of all antibiotic studies together. (There were no cases of rheumatic fever in the post 1975 studies.) There was no distinction made in this review between adults and children. The authors concluded that antibiotic use may be justified in areas where rheumatic fever is common but that in other places practitioners need to weigh the modest symptom reductions against the hazards of antibiotic treatment.

Robertson KA, Volmink JA, Mayosi BM. 2005. **Antibiotics for the primary prevention of acute rheumatic fever: a meta-analysis**. BMC Cardiovascular Disorders, 5(1), 11.

This review included 10 random or quasi-randomised trials with a total of 7665 participants, generally considered to be of poor methodological quality. All were conducted between 1950 and 1961 and 8 of them involved young men in U.S. military bases. The results of the meta-analysis showed an overall protective effect for antibiotics in the prevention of rheumatic fever following sore throat (with or without confirmation of group A streptococcal infection) (RR 0.32, 95% CI 0.21 – 0.48). When only the 9 trials including intramuscular penicillin were included in the meta-analysis the protective effect was greater (an 80% reduction, RR 0.20, 95% CI 0.11 – 0.36). The authors state that their findings support the view that treating cases of suspected streptococcal pharyngitis with antibiotics is an effective and safe way to prevent rheumatic fever in children in poor socioeconomic conditions where rheumatic fever is common.

Manyemba J, Mayosi B M. 2002. **Penicillin for secondary prevention of rheumatic fever**. Cochrane Database of Systematic Reviews, 2002(3), Art. No.: CD002227. DOI: 10.1002/14651858.CD002227.

Recurrent (secondary) episodes of rheumatic fever are associated with a high risk of developing chronic rheumatic heart disease and also of worsening already existing rheumatic heart disease. Continuing treatment with penicillin can prevent recurrent attacks. This review included 9 studies (3008 participants in total), which the authors considered to be of generally poor quality, investigating various preventive penicillin regimens and formulations. Based on the findings from four trials (1098 participants) the authors concluded that intramuscular penicillin seemed to be more effective than oral penicillin in preventing rheumatic fever recurrence and streptococcal throat infections. There was limited evidence that two-weekly or three-weekly injections were more effective than four weekly injections (one trial for each).

Relevant New Zealand Publications and Websites
White H, Walsh W, Brown A, et al. 2010. **Rheumatic heart disease in indigenous populations**. Heart, Lung & Circulation, 19(5-6), 273-81. Proceedings of the Inaugural CSANZ Indigenous Cardiovascular Health Conference The section of this conference presentation entitled: **Rheumatic Fever and Rheumatic Heart Disease in New Zealand (Nigel Wilson**) provides a useful outline of the topic and some of the New Zealand studies and initiatives. It explains that it is very important to ensure that national campaigns to educate the whole population that most sore throats do not require antibiotics and thus limit unnecessary prescribing (because most sore throats are due to viral infections) do not undermine efforts to encourage identification and treatment of streptococcal sore throats which can lead to rheumatic fever in vulnerable Māori and Pacific people.
The following publications and websites provide information on a variety of New Zealand studies and initiatives: Spinetto H, Lennon D, Horsburgh M. 2011. **Rheumatic fever recurrence prevention: A nurse-led programme of 28-day penicillin in an area of high endemnicity**. Journal of Paediatrics and Child Health, 47(4), 228-34. Jaine R, Baker M, Venugopal K. 2011. **Acute rheumatic fever associated with household crowding in a developed country**. Pediatric Infectious Disease Journal, 30(4), 315-9. Webb RH, Wilson NJ, Lennon DR, et al. 2011. **Optimising echocardiographic screening for rheumatic heart disease in New Zealand: not all valve disease is rheumatic**. Cardiol Young, March 31, 1-8. Northland District Health Board. 2010. **Preliminary Rheumatic Fever ResultsReleased**.http://www.northlanddhb.org.nz/media-releases/media-releases/preliminary-rheumatic-fever-results-released.html accessed 2/5/2011 White H, Walsh W, Brown A, et al. 2010. **Rheumatic heart disease in indigenous populations**. Heart, Lung & Circulation, 19(5-6), 273-81. Lennon D, Stewart J, Farrell E, et al. 2009. **School-based prevention of acute rheumatic fever: a group randomized trial in New Zealand**. Pediatric Infectious Disease Journal, 28(9), 787-94 Emery Tepora. 2009. **Rheumatic Fever Awareness Campaign 2009 Evaluation Report**. Rotorua: Mātara Limited. http://www.toiteorapublichealth.govt.nz/vdb/document/275 Lennon DR, Farrell E, Martin DR, et al. 2008. **Once-daily amoxicillin versus twice-daily penicillin V in group A beta-haemolytic streptococcal pharyngitis.** Archives of Disease in Childhood, 93(6), 474-8. Loring B. 2008. **Rheumatic Fever in the Bay of Plenty and Lakes District Health Boards. A Review of the Evidence and Recommendations for Action.** Toi Te Ora Public Health, Tauranga. http://www.toiteorapublichealth.govt.nz/vdb/document/150 Atatoa-Carr P, Bell A, Lennon DR. 2008. **Acute rheumatic fever in the Waikato District Health Board region of New Zealand: 1998-2004.** New Zealand Medical Journal, 121(1285), 96-105. Yang L, Eriksson B, Harrington Z, et al. 2006. **Variations in the protective immune response against streptococcal superantigens in populations of different ethnicity.** Medical Microbiology & Immunology, 195(1), 37-43. Thornley C, McNicholas A, Baker M, et al. 2001. **Rheumatic Fever Registers in New Zealand.** New Zealand Public Health Report, 8(6). Dierksen KP, Inglis M, Tagg JR. 2000. **High pharyngeal carriage rates of Streptococcus pyogenes in Dunedin school children with a low incidence of rheumatic fever.** New Zealand Medical Journal, 113(1122), 496-9. Harre N, Thomas D, Brown K, et al. 2000. **Communicating information about sore throats and rheumatic fever to South Auckland high-school students.** New Zealand Medical Journal, 113(1111), 215-7. Martin DR, Voss LM, Walker SJ, et al. 1994. **Acute rheumatic fever in Auckland, New Zealand: spectrum of associated group A streptococci different from expected.** Pediatric Infectious Disease Journal, 13(4), 264-9.

SERIOUS SKIN INFECTIONS

Introduction

Bacterial skin infections are a common cause of hospitalisation in children. The most frequently implicated organisms are *Staphylococcus aureus* and *Streptococcus pyogenes* [166]. Skin infections are more likely to develop in damaged skin which, in children, is often due to eczema, abrasions or insect bites. Common clinical presentations include:

Cellulitis: A diffuse infection of the skin and subcutaneous tissue characterised by local heat, redness, pain, swelling and occasionally fever, swollen lymph glands, malaise, chills and headache. Tissue destruction or abscess formation may occur if antibiotics are not taken [167].

Abscesses, Furuncles and Carbuncles: Skin abscesses are collections of pus within the dermis and deeper skin tissues. They are tender, red, firm or fluctuant masses of walled off purulent material. A furuncle (commonly known as a boil) is an abscess which arises from infection of a hair follicle (usually involving *S. aureus*), which then enlarges and eventually opens to the skin surface, allowing the purulent contents to drain. A carbuncle is an aggregate of infected hair follicles forming a broad, swollen, red and painful mass which usually opens and drains through multiple tracts. Associated symptoms may include fever and malaise [168].

In New Zealand, hospital admissions for childhood skin infections have increased in recent years [169] and have been reported to be double those of the USA and Australia [170]. Admissions are highest during summer and autumn and are higher for Māori and Pacific children and those living in the most deprived areas [169,170]. In developing interventions to reduce childhood skin infections, issues such as overcrowding, access to washing machines and first aid kits, treatment of eczema, the cleaning and covering of wounds, exposure to insect bites, and access to primary health care may all need to be addressed simultaneously [170].

The following section explores skin infection rates in children and young people using information from the National Minimum Dataset and Mortality Collection, and a coding algorithm recently developed by O'Sullivan and Baker [169] for use in the New Zealand context. The section concludes with an overview of policy documents and evidence-based reviews which consider interventions to address skin infections at the population level.

Data Sources and Methods

Indicator

1. *Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0–24 years with a diagnosis of a Serious Skin Infection in any of their first 15 diagnoses.

The ICD-10-AM coding used is that developed by O'Sullivan and Baker in 2010 for use in the New Zealand context [169] as follows: Impetigo (L010, L011); Cutaneous Abscess/Furuncle/Carbuncle (L02); Cellulitis (L03); Acute Lymphadenitis (L04); Pilonidal Cyst with Abscess (L050); Other Infections Skin/Subcutaneous Tissue (L08); Infections of Other Anatomical Sites (H000, H600, H601, H602, H603, H620, H624, J340, K610, H050, N482, N492, N499, N764 A46); Infected/Unspecified/Other Dermatitis (L303, L308, L309);Insect/Spider Bites (S1013, S1083, S1093, S2013, S2033, S2043, S2083, S3083, S3093, S4083, S5083, S6083, S7083, S8083, S9083, T0903, T1108, T1303, T1403, T633, T634,T009); Post Traumatic/Open Wound Infection (T793, T8901, T8902); Scabies (B86); Varicella with Other Complications (B018);

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: The rates presented here differ from those in the Ambulatory Sensitive Hospital Admissions and Hospital Admissions with a Social Gradient sections in two key ways. Firstly, these former sections use primary diagnosis only, so that each hospital admission can be ascribed a single reason for admission. In this section however, hospital admissions with the ICD-10-AM codes listed above in ANY of their first 15 diagnoses have been included. Secondly, the codes included here are broader than those used in the ASH or Hospital Admissions with a social gradient section, as they include codes outside of the traditional ICD-10-AM skin infection sub-chapter (e.g. they include admissions following insect and spider bites, infected and unspecified

eczema, infected open wounds, and infections at specific anatomical sites (e.g. the genitalia)). The rationale for the inclusion of these wider categories is to align the coding in this section with that proposed by O'Sullivan and Baker in their recent review of skin infections in children [169], so that a standard reporting convention can be adopted within the sector. The coding conventions however, have not been retrospectively applied to the ASH and Admissions with a Social Gradient sections as these composite indicators require the use of the primary diagnoses only (so that later diagnoses in the coding algorithm do not overwrite earlier primary diagnoses) and because the social gradients and primary care preventability of these additional diagnoses (e.g. open wounds, superficial infections of the genitalia) have not as yet been fully assessed/consulted on within the sector.

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

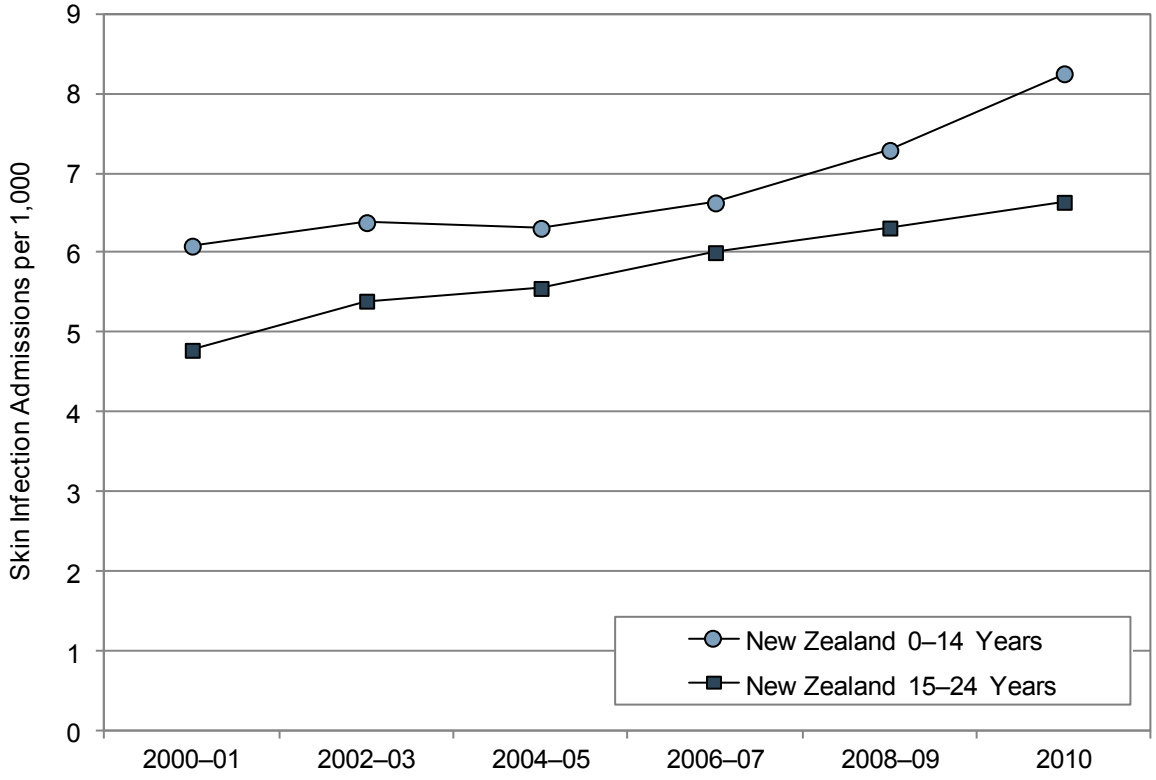
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for serious skin infections increased in both children and young people, with admission rates for children being higher than for young people throughout this period (**Figure 93**).

Figure 93. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution

In New Zealand during 2006–2010, cellulitis and cutaneous abscesses/furuncles/ carbuncles were the most frequent primary diagnoses in children admitted to hospital with serious skin infections, followed by infected/unspecified/other dermatitis. In contrast, in young people, cutaneous abscesses/furuncles/carbuncles, cellulitis and pilonidal cysts with abscesses were the main reasons for hospital admission (**Table 89**).

Table 89. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, New Zealand 2006–2010

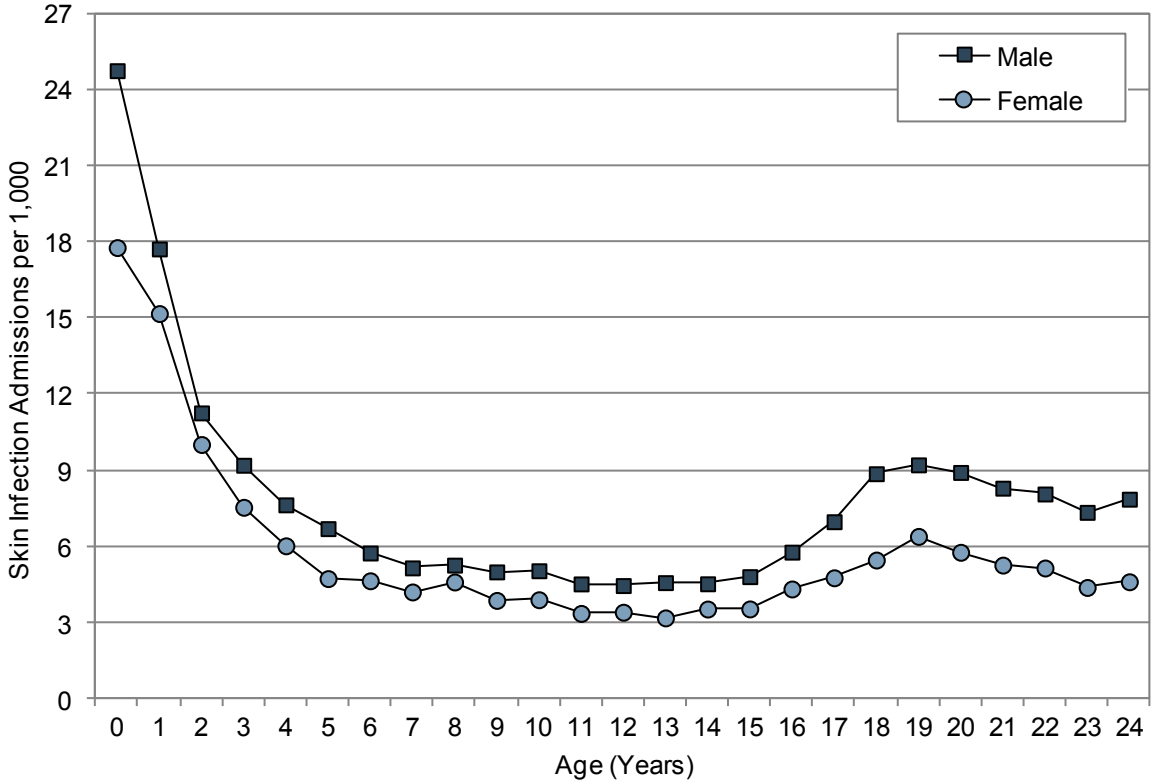
Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
Children 0–14 Years				
Cellulitis	6,581	1,316.2	1.47	20.4
Cutaneous Abscess/Furuncle/Carbuncle	6,065	1,213.0	1.36	18.8
Infected/Unspecified/Other Dermatitis	2,373	474.6	0.53	7.4
Infections of Other Anatomical Sites	1,757	351.4	0.39	5.5
Acute Lymphadenitis	990	198.0	0.22	3.1
Impetigo	732	146.4	0.16	2.3
Other Infections Skin/Subcutaneous Tissue	570	114.0	0.13	1.8
Varicella with Other Complications	453	90.6	0.10	1.4
Insect/Spider Bites	420	84.0	0.09	1.3
Scabies	385	77.0	0.09	1.2
Post Traumatic/Open Wound Infection	182	36.4	0.04	0.6
Pilonidal Cyst with Abscess	90	18.0	0.02	0.3
Other Diagnoses	11,624	2,324.8	2.60	36.1
Total 0–14 Years	32,222	6,444.4	7.22	100.0
Young People 15–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	3,997	799.4	1.26	20.2
Cellulitis	3,441	688.2	1.09	17.4
Pilonidal Cyst with Abscess	2,774	554.8	0.88	14.0
Infections of Other Anatomical Sites	1,467	293.4	0.46	7.4
Infected/Unspecified/Other Dermatitis	306	61.2	0.10	1.5
Insect/Spider Bites	246	49.2	0.08	1.2
Other Infections Skin/Subcutaneous Tissue	172	34.4	0.05	0.9
Post Traumatic/Open Wound Infection	158	31.6	0.05	0.8
Acute Lymphadenitis	118	23.6	0.04	0.6
Impetigo	111	22.2	0.04	0.6
Scabies	30	6.0	0.01	0.2
Varicella with Other Complications	12	2.4	<0.01	0.1
Other Diagnoses	6,998	1,399.6	2.21	35.3
Total 15–24 Years	19,830	3,966.0	6.26	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution by Age

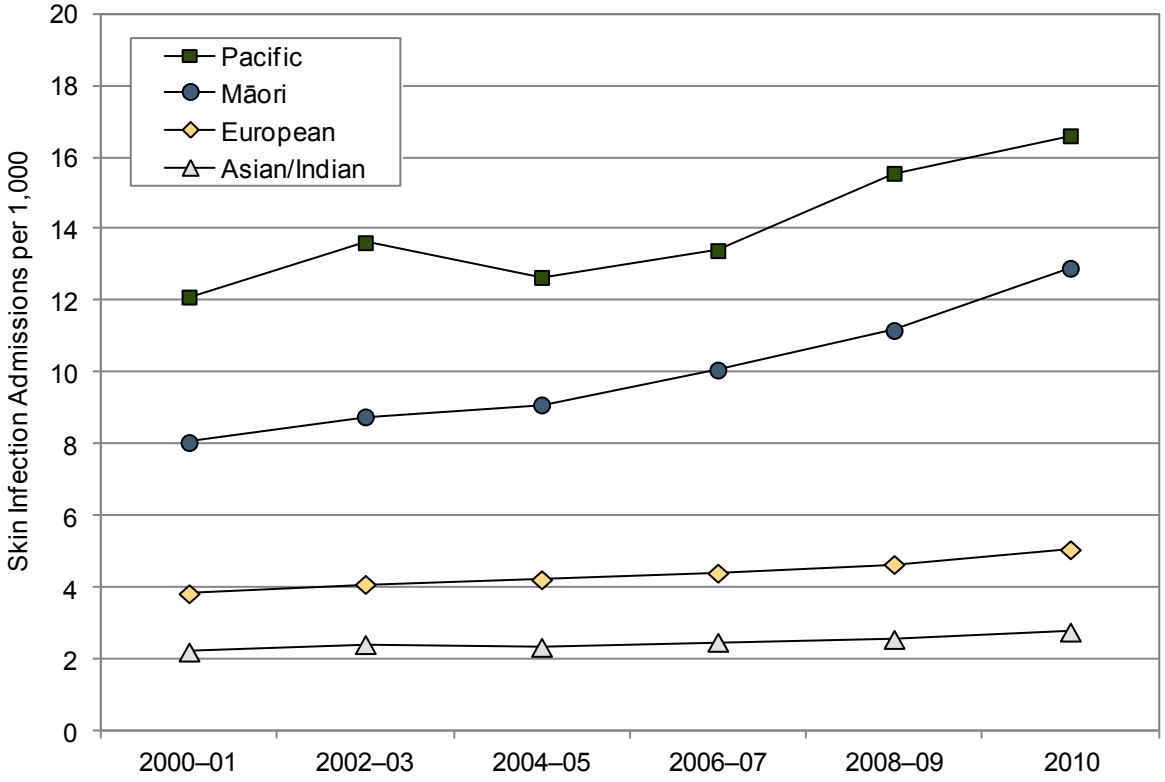
In New Zealand during 2006–2010, hospital admissions for serious skin infections were highest in infants <1 year, with rates tapering off rapidly during the first five years of life. A second, smaller peak in admissions was evident amongst those in their late teens and early twenties. At each age, admission rates were higher for males than for females (**Figure 94**).

Figure 94. Hospital Admissions for Serious Skin Infections in Children and Young People 0–24 Years by Age and Gender, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 95. Hospital Admissions for Serious Skin Infections in Children and Young People 0–24 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

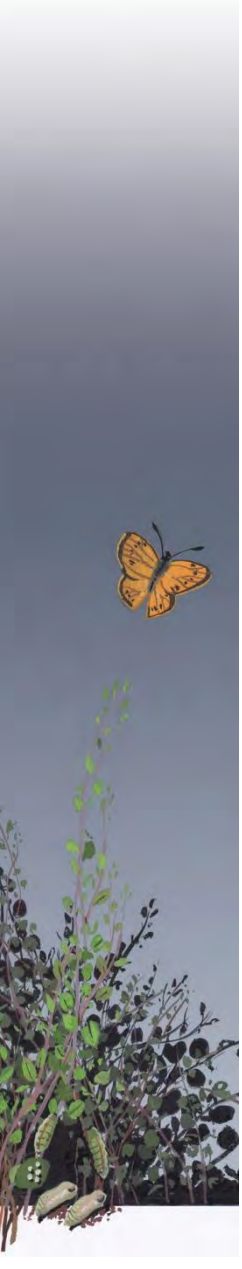
New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for serious skin infections in children were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas. Similarly, for young people, admission rates were *significantly* higher for males, Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 90**). Similar ethnic differences were seen, when both age groups were combined during 2000–2010 (**Figure 95**).

Table 90. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Serious Skin Infections							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.09	1.00		Decile 1–2	3.12	1.00	
Decile 2	3.14	1.02	0.94–1.10	Decile 3–4	3.95	1.27	1.20–1.33
Decile 3	3.64	1.18	1.09–1.27	Decile 5–6	5.52	1.77	1.69–1.85
Decile 4	4.24	1.37	1.28–1.47	Decile 7–8	8.23	2.64	2.52–2.76
Decile 5	5.01	1.62	1.51–1.74	Decile 9–10	13.6	4.36	4.18–4.54
Decile 6	5.95	1.92	1.80–2.05	Prioritised Ethnicity			
Decile 7	7.39	2.39	2.24–2.54	European	3.97	1.00	
Decile 8	8.94	2.89	2.72–3.07	Māori	11.8	2.97	2.89–3.05
Decile 9	11.5	3.70	3.49–3.93	Pacific	17.5	4.42	4.29–4.55
Decile 10	15.4	4.98	4.70–5.27	Asian/Indian	3.97	1.00	0.95–1.05
Gender							
Female	6.35	1.00					
Male	8.04	1.27	1.24–1.29				
Young People 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.64	1.00		Decile 1–2	3.78	1.00	
Decile 2	3.90	1.07	0.98–1.17	Decile 3–4	4.48	1.18	1.12–1.26
Decile 3	4.14	1.14	1.04–1.24	Decile 5–6	5.48	1.45	1.37–1.53
Decile 4	4.78	1.31	1.21–1.42	Decile 7–8	6.81	1.80	1.71–1.90
Decile 5	5.40	1.48	1.37–1.61	Decile 9–10	9.01	2.39	2.27–2.51
Decile 6	5.55	1.52	1.41–1.65	Prioritised Ethnicity			
Decile 7	6.65	1.82	1.69–1.97	European	5.56	1.00	
Decile 8	6.95	1.91	1.77–2.05	Māori	9.86	1.77	1.72–1.83
Decile 9	7.84	2.15	2.00–2.31	Pacific	10.5	1.89	1.81–1.98
Decile 10	10.4	2.86	2.67–3.07	Asian/Indian	1.37	0.25	0.23–0.27
Gender							
Female	4.95	1.00					
Male	7.55	1.53	1.48–1.57				

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001



Midland Region Distribution and Trends

Midland Region Distribution

In the Midland Region during 2006–2010, cutaneous abscesses/furuncles/carbuncles and cellulitis and were the most frequent primary diagnoses in children and young people admitted to hospital with serious skin infections in all five DHBs (**Table 91** to **Table 95**).

Table 91. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, Waikato 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Waikato				
Children 0–14 Years				
Cutaneous Abscess/Furuncle/Carbuncle	459	91.8	1.17	20.9
Cellulitis	420	84.0	1.07	19.1
Infections of Other Anatomical Sites	119	23.8	0.30	5.4
Infected/Unspecified/Other Dermatitis	108	21.6	0.28	4.9
Acute Lymphadenitis	44	8.8	0.11	2.0
Varicella with Other Complications	36	7.2	0.09	1.6
Impetigo	36	7.2	0.09	1.6
Insect/Spider Bites	33	6.6	0.08	1.5
Scabies	32	6.4	0.08	1.5
Other Infections Skin/Subcutaneous Tissue	31	6.2	0.08	1.4
Post Traumatic/Open Wound Infection	8	1.6	0.02	0.4
Pilonidal Cyst with Abscess	<3	s	s	s
Other Diagnoses	869	173.8	2.21	39.6
Total 0–14 Years	2,197	439.4	5.60	100.0
Young People 15–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	318	63.6	1.19	21.2
Cellulitis	221	44.2	0.83	14.8
Pilonidal Cyst with Abscess	210	42.0	0.79	14.0
Infections of Other Anatomical Sites	113	22.6	0.42	7.5
Insect/Spider Bites	20	4.0	0.07	1.3
Infected/Unspecified/Other Dermatitis	14	2.8	0.05	0.9
Other Infections Skin/Subcutaneous Tissue	14	2.8	0.05	0.9
Impetigo	9	1.8	0.03	0.6
Acute Lymphadenitis	7	1.4	0.03	0.5
Post Traumatic/Open Wound Infection	3	0.6	0.01	0.2
Varicella with Other Complications	<3	s	s	s
Scabies	<3	s	s	s
Other Diagnoses	566	113.2	2.12	37.8
Total 15–24 Years	1,498	299.6	5.60	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

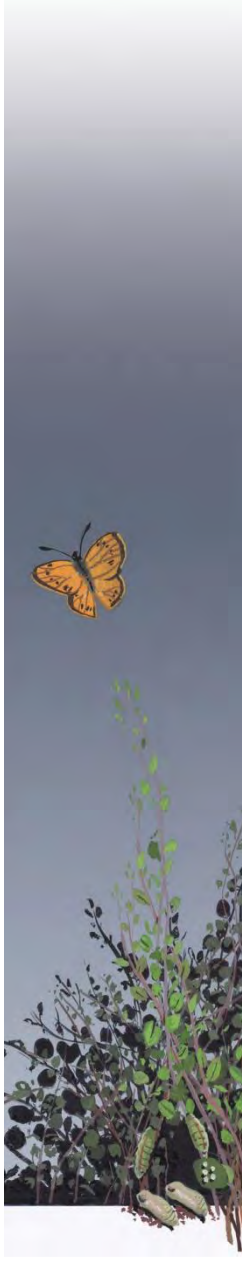


Table 92. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, Bay of Plenty 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Bay of Plenty				
Children 0–14 Years				
Cutaneous Abscess/Furuncle/Carbuncle	364	72.8	1.64	18.1
Cellulitis	345	69.0	1.55	17.1
Infected/Unspecified/Other Dermatitis	202	40.4	0.91	10.0
Infections of Other Anatomical Sites	85	17.0	0.38	4.2
Acute Lymphadenitis	67	13.4	0.30	3.3
Insect/Spider Bites	65	13.0	0.29	3.2
Impetigo	58	11.6	0.26	2.9
Varicella with Other Complications	43	8.6	0.19	2.1
Scabies	38	7.6	0.17	1.9
Other Infections Skin/Subcutaneous Tissue	36	7.2	0.16	1.8
Post Traumatic/Open Wound Infection	15	3.0	0.07	0.7
Pilonidal Cyst with Abscess	<3	s	s	s
Other Diagnoses	696	139.2	3.13	34.5
Total 0–14 Years	2,016	403.2	9.07	100.0
Young People 15–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	220	44.0	1.75	21.9
Cellulitis	184	36.8	1.46	18.3
Pilonidal Cyst with Abscess	118	23.6	0.94	11.8
Infections of Other Anatomical Sites	68	13.6	0.54	6.8
Infected/Unspecified/Other Dermatitis	22	4.4	0.17	2.2
Insect/Spider Bites	21	4.2	0.17	2.1
Post Traumatic/Open Wound Infection	11	2.2	0.09	1.1
Other Infections Skin/Subcutaneous Tissue	11	2.2	0.09	1.1
Impetigo	9	1.8	0.07	0.9
Acute Lymphadenitis	8	1.6	0.06	0.8
Scabies	3	0.6	0.02	0.3
Varicella with Other Complications	<3	s	s	s
Other Diagnoses	328	65.6	2.61	32.7
Total 15–24 Years	1,004	200.8	7.98	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

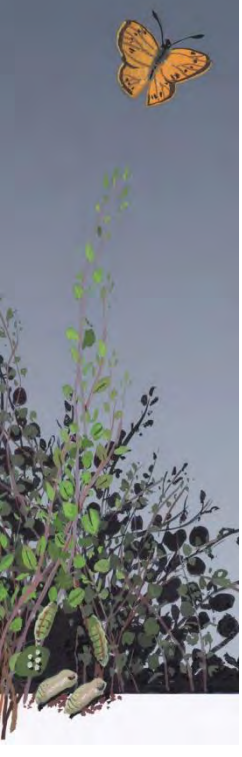


Table 93. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, Lakes DHB 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Lakes DHB				
Children 0–14 Years				
Cutaneous Abscess/Furuncle/Carbuncle	213	42.6	1.78	19.9
Cellulitis	207	41.4	1.73	19.3
Infected/Unspecified/Other Dermatitis	92	18.4	0.77	8.6
Infections of Other Anatomical Sites	51	10.2	0.43	4.8
Impetigo	40	8.0	0.33	3.7
Acute Lymphadenitis	31	6.2	0.26	2.9
Insect/Spider Bites	25	5.0	0.21	2.3
Other Infections Skin/Subcutaneous Tissue	19	3.8	0.16	1.8
Varicella with Other Complications	17	3.4	0.14	1.6
Scabies	14	2.8	0.12	1.3
Pilonidal Cyst with Abscess	6	1.2	0.05	0.6
Post Traumatic/Open Wound Infection	3	0.6	0.03	0.3
Other Diagnoses	352	70.4	2.94	32.9
Total 0–14 Years	1,070	214.0	8.94	100.0
Young People 15–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	132	26.4	1.99	20.4
Cellulitis	115	23.0	1.73	17.8
Pilonidal Cyst with Abscess	65	13.0	0.98	10.1
Infections of Other Anatomical Sites	38	7.6	0.57	5.9
Insect/Spider Bites	16	3.2	0.24	2.5
Infected/Unspecified/Other Dermatitis	14	2.8	0.21	2.2
Post Traumatic/Open Wound Infection	6	1.2	0.09	0.9
Impetigo	<3	s	s	s
Other Infections Skin/Subcutaneous Tissue	<3	s	s	s
Varicella with Other Complications	<3	s	s	s
Acute Lymphadenitis	<3	s	s	s
Other Diagnoses	254	50.8	3.83	39.3
Total 15–24 Years	646	129.2	9.74	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

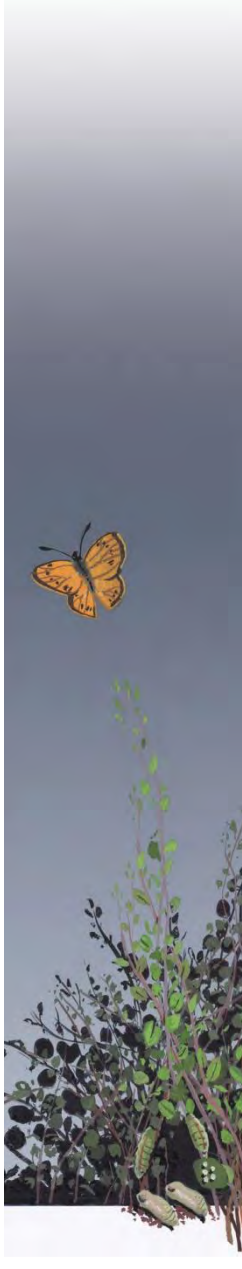


Table 94. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, Tairawhiti 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tairawhiti				
Children 0–14 Years				
Cutaneous Abscess/Furuncle/Carbuncle	121	24.2	2.09	17.2
Cellulitis	119	23.8	2.06	16.9
Infected/Unspecified/Other Dermatitis	77	15.4	1.33	10.9
Infections of Other Anatomical Sites	35	7.0	0.60	5.0
Impetigo	18	3.6	0.31	2.6
Acute Lymphadenitis	18	3.6	0.31	2.6
Other Infections Skin/Subcutaneous Tissue	16	3.2	0.28	2.3
Scabies	13	2.6	0.22	1.8
Varicella with Other Complications	6	1.2	0.10	0.9
Insect/Spider Bites	6	1.2	0.10	0.9
Post Traumatic/Open Wound Infection	<3	s	s	s
Pilonidal Cyst with Abscess	<3	s	s	s
Other Diagnoses	274	54.8	4.73	38.9
Total 0–14 Years	705	141.0	12.18	100.0
Young People 15–24 Years				
Cellulitis	88	17.6	2.78	24.8
Cutaneous Abscess/Furuncle/Carbuncle	50	10.0	1.58	14.1
Infections of Other Anatomical Sites	27	5.4	0.85	7.6
Pilonidal Cyst with Abscess	25	5.0	0.79	7.0
Infected/Unspecified/Other Dermatitis	10	2.0	0.32	2.8
Impetigo	7	1.4	0.22	2.0
Insect/Spider Bites	5	1.0	0.16	1.4
Acute Lymphadenitis	5	1.0	0.16	1.4
Other Infections Skin/Subcutaneous Tissue	<3	s	s	s
Other Diagnoses	136	27.2	4.30	38.3
Total 15–24 Years	355	71.0	11.2	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

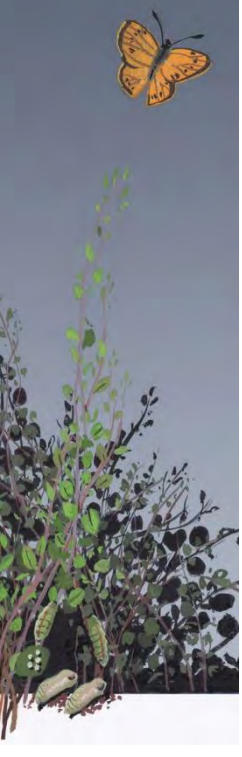


Table 95. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Primary Diagnosis, Taranaki 2006–2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Taranaki				
Children 0–14 Years				
Cellulitis	123	24.6	1.10	20.7
Cutaneous Abscess/Furuncle/Carbuncle	89	17.8	0.80	15.0
Infected/Unspecified/Other Dermatitis	61	12.2	0.55	10.3
Infections of Other Anatomical Sites	30	6.0	0.27	5.1
Acute Lymphadenitis	13	2.6	0.12	2.2
Insect/Spider Bites	13	2.6	0.12	2.2
Other Infections Skin/Subcutaneous Tissue	11	2.2	0.10	1.9
Impetigo	11	2.2	0.10	1.9
Scabies	9	1.8	0.08	1.5
Varicella with Other Complications	4	0.8	0.04	0.7
Other Diagnoses	229	45.8	2.05	38.6
Total 0–14 Years	593	118.6	5.30	100.0
Young People 15–24 Years				
Cellulitis	113	22.6	1.61	23.4
Cutaneous Abscess/Furuncle/Carbuncle	76	15.2	1.08	15.8
Pilonidal Cyst with Abscess	57	11.4	0.81	11.8
Infections of Other Anatomical Sites	29	5.8	0.41	6.0
Other Infections Skin/Subcutaneous Tissue	7	1.4	0.10	1.5
Infected/Unspecified/Other Dermatitis	7	1.4	0.10	1.5
Insect/Spider Bites	6	1.2	0.09	1.2
Acute Lymphadenitis	3	0.6	0.04	0.6
Other Diagnoses	184	36.8	2.63	38.2
Total 15–24 Years	482	96.4	6.88	100.0

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Midland DHBs vs. New Zealand

In Lakes, the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for serious skin infections in children and young people were *significantly* higher than the New Zealand rate, while admissions in Waikato children and young people were *significantly* lower. In Taranaki, admissions in children were *significantly* lower than the New Zealand rate, while admissions in young people were similar (**Table 96**).

Midland Region Trends

In the Midland Region during 2000–2010, hospital admissions for serious skin infections in children and young people increased in all five DHBs, with the most rapid increases in most DHBs occurring during the mid-late 2000s (**Figure 96**).

Midland Region Distribution by Ethnicity

In the Waikato during 2000–2010, hospital admissions for serious skin infections were higher for Māori > Pacific > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki rates were higher for Māori children and young people than for European children and young people (**Figure 97**).

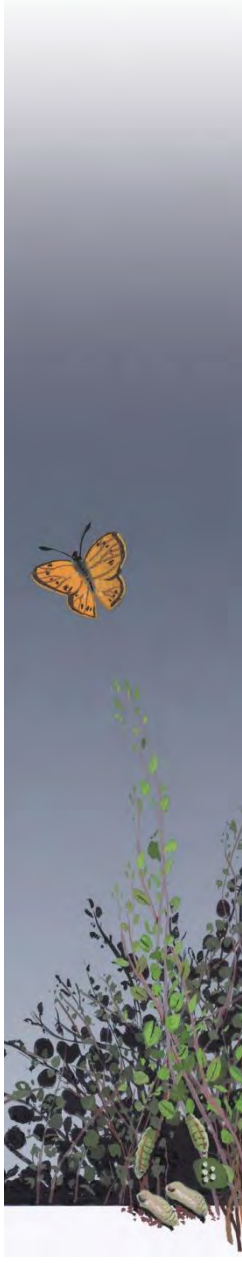


Table 96. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Serious Skin Infections					
Children 0–14 Years					
Waikato	2,197	439.4	5.60	0.78	0.74–0.81
Lakes	1,070	214.0	8.94	1.24	1.17–1.32
Bay of Plenty	2,016	403.2	9.07	1.26	1.20–1.31
Tairawhiti	705	141.0	12.2	1.69	1.57–1.82
Taranaki	593	118.6	5.30	0.73	0.68–0.80
New Zealand	32,222	6,444.4	7.22	1.00	
Young People 15–24 Years					
Waikato	1,498	299.6	5.60	0.89	0.85–0.94
Lakes	646	129.2	9.74	1.56	1.44–1.68
Bay of Plenty	1,004	200.8	7.98	1.27	1.20–1.36
Tairawhiti	355	71.0	11.2	1.79	1.61–1.99
Taranaki	482	96.4	6.88	1.10	1.00–1.20
New Zealand	19,830	3,966.0	6.26	1.00	

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population.

Midland Region Distribution by Season

In the Midland Region during 2006–2010, there were no consistent seasonal variations in hospital admissions for serious skin infections in children or young people (**Figure 98**).

Summary

In New Zealand during 2000–2010, hospital admissions for serious skin infections increased in both children and young people. During 2006–2010, cellulitis and cutaneous abscesses/furuncles/carbuncles were the most frequent primary diagnoses in children admitted with serious skin infections, while in young people, cutaneous abscesses / furuncles/carbuncles and cellulitis were the main reasons for admission. Admissions were highest in infants <1 year, with a second, smaller peak evident amongst those in their late teens and early twenties. Admissions in children were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were *significantly* higher for Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas.

In the Midland Region during 2000–2010, hospital admissions for serious skin infections in children and young people increased in all five DHBs, with the most rapid increases in most DHBs occurring during the mid-late 2000s. During 2006–2010, admissions in children and young people were *significantly* higher than the New Zealand rate in Lakes, the Bay of Plenty and Tairawhiti, while admissions in Waikato were *significantly* lower. In Taranaki, admissions in children were *significantly* lower than the New Zealand rate, while admissions in young people were similar. In the Waikato, admissions were higher for Māori > Pacific > European > Asian/Indian children and young people, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki rates were higher for Māori children and young people than for European children and young people.

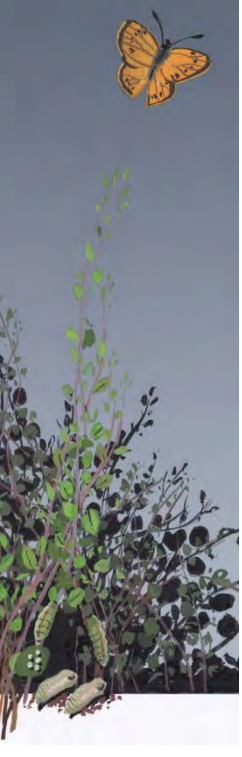
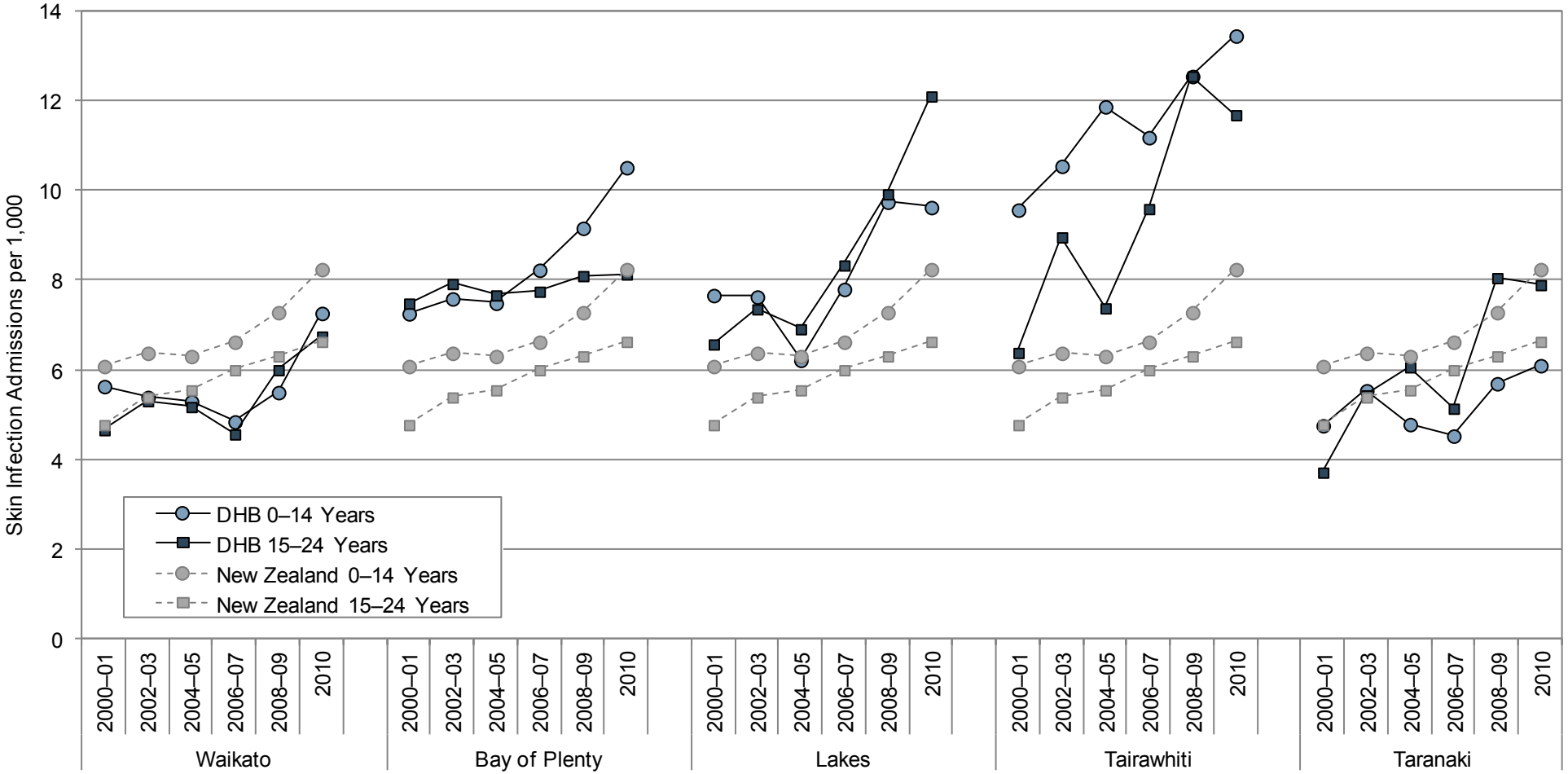
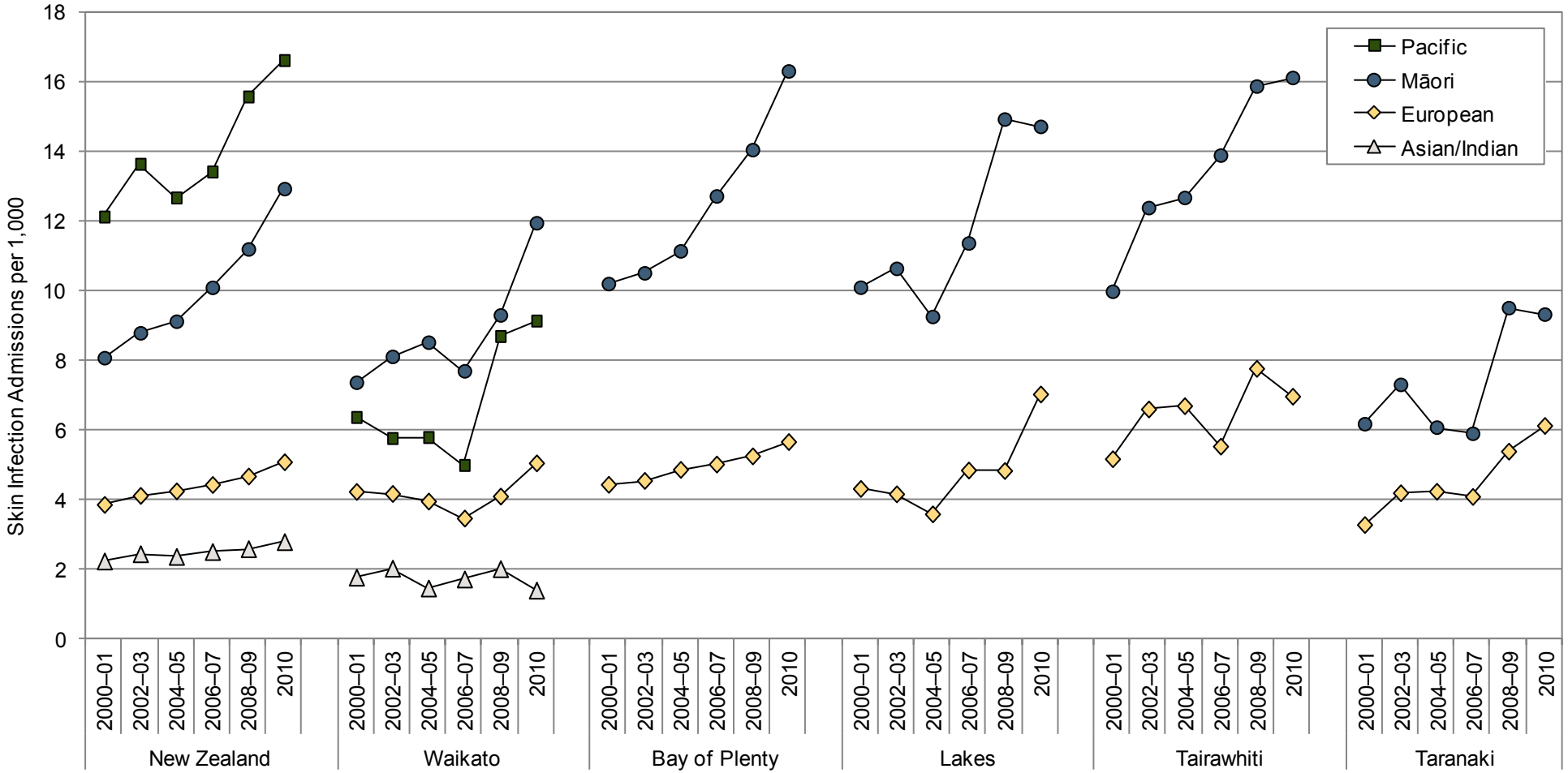


Figure 96. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000−2010



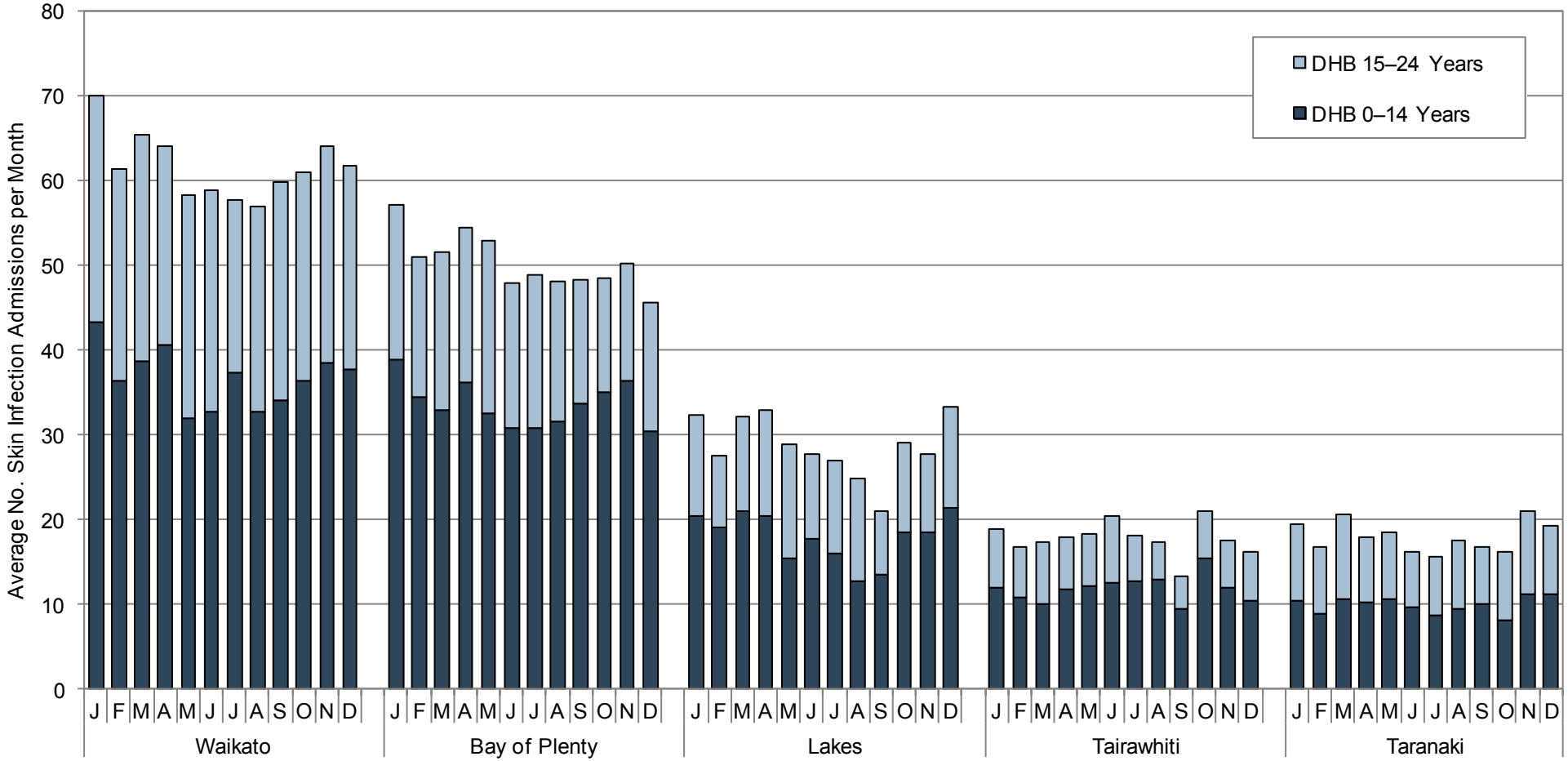
Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 97. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Ethnicity, Midland DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 98. Average Number of Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Month, Midland DHBs 2006−2010



Source: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses)

Local Policy Documents and Evidence-Based Reviews Relevant to Serious Skin Infections

In New Zealand there are no policy documents which focus solely on the prevention of serious skin infections. A 2004 review of serious skin infections in the Wellington region however, may provide a useful starting point for DHBs wishing to undertake initiatives in this area. This document is briefly summarised in **Table 97**, along with a number of evidence-based reviews which consider these issues in the overseas context. (Note: There is also a paucity of evidence-based reviews in the international literature on effective interventions to reduce serious skin infections at the population level. However, a number of reviews consider the prevention and treatment of common skin conditions which are risk factors for serious skin infection, and these have been included in the overview table where relevant).

In addition, a range of documents consider approaches infectious diseases and their risk factors more generally and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious Disease:** Table 44 on Page 158
2. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162

Table 97. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention or Management of Serious Skin Infections

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of skin infections. There are however, aspects of the Local Government Act 2002, the Local Government Amendment Act 2004 and the Health (drinking water) Amendment Act 2007 that potentially have implications for skin sepsis and other infectious diseases. These Acts require that water companies ensure that households have adequate water to meet minimum drinking, food preparation and sanitary needs even if they do not or are unable to pay their water bill. In the Building Regulations 1992, clause G12.1 has as one of its objectives ensuring that people have hot water for personal hygiene.
Systematic and Other Reviews from the International Literature
Kilburn SA, Featherstone P, Higgins B, et al. 2010. **Interventions for cellulitis and erysipelas**. Cochrane Database of Systematic Reviews, 2010(6), CD004299.
This review reports on 25 randomised trials (with a total of 2488 participants) each of which compared two or more different interventions for cellulitis. Most trials compared different drug treatments. The authors concluded that they could not define the best treatment for cellulitis. They noted that most recommendations are made on the basis of single trials. They stated that there is an urgent need for trials comparing oral antibiotics against intravenous antibiotics in community settings as there are implications for health services as well as patient comfort and convenience.
Krakowski AC, Eichenfield LF, Dohil MA. 2008. **Management of atopic dermatitis in the pediatric population**. Pediatrics, 122(4), 812-24.
This is a comprehensive review article discussing the various treatment strategies for atopic dermatitis in children.
Fernandez R, Griffiths R. 2008. **Water for wound cleansing**. Cochrane Database of Systematic Reviews, 20008(1), CD003861. Content assessed as up to date after new search for studies and content updated, no change to conclusions 2010.
This review considered 11 randomised or quasi randomised trials, 7 of which compared rates of infection and healing in wounds cleansed with water and those cleansed with normal saline, 3 of which compared cleansing with no cleansing and one of which compared procaine spirit with water. Pooled results from three trials in adults (1338 people in total) comparing infection rates between wounds cleansed with tap water and those cleaned with normal saline (in acute soft tissue wounds and lacerations that were sutured) showed a reduction in infection with tap water cleansing compared to normal saline (RR 0.63, 95% CI 0.40-0.99, p= 0.05). Pooled results from two trials in children (535 children in total) comparing tap water with normal saline for cleansing of acute wounds showed no significant difference in infection rates (RR 1.07, 95% CI 0.43-2.64, p = 0.88). The authors concluded that there is no evidence that using tap water to clean acute wounds in adults increases infection and some evidence that it reduces it. They state that there is not strong evidence that cleaning wounds per se increases healing or reduces infection (compared to not cleaning).
Jull AB, Rodgers A, Walker N. 2008. **Honey as a topical treatment for wounds**. Cochrane Database of Systematic Reviews, 2008(4), CD005083. (Edited, no change to conclusions published in issue 4 2009)
This review identified 19 randomised or quasi-randomised controlled trials (with a total of 2554 patients) investigating honey as a treatment for any sort of acute or chronic wound. Evidence from a single centre suggested that that honey may reduce healing time in partial thickness burns compared to other dressings but overall the authors concluded that there is insufficient evidence to determine the effect of honey compared to other treatments for burns or other acute or chronic wounds.

Birnie AJ, Bath-Hextall FJ, Ravenscroft JC, et al. 2008. **Interventions to reduce Staphylococcus aureus in the management of atopic eczema**. Cochrane Database of Systematic Reviews, 2008(3), CD003871.

Staphylococcus aureus is usually present on the lesions of atopic eczema and there tends to be higher levels of S. aureus colonisation on more severe lesions. It is unknown whether S. aureus has a role causing atopic eczema, makes existing eczema worse or is merely an opportunistic coloniser of damaged skin. Children with atopic eczema have been reported to be at increased risk of skin infections, both mild and severe. The authors of this review considered 21 studies (1018 participants in total) covering 7 treatment categories including oral and topical antibiotics, the addition of antibiotics to steroid creams or ointments, and antibacterial soaps or bath additives. The studies were overall mostly small and poorly reported. The authors concluded that there was no clear evidence that antimicrobial interventions are beneficial in the treatment of atopic eczema, despite their widespread use, and they stated that this does not mean that such treatments do not work but that further large, long term studies are required to determine the efficacy or otherwise of such treatments. The authors have published an update of this review as:

Bath-Hextall FJ, Birnie AJ, Ravenscroft JC, et al. 2010. **Interventions to reduce Staphylococcus aureus in the management of atopic eczema: an updated Cochrane review**. British Journal of Dermatology, 163(1), 12-26.

Katz TM, Miller JH, Hebert AA. 2008. **Insect repellents: historical perspectives and new developments**. Journal of the American Academy of Dermatology, 58(5), 865-71.

This is a useful review article with 68 references covering the history of insect repellents, currently used compounds, and the use of insect repellents in children. The American Academy of Pediatrics has published the following guidance:

AAP Committee on Environmental Health A. 2003. **Follow safety precautions when using DEET on children**. AAP News, 22(5), 200399-.

This article states that DEET (N,N-diethyl-m-toluamide, now called N,N-diethyl-3-methylbenzamide) is the most effective mosquito repellent available. The maximum concentration recommended for infants and children is 30%. Lower concentrations provide shorter periods of protection. DEET is not recommended for children under 2 months of age, nor should it be applied to the hands, around the eyes or to cuts, wounds or irritated skin.

Strong M, Johnstone P. 2007. **Interventions for treating scabies**. Cochrane Database of Systematic Reviews, 2007(3), CD000320. Content assessed as up to date after new search for studies and updated content, no change to conclusions, 2010.

Scabies is an extremely itchy parasitic infection caused by the scabies mite. It is spread via direct skin contact and via clothing or furnishings. Secondary bacterial infection can occur via broken skin resulting from scratching. This review included twenty-two small RCTs with a total of 2676 participants. There was one placebo-controlled trial, 18 comparing two or more drug treatments, 3 compared treatment regimens and one compared 2 different vehicles for the same drug. On the basis of the evidence from these trials topical permethrin appears to be the most effective treatment for scabies. Oral Ivermectin appears to be an effective oral treatment.

Laupland KB, Conly JM. 2003. **Treatment of Staphylococcus aureus colonization and prophylaxis for infection with topical intranasal mupirocin: an evidence-based review**. Clinical Infectious Diseases, 37(7), 933-8.

Asymptomatic nasal carriage of Staphylococcus aureus is common and eliminating it is one possible strategy for reducing Staphylococcal infections including skin infections and post-surgical infections. This review considered 16 RCTs two of which involved skin infections although not in children. The authors concluded that, despite several studies showing that mupirocin applied intra-nasally was effective in eliminating nasal colonisation with S. aureus in the short term, the available evidence did not support the use of topical mupirocin intra-nasally as a strategy to reduce infections with S. aureus at other sites.

Koning S, Verhagen AP, van Suijlekom-Smit LWA, et al. 2003. **Interventions for impetigo**. Cochrane Database of Systematic Reviews, 2003(2), CD003261. (Edited, no change to conclusions, republished in Issue 1, 2009)

This review included 57 randomised trials involving a total of 3533 participants studying a variety of oral and topical treatments for impetigo. Most trials compared different treatments rather than treatment vs. placebo. The authors state that there is a lack of data on the untreated course of impetigo and little evidence for the effectiveness of topical disinfectant solution or creams. For people with limited disease, topical antibiotics (mupirocin or fusidic acid) are as effective, or better than oral antibiotics. Penicillin is less effective than most other antibiotics. For extensive disease it is unclear whether oral antibiotics are superior to topical antibiotics. Trials that study topical treatments usually exclude participants with extensive disease and it is commonly believed that more serious forms of impetigo need oral rather than topical antibiotics. The authors note that bacterial antibiotic resistance patterns change over time and from place to place and this should be taken into account when choosing therapy.

Medeiros IM, Saconato H. 2001. **Antibiotic prophylaxis for mammalian bites**. Cochrane Database of Systematic Reviews, 2001(2), CD001738.

School age children make up almost half of those bitten by animals. Most commonly people are bitten by their own pet cat or dog, or by an animal known to them. This review aimed to determine whether prophylactic antibiotics are effective in preventing infection in mammalian bites. Eight RCTs were included in the review. The authors concluded that due methodological deficiencies and small sample sizes in the reviewed studies there is insufficient evidence that prophylactic antibiotics prevent infection after dog bites. There is evidence that the use of antibiotics reduces infection after bites to the hand (pooled data from 4 trials, infection rate 2% in antibiotic group c.f. 28% in the control group, OR 0.10, 95% CI 0.01-0.86).There is weak evidence that antibiotic prophylaxis after human bites reduces infection. (1 trial, 33 participants, infection rate 0% in antibiotic group vs. 47% in the control group, OR 0.02, 95% CI 0.00-0.33).

Other Relevant Publications and Useful Websites
Centers for Disease Control and Prevention. 2011. **Methicillin-resistant Staphylococcus aureus (MRSA) infections.** http://www.cdc.gov/mrsa/index.htmlaccessed 19/05/11 This is the home page for the MRSA-related material on the website of the U.S. Centers for Disease Control and Prevention. While some of the material is MRSA specific much of it applies to all staphylococcal skin infections. There are sections on Definition, Symptoms, Prevention, People at Risk, Treatment, Causes, Diagnosis and Testing, Environmental Cleaning, Statistics and Educational Resources.
Richardson A, Desai U, Mowat E, et al. 2010. **Annual survey of methicillin-resistant Staphylococcus aureus (MRSA) 2010**. Wellington: Nosocomial Infections Laboratory, Institute of Environmental Science and Research Limited (ESR). http://www.surv.esr.cri.nz/PDF_surveillance/Antimicrobial/MRSA/aMRSA_2010.pdf The ESR conducts annual surveys to provide information on the epidemiology of Methicillin-resistant Staphylococcus aureus (MRSA) in New Zealand. The survey in 2010 involved all MRSA isolated in hospital and community laboratories during either August or October. The report gives the frequencies of different MRSA strains in the different DHBs. The prevalence of MRSA has risen significantly during the last 10 years and it increased by 7.5% from 2009 to 2010.The report states that about half of all MRSA infections were acquired in the community but it does not give the ages of the patients involved. Counties Manukau DHB had the highest rate of MRSA isolations, followed by Northland and Waikato. The authors note that differences between DHBs could be due, in part, to variations in screening practices.
Regional Public Health (Wellington), Auckland Regional Public Health Service. 2006. **Skin Infections**. http://www.skininfections.co.nz/ This website was created to provide information for New Zealand health professionals, community workers, schools and families about the prevention and treatment of serious skin infections. It has a large number of useful resources some of which are available in Pacific languages as well as English.
Hunt D. 2004. **Assessing and Reducing the Burden of Serious Skin Infections in Children and Young People in the Greater Wellington Region. Six-month report January - July 2004 and update on progress October 2004**. Wellington: Capital and Coast DHB, Hutt Valley DHB and Regional Public Health. http://www.skininfections.co.nz/documents/Serious_Skin_Infections_Nov2004.pdf This is the report of a project involving Capital and Coast DHB, Hutt Valley DHB and Regional Public Health (RPH).It contains data on serious skin infections in children in the region and it outlines interventions relevant to prevention of serious skin infections under four broad categories: Socio-economic and environmental issues, Skin health promotion, Healthcare services and research and National best-practice guidelines. These recommendations are primarily for the DHBs and RPH and they include collaboration with relevant community and non-health sector organisations.
Eady E, Cove J. **Staphylococcal Resistance Revisited: Community Acquired Methicillin Resistant Staphylococcus Aureus - An Emerging Problem For The Management of Skin and Soft Tissue Infections**. Current Opinion in Infectious Diseases, 2003. 16(2): 103-24. This review of Staphylococcal resistance suggests that improved hygiene offers a very reasonable approach to prevent the spread of Community Acquired Methicillin-Resistant Staphylococcus Aureus(CA-MRSA) in children and that parents, carers, teachers and childcare providers all have an important role to play in helping children to learn and use vigorous hand-washing.

GASTROENTERITIS

Introduction

Gastroenteritis is a non-specific term indicating various pathological states of the gastrointestinal tract. Its primary manifestation is diarrhoea and it may also be associated with nausea, anorexia, fever, abdominal pain and vomiting [171,172]. Acute gastroenteritis is normally of infectious origin and the causative agent may be viral, bacterial or parasitic. Infection is transmitted via the faecal-oral route and in young children, acute infectious gastroenteritis is much the most common cause of diarrhoea, with or without vomiting [173]. Severe gastroenteritis in infants and young children can rapidly lead to dehydration, which is a potentially life-threatening condition and a common cause of infant mortality in the third world [173].

In New Zealand, gastroenteritis is one of the top 10 causes of potentially avoidable hospital admissions in children [174]. It is more common in younger children, with most children requiring hospitalisation being under 2 years of age [175]. Hospital admissions are also higher for Pacific children and children from more deprived areas [97] [175]. Admissions are also higher in the winter months [176]. The most significant risk factor for gastroenteritis is contact with another person with gastroenteritis, hence the increased risks associated with attending childcare and overcrowding [177]. In contrast, breastfeeding is a protective factor, particularly for infants less than 6 months of age [25].

In New Zealand, rotavirus is the commonest cause of severe gastroenteritis in infants [178] with New Zealand estimates of the proportion of gastroenteritis admissions attributable to rotavirus ranging from 34% [176] to 58% [175]. In terms of prevention, the two commercially available Rotavirus vaccines are RotaTeq® and Rotarix®. These are both oral vaccines, requiring either 2 (Rotarix®) or 3 doses (RotaTeq®). They are available, but not funded, in New Zealand and cost parents around $100 per dose [179].

The World Health Organisation recommends that rotavirus vaccination be included in all national immunisation programmes [180]. In 2006, the New Zealand Immunisation Technical Working Group placed Rotavirus fourth on its prioritised recommendations for the 2008 National Immunisation Schedule [181]. An analysis of the cost-effectiveness of introducing a rotavirus vaccine into the national immunisation schedule estimated that the vaccination would save money from a societal perspective, if the price was less than $32.39 per dose [182]. In the absence of vaccination, strategies that could reduce admission rates for gastroenteritis include the promotion of breastfeeding, educating parents about oral rehydration methods, improving access to primary care and encouraging the use of oral rehydration solutions in primary care settings.

The following section explores gastroenteritis rates in children and young people using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of policy documents and evidence-based reviews which consider interventions to address gastroenteritis at the population level.

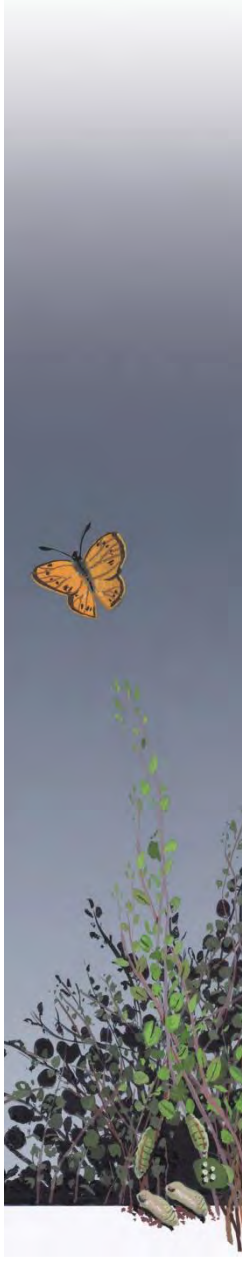
Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Gastroenteritis in Children and Young People 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions in children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Gastroenteritis (A00–A09, R11, K529).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).



2. Mortality from Gastroenteritis in Children and Young People 0–24 Years

Numerator: National Mortality Collection: Deaths in children and young people aged 0–24 years where the main underlying cause of death was Gastroenteritis (A00–A09, R11, K529).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: The gastroenteritis codes used here differ from those used previously, as the result of a change from ICD-10-AM Version 3 to Version 6, which occurred in the National Minimum Dataset in 2008. Prior to this change, a large proportion of gastroenteritis cases were coded to A09 (diarrhoea and gastroenteritis of presumed infectious origin). From 2008 however, the Ministry of Health began to back-map the majority of these cases to K529 (non-infective gastroenteritis and colitis unspecified). Because K529 only accounted for a minority of cases prior to 2008 (n ≈50–60 cases per year), and because the majority of gastroenteritis cases in the paediatric population are presumed to be of infectious origin, the K529 code was not included in previous reports. The coding change however resulted in a large reduction in the number A09 mapped cases and a large increase in the number of K529 mapped cases after 2008. Thus, in order to preserve time series continuity (even though the clinical appropriateness of such a coding change remains debatable) the current year's analysis includes both the A09 and K529 gastroenteritis codes (with this coding change being extended back to 2000). As a result, the results presented here may differ from those reported previously.

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 3: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 4: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, gastroenteritis admissions increased gradually during the early-mid 2000s but became relatively static after 2006-07 in both children and young people. During 2000–2008, on average two children or young people per year died as a result of gastroenteritis, although this fell to around one death per year, if only the years 2002–08 were included (**Figure 99**).

New Zealand Distribution by Age

In New Zealand during 2006–2010, hospital admissions for gastroenteritis were highest in infants <1 year, with rates then tapering off rapidly during the preschool years, to reach their lowest point in those in their early teens. Mortality was also highest in infants <1 year, although a small number of deaths also occurred during early childhood (**Figure 100**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for gastroenteritis in children were *significantly* higher for males, Pacific > Asian/Indian and European > Māori children and those living in average-to-more deprived (NZDep decile 4–10) areas (**Table 98**). In contrast, gastroenteritis admissions in young people were *significantly* higher for females, European > Pacific and Māori > Asian/Indian young people, and those living in average-to-more deprived (NZDep decile 4–10) areas (**Table 99**). When both age groups were combined, gastroenteritis admissions during 2000–2010 were consistently higher for Pacific than for European, Māori and Asian/Indian children and young people (**Figure 101**).

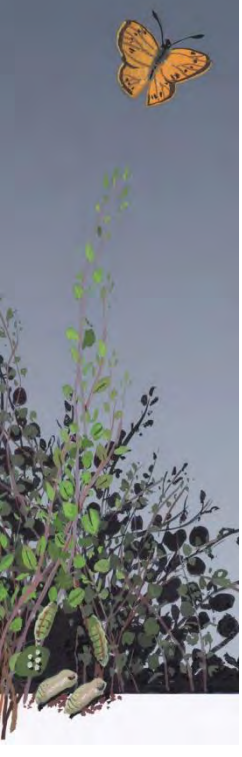
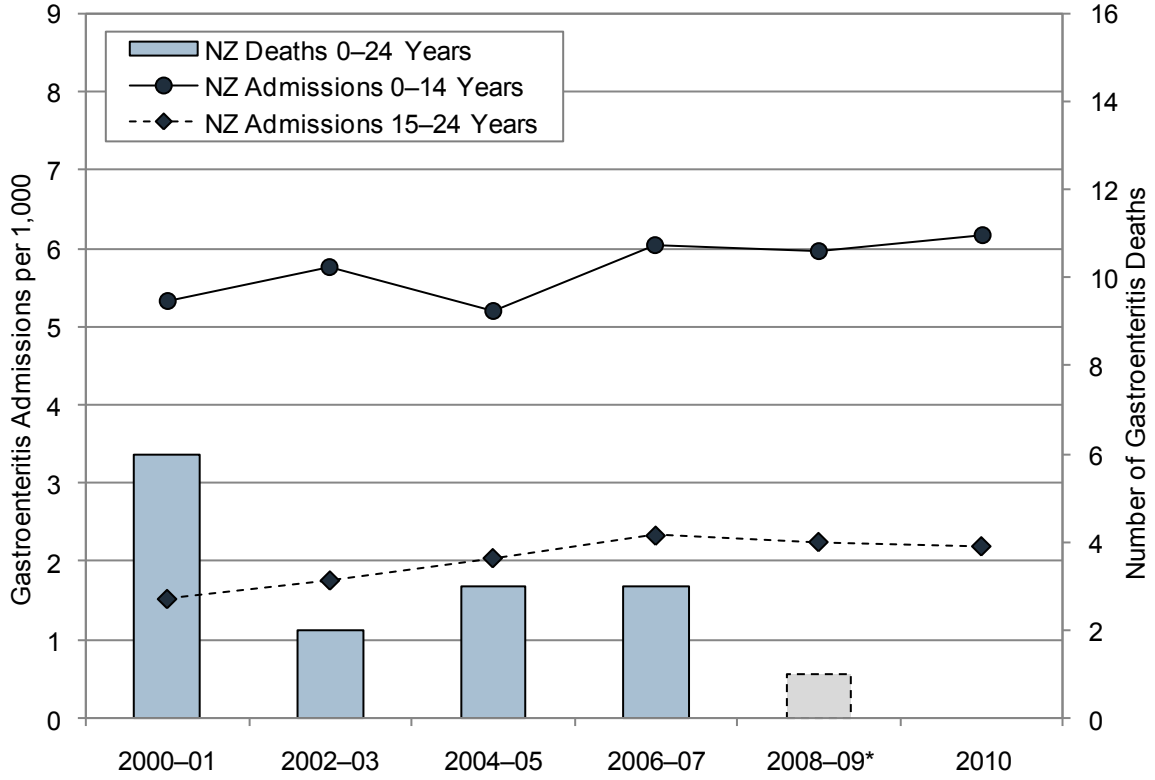
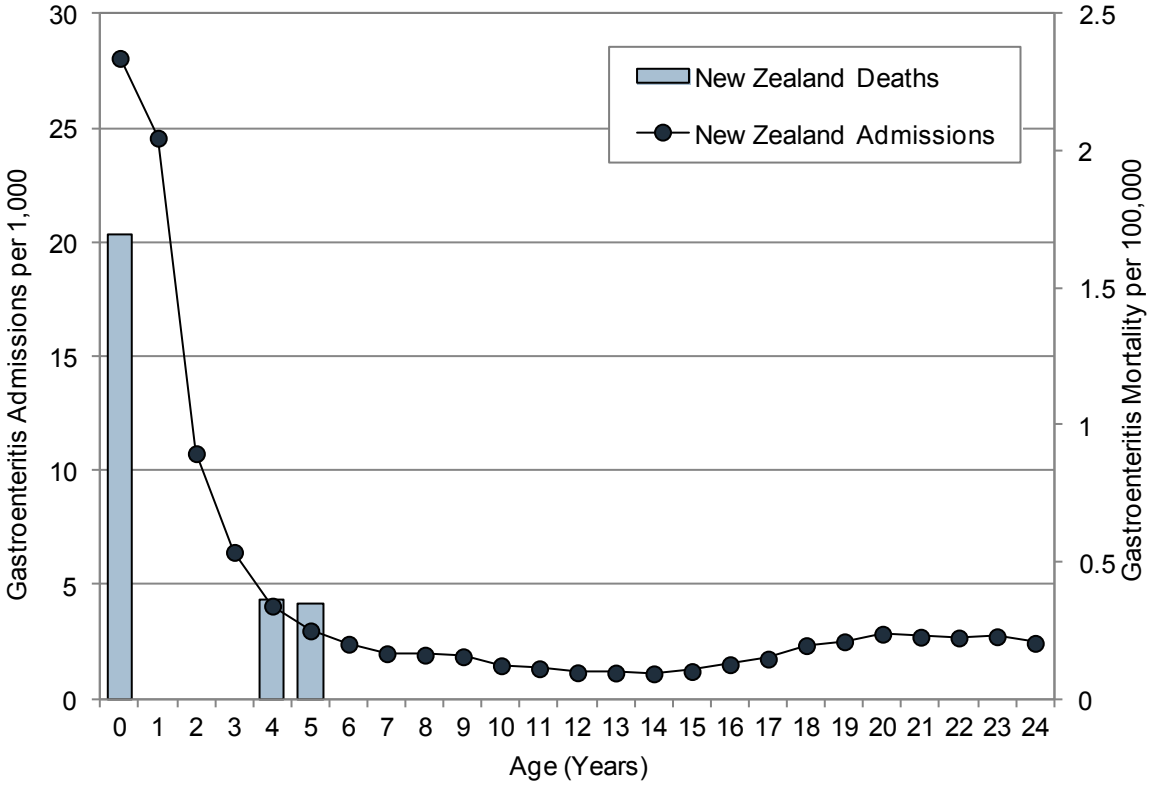


Figure 99. Acute and Semi-Acute Hospital Admissions (2000−2010) and Deaths (2000–2008) from Gastroenteritis in New Zealand Children and Young People Aged 0–24 Years



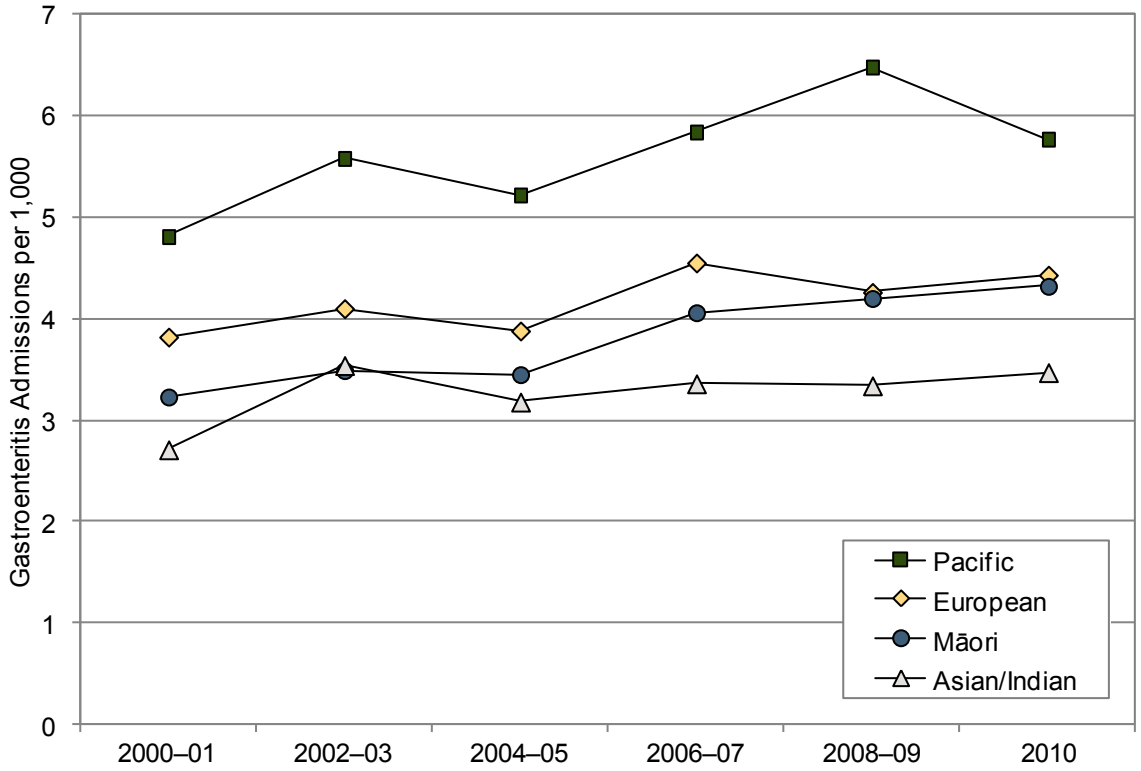
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; *Note: Number of Deaths is per 2 year period, with the exception of 2008–09, which is for a single year (2008) only.

Figure 100. Acute and Semi-Acute Hospital Admissions (2006−2010) and Deaths (2004−2008) from Gastroenteritis in New Zealand Children and Young People by Age



Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.

Figure 101. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 98. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children Aged 0−14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Gastroenteritis							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	4.07	1.00		Decile 1–2	3.96	1.00	
Decile 2	3.85	0.95	0.88–1.01	Decile 3–4	4.64	1.17	1.12–1.23
Decile 3	4.27	1.05	0.98–1.12	Decile 5–6	5.87	1.48	1.42–1.55
Decile 4	4.99	1.22	1.15–1.30	Decile 7–8	6.95	1.76	1.68–1.83
Decile 5	5.45	1.34	1.26–1.43	Decile 9–10	8.01	2.02	1.94–2.10
Decile 6	6.23	1.53	1.44–1.62	Prioritised Ethnicity			
Decile 7	6.41	1.57	1.48–1.67	European	5.75	1.00	
Decile 8	7.42	1.82	1.72–1.93	Māori	5.29	0.92	0.89–0.95
Decile 9	8.31	2.04	1.93–2.16	Pacific	8.38	1.46	1.41–1.51
Decile 10	7.75	1.90	1.80–2.01	Asian/Indian	6.00	1.04	1.00–1.09
Gender							
Female	5.75	1.00					
Male	6.31	1.10	1.07–1.12				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Table 99. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Young People Aged 15−24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Gastroenteritis							
Young People 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	1.64	1.00		Decile 1–2	1.63	1.00	
Decile 2	1.62	0.99	0.87–1.13	Decile 3–4	1.98	1.21	1.11–1.32
Decile 3	1.87	1.14	1.00–1.30	Decile 5–6	2.34	1.44	1.32–1.57
Decile 4	2.07	1.26	1.12–1.43	Decile 7–8	2.39	1.47	1.35–1.59
Decile 5	2.42	1.47	1.31–1.67	Decile 9–10	2.65	1.63	1.50–1.76
Decile 6	2.28	1.39	1.24–1.57	Prioritised Ethnicity			
Decile 7	2.44	1.49	1.32–1.68	European	2.52	1.00	
Decile 8	2.34	1.43	1.27–1.60	Māori	2.18	0.87	0.82–0.92
Decile 9	2.46	1.50	1.34–1.68	Pacific	2.20	0.87	0.80–0.95
Decile 10	2.87	1.75	1.57–1.96	Asian/Indian	1.12	0.44	0.41–0.49
Gender							
Female	2.68	1.00					
Male	1.88	0.70	0.67–0.74				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Midland Region Distribution and Trends

Table 100. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0−24 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Gastroenteritis					
Children 0–14 Years					
Waikato	1,740	348.0	4.43	0.73	0.70–0.77
Lakes	740	148.0	6.18	1.02	0.95–1.10
Bay of Plenty	1,769	353.8	7.96	1.32	1.26–1.38
Tairawhiti	423	84.6	7.31	1.21	1.10–1.33
Taranaki	523	104.6	4.68	0.77	0.71–0.84
New Zealand	26,945	5,389.0	6.04	1.00	
Young People 15–24 Years					
Waikato	540	108.0	2.02	0.89	0.81–0.97
Lakes	204	40.8	3.08	1.35	1.18–1.55
Bay of Plenty	392	78.4	3.11	1.37	1.24–1.52
Tairawhiti	98	19.6	3.10	1.36	1.12–1.66
Taranaki	153	30.6	2.18	0.96	0.82–1.13
New Zealand	7,203	1,440.6	2.27	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population.

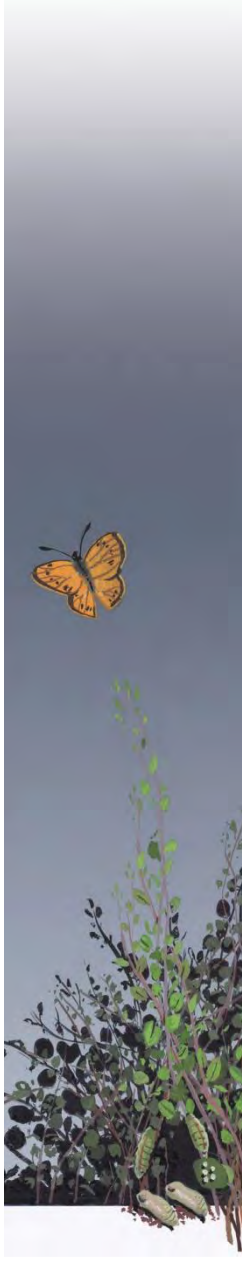
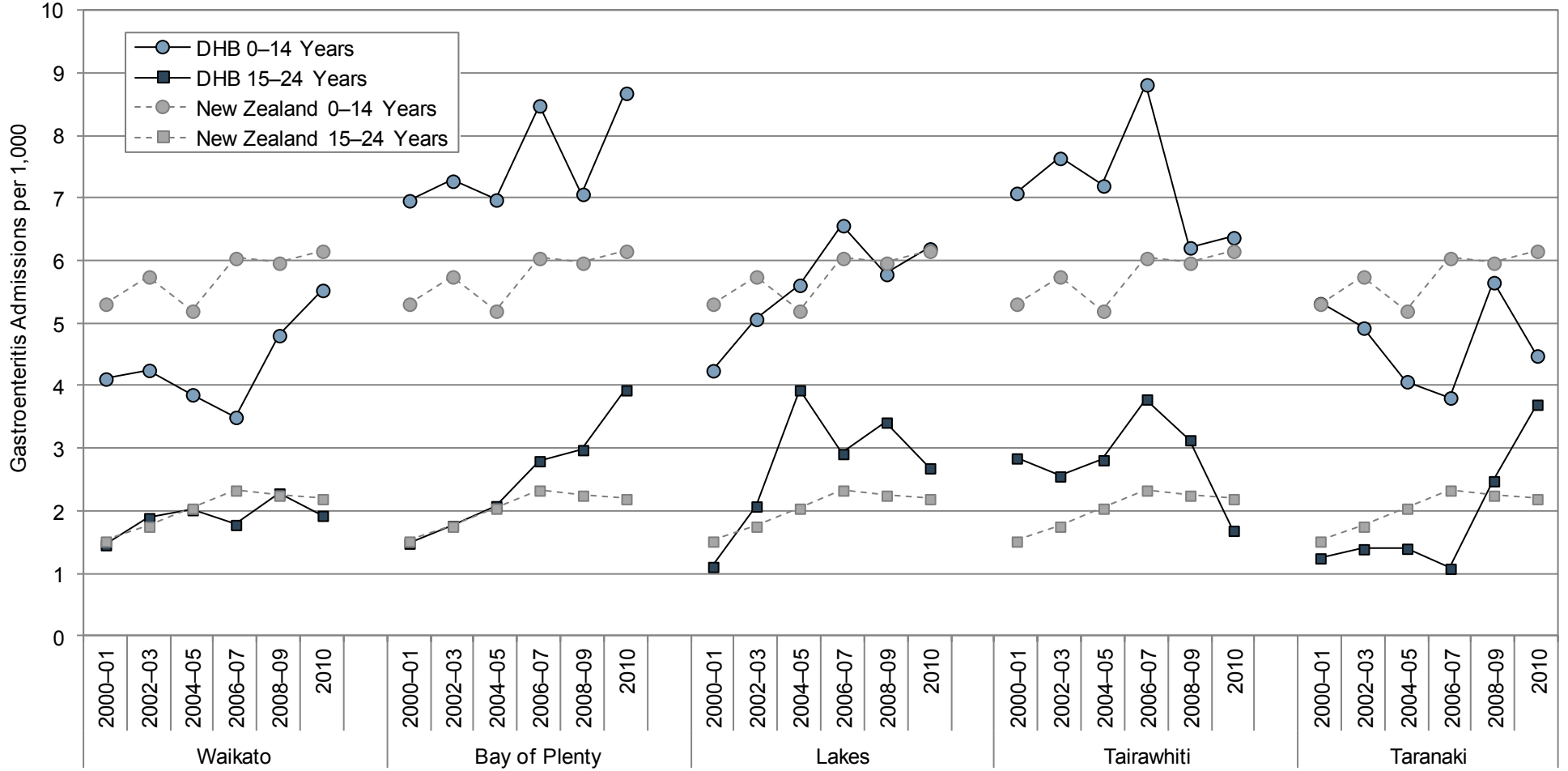
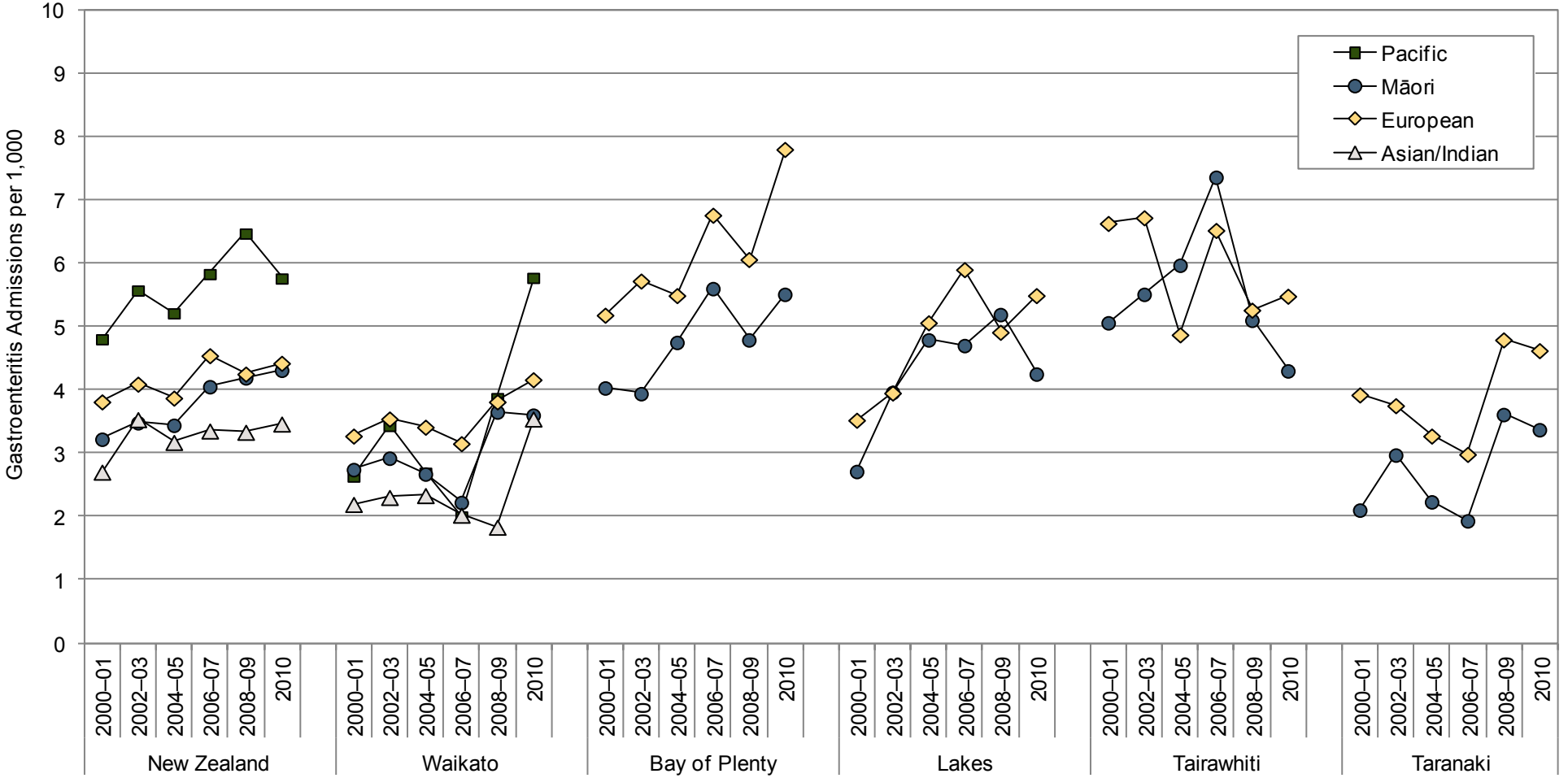


Figure 102. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0−24 Years, Midland DHBs vs. New Zealand 2000−2010



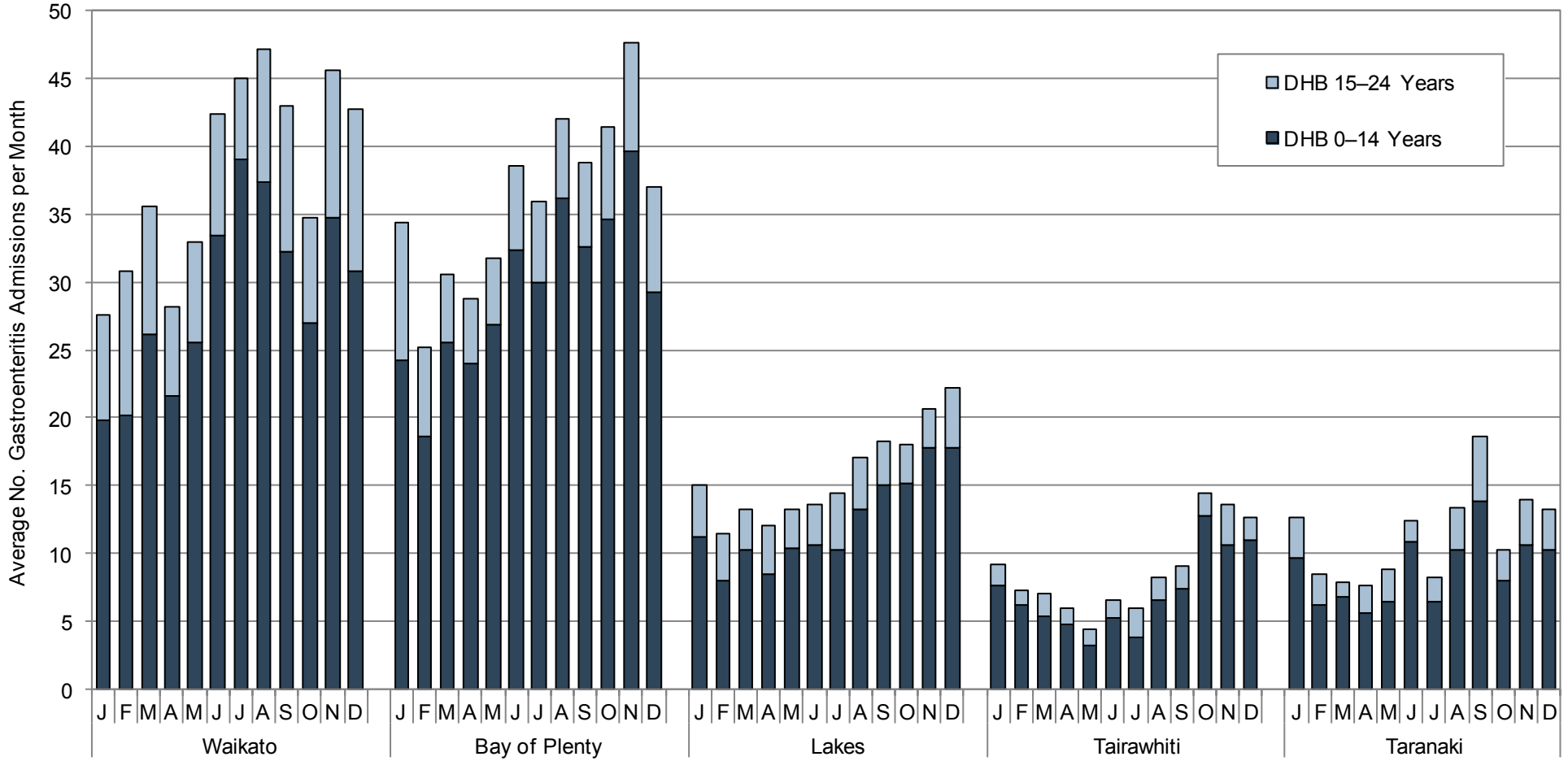
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 103. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0–24 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 104. Average Number of Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0–24 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Midland DHBs vs. New Zealand

In the Bay of Plenty and Tairawhiti during 2006–2010, gastroenteritis admissions in children and young people were *significantly* higher than the New Zealand rate, while admissions in the Waikato were *significantly* lower. In Lakes, admissions in children were similar to the New Zealand rate, while admissions in young people were *significantly* higher. In Taranaki, admissions in children were *significantly* lower than the New Zealand rate while admissions in young people were similar (**Table 100**).

Midland Region Trends

In the Midland Region during 2000–2010, there were no consistent trends in gastroenteritis admissions in children and young people, with large year to year variations being seen in a number of DHBs (**Figure 102**).

Midland Region Distribution by Ethnicity

In the Waikato, Bay of Plenty and Taranaki during 2000–2010, gastroenteritis admissions were higher for European than for Māori children and young people, although in Lakes and Tairawhiti ethnic differences were less consistent (**Figure 103**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, there were no consistent seasonal variations in gastroenteritis admissions in children and young people, although admissions were higher in September– December in a number of DHBs (**Figure 104**).

Summary

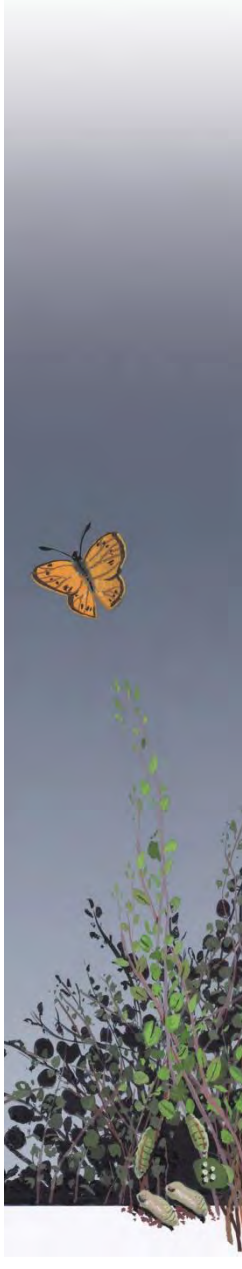
In New Zealand, gastroenteritis admissions increased gradually during the early-mid 2000s but became relatively static after 2006-07 in both children and young people. During 2002–2008, on average one child or young person per year died as a result of gastroenteritis. During 2006–2010, gastroenteritis admissions were highest in infants <1 year of age, with rates then tapering off rapidly during the preschool years. Mortality was also highest in infants <1 year. Admissions in children were also *significantly* higher for males, Pacific > Asian/Indian and European > Māori children and those from average-to-more deprived (NZDep decile 4–10) areas. In contrast, admissions in young people were *significantly* higher for females, European > Pacific and Māori > Asian/Indian young people, and those from average-to-more deprived (NZDep decile 4–10) areas.

In the Midland Region during 2000–2010, there were no consistent trends in gastroenteritis admissions in children and young people, with large year to year variations being seen in a number of DHBs. During 2006–2010, admissions in children and young people were *significantly* higher than the New Zealand rate in the Bay of Plenty and Tairawhiti, but *significantly* lower in the Waikato. In Lakes, admissions in children were similar to the New Zealand rate, while admissions in young people were *significantly* higher. In Taranaki, admissions in children were *significantly* lower than the New Zealand rate while admissions in young people were similar. In the Waikato, Bay of Plenty and Taranaki, admissions were higher for European than for Māori children and young people, although in Lakes and Tairawhiti ethnic differences were less consistent.

Local Policy Documents and Evidence-Based Reviews Relevant to Gastroenteritis

In New Zealand there are no policy documents which focus solely on the prevention of gastroenteritis. A range of documents however consider approaches to infectious diseases and their risk factors more generally, and these have been reviewed in other sections:

1. **Generic Approaches to Infectious Disease:** Table 44 on Page 158
2. **Interventions Aimed at Housing and Household Crowding:** Table 46 on Page 162
3. **Interventions to Improve Breastfeeding:** Table 27 on Page 101



In addition, a range of international reviews consider the most effective approaches for the prevention and management of gastroenteritis and these are summarised in **Table 101**.

Table 101. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Gastroenteritis

Ministry of Health Policy and Other Documents
In New Zealand there are aspects of the Local Government Act 2002, the Local Government Amendment Act 2004 and the Health (drinking water) Amendment Act 2007 that may have implications for gastroenteritis and other infectious diseases. These Acts require that water companies must ensure that households have adequate water to meet minimum drinking, food preparation and sanitary needs even if they do not or are unable to pay their water bill. In The Building Regulations 1992, clause G12.1 has as one of its objectives ensuring that people have hot water for personal hygiene.
Ministry of Health. 1998. **Communicable Disease Control Manual**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/49ba80c00757b8804c256673001d47d0/019e54d1de5e73534c25666e00835b79/$FILE/cdcm.pdf This manual provides information on the prevention of communicable diseases in New Zealand and protocols for their control. Part Two covers food and waterborne diseases including acute gastroenteritis.
Ministry of Health. 2011. **Immunisation Handbook 2011**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/Files/immunise-handbook/$file/19Rotavirus.pdf Chapter 19 of the Immunisation Handbook provides information on rotavirus gastroenteritis, New Zealand rotavirus epidemiology and the two vaccines which are available, but unfunded, in New Zealand: Rotarix® and RotaTeq®.
Ministry of Health. 1998. **Child Health Programme Review**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/82f4780aa066f8d7cc2570bb006b5d4d/0b8626c506d2e5854c25666e000c2b20/$FILE/chpr.pdf The Child Health Programme Review considered research on the effectiveness of preventive interventions in child health. Chapter 2: Control of Communicable Diseases, lists provision of safe water supplies and enforcement of adequate food safety measures as being essential elements in communicable disease control and also emphasises the importance of encouraging breastfeeding and the early identification, treatment and control of communicable disease outbreaks. It suggests considering the use of a rotavirus vaccine.
Evidence-Based and Other Publications Relevant to Rotavirus Vaccination
Buttery JP, Lambert SB, Grimwood K, et al. 2011. **Reduction in rotavirus-associated acute gastroenteritis following introduction of rotavirus vaccine into Australia's National Childhood vaccine schedule**. Pediatric Infectious Disease Journal, 30(1 Suppl), S25-9. Rotavirus vaccination was added to the Australian National Immunisation Program in July 2007. Due to vaccine purchasing arrangements, Queensland, Victoria and South Australia use the3-dose RotaTeq® while the other states and the ACT use the 2-dose Rotarix®. Eighteen months after the vaccines' introduction the Australian Childhood Immunisation Register estimated that 87% of those eligible had received at least 1 dose by 4 months of age and 84% had received a full vaccine course by 13 months of age. This study assessed the impact of vaccination on laboratory confirmed rotavirus disease using studies at 3 sites. All studies showed reductions in rotavirus-positive tests and hospital encounters and also in non-rotavirus-coded episodes of gastroenteritis (suggesting that testing and coding practices tend to underestimate rates of rotavirus infection). These reductions occurred not only for children in the age group eligible for vaccination but also for older children, indicating a degree of herd protection. There were also marked reductions in emergency department presentations and short stay unit admissions due to gastroenteritis.
Soares-Weiser K, Maclehose H, Ben-Aharon I, et al. 2010. **Vaccines for preventing rotavirus diarrhoea: vaccines in use**. Cochrane Database of Systematic Reviews, 2010(5), Art. No.: CD008521. DOI: 10.1002/14651858.CD008521. This review evaluated the rotavirus vaccines ®, RotaTeq® and Lanzhou Lamb Rotavirus (LLR) for the prevention of rotavirus diarrhoea. All included trials compared the vaccine with a placebo. There were 26 RCTs (99,841 participants) testing Rotarix®, and 8 RCTs (76,103 participants) testing RotaTeq®. No trials compared the effectiveness of different vaccines. Rotarix® and RotaTeq® were both effective at reducing rotavirus diarrhoea (both severe and any diarrhoea). They reduced need for medical attention and for hospitalisation due to rotavirus diarrhoea and also reduced severe diarrhoea from any cause (although there was little data on Rotarix® and all-cause diarrhoea). Both vaccines were similar in terms of rates of deaths and adverse events, and reactogenicity profiles (i.e. fever, diarrhoea and vomiting following vaccination). Both were immunogenic as indicated by seroconversion and/or virus shedding in stools.
Milne RJ, Grimwood K. 2009. **Budget impact and cost-effectiveness of including a pentavalent rotavirus vaccine in the New Zealand childhood immunization schedule**. Value in Health, 12(6), 888-98. This study estimated the burden of rotavirus gastroenteritis in New Zealand and the budget impact and cost-effectiveness of including a pentavalent rotavirus vaccine (i.e. RotaTeq®) in the childhood immunisation schedule (3 oral doses administered with other vaccines at 6 weeks, 3 months and 5 months of age). It considered the costs of hospital admissions, emergency department presentations, GP costs and caregiver costs (transport to hospital, lost wages). Using a static equilibrium model with the price of the vaccine at $50 per dose the authors estimated cost-effectiveness from a societal perspective at year 5 of a vaccination programme. They calculated that it would cost $2509 to avert one hospitalisation and $305 to prevent one case seeking health care assistance. The break-even price per vaccine dose was $32.29 at 2006 prices.

Peter G, Aguado T, Bhutta L, et al. 2009. **Detailed Review Paper on Rotavirus Vaccines to be presented to the WHO Strategic Advisory Group of Experts (SAGE) on Immunization**, April 2009. Geneva: World Health Organisation. http://www.who.int/immunization/sage/3_Detailed_Review_Paper_on_Rota_Vaccines_17_3_2009.pdf

This review paper has comprehensive information on rotavirus epidemiology and on issues relating to vaccination including efficacy and safety, data from clinical trials and post-introduction vaccine effectiveness evaluations, schedules, programme implementation and logistics, cost-effectiveness, and surveillance. The two vaccines assessed are Rotarix® and RotaTeq®. It states that rates of rotavirus infection are similar in developed and less developed countries (although children in developed countries have an older median age at first infection) and that hygienic measures are unlikely to decrease infections because of the ubiquity of the virus and the ease with which it is transmitted. Almost all children worldwide have been infected by the age of 3-5 years. A child's first infection is most likely to result in severe gastroenteritis; subsequent episodes tend to be progressively milder.

In June 2009 the WHO recommended that the rotavirus vaccination be included in all national immunisation programmes (see following link for press release). http://www.rotavirusvaccine.org/files/WHO_GAVI_PATH_Press-Release-on-SAGE_FINAL_4June09_000.pdf

Centers for Disease Control and Prevention. 2009. **Prevention of Rotavirus Gastroenteritis Among Infants and Children: Recommendations of the Advisory Committee on Immunization Practices (ACIP).** MMWR - Morbidity & Mortality Weekly Report, 58(RR-2), 1-25.

This U.S. report states that prior to the introduction of vaccination, approximately 80% of U.S. children had had rotavirus gastroenteritis by the age of 5 years and 1 in 70 had been hospitalised because of it. RotaTeq® was licensed for use in the U.S. as a 3-dose series in infants (given at ages 2, 4 and 6 months) in 2006 and Rotarix® was licensed for use as a 2-dose series (given at ages 2 and 4 months) in 2008. The report includes tables summarising the major efficacy trials and the adverse events reported in association with vaccination for the 2 vaccines. Data from the National Respiratory and Enteric Virus Surveillance System indicated a substantial reduction in the percentage of faecal specimens from children with gastroenteritis testing positive for rotavirus following the introduction of vaccination (from 51% in 2006 to 6% in 2008). The ACIP recommends routine vaccination of U.S. children but does not express a preference for either RotaTeq® or Rotarix®. Table 7 sets out the details of the recommendations (including maximum age for doses, contraindications, precautions and special situations) and the level and strength of the evidence on which each recommendation is based is indicated. The report contains a comprehensive list of references.

International Evidence-based Guidelines for Gastroenteritis

National Collaborating Centre for Women's and Children's Health. 2009. **Diarrhoea and vomiting caused by gastroenteritis: diagnosis, assessment and management in children younger than 5 years**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/11846/43817/43817.pdf

These guidelines are intended for healthcare professionals, those responsible for commissioning and planning healthcare services, and parents/carers and families of children. They are very detailed with 10 chapters covering diagnosis, assessment, management, therapeutic agents, indications for hospitalisation, and advice for parents and carers. Recommendations are based on the best available evidence where it exists and on the consensus of the Guideline Development Group where it does not. The guidelines include overviews of the relevant studies (with summaries of results and data) in each area. The recommendations do not include a grading for the evidence on which they are based however chapter 1 explains the methodology used and states that more detailed results and data are presented in tables in the CD-ROM accompanying the printed guideline. Appendix A is an analysis of the cost-effectiveness of IV vs. oral rehydration which concludes that oral rehydration is more cost-effective. Appendix B considers the health economics of ondansetron and concludes that its use is likely to have both clinical and economic benefits but that more research is needed on its effects on diarrhoea.

Guarino A, Albano F, Ashkenazi S, et al. 2008. **European Society for Paediatric Gastroenterology, Hepatology, and Nutrition/European Society for Paediatric Infectious Diseases evidence-based guidelines for the management of acute gastroenteritis in children in Europe**. Journal of Pediatric Gastroenterology & Nutrition, 46 Suppl 2, S81-122.

These comprehensive European guidelines were designed for practitioners in Europe. They are structured as a series of clinical questions, each followed by answers (accompanied by a grade indicating the strength of the evidence on which they are based) and recommendations (also graded) and a discussion of the relevant studies. The clinical questions are grouped into the following categories: definition and epidemiology, risk factors for severe and/or persistent disease, clinical evaluation and disease severity, diagnostic workup, indications for medical visits and hospitalisation, rehydration, nutritional management, drugs and other therapies and prevention.

King CK, Glass R, Bresee JS, et al. 2003. **Managing acute gastroenteritis among children: oral rehydration, maintenance, and nutritional therapy**. Morbidity & Mortality Weekly Report. Recommendations & Reports, 52(RR-16), 1-16.www.cdc.gov/mmwr/PDF/RR/RR5216.pdf

These guidelines are endorsed by the American Academy of Pediatrics. They review the historical background of oral rehydration therapy and its scientific basis and provide a framework for assessing and treating infants and children with acute diarrhoea. There is a comprehensive list of references.

Systematic and Other Reviews on Gastroenteritis From the International Literature
Gregorio GV, Dans LF, Silvestre MA. 2011. **Early versus Delayed Refeeding for Children with Acute Diarrhoea**. Cochrane Database of Systematic Reviews, 2011(7), Art. No.: CD007296. DOI: 10.1002/14651858.CD007296.pub2. It used to be common practice to starve children with diarrhoea for fear of exacerbating the illness and prolonging its course. This review considered RCTs comparing early re-feeding (within 12 hours of the start of rehydration) with late re-feeding (12+ hours after the start of rehydration) in children with acute diarrhoea aged less than ten years. Twelve trials including 1283 participants were included and data relating to 1226 participants were included in a meta-analysis (724 who had early re-feeding and 502 who had late re-feeding). There was no significant difference between the early and late re-feeding groups in the proportion of participants who experienced vomiting (five trials, 466 participants), the proportion who needed intravenous fluids (six trials, 813 participants) or the proportion who developed persistent diarrhoea (four trials, 522 participants). Data from two trials (246 participants) indicated that the mean length of hospital stay was also similar. The authors concluded there was no evidence that early re-feeding increased the risk of vomiting, necessity for intravenous fluids or the development of persistent diarrhoea. They were unable to draw any conclusions about the duration of diarrhoea.
Freedman SB, Steiner MJ, Chan KJ. 2010. Freedman SB, Steiner MJ, Chan KJ. 2010. **Oral ondansetron administration in emergency departments to children with gastroenteritis: an economic analysis**. PLoS Medicine / Public Library of Science, 7(10). Ondansetron is an orally administered anti-emetic which, if given to children with vomiting, can increase the chances of oral rehydration being successful and decrease the likelihood of a child needing intravenous rehydration. Despite this, clinical practice guidelines in North America and Europe do not recommend its use, possibly because of concerns about the cost and because of memories of the severe side-effects of older anti-emetics such as promethazine and prochlorperazine. This study involved conducting cost analyses for the use of Ondansetron in the emergency department (ED) from both the societal perspective and the health care payer's perspective in both the U.S. and Canada. The results showed that in both countries administration of Ondansetron in the ED would save money. In Canada (where the health system is similar to New Zealand's) it was estimated that it would prevent 4,065 IV insertions and 1,003 hospital admissions, saving society CDN$1.72 million and the health care system CDN$ 1.18 million p.a.
Gregorio GV, Gonzales MLM, Dans LF, et al. 2009. **Polymer-based oral rehydration solution for treating acute watery diarrhoea**. Cochrane Database of Systematic Reviews, 2009(2), Art. No.: CD006519. DOI: 10.1002/14651858.CD006519.pub2. Polymer-based oral rehydration solutions (ORS) contain compounds such as whole rice, wheat, maize and sorghum which release glucose slowly into the gut as they are digested and thereby improve the absorption of water and salt from the solution. This review aimed to compare the effectiveness of polymer-based ORS with glucose-based ORS with the same electrolyte content. This review included 34 RCTs with 4212 participants, 27 of which involved children, 5 adults and 2 both adults and children. Combining the results of 19 trials with 2235 participants (some of which involved ORS with osmolarity ≥ 310 mOsm/l and some of which involved ORS with osmolarity ≤270 mOsm/l) showed that there were fewer unscheduled intravenous infusions in the polymer ORS group compared to the glucose ORS group (RR 0.75, 95% CI 0.59 to 0.95). Polymer-based ORS and glucose-based ORS had similar adverse effects. The authors concluded that there may be some advantages in using polymer-based ORS instead of glucose-based ORS for treating diarrhoea due to any cause and due to cholera although the evidence was limited for ORS of osmolarity ≤270 mOsm/l.
Alhashimi D, Al-Hashimi H, Fedorowicz Z. 2009. **Antiemetics for reducing vomiting related to acute gastroenteritis in children and adolescents**. Cochrane Database of Systematic Reviews, 2009(2), Art.No.: CD005506. DOI: 10.1002/14651858.CD005506.pub4. Treating children who are vomiting with anti-emetics has been a somewhat controversial issue. Older anti-emetics, such as promethazine and metoclopramide, were associated with severe side-effects including sedation and extra-pyramidal reactions (movement disorders including twitching, muscle spasms and restlessness). Newer anti-emetics, particularly ondansetron, may be better tolerated and have the potential benefits of alleviating the distress caused by vomiting and increasing the success of oral rehydration therapy. This review considered 4 RCTs, with 501 participants, which compared anti-emetics with placebo or nothing in children and adolescents with a clinical diagnosis of vomiting secondary to gastroenteritis. Three trials compared oral ondansetron with placebo and one (36 participants in total) compared Intravenous metoclopramide, ondansetron and saline. Three of the trials received financial support from pharmaceutical companies. The authors concluded that there was limited evidence favouring the use of ondansetron and metoclopramide to reduce the number of episodes of vomiting in children with gastroenteritis and that the use of ondansetronmay reduce the number of children needing intravenous rehydration and hospital admission. There was more diarrhoea in children given ondansetron or metoclopramide rather than a placebo and the authors considered that this was due to the retention of fluids and toxins that would otherwise have been eliminated by vomiting.
Ejemot RI, Ehiri JE, Meremikwu MM, et al. 2008. **Hand washing for preventing diarrhoea**. Cochrane Database of Systematic Reviews, 2008(1), Art. No.: CD004265. DOI:10.1002/14651858.CD004265.pub2. The authors state that interventions to promote hand washing can produce a 30% reduction in episodes of diarrhoea. This conclusion is based on 14 RCTs, eight of which were institution-based in high income countries, 5 of which were community-based in low or middle-income countries and one of which was in a high-risk group (people with AIDS). When only the results of trials adjusting for cluster randomisation and confounders were considered, interventions to promote hand washing produced a 39% reduction in diarrhoea episodes in children in day-care centres in high-income countries (2 trials, 2287 children, Incidence rate ratio 0.61, 95% CI 0.40 - 0.92) and a 32% reduction in diarrhoea episodes in children living in communities in low or middle-income countries (4 trials, IRR 0.68, 95% CI 0.52 – 0.90).

Hartling L, Bellemare S, Wiebe N, et al. 2006. **Oral versus intravenous rehydration for treating dehydration due to gastroenteritis in children**. Cochrane Database of Systematic Reviews, 2006(3), Art. No.: CD004390. DOI:10.1002/14651858.CD004390.pub2.

Based on a review of 17 randomised and quasi-randomised trials (with 1811 participants), which they considered to be of poor to moderate quality, the authors of this review concluded that there were no clinically important differences between oral rehydration therapy (ORS) and intravenous rehydration therapy. Paralytic ileus occurred more often in the oral rehydration group (risk difference 3%, 95% CI 1-5) and intravenous therapy has a risk (c. 2.5%) of causing phlebitis (inflammation of the veins).The authors state that for every 25 children treated with ORS, one would fail to achieve adequate rehydration and require intravenous therapy. They recommend oral rehydration as the first choice therapy for children with mild to moderate diarrhoea due to gastroenteritis with intravenous therapy if oral rehydration fails.

Hahn S, Kim S, Garner P. 2002. **Reduced osmolarity oral rehydration solution for treating dehydration caused by acute diarrhoea in children**. Cochrane Database of Systematic Reviews, 2002(1), Art. No.: CD002847. DOI: 10.1002/14651858.CD002847.

The findings of this review are based on the results of 11 RCTs comparing reduced osmolarity oral rehydration solution (ORS) with the WHO standard ORS in which the primary outcome was unscheduled intravenous fluid infusion and the secondary outcomes were measures of clinical illness. Results of a meta-analysis of 8 trials indicated that reduced osmolarity ORS was associated with fewer unscheduled intravenous fluid infusions than WHO standard ORS (odds ratio 0.59, 95% confidence interval 0.45 to 0.79). There was no evidence for heterogeneity between trials. In 3 trials no participant required unscheduled intravenous fluid infusion therapy.

Since this review as published, the WHO has revised its ORS guidelines and now recommends a reduced osmolarity ORS with 245 mOsm/l instead of 311 mOsm/l. Details can be found in the following publication:

World Health Organisation, Unicef. 2006. **Oral Rehydration Salts Production of the new ORS**. Geneva: World Health Organisation. http://libdoc.who.int/hq/2006/WHO_FCH_CAH_06.1.pdf

In addition to the reviews mentioned above, there are a number of Cochrane reviews which consider interventions that are specific to particular situations or particular pathogens. These are listed below:

Clasen T F, Bostoen K, Schmidt W-P, et al. 2010. **Interventions to improve disposal of human excreta for preventing diarrhoea**. Cochrane Database of Systematic Reviews, 2010(6), Art. No.: CD007180. DOI: 10.1002/14651858.CD007180.pub2.

Allen SJ, Martinez EG, Gregorio GV, et al. 2010. **Probiotics for treating acute infectious diarrhoea**. Cochrane Database of Systematic Reviews, 2010(11), Art. No.: CD003048. DOI: 10.1002/14651858.CD003048.pub3

Bernaola Aponte G, Bada Mancilla CA, Carreazo Pariasca NY, et al. 2010. **Probiotics for treating persistent diarrhoea in children**. Cochrane Database of Systematic Reviews, 2010(11), Art.No.: CD007401. DOI: 10.1002/14651858.CD007401.pub2.

Christopher PR, David KV, John SM, et al. 2010. **Antibiotic therapy for Shigella dysentery**. Cochrane Database of Systematic Reviews, 2010(8), Art. No.: CD006784. DOI: 10.1002/14651858.CD006784.pub4.

Lazzerini M, Ronfani L. 2008. **Oral zinc for treating diarrhoea in children**. Cochrane Database of Systematic Reviews, 2008(3), Art. No.: CD005436. DOI: 10.1002/14651858.CD005436.pub2.

Mohan P, Haque K. 2003. **Oral immunoglobulin for the prevention of rotavirus infection in low birth weight infants**. Cochrane Database of Systematic Reviews, 2002(3), Art. No.: CD003740. DOI: 10.1002/14651858.CD003740

Mohan P, Haque K. 2002. **Oral immunoglobulin for the treatment of rotavirus infection in low birth weight infants**. Cochrane Database of Systematic Reviews, 2002(3), Art. No.: CD003742. DOI: 10.1002/14651858.CD003742.

Sirinavin S, Garner P. 1999. **Antibiotics for treating salmonella gut infections**. Cochrane Database of Systematic Reviews, 1999(1), Art. No.: CD001167. DOI: 10.1002/14651858.CD001167.

Other Relevant Publications

Neuwelt P, Simmons G. 2006. **A Public Health Portrait of Severe Paediatric Gastroenteritis in the Auckland Region: Report of the 2005 Auckland Paediatric Gastroenteritis Investigation**. Auckland: Auckland Regional Public Health Service. http://www.arphs.govt.nz/Publications_reports/reports/PaedsGastro_Apr06.pdf

This is the report of an investigation to identify the causes of gastroenteritis in children admitted to paediatric hospitals in Auckland and to investigate associations between hospitalisation for gastroenteritis and ethnicity and socioeconomic status (as measured by neighbourhood deprivation levels). The investigation found that 92.4% of children admitted with gastroenteritis were under 5 years of age and almost 80% were under two. Pacific children were overrepresented (35.9% of cases) and there was an association with socioeconomic deprivation (71% of cases lived in areas with an NZDep decile of 6 or more). Rotavirus was the most common pathogen accounting for 57.3% of cases. Preventive strategies identified included measures to improve hygiene at home and in childcare centres, vaccination, and promoting early and intensive rehydration treatment in the community through educating parents and general practice staff and removing barriers to accessing primary care.

OTHER ISSUES

INJURIES IN CHILDREN

Introduction

Unintentional injury remains the leading cause of death in New Zealand children aged 1–14 years [183]. In national data for 2004–2008, the most common causes of injury deaths in this age group were related to land transport incidents, either as a vehicle occupant or a pedestrian. Drowning rates are similar to those of pedestrians, with assault being the fifth most common cause of death. In terms of trends, mortality rates from both land transport and non-land transport are decreasing, with the exception of threats to breathing [184].

Age and developmental stage affect the types of injury incurred. For example, children under one year of age are the most likely to die from choking or asphyxiation, while drowning commonly occurs in children aged 1–3 years [184]. The rate of transport-related deaths increases with age, mostly driven by fatal events occurring to pedal cyclists and motorcyclists. For non-transport injury, after drowning and assault, fire and flames, burns and self-harm are the next most common causes of mortality in 0–14 year olds, with the latter cause being more common in those aged 10–14 years [183]. For almost all injury causes, males predominate [183], with mortality from land transport injuries also being higher for Māori children than for children of other ethnic groups [97].

The causes and diagnoses for children hospitalised for injuries also vary with age and the child's developmental stage [185]. The circumstances surrounding falls, a common cause of injury hospitalisation vary with age but dominate all age groups [185], as do injuries from inanimate mechanical forces [97]. In contrast, incidents involving electricity/fire/burns peak at one year of age, while admissions for poisoning are more common at two years of age. Admissions for injuries resulting from falling are most evident in children around five years of age [97].

In terms of prevention, New Zealand has a national Injury Prevention Strategy (NZIPS) that details a philosophical approach to reducing injury and identifies strategies for achieving injury prevention goals [186]. In 2011, childhood injury was identified as a priority area, and various government sectors are likely to collaborate with lead agencies to implement the strategies identified [187]. These may include interventions proven to be effective in reducing injury from some causes. For example, cycle helmets reduce head injury except to the jaw area [188], child restraints should be used by all children but need to be correctly used [189], isolation fencing reduces the risk of young children drowning in domestic swimming pools [190], and smoke detectors alert households so they can leave a potentially burning building [191]. The effectiveness of many interventions is, however, affected by the complexity of the environments in which families live, play and travel. The value of multifaceted interventions is increasingly noted in systematic reviews of interventions to prevent childhood injury [192]. Critical to effectiveness of any proven intervention, is that its implementation is well executed and sustainably resourced.

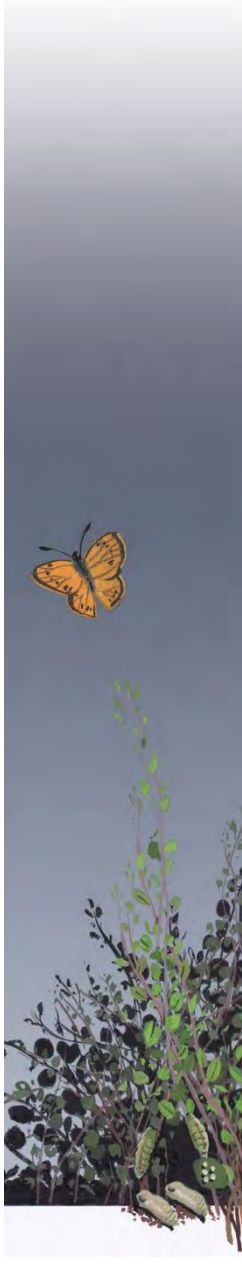
The following section reviews injuries in children using data from the National Minimum Dataset and the National Mortality Collection. The section concludes with a brief overview of local policy documents and evidence-based reviews which consider the prevention of childhood injuries at the population level.

Data Sources and Methods

Indicator

1. *Hospital Admissions for Injuries in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Hospital admissions in children aged 0–14 years with a primary diagnosis of Injury (ICD-10-AM S00–T79). Causes of injury were assigned using the ICD-10-AM primary external cause code (E code). The following were excluded: 1) Admissions with an E code in the Y40–Y89 range (complications of drugs/medical/surgical care and late sequelae of injury). 2) Admissions with an Emergency Medicine Specialty code (M05–M08) on discharge.



Causes of injury were assigned using the primary E code (hospital admissions) or the main underlying cause of death as follows: Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34). Broader Categories included Land Transport Injuries (V01–V89) and Unintentional Non-Transport Injuries (W00–W74, W85–X19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Injuries in Children Aged 0–14 Years

Numerator: National Mortality Collection; Deaths in children aged 0–14 years where the main underlying cause of death was an injury (V01–Y36). Causes of injury were assigned using the codes listed above.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

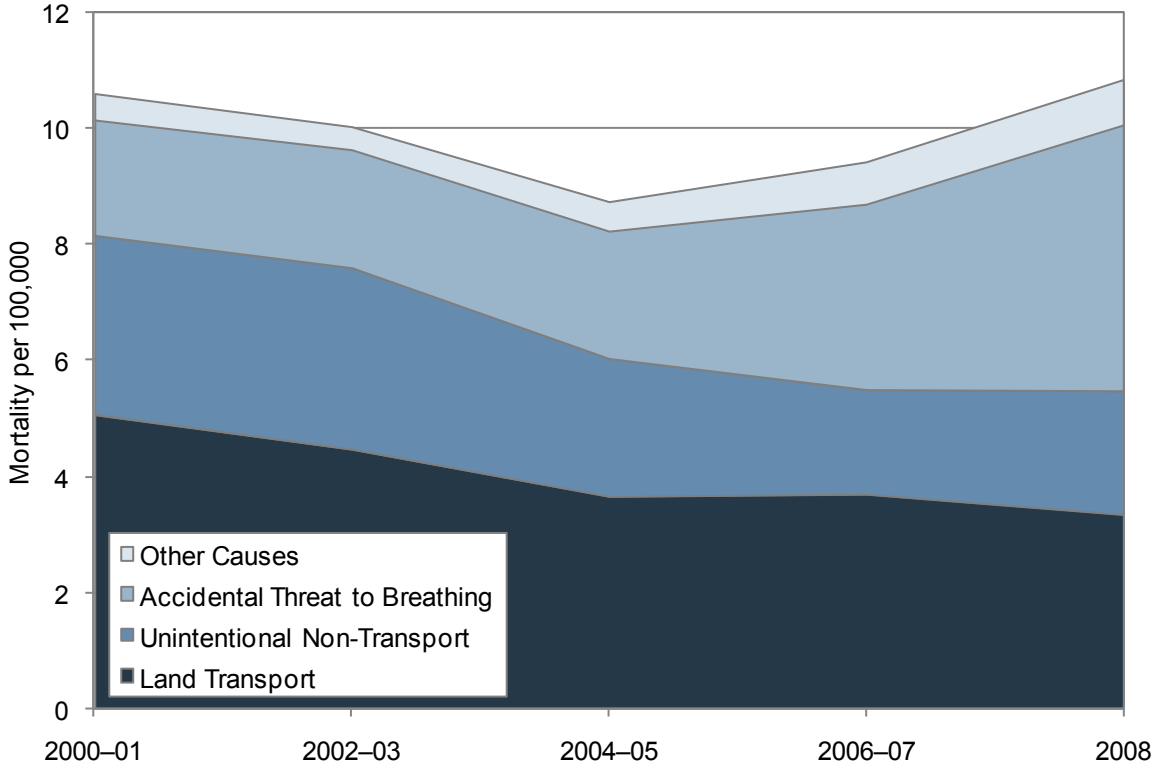
Notes on Interpretation

Note 1: Because of regional inconsistencies in the uploading of Emergency Department cases to the National Minimum dataset (see **Appendix 3**) all hospital admissions with an Emergency Department specialty code on discharge have been excluded. In addition, because of the potential for these inconsistencies to impact significantly on time series analysis, any reviews of long term trends have been restricted to mortality data, with hospital admission data being used to explore cross sectional associations between demographic factors and different injury types. Despite these restrictions, the reader must bear in mind the fact that differences in the ways different DHBs upload their injury cases to the NMDS may also impact on the regional vs. New Zealand analyses presented (see **Appendix 3** for a fuller explanation of these issues).

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

All Injuries

Figure 105. Mortality from Unintentional Injuries in Children Aged 0–14 Years by Main Underlying Cause of Death, New Zealand 2000–2008

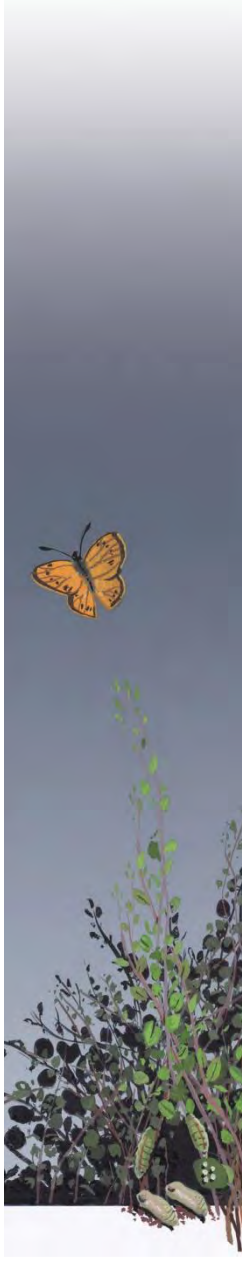


Source: Numerator: National Mortality Collection (Assault and Suicide excluded); Denominator: Statistics NZ Estimated Resident Population

Table 102. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in New Zealand Children Aged 0–14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
New Zealand				
Injury Admissions 0–14 Years, 2006–2010				
Falls	24,576	4,915.2	550.6	43.1
Mechanical Forces: Inanimate	12,726	2,545.2	285.1	22.3
Mechanical Forces: Animate	2,818	563.6	63.1	4.9
Transport: Vehicle Occupant	1,182	236.4	26.5	2.1
Transport: Motorbike	1,283	256.6	28.7	2.3
Transport: Cyclist	2,926	585.2	65.6	5.1
Transport: Pedestrian	975	195.0	21.8	1.7
Transport: Other Land Transport	976	195.2	21.9	1.7
Transport: Other Transport	108	21.6	2.42	0.2
Electricity / Fire / Burns	1,963	392.6	44.0	3.4
Accidental Poisoning	2,634	526.8	59.0	4.6
Accidental Threat to Breathing	440	88.0	9.86	0.8
Drowning / Submersion	176	35.2	3.94	0.3
Assault	829	165.8	18.6	1.5
Intentional Self-Harm	449	89.8	10.1	0.8
Undetermined Intent	216	43.2	4.84	0.4
No External Cause Listed	7	1.4	0.16	0.0
Other Causes	2,730	546.0	61.2	4.8
New Zealand Total	57,014	11,402.8	1,277.30	100.0
Injury Mortality 0–14 Years, 2004–2008				
Accidental Threat to Breathing	137	27.4	3.08	28.6
Transport: Vehicle Occupant	88	17.6	1.98	18.4
Transport: Pedestrian	46	9.2	1.04	9.6
Transport: Cyclist	12	2.4	0.27	2.5
Transport: Motorbike	9	1.8	0.20	1.9
Transport: Other Land Transport	6	1.2	0.14	1.3
Transport: Other Transport	6	1.2	0.14	1.3
Drowning / Submersion	46	9.2	1.04	9.6
Assault	39	7.8	0.88	8.1
Electricity / Fire / Burns	21	4.2	0.47	4.4
Intentional Self-Harm	20	4.0	0.45	4.2
Falls	12	2.4	0.27	2.5
Mechanical Forces: Inanimate	12	2.4	0.27	2.5
Mechanical Forces: Animate	<3	s	s	s
Accidental Poisoning	8	1.6	0.18	1.7
Undetermined Intent	8	1.6	0.18	1.7
Other Causes	7	1.4	0.16	1.5
New Zealand Total	479	95.8	10.78	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.



New Zealand Mortality Trends

In New Zealand during 2000–2008, mortality from land transport injuries and unintentional non-transport injuries in children both declined, while mortality from accidental threats to breathing increased. The majority of accidental threats to breathing deaths however, occurred in infants <1 year, who were coded as dying as a result of suffocation or strangulation in bed, and thus the potential exists for some of the increases seen to have arisen from a diagnostic shift in the coding of Sudden Unexpected Death in Infancy (SUDI) [193] (see SUDI section) (**Figure 105**).

New Zealand Distribution by Cause

In New Zealand during 2006–2010 falls, followed by inanimate mechanical forces were the leading causes of injury admissions in children, although transport injuries as a group also made a significant contribution. In contrast, accidental threats to breathing, followed by vehicle occupant injuries were the leading causes of injury mortality in children during 2004–2008 (**Table 102**).

Table 103. Hospital Admissions (2006−2010) and Mortality (2004−2008) from Injuries in Waikato Children Aged 0−14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Waikato				
Injury Admissions 0–14 Years, 2006–2010				
Falls	1,843	368.6	469.4	42.1
Mechanical Forces: Inanimate	926	185.2	235.8	21.1
Mechanical Forces: Animate	212	42.4	54.0	4.8
Transport: Vehicle Occupant	114	22.8	29.0	2.6
Transport: Motorbike	181	36.2	46.1	4.1
Transport: Cyclist	286	57.2	72.8	6.5
Transport: Pedestrian	104	20.8	26.5	2.4
Transport: Other Land Transport	74	14.8	18.8	1.7
Transport: Other Transport	6	1.2	1.53	0.1
Electricity / Fire / Burns	166	33.2	42.3	3.8
Accidental Poisoning	115	23.0	29.3	2.6
Accidental Threat to Breathing	26	5.2	6.62	0.6
Drowning / Submersion	13	2.6	3.31	0.3
Assault	42	8.4	10.7	1.0
Intentional Self-Harm	26	5.2	6.62	0.6
Undetermined Intent	22	4.4	5.60	0.5
Other Causes	226	45.2	57.6	5.2
Waikato Total	4,382	876.4	1,116.0	100.0
Injury Mortality 0–14 Years, 2004–2008				
Accidental Threat to Breathing	10	2.0	2.54	23.8
Transport: Vehicle Occupant	9	1.8	2.28	21.4
Transport: Pedestrian	6	1.2	1.52	14.3
Transport: All Other Causes	3	0.6	0.76	7.1
Drowning / Submersion	4	0.8	1.02	9.5
All Other Causes	10	2.0	2.54	23.8
Waikato Total	42	8.4	10.7	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

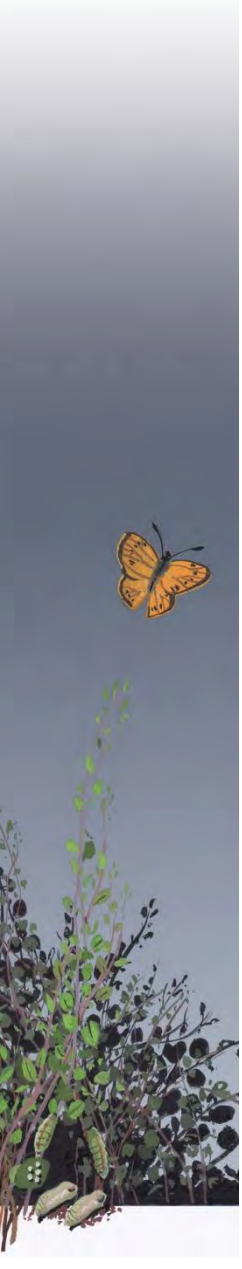


Table 104. Hospital Admissions (2006−2010) and Mortality (2004−2008) from Injuries in Bay of Plenty Children Aged 0−14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Bay of Plenty				
Injury Admissions 0–14 Years, 2006–2010				
Falls	1,465	293.0	658.9	42.3
Mechanical Forces: Inanimate	529	105.8	237.9	15.3
Mechanical Forces: Animate	183	36.6	82.3	5.3
Transport: Vehicle Occupant	112	22.4	50.4	3.2
Transport: Motorbike	129	25.8	58.0	3.7
Transport: Cyclist	217	43.4	97.6	6.3
Transport: Pedestrian	62	12.4	27.9	1.8
Transport: Other Land Transport	107	21.4	48.1	3.1
Transport: Other Transport	6	1.2	2.70	0.2
Electricity / Fire / Burns	112	22.4	50.4	3.2
Accidental Poisoning	199	39.8	89.5	5.7
Accidental Threat to Breathing	25	5.0	11.2	0.7
Drowning / Submersion	21	4.2	9.45	0.6
Assault	73	14.6	32.8	2.1
Intentional Self-Harm	24	4.8	10.8	0.7
Undetermined Intent	12	2.4	5.40	0.3
Other Causes	189	37.8	85.0	5.5
Bay of Plenty Total	3,465	693.0	1,558.5	100.0
Injury Mortality 0–14 Years, 2004–2008				
Transport: Vehicle Occupant	7	1.4	3.16	20.6
Transport: Pedestrian	3	0.6	1.35	8.8
Transport: All Other Causes	4	0.8	1.80	11.8
Accidental Threat to Breathing	5	1.0	2.25	14.7
Drowning / Submersion	5	1.0	2.25	14.7
Assault	3	0.6	1.35	8.8
Electricity / Fire / Burns	3	0.6	1.35	8.8
All Other Causes	4	0.8	1.80	11.8
Bay of Plenty Total	34	6.8	15.3	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Midland Region Distribution by Cause

In the Midland Region during 2006–2010, falls followed by inanimate mechanical forces were the leading causes of injury admissions in children in all five DHBs, although transport injuries as a group also made a significant contribution. During 2004–2008, accidental threats to breathing, vehicle occupant, pedestrian and other transport injuries, and drowning / submersion were the most frequent causes of injury mortality in children in most DHBs (**Table 103** to **Table 107**).

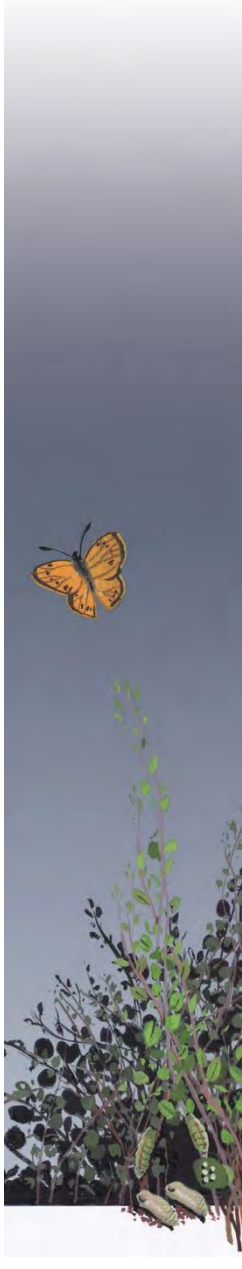


Table 105. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Lakes DHB Children Aged 0–14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Lakes DHB				
Injury Admissions 0–14 Years, 2006–2010				
Falls	699	139.8	584.2	42.7
Mechanical Forces: Inanimate	273	54.6	228.1	16.7
Mechanical Forces: Animate	78	15.6	65.2	4.8
Transport: Vehicle Occupant	33	6.6	27.6	2.0
Transport: Motorbike	71	14.2	59.3	4.3
Transport: Cyclist	110	22.0	91.9	6.7
Transport: Pedestrian	31	6.2	25.9	1.9
Transport: Other Land Transport	41	8.2	34.3	2.5
Transport: Other Transport	3	0.6	2.51	0.2
Electricity / Fire / Burns	65	13.0	54.3	4.0
Accidental Poisoning	82	16.4	68.5	5.0
Accidental Threat to Breathing	9	1.8	7.52	0.6
Drowning / Submersion	7	1.4	5.85	0.4
Assault	39	7.8	32.6	2.4
Intentional Self-Harm	14	2.8	11.7	0.9
Undetermined Intent	<3	s	s	s
Other Causes	79	15.8	66.0	4.8
Lakes DHB Total	1,636	327.2	1,367.2	100.0
Injury Mortality 0–14 Years, 2004–2008				
Accidental Threat to Breathing	7	1.4	5.76	36.8
Transport: Vehicle Occupant	6	1.2	4.94	31.6
All Other Causes	6	1.2	4.94	31.6
Lakes DHB Total	19	3.8	15.6	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

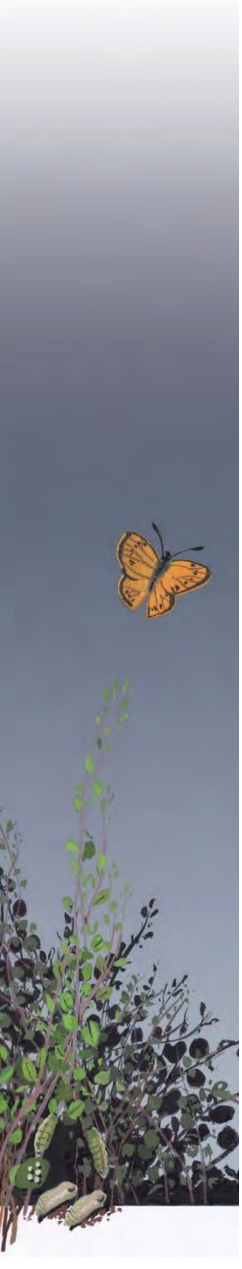


Table 106. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Tairawhiti Children Aged 0–14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Tairawhiti				
Injury Admissions 0–14 Years, 2006–2010				
Falls	458	91.6	791.1	41.8
Mechanical Forces: Inanimate	207	41.4	357.5	18.9
Mechanical Forces: Animate	72	14.4	124.4	6.6
Transport: Vehicle Occupant	27	5.4	46.6	2.5
Transport: Motorbike	16	3.2	27.6	1.5
Transport: Cyclist	76	15.2	131.3	6.9
Transport: Pedestrian	27	5.4	46.6	2.5
Transport: Other Land Transport	44	8.8	76.0	4.0
Transport: Other Transport	<3	s	s	s
Electricity / Fire / Burns	33	6.6	57.0	3.0
Accidental Poisoning	38	7.6	65.6	3.5
Accidental Threat to Breathing	4	0.8	6.91	0.4
Drowning / Submersion	<3	s	s	s
Assault	20	4.0	34.5	1.8
Intentional Self-Harm	8	1.6	13.8	0.7
Undetermined Intent	11	2.2	19.0	1.0
Other Causes	52	10.4	89.8	4.7
Tairawhiti Total	1,097	219.4	1,894.8	100.0
Injury Mortality 0–14 Years, 2004–2008				
All Causes	9	1.8	15.2	100.0
Tairawhiti Total	9	1.8	15.2	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

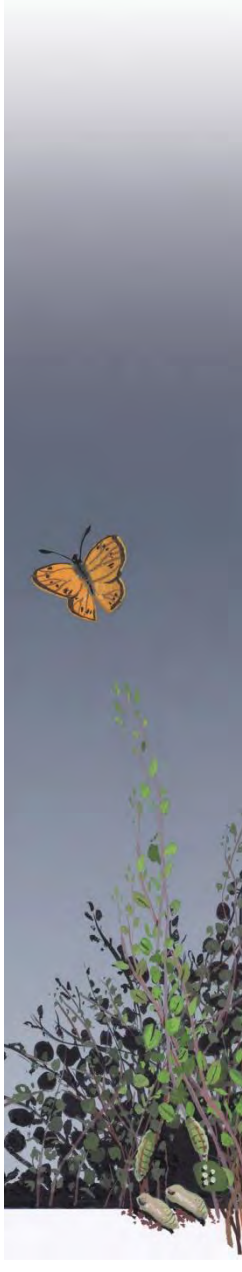


Table 107. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Taranaki Children Aged 0–14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Taranaki				
Injury Admissions 0–14 Years, 2006–2010				
Falls	539	107.8	481.9	44.5
Mechanical Forces: Inanimate	202	40.4	180.6	16.7
Mechanical Forces: Animate	60	12.0	53.6	5.0
Transport: Vehicle Occupant	26	5.2	23.2	2.1
Transport: Motorbike	41	8.2	36.7	3.4
Transport: Cyclist	69	13.8	61.7	5.7
Transport: Pedestrian	16	3.2	14.3	1.3
Transport: Other Land Transport	28	5.6	25.0	2.3
Transport: Other Transport	8	1.6	7.15	0.7
Electricity / Fire / Burns	58	11.6	51.9	4.8
Accidental Poisoning	53	10.6	47.4	4.4
Accidental Threat to Breathing	17	3.4	15.2	1.4
Drowning / Submersion	5	1.0	4.47	0.4
Assault	20	4.0	17.9	1.7
Intentional Self-Harm	9	1.8	8.05	0.7
Undetermined Intent	4	0.8	3.58	0.3
Other Causes	56	11.2	50.1	4.62
Taranaki Total	1,211	242.2	1,082.7	100.0
Injury Mortality 0–14 Years, 2004–2008				
Transport: All Causes	4	0.8	3.46	40.0
All Other Causes	6	1.2	5.19	60.0
Taranaki Total	10	2.0	8.65	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Land Transport Injuries

Midland DHBs vs. New Zealand Distribution

In the Waikato, Bay of Plenty, Lakes and Tairawhiti during 2006–2010, hospital admissions for land transport injuries in children were *significantly* higher than the New Zealand rate, while in Taranaki rates were similar. Mortality from land transport injuries during 2004–2008 was not *significantly* different from the New Zealand rate in any of the Midland DHBs, although small numbers in Tairawhiti precluded a valid analysis (**Table 108**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, hospital admissions for land transport injuries in children were lowest during the winter months in all five DHBs (**Figure 107**).

New Zealand Distribution by Age

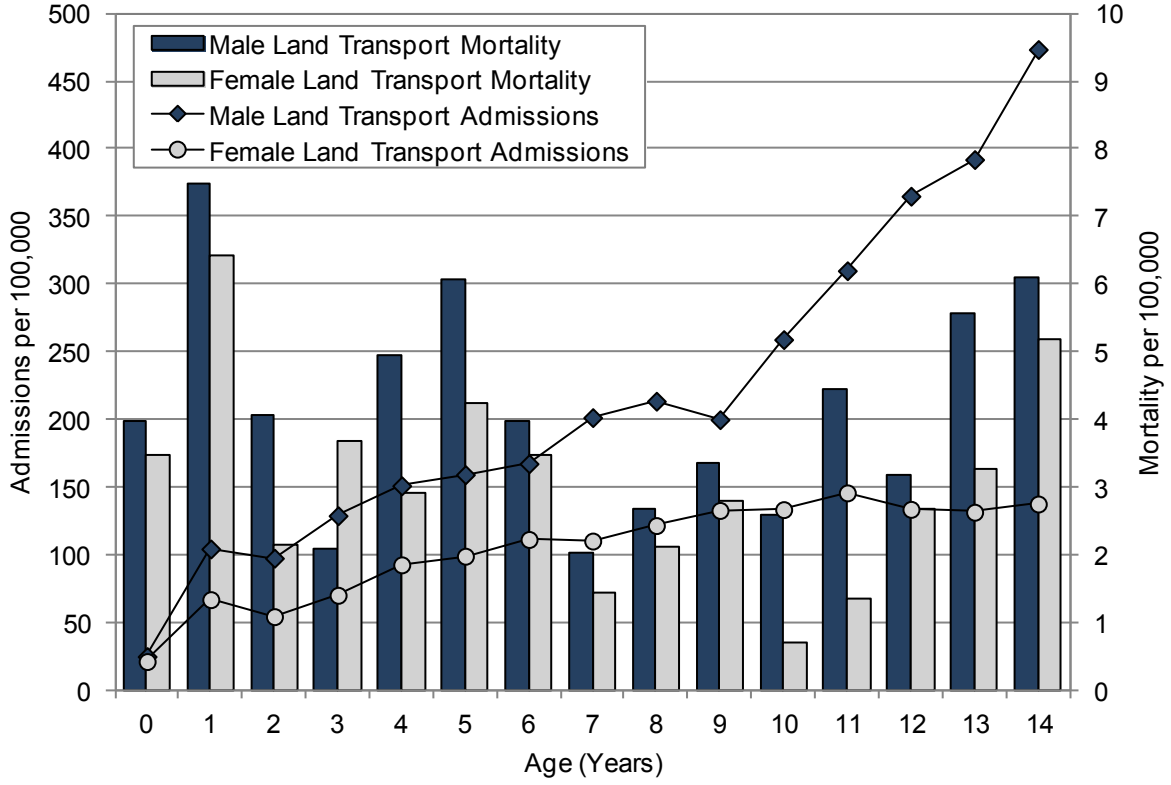
Age and Gender: In New Zealand during 2006–2010, hospital admissions for land transport injuries were lowest in infants <1 year, with rates increasing progressively thereafter. After infancy, admission rates were consistently higher for males than females, with the rate of increase with age being particularly rapid for males after nine years of age. Gender differences were less marked for land transport mortality during 2004–2008 although a male predominance was evident in many age categories (**Figure 106**).

Table 108. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Land Transport Injuries in Children Aged 0–14 Years, Midland DHBs vs. New Zealand

DHB	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Land Transport Injuries					
Hospital Admissions in Children 0–14 Years, 2006–2010					
Waikato	759	151.8	193.3	1.18	1.09–1.27
Lakes	286	57.2	239.0	1.45	1.29–1.64
Bay of Plenty	627	125.4	282.0	1.71	1.58–1.86
Tairawhiti	190	38.0	328.2	2.00	1.73–2.30
Taranaki	180	36.0	160.9	0.98	0.84–1.13
New Zealand	7,342	1,468.4	164.5	1.00	
Mortality in Children 0–14 Years, 2004–2008					
Waikato	18	3.6	4.57	1.26	0.77–2.05
Lakes	7	1.4	5.76	1.59	0.75–3.39
Bay of Plenty	13	2.6	5.86	1.62	0.92–2.85
Tairawhiti	<3	s	s	s	s
Taranaki	4	0.8	3.46	0.95	0.35–2.57
New Zealand	161	32.2	3.62	1.00	

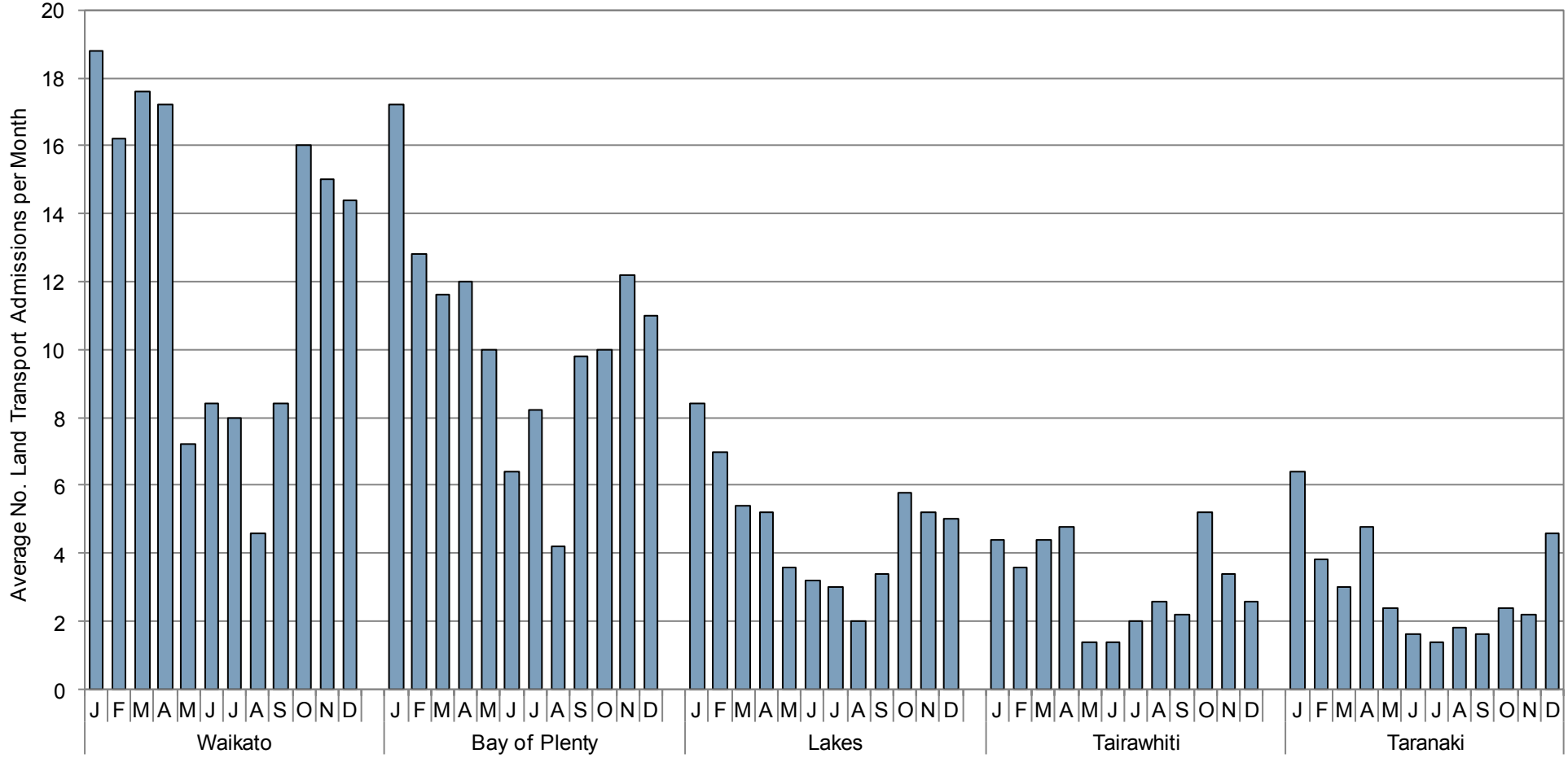
Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Figure 106. Hospital Admissions (2006–2010) and Deaths (2004–2008) from Land Transport Injuries in New Zealand Children 0–14 Years by Age and Gender



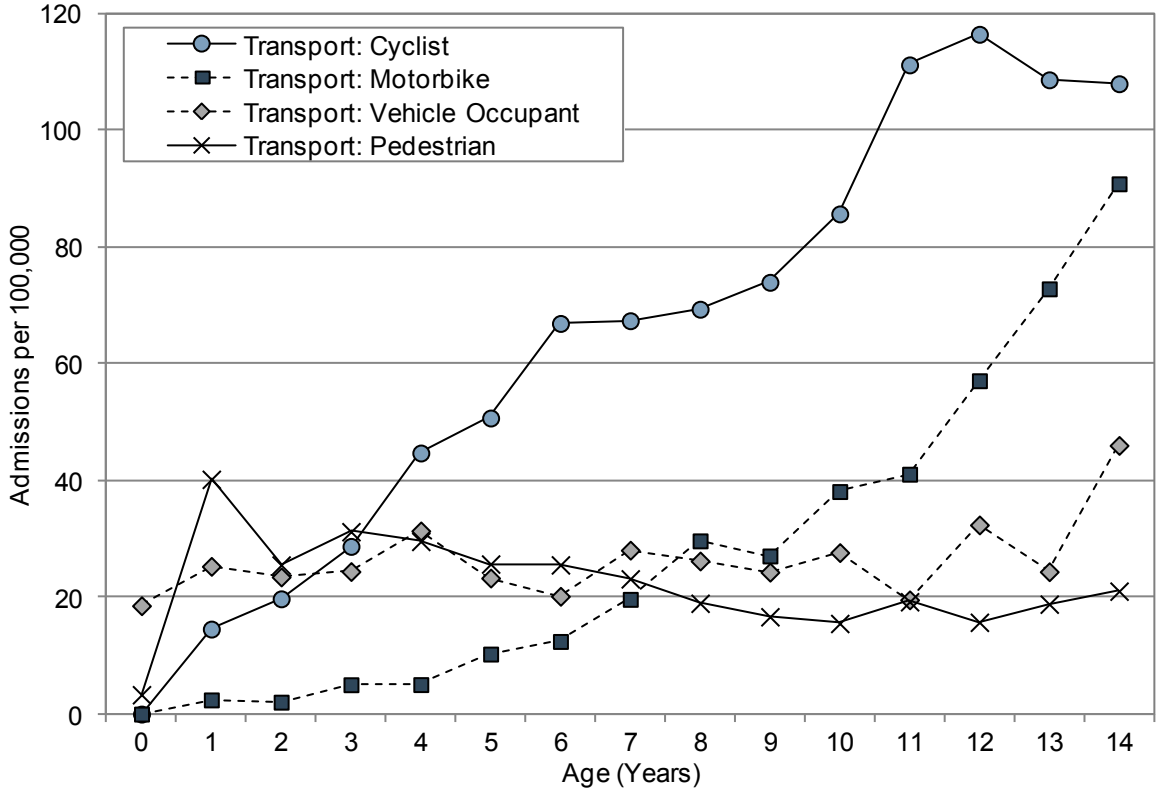
Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 107. Average Number of Hospital Admissions for Land Transport Injuries per Month in Children Aged 0−14 Years, Midland DHBs 2006−2010



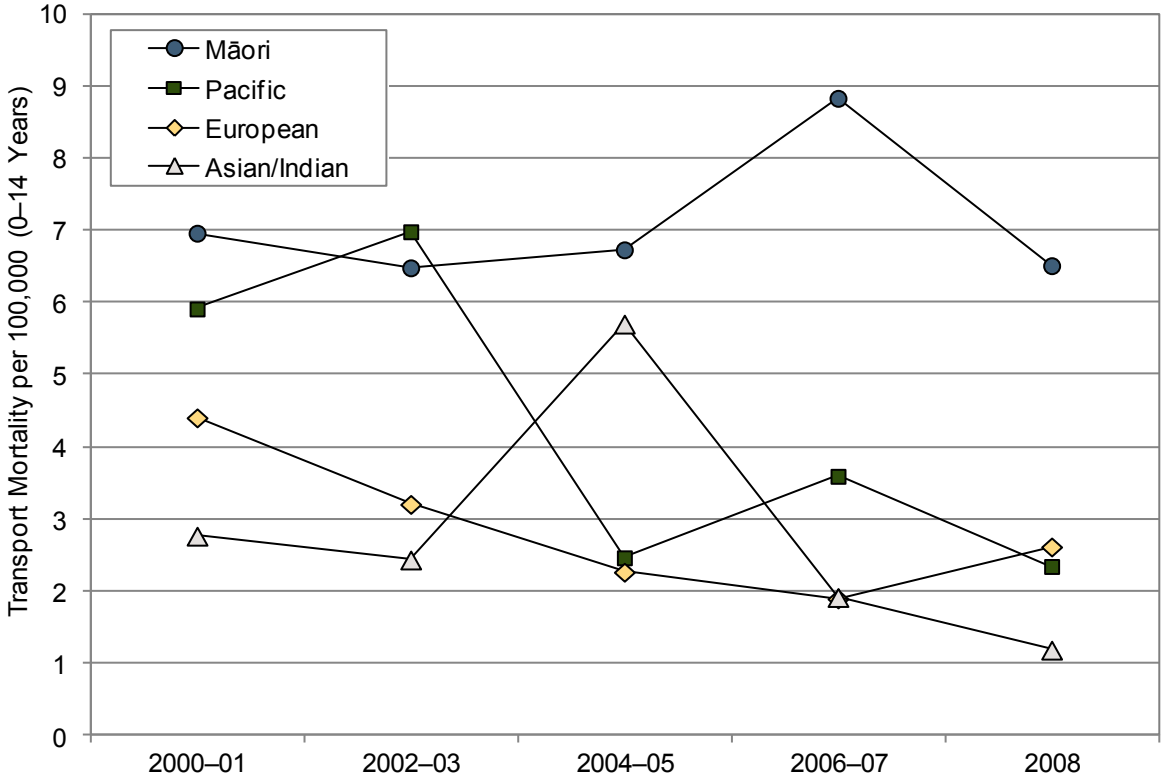
Source: National Minimum Dataset

Figure 108. Hospital Admissions for Transport Injuries in Children 0–14 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 109. Mortality from Land Transport Injuries in Children Aged 0–14 Years by Ethnicity, New Zealand 2000–2008



Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised.

Age and Cause: In New Zealand during 2006–2010, hospital admissions for cycle and motorbike injuries increased with increasing age, although cycle injuries began to taper off after 12 years of age, while motorbike injuries continued to increase. In contrast (with the exception of the first year), admissions for pedestrian injuries were more evenly distributed by age, as were admissions for vehicle occupant injuries (**Figure 108**).

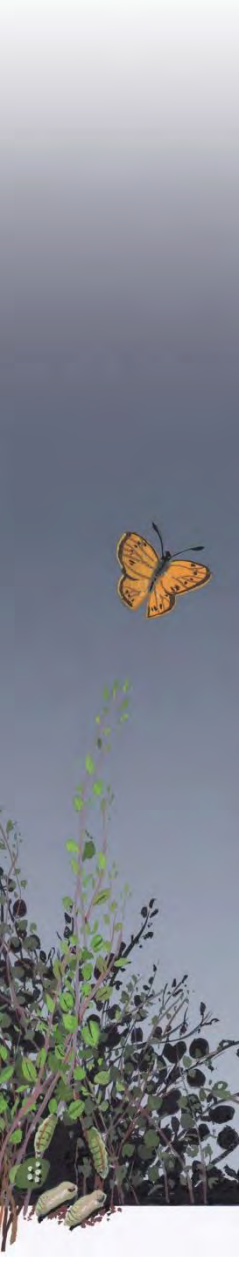
New Zealand Mortality Trends by Ethnicity

In New Zealand during 2000–2008, land transport mortality was consistently higher for Māori than for European and Asian/Indian children. Mortality for Māori children was also higher than for Pacific children from 2004–05 onwards (**Figure 109**).

Table 109. Hospital Admissions for Pedestrian and Cyclist Injuries in Children Aged 0–14 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Pedestrian Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	9.27	1.00		Decile 1–2	11.1	1.00	
Decile 2	13.0	1.40	0.94–2.10	Decile 3–4	15.1	1.36	1.04–1.77
Decile 3	14.3	1.54	1.03–2.30	Decile 5–6	19.6	1.76	1.37–2.27
Decile 4	15.8	1.71	1.16–2.51	Decile 7–8	18.8	1.69	1.32–2.17
Decile 5	16.4	1.77	1.19–2.63	Decile 9–10	40.3	3.63	2.91–4.53
Decile 6	22.2	2.40	1.66–3.45	Prioritised Ethnicity			
Decile 7	16.3	1.76	1.19–2.59	European	14.0	1.00	
Decile 8	21.0	2.26	1.57–3.25	Māori	35.4	2.53	2.19–2.93
Decile 9	37.4	4.03	2.87–5.66	Pacific	36.3	2.59	2.15–3.13
Decile 10	42.7	4.61	3.31–6.41	Asian/Indian	13.7	0.98	0.74–1.29
Gender							
Female	15.6	1.00					
Male	27.8	1.78	1.56–2.03				
Cyclist Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	57.7	1.00		Decile 1–2	56.1	1.00	
Decile 2	54.5	0.94	0.79–1.13	Decile 3–4	61.0	1.09	0.96–1.23
Decile 3	65.1	1.13	0.95–1.34	Decile 5–6	64.7	1.15	1.02–1.30
Decile 4	57.2	0.99	0.83–1.18	Decile 7–8	68.5	1.22	1.08–1.37
Decile 5	63.6	1.10	0.93–1.32	Decile 9–10	73.9	1.32	1.18–1.48
Decile 6	65.5	1.14	0.96–1.34	Prioritised Ethnicity			
Decile 7	65.9	1.14	0.96–1.35	European	73.9	1.00	
Decile 8	70.7	1.23	1.04–1.44	Māori	68.1	0.92	0.85–1.00
Decile 9	81.9	1.42	1.21–1.66	Pacific	40.7	0.55	0.47–0.64
Decile 10	67.2	1.16	0.99–1.37	Asian/Indian	26.1	0.35	0.29–0.43
Gender							
Female	31.0	1.00					
Male	98.5	3.18	2.91–3.46				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.



New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

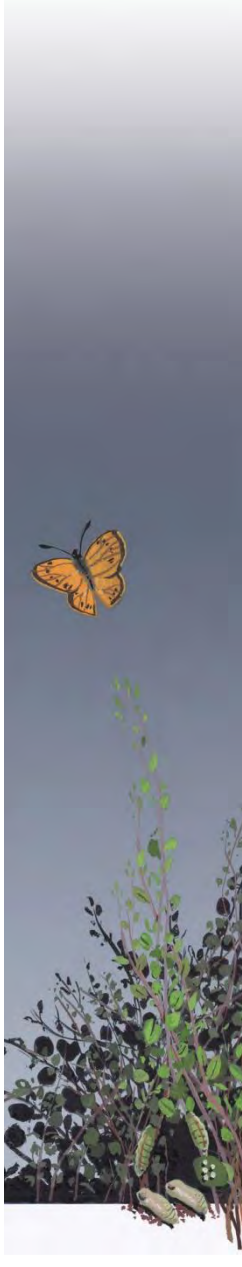
Pedestrian Injuries: In New Zealand during 2006–2010, hospital admissions for pedestrian injuries were *significantly* higher for males, Pacific and Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 109**).

Cyclist Injuries: In New Zealand during 2006–2010, hospital admissions for cycle injuries were *significantly* higher for males, and for Māori and European > Pacific > Asian/Indian children. Socioeconomic differences were not large, although once grouped by NZDep quintile, admission rates were *significantly* higher for those from NZDep deciles 5–10 (**Table 109**).

Table 110. Hospital Admissions for Motorbike and Vehicle Occupant Injuries in Children 0−14 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Motorbike Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	22.6	1.00		Decile 1–2	27.2	1.00	
Decile 2	32.0	1.41	1.09–1.83	Decile 3–4	37.6	1.38	1.17–1.64
Decile 3	39.8	1.76	1.37–2.26	Decile 5–6	28.2	1.04	0.87–1.25
Decile 4	35.6	1.57	1.22–2.02	Decile 7–8	27.1	1.00	0.83–1.19
Decile 5	26.5	1.17	0.89–1.55	Decile 9–10	23.3	0.86	0.72–1.02
Decile 6	29.7	1.31	1.01–1.70	Prioritised Ethnicity			
Decile 7	31.4	1.39	1.07–1.80	European	41.3	1.00	
Decile 8	23.4	1.04	0.79–1.36	Māori	19.3	0.47	0.40–0.54
Decile 9	27.7	1.23	0.94–1.59	Pacific	3.75	0.09	0.06–0.15
Decile 10	19.5	0.86	0.66–1.13	Asian/Indian	1.65	0.04	0.02–0.08
Gender							
Female	7.85	1.00					
Male	48.7	6.21	5.28–7.29				
Vehicle Occupant Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	12.9	1.00		Decile 1–2	13.1	1.00	
Decile 2	13.3	1.03	0.71–1.49	Decile 3–4	16.8	1.28	1.00–1.64
Decile 3	15.3	1.18	0.83–1.70	Decile 5–6	23.8	1.82	1.45–2.30
Decile 4	18.1	1.41	1.00–1.98	Decile 7–8	27.4	2.10	1.68–2.62
Decile 5	21.5	1.67	1.19–2.34	Decile 9–10	43.9	3.36	2.73–4.13
Decile 6	25.9	2.01	1.46–2.76	Prioritised Ethnicity			
Decile 7	27.8	2.15	1.57–2.96	European	20.2	1.00	
Decile 8	27.1	2.10	1.54–2.87	Māori	45.2	2.24	1.98–2.54
Decile 9	43.9	3.40	2.54–4.56	Pacific	25.5	1.26	1.03–1.56
Decile 10	44.0	3.41	2.56–4.55	Asian/Indian	12.7	0.63	0.48–0.83
Gender							
Female	24.1	1.00					
Male	28.7	1.19	1.06–1.33				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.



Motorbike Injuries: In New Zealand during 2006–2010, hospital admissions for motorbike injuries were *significantly* higher for males and for European > Māori > Pacific and Asian/Indian children. Admission rates also tended to be higher for those living in average (NZDep decile 2–7) areas (**Table 110**).

Vehicle Occupant Injuries: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries were *significantly* higher for males, Māori > Pacific > European > Asian/Indian children and those from average-to-more deprived (NZDep decile 5–10) areas (**Table 110**).

Unintentional Non-Transport Injuries

Midland DHBs vs. New Zealand Distribution

In the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for unintentional non-transport injuries in children were *significantly* higher than the New Zealand rate, while in the Waikato and Taranaki rates were *significantly* lower. Rates in Lakes were similar to the New Zealand rate. Mortality from unintentional non-transport injuries in the Bay of Plenty and Tairawhiti during 2004–2008 was also *significantly* higher than the New Zealand rate, while rates in the Waikato were similar. Small numbers in Lakes and Taranaki precluded a valid analysis (**Table 111**).

Table 111. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Unintentional Non-Transport Injuries in Children Aged 0–14 Years, Midland DHBs vs. New Zealand

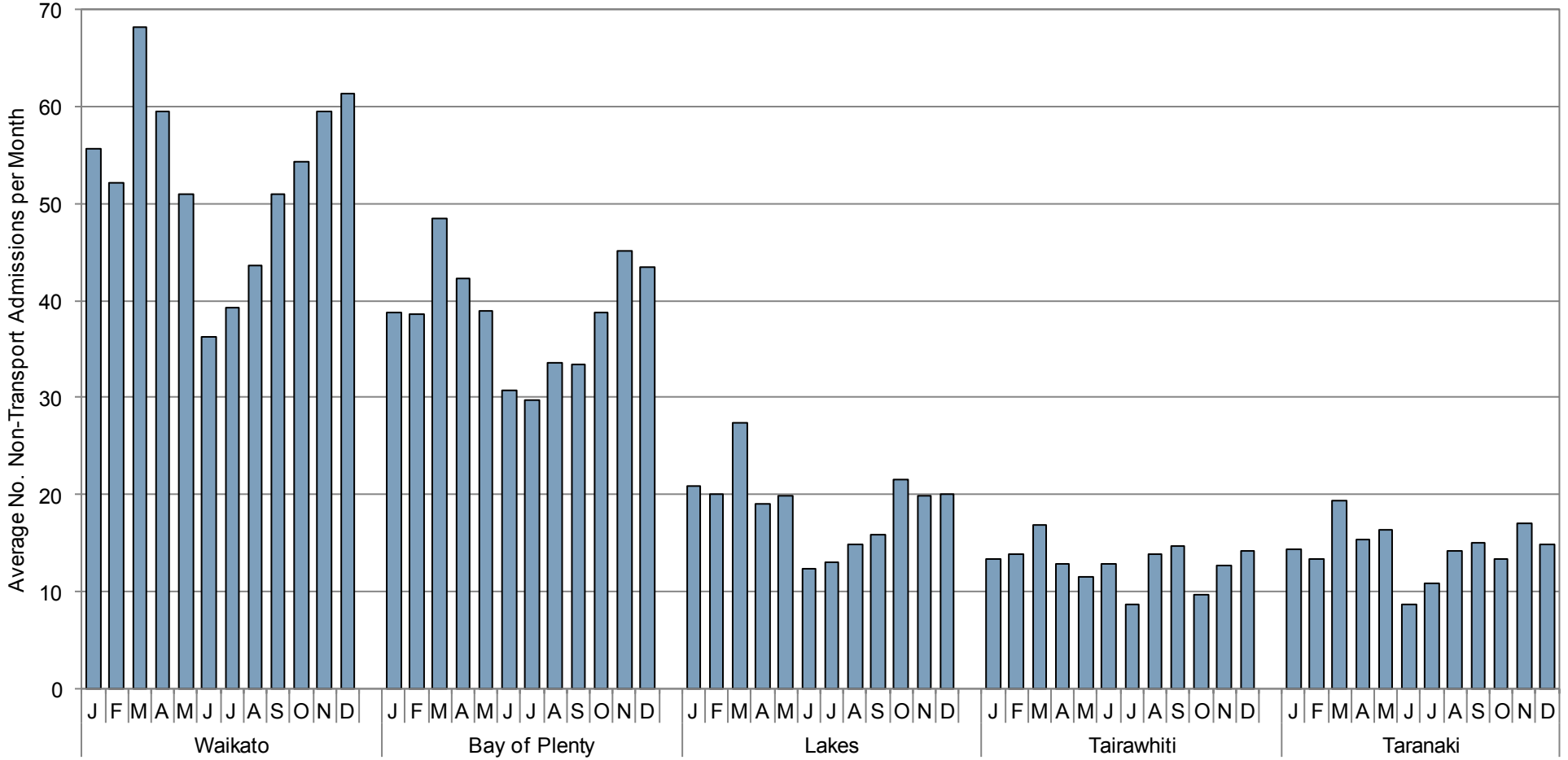
DHB	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Unintentional Non-Transport Injuries					
Hospital Admissions in Children 0–14 Years, 2006–2010					
Waikato	3,160	632.0	804.8	0.85	0.82–0.88
Lakes	1,122	224.4	937.7	0.99	0.93–1.05
Bay of Plenty	2,310	462.0	1,039.0	1.10	1.05–1.14
Tairawhiti	772	154.4	1,333.5	1.41	1.31–1.51
Taranaki	864	172.8	772.5	0.82	0.76–0.87
New Zealand	42,259	8,451.8	946.7	1.00	
Mortality in Children 0–14 Years, 2004–2008					
Waikato	8	1.6	2.03	0.97	0.47–2.00
Lakes	<3	s	s	s	s
Bay of Plenty	10	2.0	4.51	2.15	1.12–4.13
Tairawhiti	4	0.8	6.74	3.22	1.18–8.76
Taranaki	<3	s	s	s	s
New Zealand	93	18.6	2.09	1.00	

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Midland Region Distribution by Season

In the Midland Region during 2006–2010, hospital admissions for unintentional non-transport injuries were lowest during the winter months in most DHBs (**Figure 110**).

Figure 110. Average Number of Hospital Admissions for Unintentional Non-Transport Injuries per Month in Children Aged 0−14 Years, Midland DHBs 2006−2010



Source: National Minimum Dataset

New Zealand Distribution by Age

Age and Gender: In New Zealand during 2006–2010, hospital admissions for unintentional non-transport injuries were lowest in infants <1 year, with rates rising rapidly thereafter, to reach a peak at one year of age. Admission rates then tapered off during the pre-school years, with another small peak being evident at 5 years of age. At every age, admission rates were higher for males than for females. Mortality during 2004–2008 was also highest at one year of age, with rates declining thereafter. A male predominance was also evident at most ages (with the exception of those aged 8–11 years) (**Figure 111**).

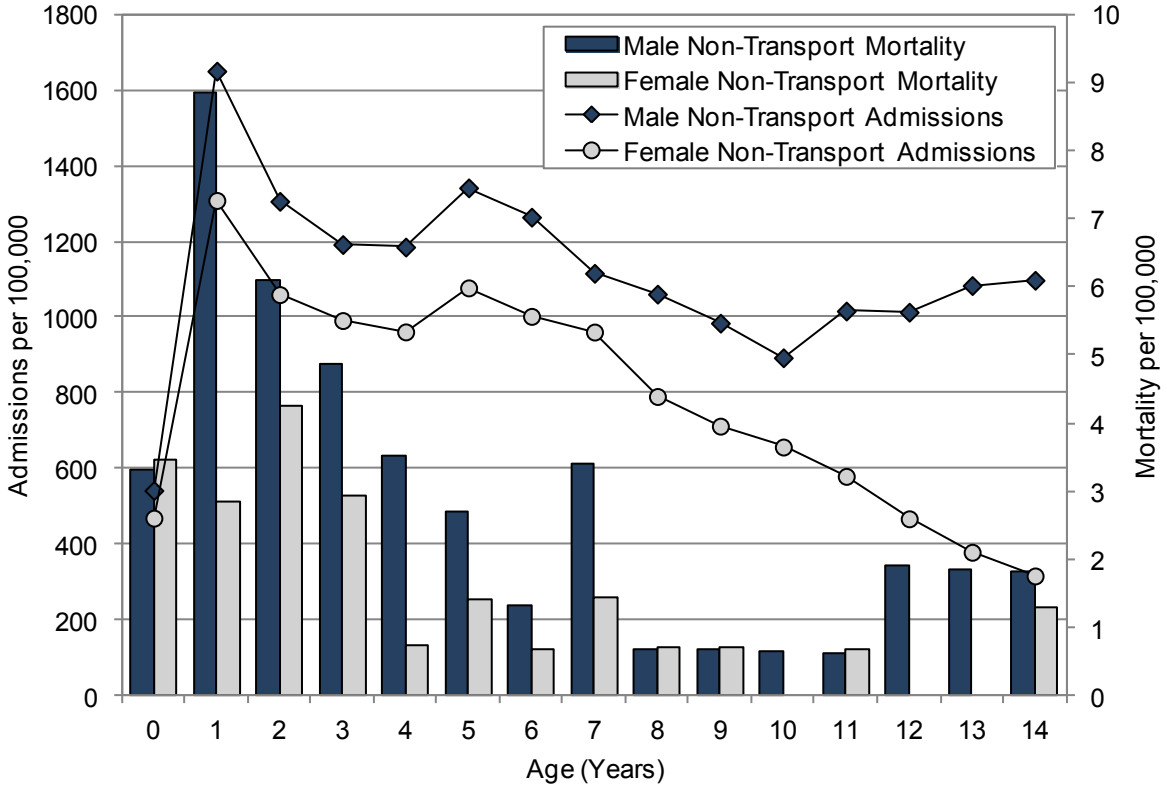
Age and Cause: In New Zealand during 2006–2010, hospital admissions for electricity/fire/burns and accidental poisoning increased rapidly after the first year, with admissions for electricity/fire burns peaking at one year, and admissions for accidental poisoning at 2 years of age (**Figure 112**). Admissions for falls and injuries arising from inanimate mechanical forces were lowest in infants <1 year, with admissions for inanimate mechanical forces peaking at one year, and falls at five years of age (**Figure 113**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

Falls: In New Zealand during 2006–2010, hospital admissions for falls were *significantly* higher for males, Māori > European > Asian/Indian children and those from average-to-more deprived (NZDep deciles 5 and 7–10) areas (**Table 112**).

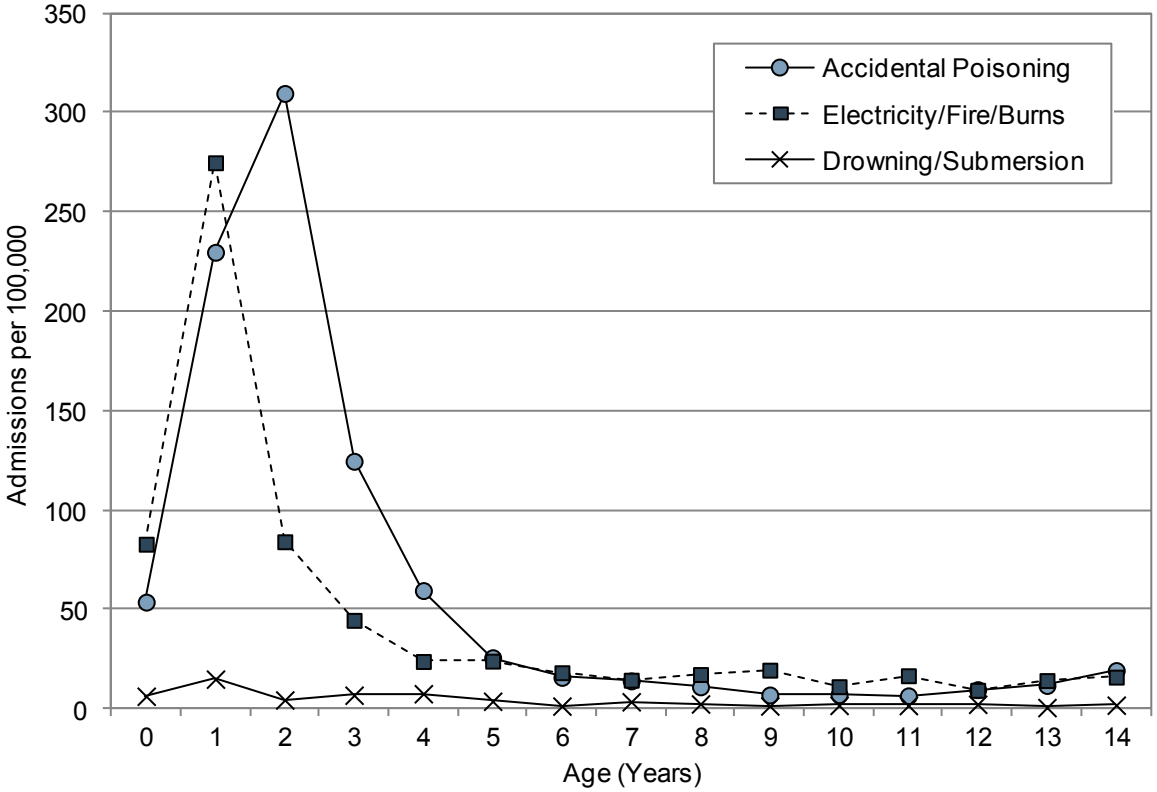
Electricity/Fire/Burns: In New Zealand during 2006–2010, hospital admissions for injuries arising from electricity/fire/burns were *significantly* higher for males, Pacific and Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 112**).

Figure 111. Hospital Admissions (2006–2010) and Deaths (2004–2008) from Unintentional Non-Transport Injuries in New Zealand Children 0–14 Years by Age and Gender



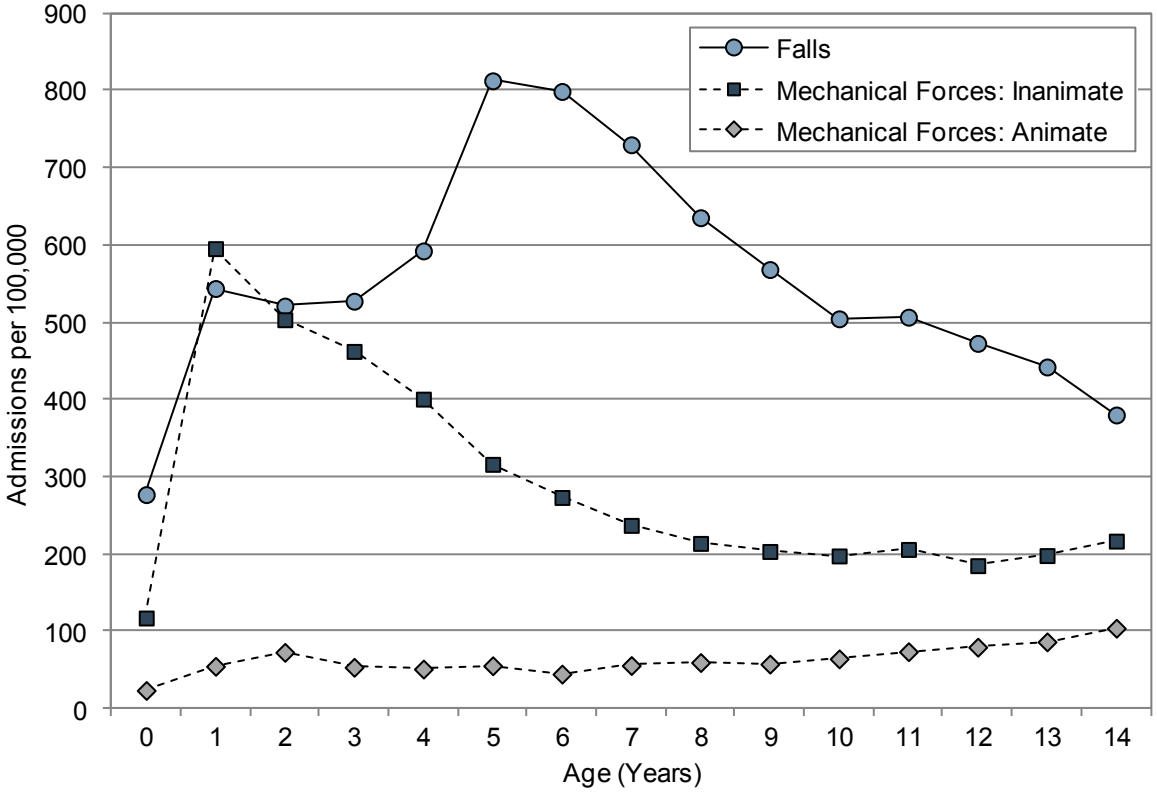
Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 112. Hospital Admissions for Selected Unintentional Non-Transport Injuries in Children 0–14 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 113. Hospital Admissions for Falls and Mechanical Force Type Injuries in Children 0–14 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

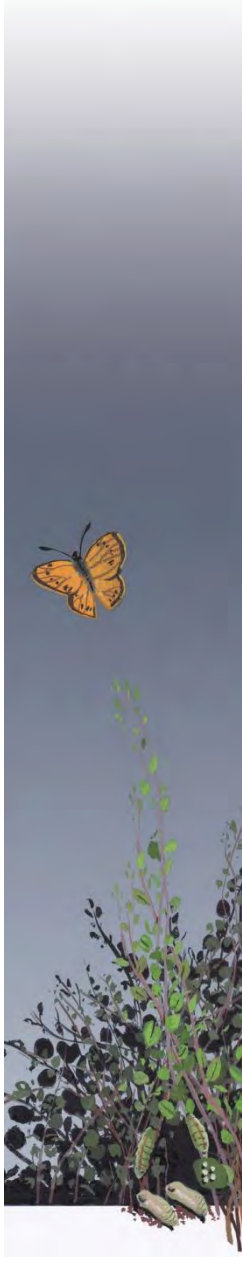


Table 112. Hospital Admissions for Falls and Electricity/Fire/Burn Injuires in Children Aged 0−14 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Falls 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	482.2	1.00		Decile 1–2	464.9	1.00	
Decile 2	446.8	0.93	0.87–0.99	Decile 3–4	468.4	1.01	0.96–1.05
Decile 3	459.5	0.95	0.90–1.01	Decile 5–6	510.4	1.10	1.05–1.15
Decile 4	476.6	0.99	0.93–1.05	Decile 7–8	565.5	1.22	1.17–1.27
Decile 5	521.6	1.08	1.02–1.15	Decile 9–10	685.7	1.47	1.42–1.53
Decile 6	500.7	1.04	0.98–1.10	Prioritised Ethnicity			
Decile 7	542.4	1.12	1.06–1.19	European	559.7	1.00	
Decile 8	585.3	1.21	1.15–1.28	Māori	593.4	1.06	1.03–1.09
Decile 9	698.9	1.45	1.37–1.53	Pacific	578.1	1.03	0.99–1.08
Decile 10	674.5	1.40	1.33–1.47	Asian/Indian	299.9	0.54	0.51–0.57
Gender							
Female	454.7	1.00					
Male	642.1	1.41	1.38–1.45				
Electricity/Fire/Burn Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	18.5	1.00		Decile 1–2	18.7	1.00	
Decile 2	18.9	1.02	0.75–1.39	Decile 3–4	26.7	1.43	1.16–1.74
Decile 3	25.5	1.38	1.03–1.84	Decile 5–6	36.8	1.96	1.62–2.38
Decile 4	27.8	1.50	1.13–1.98	Decile 7–8	51.0	2.72	2.28–3.25
Decile 5	37.7	2.03	1.55–2.66	Decile 9–10	77.4	4.13	3.49–4.89
Decile 6	36.1	1.94	1.49–2.54	Prioritised Ethnicity			
Decile 7	43.3	2.34	1.80–3.03	European	29.7	1.00	
Decile 8	57.6	3.10	2.43–3.97	Māori	66.0	2.23	2.01–2.47
Decile 9	74.1	4.00	3.14–5.08	Pacific	82.0	2.76	2.43–3.14
Decile 10	80.1	4.32	3.41–5.47	Asian/Indian	27.8	0.94	0.77–1.14
Gender							
Female	38.0	1.00					
Male	49.7	1.31	1.20–1.43				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Inanimate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from inanimate mechanical forces were *significantly* higher for males, for Pacific > Māori > European > Asian/Indian children and those from average-to-more deprived (NZDep decile 4–10) areas (**Table 113**).

Animate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from animate mechanical forces were *significantly* higher for males, for Māori and Pacific > European > Asian/Indian children and those from more deprived (NZDep decile 6–10) areas (**Table 113**).

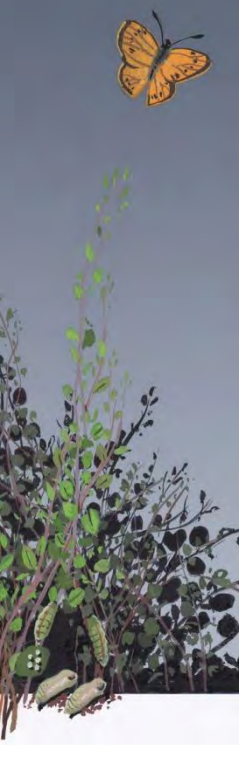


Table 113. Hospital Admissions for Injuries Arising from Inanimate and Animate Mechanical Forces in Children Aged 0–14 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Mechanical Forces: Inanimate Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	204.3	1.00		Decile 1–2	199.2	1.00	
Decile 2	193.9	0.95	0.86–1.04	Decile 3–4	221.8	1.11	1.04–1.19
Decile 3	201.8	0.99	0.90–1.09	Decile 5–6	250.7	1.26	1.18–1.34
Decile 4	240.1	1.18	1.08–1.28	Decile 7–8	292.8	1.47	1.38–1.56
Decile 5	252.2	1.23	1.13–1.35	Decile 9–10	420.9	2.11	2.00–2.23
Decile 6	249.5	1.22	1.12–1.33	Prioritised Ethnicity			
Decile 7	270.8	1.33	1.22–1.45	European	248.5	1.00	
Decile 8	311.6	1.53	1.41–1.66	Māori	313.8	1.26	1.21–1.32
Decile 9	388.8	1.90	1.76–2.06	Pacific	494.6	1.99	1.89–2.09
Decile 10	447.9	2.19	2.03–2.37	Asian/Indian	175.9	0.71	0.66–0.76
Gender							
Female	232.4	1.00					
Male	335.4	1.44	1.39–1.50				
Mechanical Forces: Animate Injuries 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	48.0	1.00		Decile 1–2	49.5	1.00	
Decile 2	51.1	1.07	0.88–1.29	Decile 3–4	54.4	1.10	0.96–1.25
Decile 3	59.6	1.24	1.03–1.50	Decile 5–6	57.1	1.15	1.01–1.31
Decile 4	49.6	1.03	0.86–1.25	Decile 7–8	67.5	1.36	1.20–1.54
Decile 5	50.9	1.06	0.87–1.29	Decile 9–10	80.4	1.62	1.44–1.82
Decile 6	62.4	1.30	1.09–1.56	Prioritised Ethnicity			
Decile 7	66.6	1.39	1.16–1.66	European	61.5	1.00	
Decile 8	68.2	1.42	1.20–1.69	Māori	77.3	1.26	1.15–1.37
Decile 9	78.1	1.63	1.38–1.93	Pacific	74.2	1.21	1.07–1.36
Decile 10	82.2	1.72	1.46–2.02	Asian/Indian	21.9	0.36	0.29–0.44
Gender							
Female	43.9	1.00					
Male	81.5	1.86	1.72–2.01				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Accidental Poisoning: In New Zealand during 2006–2010, hospital admissions for accidental poisoning were *significantly* higher for males, for European and Māori > Pacific > Asian/Indian children and those from average-to-more deprived (NZDep decile 5–10) areas (**Table 114**).

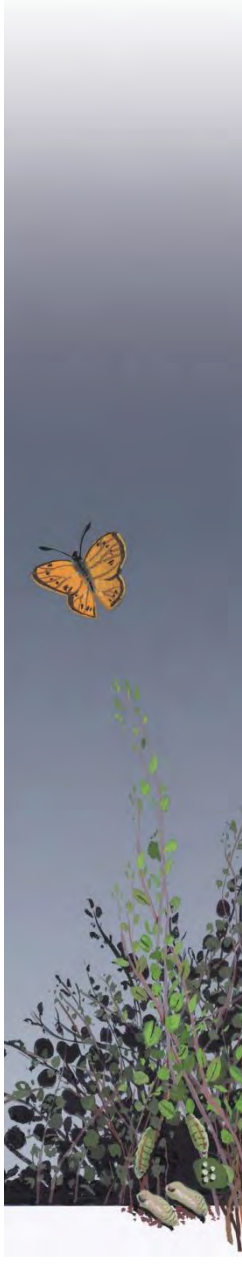
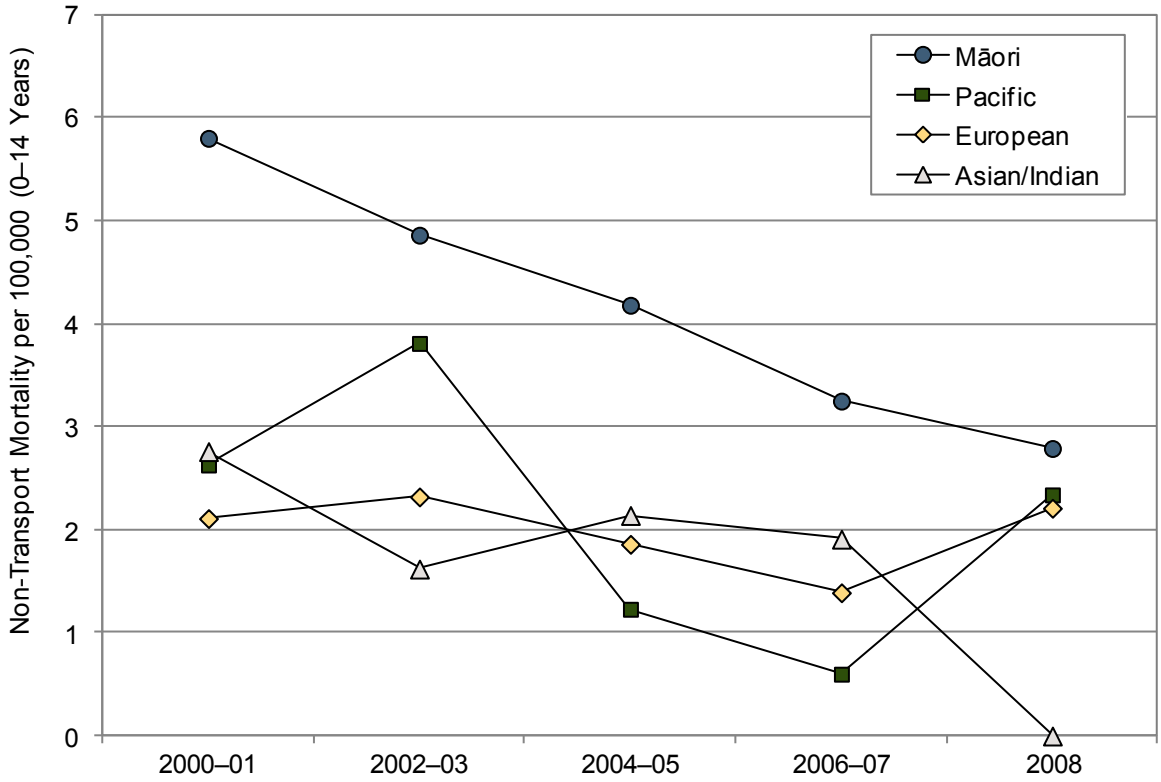


Table 114. Hospital Admissions for Accidental Poisoning in Children Aged 0−14 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Accidental Poisoning 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	41.8	1.00		Decile 1–2	37.8	1.00	
Decile 2	33.6	0.80	0.65–1.00	Decile 3–4	47.1	1.24	1.07–1.44
Decile 3	44.6	1.07	0.87–1.31	Decile 5–6	57.7	1.53	1.32–1.76
Decile 4	49.4	1.18	0.97–1.44	Decile 7–8	74.0	1.96	1.71–2.23
Decile 5	57.5	1.38	1.13–1.67	Decile 9–10	72.4	1.91	1.68–2.18
Decile 6	57.8	1.38	1.14–1.67	Prioritised Ethnicity			
Decile 7	77.6	1.85	1.55–2.22	European	66.1	1.00	
Decile 8	70.9	1.69	1.42–2.03	Māori	64.7	0.98	0.90–1.07
Decile 9	80.6	1.93	1.62–2.30	Pacific	36.1	0.55	0.46–0.64
Decile 10	65.4	1.56	1.31–1.86	Asian/Indian	21.9	0.33	0.27–0.41
Gender							
Female	51.9	1.00					
Male	65.8	1.27	1.17–1.37				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 114. Mortality from Unintentional Non-Transport Injuries in Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2008



Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised.

New Zealand Mortality Trends by Ethnicity

In New Zealand during 2000–2008, mortality arising from unintentional non-transport injuries was consistently higher for Māori children than for children of other ethnic groups, although mortality rates for Māori children declined during this period (**Figure 114**).

Summary

In New Zealand during 2006–2010 falls, followed by inanimate mechanical forces were the leading causes of injury admissions in children, although transport injuries as a group also made a significant contribution. In contrast, accidental threats to breathing, followed by vehicle occupant injuries were the leading causes of childhood injury mortality during 2004–2008. During 2000–2008, mortality from land transport injuries and unintentional non-transport injuries in children both declined, while mortality from accidental threats to breathing increased. The majority of accidental threats to breathing deaths however, occurred in infants <1 year, who were coded as dying as a result of suffocation / strangulation in bed, and thus the potential exists for some of the increases seen to have arisen from a diagnostic shift in the coding of SUDI.

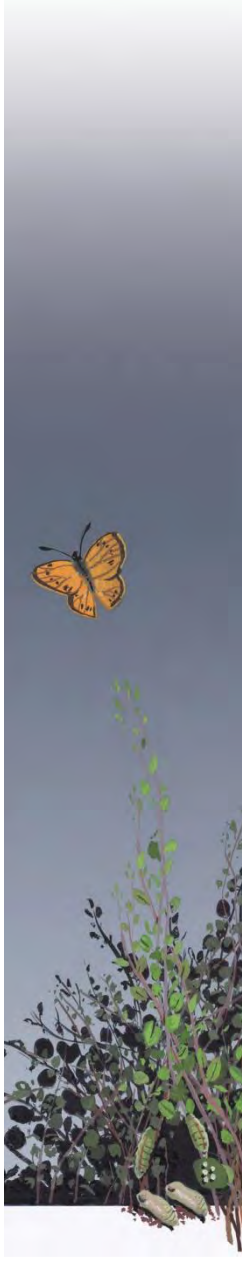
In the Midland Region during 2006–2010, falls followed by inanimate mechanical forces were the leading causes of injury admissions in children in all five DHBs, although transport injuries as a group also made a significant contribution. During 2004–2008, accidental threats to breathing, vehicle occupant, pedestrian and other transport injuries, and drowning / submersion were the most frequent causes of injury mortality in children in most DHBs.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Unintentional Injuries in Children

In New Zealand, the *NZ Injury Prevention Strategy* provides the broad strategic direction in the area of unintentional injury. The multi-factorial nature of unintentional injuries and the range of contexts in which they occur however, means that a range of initiatives may be required, if injury rates are to be reduced. **Table 115** provides an overview of local policy documents and evidence-based reviews which consider the most effective approaches to injury prevention in children, while **Table 156** on **Page 441** considers a range of initiatives relevant to young people.

Table 115. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Unintentional Injuries in Children

New Zealand Policy Documents
New Zealand Injury Prevention Strategy. Minister for Accident Compensation Corporation, Wellington, 2003. http://www.nzips.govt.nz/documents/strategycolour.pdf New Zealand's first national injury prevention strategy was published in 2003. It sets out goals and objectives for achieving a positive safety culture and creating safe environments and defines principles by which the process would operate. Children are not identified as a specific priority in the original document. However, injury to those under 25 years is included in all of the priority areas: road safety, falls, drowning, assault, suicide and work related injury.
Accident Compensation Corporation. **New Zealand Injury Prevention Strategy Outcomes Report June 2011** www.nzips.govt.nz This progress report for the New Zealand Strategy for Injury Prevention (NZIPS) recommends that unintentional child injury be prioritised as a focus area.
Drowning Prevention Strategy: Towards a Water Safe New Zealand 2005-2015. Accident Compensation Corporation, Wellington, 2005. http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_ip/documents/guide/wcm2_020949.pdf The Drowning Prevention Strategy provides a framework for people, groups, organisations and communities to work coherently to prevent drowning and improve water safety. The focus in this document is on identified priority population groups: males 15-24 years and children aged 0-4 years.



Systematic Reviews of Childhood Injury Prevention
Turner S, et al., **Modification of the home environment for the reduction of injuries**. Cochrane Database of Systematic Reviews 2011; 2(online): CD003600.
Evidence is inconclusive on the effect of interventions to modify environmental home hazards, on the reduction of injuries due to environmental hazards. While multi-factorial injury prevention interventions have been shown to reduce injuries in the home, few studies have examined the impact of physical adaptations to the home environment and their effectiveness. The 29 RCTs identified were categorised into child, older people and general/mixed age. None of the child trials indicated a reduction in injuries that might have been due to environmental adaptation in the home, a similar conclusion was drawn for all age groups.
Kendrick, D., et al., **Parenting interventions for the prevention of unintentional injuries in childhood.** Cochrane Database of Systematic Reviews, 2009 (2).
This review assessed the effects of parenting interventions for preventing unintentional injury, as well as increasing possession and use of safety equipment and parental safety practices. The 15 studies included (11RCTs, 1 non-RCT, 1 with RCT and non-RCT, and 2 CBAs) were evaluations of parenting interventions with protocols, a manual or a curriculum, administered to parents of children ≤18 years, which reported outcome data on injury (unintentional or unspecified) and possession and use of safety equipment or safety practices. Most studies involved families at risk of adverse child health outcomes. The authors concluded that parenting interventions (which are commonly provided within the home using multi-faceted interventions) may be effective in reducing child injury.
Kendrick. D., et al. **Home safety education and provision of safety equipment for injury prevention**. *Cochrane* Database of Systematic Reviews 2007, Issue 1. Art. No.: CD005014.DOI: 10.1002/14651858.CD005014.pub2.
Numerous studies have evaluated the effectiveness of home safety interventions. This review examined the effectiveness of those related to education, with or without the provision of low cost, discounted or free equipment in increasing home safety practices or reducing child (0-19 years) injury rates. Of the 80 studies included, 37 included at least one meta-analysis, of which 62% were RCTs. The authors concluded that home safety education (mainly one-to-one, face-to-face education, either in a clinical setting or at home) was effective in increasing a range of safety practices, especially if it provided safety equipment. There was a lack of evidence of the impact of home safety education on child injury rates and no consistent evidence that home safety education, with or without the provision of safety equipment, was less effective in those at greater risk of injury.
Towner, E., et al., **What Works in Preventing Unintentional Injuries in Children and Young Adolescents**. 2001, United Kingdom. Health Development Agency. www.nice.org.uk/niceMedia/documents/prevent_injuries.pdf
This systematic review was published a decade ago, but its analysis provides a valuable critique of the effectiveness of interventions for unintentional childhood injury prevention among children under 15 years. Interventions are assessed by outcome measure, whether they reduced injury, behaviour change or hazard reduction. Areas covered include road safety (ranging from the personal to the community or policy strategies, for example, from promoting helmet use to traffic calming), interventions for injuries commonly occurring in the home environment, and both generic and specific cause interventions. The authors also assessed the value of educational interventions and those related to the media.
Systematic Reviews of the Prevention of Specific Childhood Injuries
Turner, C., et al., **Community-based interventions for the prevention of burns and scalds in children**. Cochrane Database of Systematic Reviews, 2004(2): CD004335.
The small number of eligible studies in this review made it difficult to draw conclusions as to the effectiveness of community-based interventions (coordinated, multi-strategy initiatives) for reducing burns and scalds in children aged 0-14 years. One of the four studies included showed a significant decrease in paediatric burn and scald injury in an intervention community. The authors noted time-frames or failure to implement the components of the interventions in the community as limitations of the studies in general.
DiGuiseppi, C., C. Goss, and J. Higgins, **Interventions for promoting smoke alarm ownership and function**. Cochrane Database of Systematic Reviews, 2001(2); CD002246.
Based on a review of 26 trials, half of which were RCTs, the authors of this review concluded that “Counselling as part of child health surveillance may increase smoke alarm ownership and function but its effects on injuries are unevaluated.” The lack of randomisation in community based smoke alarm give-away programmes means the reductions in fire-related injuries needs to be viewed with caution.
Thompson, D. & Rivara, F. **Pool fencing for preventing drowning in children**. Cochrane Database of Systematic Reviews, 1998 (1): CD001047
Medical care offers little help to drowning victims, therefore preventing the event is critical. Results from the three case control studies in this review indicate that domestic swimming pool fencing, compared to no fencing, significantly reduces the risk of drowning. Isolation fencing (enclosing the pool only), is superior to perimeter fencing (enclosing the property and pool), a situation in which a child can access the pool through the house.

Nixon, J., Spinks, A. and Turner, C. **Community based programs to prevent poisoning in children 0-15 years**. Injury Prevention, 2004. **10**: p. 43-46.

Four studies were eligible for this review of community based poisoning prevention programmes that used poisoning rates as an evaluative component. The design for two involved a comparison community as control, while the other two used a before and after design. One study showed a statistically significant reduction in child poisoning, but the topic has of little relevance to New Zealand child poisoning priorities (child resistant containers for paraffin). Proving community implementation of interventions to be efficacious in research settings is difficult, and few high quality evaluations are conducted which can assess outcomes at the population level.

Systematic Reviews: Road Safety

Ehiri JE, et al. **Interventions for promoting booster seat use in four to eight year olds travelling in motor vehicles**. Cochrane Database of Systematic Reviews 2006, Issue 1. Art. No.: CD004334. DOI:10.1002/14651858.CD004334.pub2.

This review assessed the effectiveness of interventions to increase acquisition and use of booster seats in motor vehicles among four to eight year olds. Five studies (3,070 individuals) met the criteria for inclusion in the meta-analysis. Interventions that combined education with incentives (booster seat discount coupons or gift certificates) or the distribution of free booster seats demonstrated marked beneficial outcomes in terms of acquiring and using booster seats. There was some evidence from before-and-after studies, that legislation had a beneficial effect on booster seat acquisition and use.

Duperrex, O.J.M., et al. **Safety education of pedestrians for injury prevention.** Cochrane Database of Systematic Reviews 2002, Issue 2. Art. No.: CD001531. DOI: 10.1002/14651858.CD001531

The aim of this review was 'to quantify the effectiveness of pedestrian safety education programmes in preventing pedestrian-motor vehicle collisions'. Children are at considerable risk of pedestrian injury and almost all studies included were child focused. There was some evidence that behaviour changed with the improvement in children's knowledge, but there was no information on whether this reduced the risk of pedestrian motor vehicle collision or injury occurrence. There is evidence that safety knowledge and behaviour decline with time.

Thompson DC, Rivara F, Thompson R. **Helmets for preventing head and facial injuries in bicyclists**. Cochrane Database of Systematic Reviews 1999, Issue 4. Art. No.: CD001855. DOI: 10.1002/14651858.CD001855.

From the five case control studies the authors considered well designed in this systematic review, they concluded that 'wearing a helmet dramatically reduces the risk of head and facial injuries for bicyclists involved in a crash, even if it involves a motor vehicle'. The use of helmets generates reductions of the risk of head injury, brain injury, severe brain injury, and injuries to the upper and mid facial areas. No protection was offered to the lower face and jaw.

Macpherson A, Spinks A. **Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries**. Cochrane Database of Systematic Reviews 2008, Issue 3. Art. No.: CD005401. DOI: 10.1002/14651858.CD005401.pub3

The promotion of helmet wearing is not universally accepted, despite the conclusions from Cochrane Reviews such as the one above. The concern includes questions around the mandatory use of helmets. Macpherson and Spinks undertook 'to assess the effects of bicycle helmet legislation on bicycle-related head injuries and helmet use, and the occurrence of unintended adverse consequences'. The six studies eligible for inclusion were focused on child helmet wearing. They concluded that helmet use appeared to increase and head injury rates decrease in populations where compulsory helmet legislation was enacted. These authors noted the lack of high quality evaluative studies in this area. No eligible study reported on reputed declines in bicycle use as a result of legislation.

Kwan I, Mapstone J. **Interventions for increasing pedestrian and cyclist visibility for the prevention of death and injuries.** Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD003438. DOI: 10.1002/14651858.CD003438.pub2

No studies were found that compared crash outcomes in relation to the use of visibility aids, but 42 studies had compared driver detection of riders with or without these aids. Daytime detection was improved by fluorescent materials in yellow, red and orange. Night time detection was assisted by lamps, flashing lights, reflective materials in red and yellow. Further research is required to establish whether the visibility results in a decrease in crashes.

Royal, S., D. Kendrick, et al. (2009). **Non-legislative interventions for the promotion of cycle helmet wearing by children.** Cochrane Database of Systematic Reviews (1).

Legislative interventions are often promoted to increase cycle helmet use, but this systematic review concluded that non-legislative community based programmes that include free helmets are effective in increasing helmet use by children. The 22 studies eligible were heterogeneous, which made drawing further conclusions difficult.

Systematic Reviews: Other Topics
Parkin P, Howard, A. **Advances in the prevention of children's injuries: an examination of four common outdoor activities.** Current Opinion Pediatrics, 2008; 20(6): 719-723.
The authors examined systematic reviews of interventions to reduce bicycle related injury, playground injury, helmets for skiing and snowboarding, and modifying the physical pedestrian environment. They found that systematic reviews provided good evidence for interventions in all these areas. The reviews for bicycles have been included in the systematic reviews noted above. The use of helmets in skiing and snowboarding was clearly associated with reduced head injury, but wrist guards, while reducing wrist injury may have a negative effect on other upper body joints. Traffic calming, the focus of the studies in which the physical environment was modified, was shown to reduce child injury.
International Guidelines
MacKay M, et al., **Child Safety, Good Practice Guide: Good investments in unintentional child injury prevention and safety promotion**. Amsterdam: European Child Safety Alliance, Eurosafe; 2006. http://www.childsafetyeurope.org/publications/goodpracticeguide/info/good-practice-guide.pdf
The European Child Safety Alliance presents 'good practice' for child injury prevention, which is a combination of best available research evidence and its practical application. In these guidelines, good practice is generally defined as an evaluated prevention strategy found to be effective through a systematic review or the minimum of one rigorous evaluation. The guidelines note that rigorous evaluation can be difficult, with their criteria for inclusion being a combination of expert opinion supporting the practice and data supporting it as an effective strategy, and/or a clear link between the strategy and reduced risk (although not necessarily reduced injury). For these criteria to hold the strategy in question must have been implemented in a real world setting so that the practicality of the intervention has also been examined. The areas of child injury included are: motor vehicle traffic related, pedestrian and cycle safety, water safety, poisoning, falls, burns and scalds, choking/strangulation, as well as home and community based interventions.
World Health Organization Documents
Peden, M., et al., (Editors) **World report on child injury prevention**. World Health Organization, 2008 http://www.who.int/violence_injury_prevention/child/injury/world_report/en/
This publication provides a valuable global perspective on the epidemiology of child injury, including causes of injury such as road traffic crashes, pedestrian and cycle injuries, drowning, poisoning, and falls. It also details preventive measures of particular interest to low and middle income countries, but which may offer guidance for populations whose rate of injury is influenced by the social determinants of health.
Relevant Publications from New Zealand
Tin S, Woodward A, Ameratunga S. **Injuries to pedal cyclists on New Zealand Roads, 1988-2007** Injury Prevention. 2010 16: A183.
Injury among cyclists has been increasing over the last decade in New Zealand. This study found that cyclists under 15 years were at the highest risk for non-collision crashes which constitute 40% of crashes. Collision crashes were more likely to result in traumatic head injury than non-collision events. Cycle safety is an urgent issue with the increasing of promotion of cycling for health and environmental reasons.
Shaw C, Blakely T, Crampton P, Atkinson J: **The contribution of causes of death to socioeconomic inequalities in child mortality: New Zealand 1981-1999**. NZ Med J 2005, 118(1227)
This paper examines child mortality inequality by household income in New Zealand over two decades to 1999. Focusing on children aged 1-14 years, the authors found socioeconomic differences in child mortality for road traffic injury, non-road traffic injury, and other causes of death. They concluded that there were socioeconomic differences across most broad causes of childhood death, and that while there is a range of contributing influences, there are similar causes of inequality such as poverty that underlie the immediate causes.
Duncanson M, Woodward A, Reid P. **Social and economic deprivation and fatal unintentional domestic fire incidents in New Zealand 1988 – 1998.** 2000. New Zealand Fire Service Commission Research Report No 5.
The authors reviewed the international literature on the relationship between socioeconomic circumstances and risk of death or injury in fire events and analysed New Zealand fire fatality data from July 1988 to June 1998. Internationally, socioeconomically deprived households experience higher rates of fatal fire incidents and in New Zealand, the rate for fatal fires in the most deprived areas was 4.5 times that of the least deprived areas. The authors concluded that in the short term, strategies were needed to address this differential risk and barriers to household fire safety in high risk populations. Longer term, strategic policy development was needed to address underlying socio-economic determinants.
Duncanson M, Ormsby C, Reid P, Langley J, Woodward A. **Fire Incidents Resulting in Deaths of New Zealand Children aged Under 15 Years 1991-1997**. New Zealand Fire Service Commission Research Report Number 30.
This study collated fire fatality data from the Fire Incident Recording System and the NZ Health Information Service and linked it with coroners files to provide an overview of fire related deaths in children <15 years. The study found higher risk for males, particularly Māori, with the most common heat sources in fatalities among children being lighters and matches. A significant risk factor identified was children visiting an unfamiliar house or where there were visitors to the family home. Operating smoke detectors were not present in nearly every incident involving fatalities.

Gulliver P, Cousins K, and Chalmers D. **Achieving compliance with pool fencing legislation in New Zealand: how much progress has been made in ten years?** International Journal of Injury Control & Safety Promotion, 2009; 16(3), 127-132.

A previous study identified that the Fencing of Swimming Pools Act 1987 was poorly implemented and enforced in New Zealand. This study showed a considerable improvement in the enforcement and monitoring activities of territorial authorities. A 65% increase in compliance with the Act was noted. Local authorities were more active in re-inspecting pools, and also recorded a greater number of pools complying.

Langley J & Simpson J. **Injury Surveillance: unrealistic expectations of safe communities.** Injury Prevention, 2009;15;146-149

Community injury prevention programmes established using a WHO Safe Communities model have requirements to record injury data for use in their evaluation. This paper questions the ability of that data to provide stable statistical information from which to assess success. It suggests alternatives that would be more appropriate for community programmes to use to measure their progress and ability to create a safer environment.

Other Relevant Links – New Zealand Websites

Statistics New Zealand**. Injury Information Portal**

http://search.stats.govt.nz/browse_for_stats/health/injuries.aspx

This website provides links to various websites that provide data on New Zealand injury.

NIQS (National Injury Query System) http://ipru3.otago.ac.nz/niqs/index.php

This website has a search engine for basic queries for New Zealand injury based on national data sets. This site and the associated personalised query system that operates through StatsEnquiry@ipru.otago.ac.nz are provided by the Injury Prevention Research Unit, University of Otago, funded by the Ministry of Health.

New Zealand National Poisons Centre http://www.poisons.co.nz

Provided by the Ministry of Health and ACC, the NPC maintains an accurate and up-to-date database of almost all poisonous substances in NZ and Australia, and provides professional and timely advice during poisoning incidents.

SafeKids New Zealand http://www.safekids.org.nz/

Safekids New Zealand is an advocate for child injury prevention. It seeks the reduction of the incidence and severity of unintentional injuries to children in New Zealand aged 0–14 years. A range of information on child injury prevention relevant to the New Zealand context is found on its website.

ORAL HEALTH: SCHOOL DENTAL SERVICE DATA AND DENTAL CARIES ADMISSIONS

Introduction

In New Zealand the School Dental Service (established in 1921), is charged with providing basic preventative and restorative dental care for preschool, primary and intermediate aged school children, via its team of dental therapists.

While enrolment of preschool children is only 60% [194], enrolment of school age children is high [195]. Children are seen annually, unless deemed to be at high risk of dental disease, when 6-monthly visits are indicated. Children requiring dental care beyond the scope of the School Dental Service may be referred to a general dental practitioner, or if they require extensive treatment, to a hospital dental unit for treatment under general anaesthetic [196]. After Year 8 (Form 2), adolescents are eligible for dental care under the General Dental Benefit system up until the age of 18 years, with care being provided by private dentists working under contract with local DHBs [197].

The following section reviews the oral health status of children and young people using information from two separate sources. The first is School Dental Service data, which provides information on the proportion of children who were caries-free at 5 years, and the number who had decayed, missing or filled teeth (DMFT) at 12 years. A separate sub-section considers the proportion of eligible young people accessing publicly funded dental services. The second data source is the National Minimum Dataset, which provides information on hospital admissions for dental caries in children and young people.

School Dental Service Data

Data Sources and Methods

Indicators

1. *Proportion of Children Who Were Caries-Free at 5 Years*

Numerator: Number of children aged 5 years whose deciduous teeth were caries-free on completion of treatment with the School Dental Service

Denominator: Total number of 5 year olds who were examined in the year

2. Mean DMFT at 12 Years

Numerator: Number of permanent teeth of children aged around 12 years that are decayed, missing (due to caries) or filled on completion of treatment in Year 8, prior to leaving the School Dental Service

Denominator: Total number of Year 8 children who were examined in the year

3. *Proportion of Adolescents Using Publicly Funded Dental Services*

Numerator: Total number of adolescents (13–18 years) using publicly funded dental services

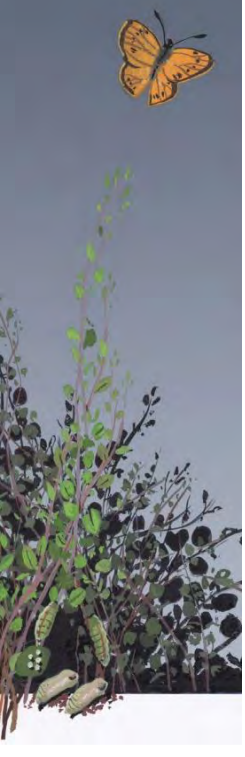
Denominator: Total number of eligible adolescents (13–18 years)

Notes on Interpretation

Note 1: The data in this section was obtained from http://www.moh.govt.nz/moh.nsf/indexmh/oralhealth-statistics, with the Ministry of Health collating this information from the School Dental Service. Once children are enrolled with the Dental Service they are seen, assessed and have appropriate treatment prescribed. Upon completion of treatment, dental health status data are collected on 5 year olds and children in Year 8 (aged approximately 12 years).

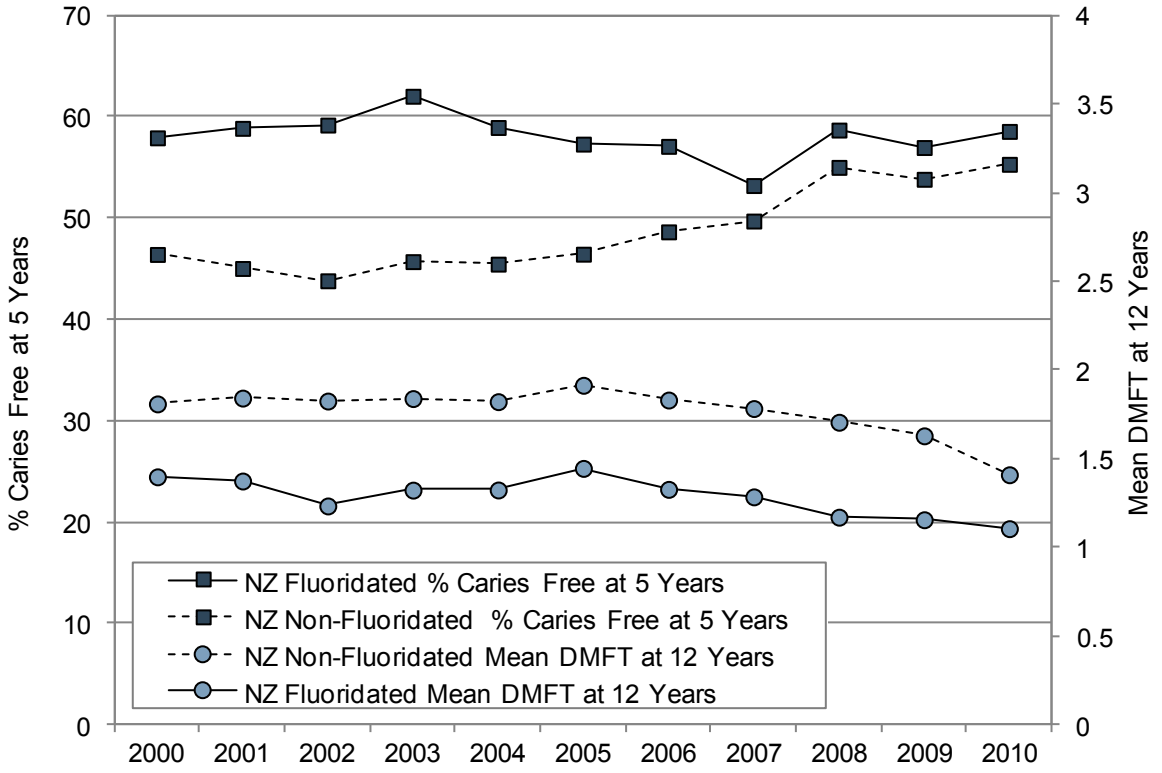
Note 2: In this section, fluoridation status refers to the water supply of the school which the student attended, rather than the fluoridation status of the area in which they resided.

Note 3: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.



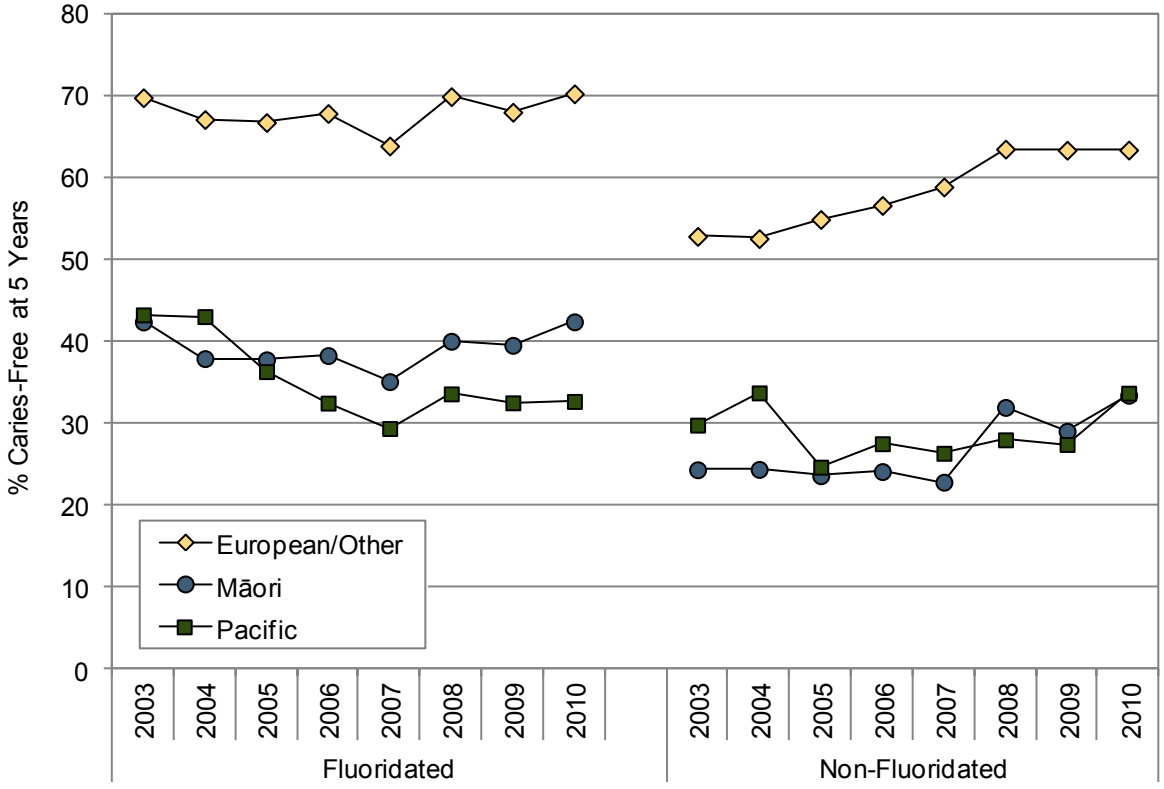
New Zealand Distribution and Trends

Figure 115. Percentage of Children Who Were Caries-Free at 5 Years and Mean DMFT Scores at 12 Years, New Zealand 2000–2010



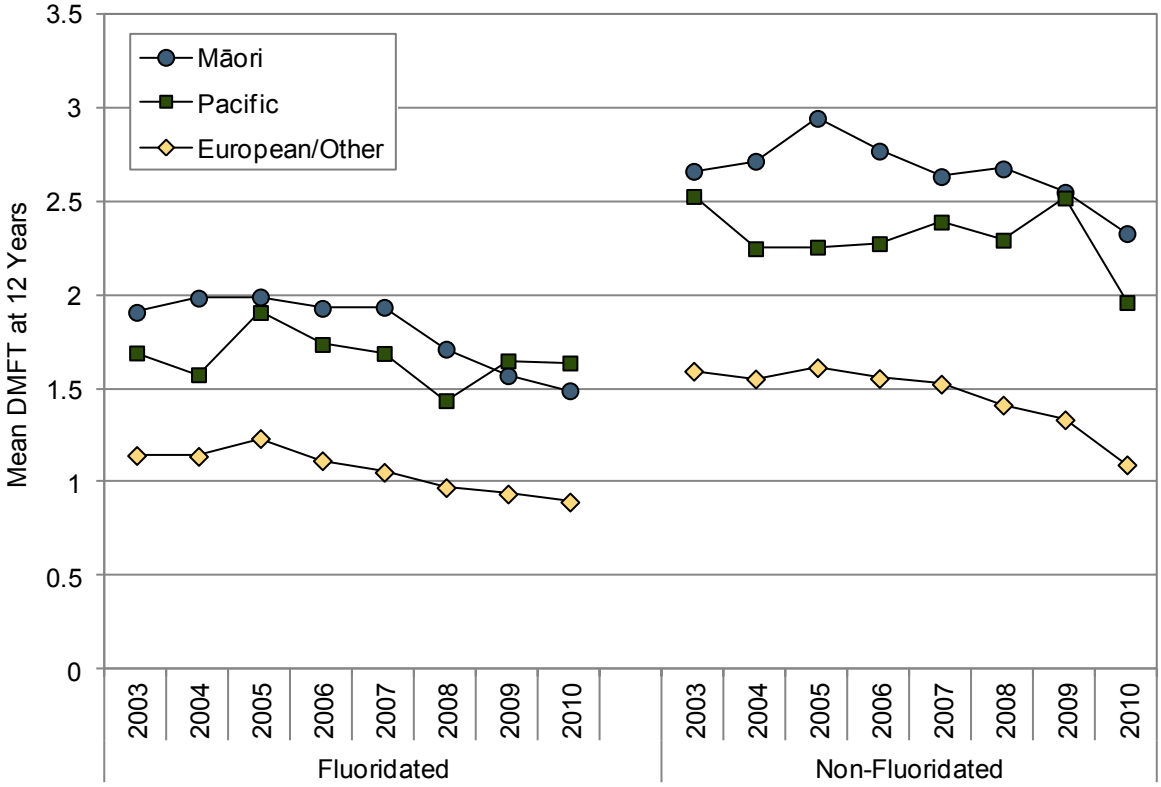
Source: School Dental Service via Ministry of Health

Figure 116. Percentage of Children Who Were Caries-Free at 5 Years by Ethnicity, New Zealand 2003–2010



Source: School Dental Service via Ministry of Health

Figure 117. Mean DMFT at 12 Years by Ethnicity, New Zealand 2003–2010



Source: School Dental Service via Ministry of Health

New Zealand Trends

In New Zealand during 2000–2010, the percentage of children who were caries-free at 5 years was consistently higher in areas with fluoridated school water supplies; while mean DMFT scores at 12 years were lower (**Figure 115**).

New Zealand Distribution by Ethnicity

In New Zealand during 2003–2010, a higher proportion of European/Other children, than Māori or Pacific children were caries-free at 5 years. For European/Other and Māori children, the proportion that were caries-free was higher in areas with fluoridated school water supplies throughout 2003–2010, while for Pacific children the proportion was higher for the majority of this period (**Figure 116**).

In New Zealand during 2003–2010, mean DMFT scores at 12 years were higher for Māori and Pacific children than for European/Other children. For each ethnic group, mean DMFT scores were higher for those with non-fluoridated school water supplies (**Figure 117**).

Midland Region Distribution and Trends

In the Waikato during 2010, 44.8% of 5 year olds examined by the School Dental Service had access to fluoridated water, as compared to 10.3% in Bay of Plenty, 18.4% in Lakes, 62.4% in Tairawhiti, and 69.0% in Taranaki. This proportion is based on the fluoridation status of their school water supply however, rather than the residential area in which they lived.

Midland Region Trends

Proportion Caries-Free at 5 Years

In Lakes, Tairawhiti and Taranaki during 2000–2010, the proportion of children who were caries-free at 5 years was higher for those with fluoridated school water supplies, although differences were less consistent in the Waikato and Bay of Plenty (**Figure 118**). While mean DMFT scores in Lakes, Tairawhiti, Taranaki and the Bay of Plenty were lower for those with fluoridated school water supplies in most years, differences were again less consistent in the Waikato (**Figure 119**).

Midland Region Distribution by Ethnicity

Proportion Caries-Free at 5 Years

In the Midland Region during 2003–2010, a higher proportion of European/Other children, than Māori children were caries-free at five years in all five DHBs. This pattern was evident in both fluoridated and non-fluoridated areas (**Figure 120**).

Mean DMFT at 12 Years

In the Midland Region during 2003–2010, mean DMFT scores at 12 years were higher for Māori children than for European/Other children in all five DHBs. This pattern was also evident in both fluoridated and non-fluoridated areas (**Figure 121**).

Proportion of Adolescents Using Publicly Funded Dental Services

In the Waikato during 2009, 66.4% of eligible adolescents (aged ≈13–18 years) were reported as accessing publicly funded dental services, as compared to 63.0% in the Bay of Plenty, 55.2% in Lakes, 67.0% in Tairawhiti, and 72.5% in Taranaki (**Table 116**). No information was available for these young people however on the frequency or type of service access.

Table 116. Proportion of Adolescents Using Publicly Funded Dental Services, Midland DHBs vs. New Zealand 2004–2009

	No. Eligible	% Using	No. Eligible	% Using	No. Eligible	% Using
DHB	2004		2005		2006	
Waikato	28,031	47.3	29,580	59.4	25,720	60.9
Bay of Plenty	14,386	55.8	14,752	51.6	14,585	55.6
Lakes	8,524	44.0	8,524	40.5	7,550	44.7
Tairawhiti	4,109	55.7	4,109	55.7	3,770	65.1
Taranaki	8,594	54.7	8,594	52.5	7,905	58.0
Midland Region	63,644	50.3	65,559	54.0	59,530	57.4
New Zealand	298,506	52.6	303,768	53.7	284,460	58.3
	2007		2008		2009	
Waikato	25,660	59.9	25,525	61.3	25,195	66.4
Bay of Plenty	14,695	56.0	14,595	55.8	14,300	63.0
Lakes	7,585	45.6	7,475	47.7	7,315	55.2
Tairawhiti	3,715	67.6	3,625	62.7	3,650	67.0
Taranaki	7,795	71.9	7,630	69.5	7,375	72.5
Midland Region	59,450	59.2	58,850	59.4	57,835	65.0
New Zealand	285,275	58.7	286,770	60.5	283,645	65.4

Source: Ministry of Health

School Dental Service Data Summary

In New Zealand during 2000–2010, the percentage of children caries-free at 5 years was higher in areas with fluoridated school water supplies, while mean DMFT scores at 12 years were lower. During 2003–2010, a higher proportion of European/Other children, than Māori or Pacific children were caries-free at 5 years, while mean DMFT scores at 12 years were higher for Māori and Pacific children than for European/Other children.

In the Waikato during 2010, 44.8% of 5 year olds examined by the School Dental Service had access to fluoridated school water, as compared to 10.3% in Bay of Plenty, 18.4% in Lakes, 62.4% in Tairawhiti, and 69.0% in Taranaki. During 2003–2010, a higher proportion of European/other children than Māori children were caries-free at 5 years, while mean DMFT scores at 12 years were higher for Māori, than for European/Other children in all five Midland DHBs. In the Waikato during 2009, 66.4% of eligible adolescents (aged ≈13–18 years) were reported as accessing publicly funded dental services, as compared to 63.0% in the Bay of Plenty, 55.2% in Lakes, 67.0% in Tairawhiti, and 72.5% in Taranaki.

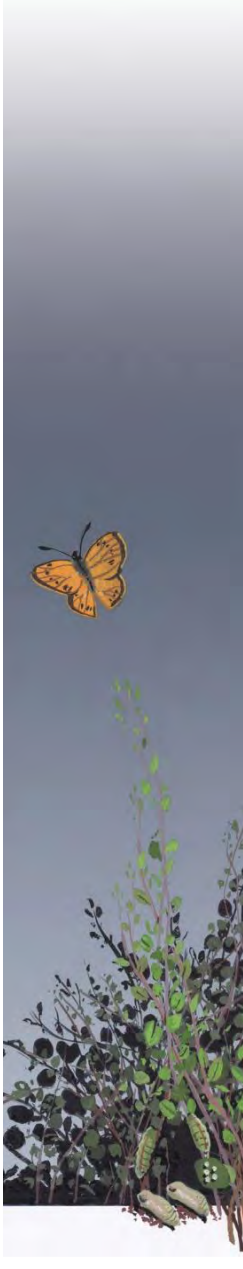
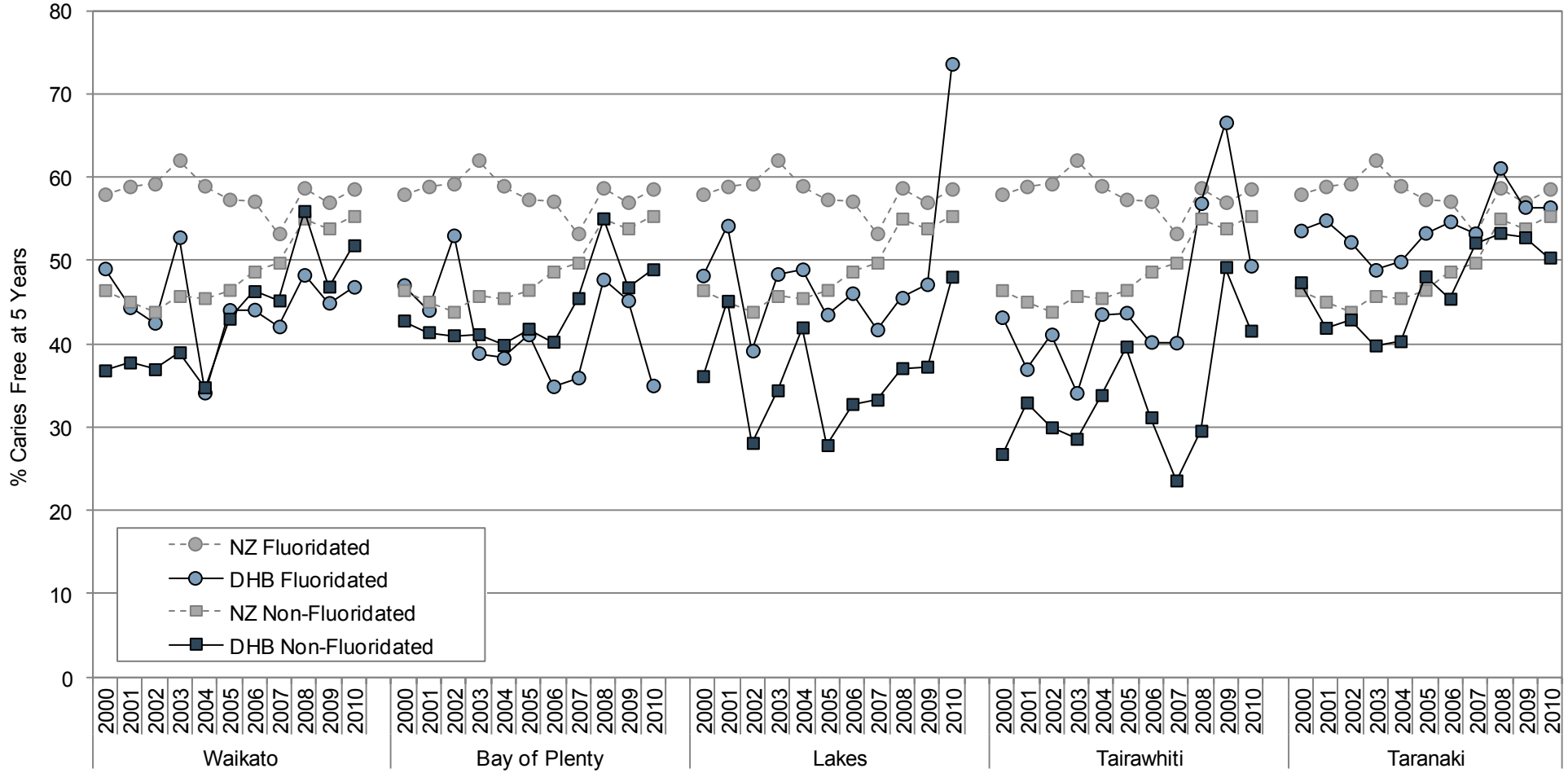
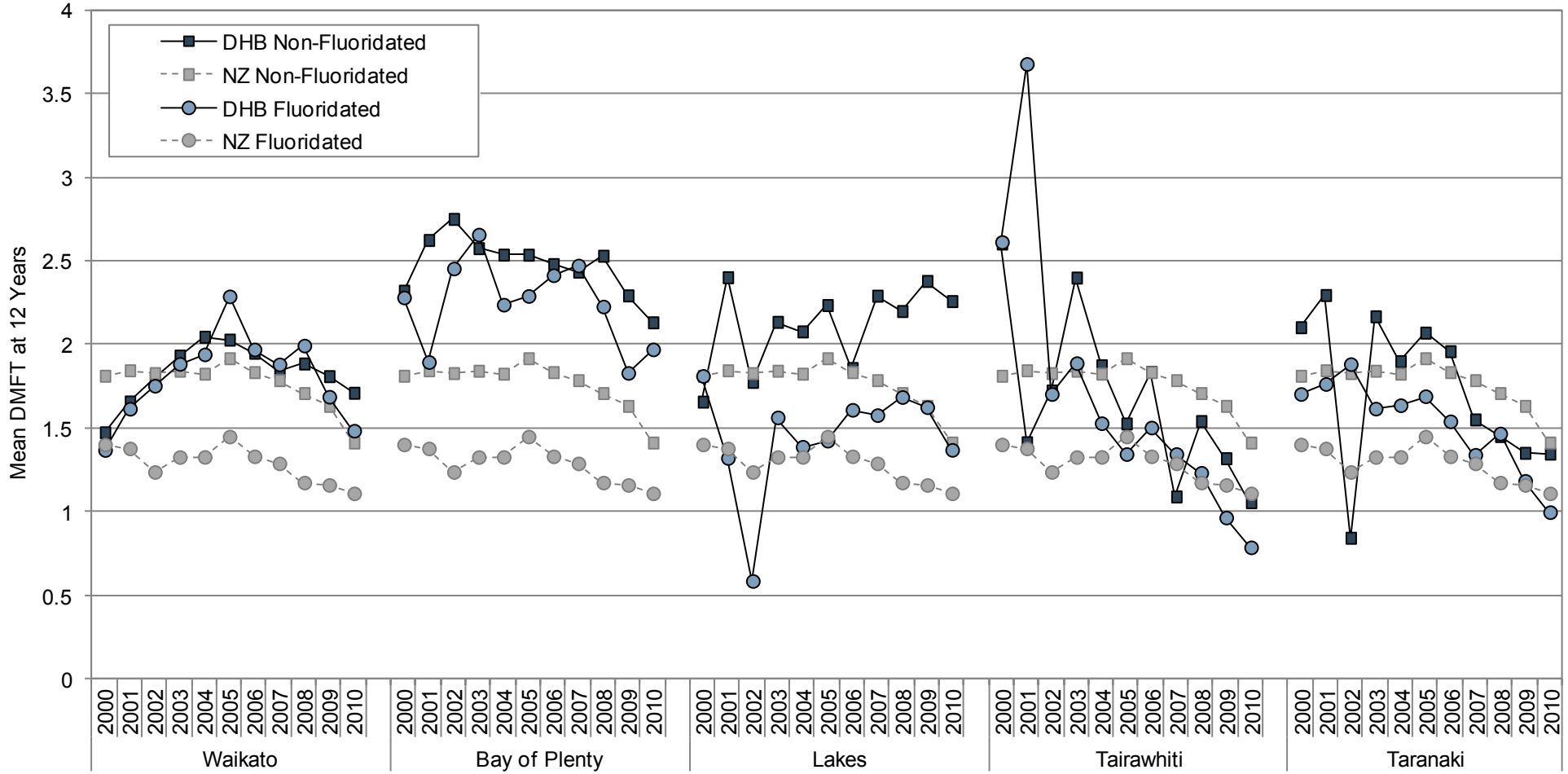


Figure 118. Percentage of Children Who Were Caries-Free at 5 Years, Midland DHBs vs. New Zealand 2000–2010



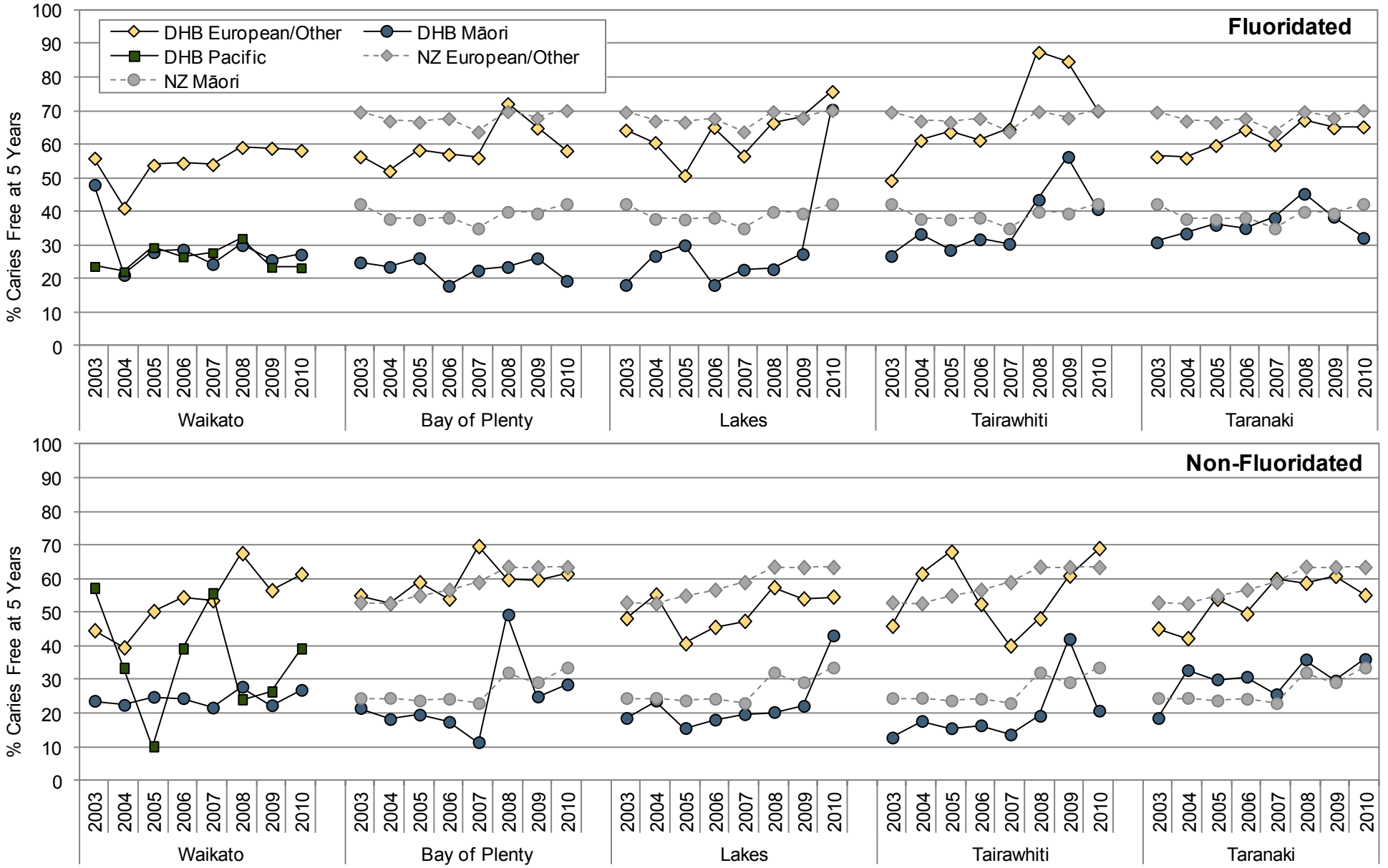
Source: School Dental Service via Ministry of Health

Figure 119. Mean DMFT at 12 Years, Midland DHBs vs. New Zealand 2000–2010



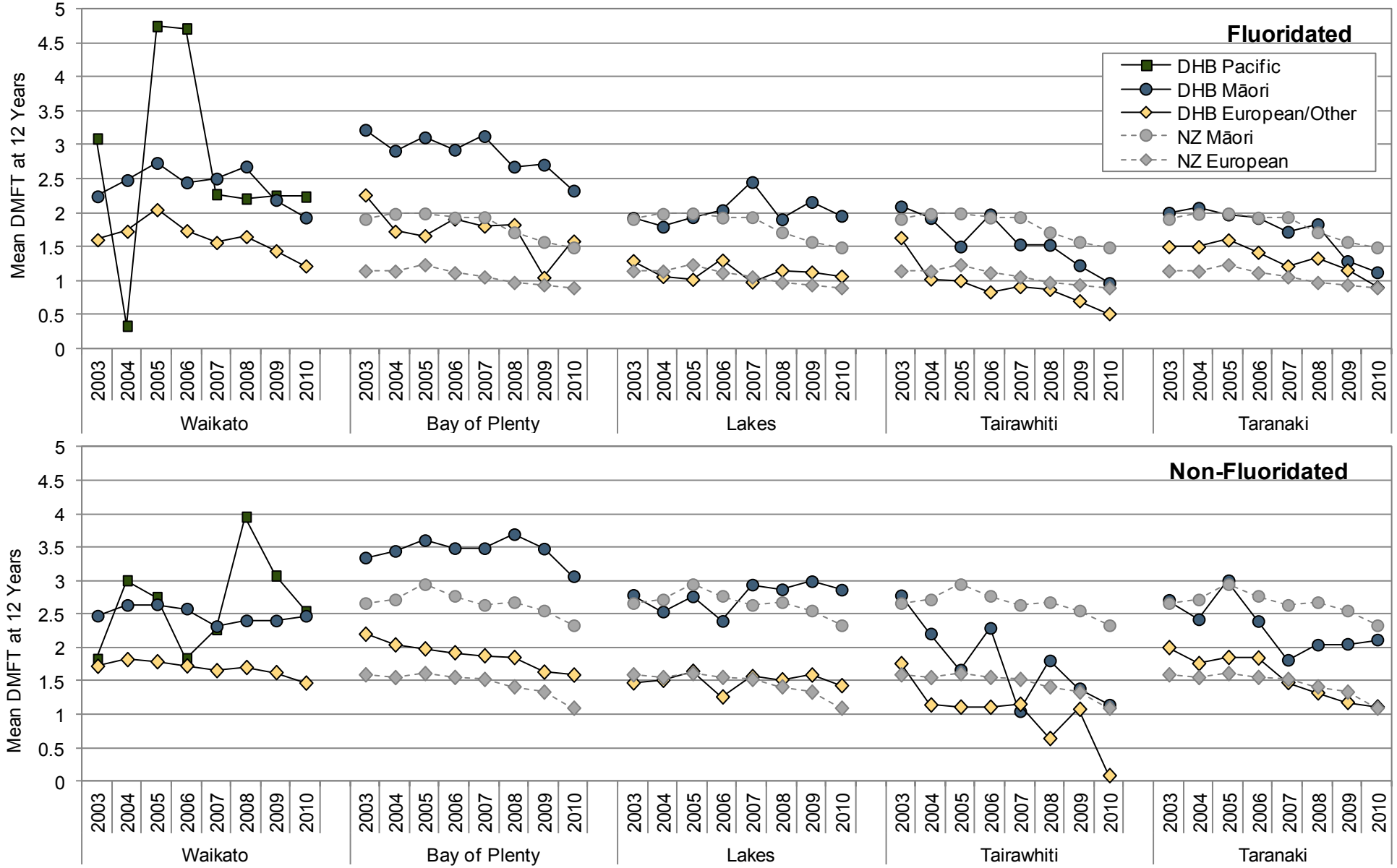
Source: School Dental Service via Ministry of Health

Figure 120. Percentage of Children Who Were Caries-Free at 5 Years by Ethnicity, Midland DHBs vs. New Zealand 2003–2010



Source: School Dental Service via Ministry of Health

Figure 121. Mean DMFT at 12 Years by Ethnicity, Midland DHBs vs. New Zealand 2003–2010



Source: School Dental Service via Ministry of Health

Hospital Admissions for Dental Caries

Data Sources and Methods

Indicators

1. *Hospital Admissions for Dental Caries in Children and Young People Aged 0-24 Years*

Numerator: National Minimum Dataset: Hospital admissions (acute, semi acute and waiting list) for children and young people aged 0-24 years with a primary ICD-10-AM diagnosis of Dental Caries (K02). Other dental conditions assessed in some tables include: Disorders of Tooth Development/Eruption (K00), Embedded/ Impacted Teeth (K01), Other Diseases of the Teeth Hard Tissue (K03), Diseases of the Pulp/Periapical Tissue (K04), Gingivitis/Periodontal Diseases (K05), Other Disorders of the Gingiva/Edentulous Alveolar Ridge (K06), Dentofacial Anomalies/Malocclusion (K07), Other Disorders of the Teeth/Supporting Structures (K08).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary. In New Zealand, most DHBs admit children and young people with dental caries/other oral health problems, either from the waiting list, or on a semi-acute basis (as an arranged admission).

Note 2: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for dental caries were higher for children aged 0–4 years > children aged 5–14 years > young people aged 15–24 years. While admissions increased for all three age groups during 2000–2010, in absolute terms, increases were greatest for those aged 5–14 and 0–4 years (**Figure 122**).

New Zealand Distribution by Age

In New Zealand during 2006–2010, hospital admissions for dental caries were infrequent in infants <1 year, but rose rapidly thereafter, to reach a peak at 4 years of age. Rates then decreased, with admissions being relatively infrequent after 14 years of age (**Figure 123**).

New Zealand Distribution by Primary Diagnosis

In New Zealand during 2006–2010, dental caries, followed by diseases of the pulp and periapical tissue, were the leading reasons for a dental admission in children aged 0–4 and 5–14 years. In contrast, embedded/impacted teeth, followed by dental caries were the leading reasons for an admission in young people aged 15–24 years (**Table 117**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for dental caries in children aged 0–4 years were *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those from average-to-more deprived (NZDep decile 2–10) areas (**Table 118**). Similarly, admissions for children aged 5–14 years were *significantly* higher for males, Māori and Pacific > Asian/Indian and European children and those from average-to-more deprived (NZDep decile 3–10) areas. In contrast, for young people aged 15–24 years, admissions were *significantly* higher for European and Māori > Pacific > Asian/Indian young people and those from more deprived (NZDep decile 5–10) areas (**Table 119**). Similar ethnic differences were seen during 2000–2010 (**Figure 124**).

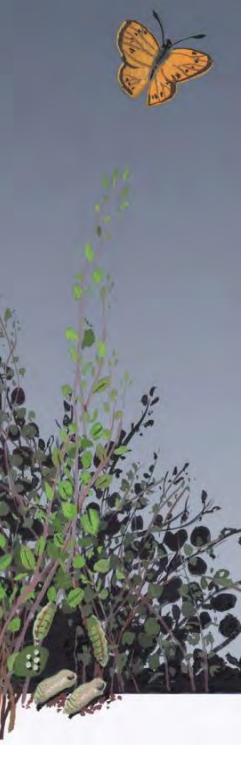
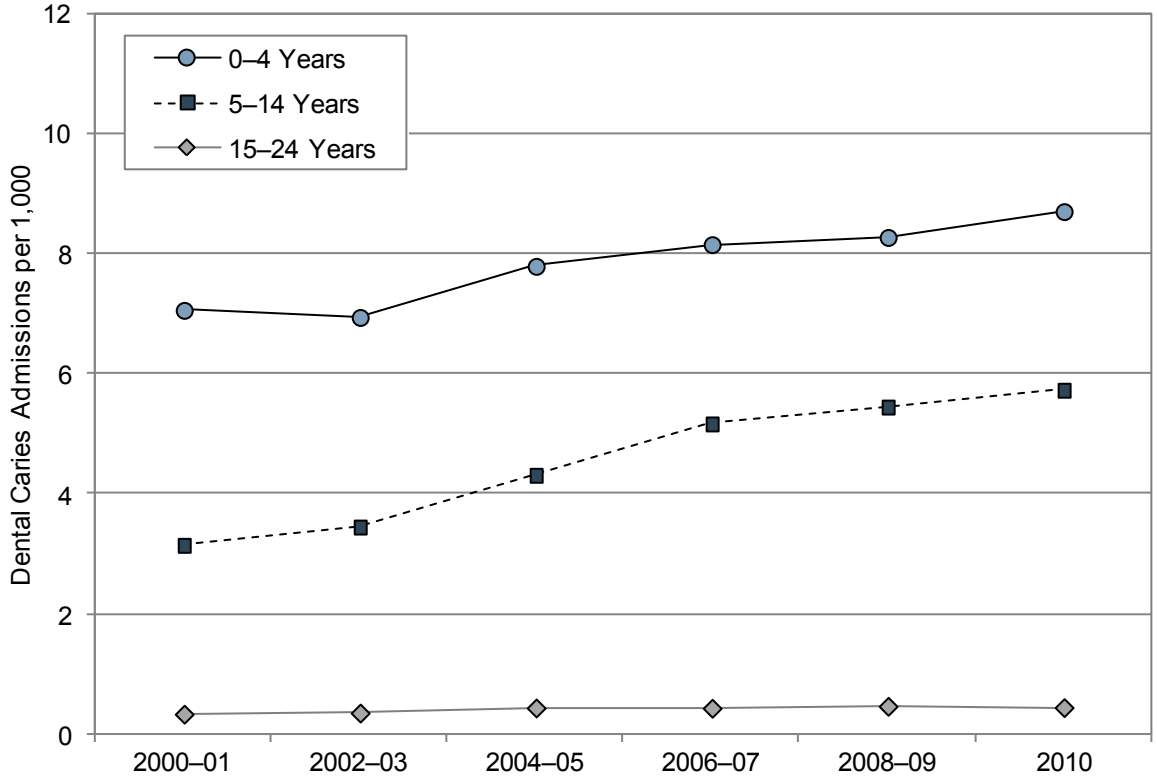
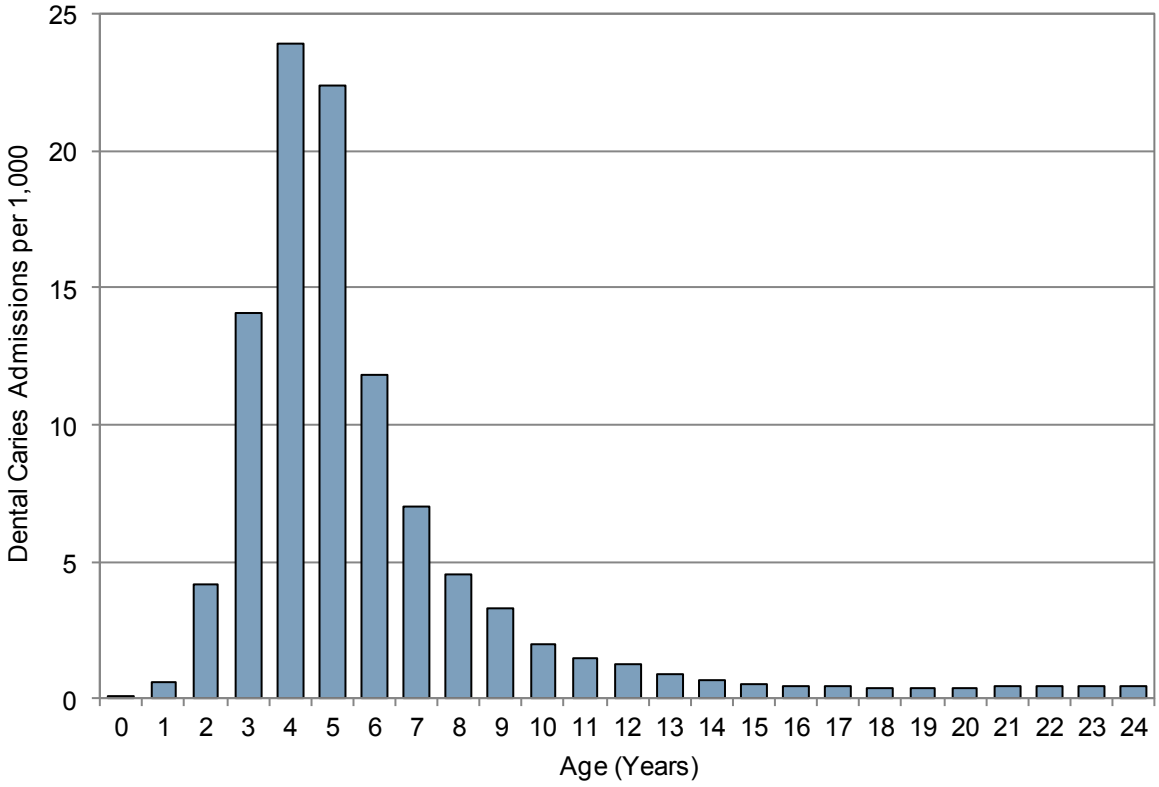


Figure 122. Hospital Admissions for Dental Caries in Children and Young People Aged 0−24 Years, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 123. Hospital Admissions for Dental Caries in Children and Young People by Age, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Table 117. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
0–4 Years				
Dental Caries	11,965	2,393.0	8.31	88.3
Diseases Pulp/Periapical Tissue	1,241	248.2	0.86	9.2
Disorders Tooth Development/Eruption	121	24.2	0.08	0.9
Other Disorders Teeth/Supporting Structures	72	14.4	0.05	0.5
Gingivitis / Periodontal Diseases	55	11.0	0.04	0.4
Dentofacial Anomalies / Malocclusion	44	8.8	0.03	0.3
Embedded/Impacted Teeth	17	3.4	0.01	0.1
Other Disorders Gingiva/Edentulous Alveolar Ridge	16	3.2	0.01	0.1
Other Diseases Teeth Hard Tissue	15	3.0	0.01	0.1
Total 0–4 Years	13,546	2,709.2	9.41	100.0
5–14 Years				
Dental Caries	16,300	3,260.0	5.39	79.0
Diseases Pulp/Periapical Tissue	2,084	416.8	0.69	10.1
Disorders Tooth Development/Eruption	928	185.6	0.31	4.5
Embedded/Impacted Teeth	617	123.4	0.20	3.0
Dentofacial Anomalies / Malocclusion	268	53.6	0.09	1.3
Other Disorders Teeth/Supporting Structures	187	37.4	0.06	0.9
Other Diseases Teeth Hard Tissue	145	29.0	0.05	0.7
Gingivitis / Periodontal Diseases	72	14.4	0.02	0.3
Other Disorders Gingiva/Edentulous Alveolar Ridge	24	4.8	0.01	0.1
Total 5–14 Years	20,625	4,125.0	6.82	100.0
15–24 Years				
Embedded/Impacted Teeth	2,325	465.0	0.73	41.9
Dental Caries	1,415	283.0	0.45	25.5
Diseases Pulp/Periapical Tissue	569	113.8	0.18	10.3
Dentofacial Anomalies / Malocclusion	495	99.0	0.16	8.9
Gingivitis / Periodontal Diseases	294	58.8	0.09	5.3
Other Disorders Teeth/Supporting Structures	222	44.4	0.07	4.0
Disorders Tooth Development/Eruption	127	25.4	0.04	2.3
Other Diseases Teeth Hard Tissue	89	17.8	0.03	1.6
Other Disorders Gingiva/Edentulous Alveolar Ridge	15	3.0	<0.01	0.3
Total 15–24 Years	5,551	1,110.2	1.75	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

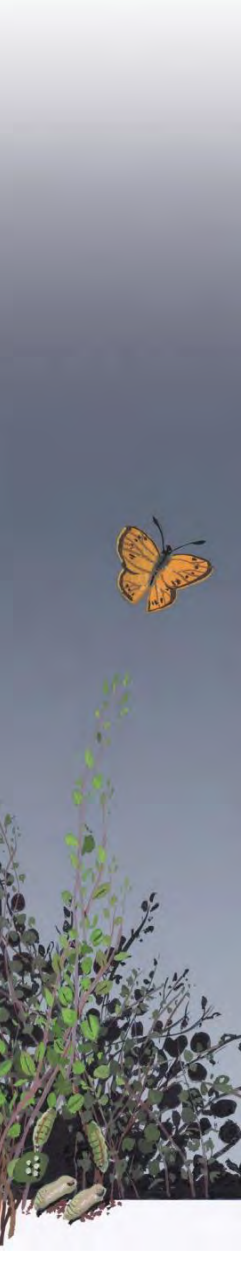
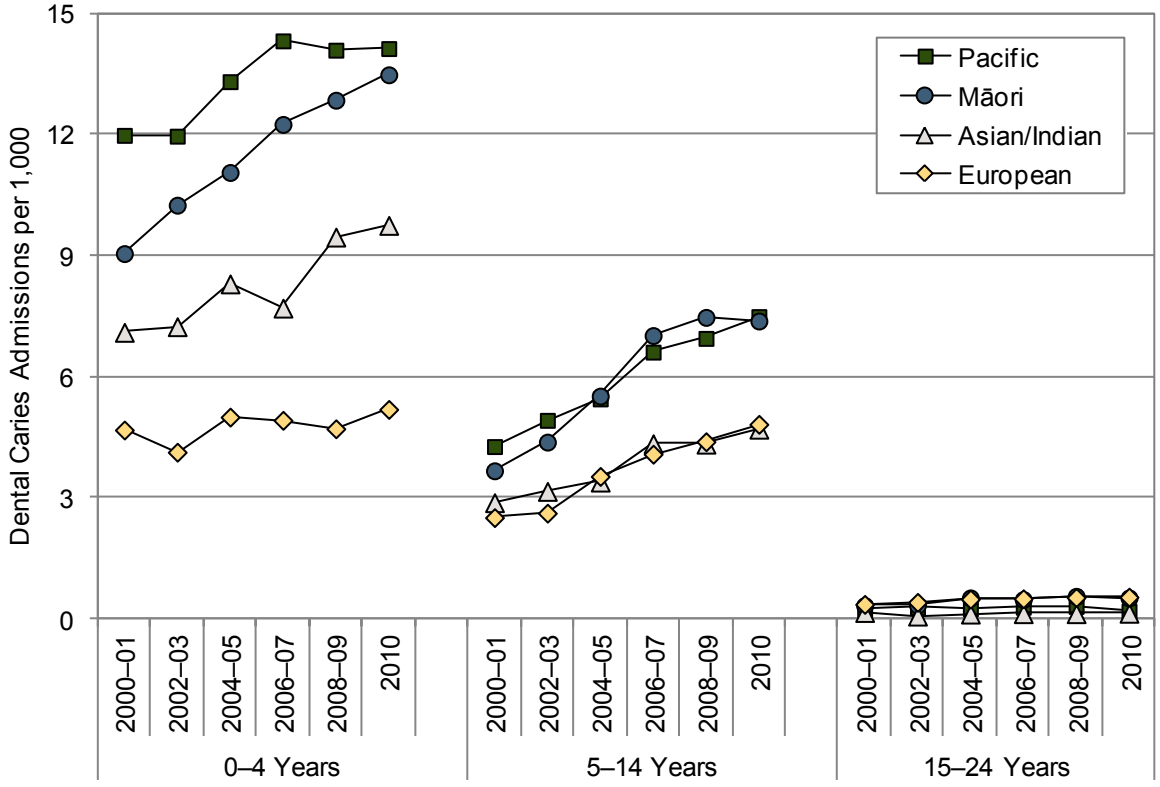


Figure 124. Hospital Admissions for Dental Caries in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised

Table 118. Hospital Admissions for Dental Caries in Children Aged 0–4 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Dental Caries Admissions 0–4 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.64	1.00		Decile 1–2	3.90	1.00	
Decile 2	4.16	1.14	1.01–1.29	Decile 3–4	4.92	1.26	1.16–1.37
Decile 3	4.53	1.24	1.10–1.41	Decile 5–6	7.00	1.80	1.67–1.94
Decile 4	5.26	1.44	1.29–1.62	Decile 7–8	9.70	2.49	2.32–2.67
Decile 5	6.58	1.81	1.61–2.02	Decile 9–10	13.8	3.54	3.31–3.79
Decile 6	7.36	2.02	1.81–2.25	Prioritised Ethnicity			
Decile 7	8.89	2.44	2.20–2.71	European	4.89	1.00	
Decile 8	10.4	2.85	2.57–3.15	Māori	12.7	2.60	2.50–2.72
Decile 9	12.5	3.43	3.11–3.79	Pacific	14.2	2.90	2.75–3.06
Decile 10	14.9	4.09	3.71–4.51	Asian/Indian	8.87	1.81	1.70–1.94
Gender							
Female	8.08	1.00		Male	8.53	1.05	1.02–1.09

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

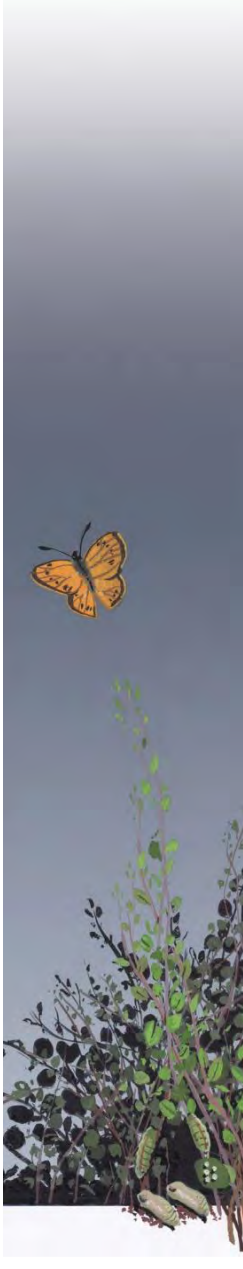


Table 119. Hospital Admissions for Dental Caries in Children and Young People Aged 5−24 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Dental Caries Admissions 5–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.09	1.00		Decile 1–2	3.07	1.00	
Decile 2	3.04	0.98	0.90–1.08	Decile 3–4	3.87	1.26	1.19–1.34
Decile 3	3.47	1.12	1.02–1.22	Decile 5–6	5.05	1.65	1.55–1.75
Decile 4	4.25	1.37	1.26–1.49	Decile 7–8	6.36	2.07	1.96–2.19
Decile 5	4.83	1.56	1.43–1.70	Decile 9–10	8.11	2.64	2.51–2.78
Decile 6	5.25	1.70	1.56–1.84	Prioritised Ethnicity			
Decile 7	5.99	1.94	1.79–2.10	European	4.35	1.00	
Decile 8	6.68	2.16	2.00–2.33	Māori	7.27	1.67	1.61–1.73
Decile 9	8.31	2.69	2.49–2.89	Pacific	6.93	1.59	1.52–1.67
Decile 10	7.94	2.57	2.39–2.76	Asian/Indian	4.41	1.02	0.96–1.08
Gender							
Female	5.23	1.00		Male	5.55	1.06	1.03–1.09
Dental Caries Admissions 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	0.28	1.00		Decile 1–2	0.28	1.00	
Decile 2	0.28	1.01	0.73–1.39	Decile 3–4	0.31	1.12	0.90–1.40
Decile 3	0.31	1.11	0.81–1.52	Decile 5–6	0.50	1.78	1.46–2.17
Decile 4	0.32	1.15	0.84–1.56	Decile 7–8	0.58	2.09	1.74–2.52
Decile 5	0.52	1.87	1.41–2.48	Decile 9–10	0.50	1.78	1.48–2.15
Decile 6	0.48	1.72	1.30–2.28	Prioritised Ethnicity			
Decile 7	0.65	2.34	1.79–3.06	European	0.52	1.00	
Decile 8	0.53	1.91	1.46–2.50	Māori	0.52	1.00	0.88–1.13
Decile 9	0.52	1.89	1.45–2.45	Pacific	0.28	0.53	0.42–0.68
Decile 10	0.46	1.67	1.27–2.20	Asian/Indian	0.13	0.25	0.20–0.32
Gender							
Female	0.44	1.00		Male	0.45	1.02	0.92–1.13

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Midland Region Distribution and Trends

Midland Region Distribution by Primary Diagnosis

In the Midland Region during 2006–2010, dental caries was the leading reason for a dental admission in children aged 0–4 and 5–14 years in all five DHBs. In the Waikato, Lakes, Bay of Plenty and Tairawhiti, dental caries was also the leading reason for admission in young people aged 15–24 years, while in Taranaki embedded/ impacted teeth was the leading reason for admission (**Table 120**–**Table 124**).

Table 120. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years, Waikato 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Waikato				
0–4 Years				
Dental Caries	1,301	260.2	10.4	93.9
Diseases Pulp/Periapical Tissue	59	11.8	0.47	4.3
Other Disorders Teeth/Supporting Structures	11	2.2	0.09	0.8
Disorders Tooth Development/Eruption	8	1.6	0.06	0.6
Gingivitis / Periodontal Diseases	3	0.6	0.02	0.2
Dentofacial Anomalies / Malocclusion	<3	s	s	s
Other Disorders Gingiva/Edentulous Alveolar Ridge	<3	s	s	s
Other Diseases Teeth Hard Tissue	<3	s	s	s
Total 0–4 Years	1,386	277.2	11.0	100.0
5–14 Years				
Dental Caries	1,891	378.2	7.08	89.9
Diseases Pulp/Periapical Tissue	91	18.2	0.34	4.3
Disorders Tooth Development/Eruption	47	9.4	0.18	2.2
Embedded/Impacted Teeth	21	4.2	0.08	1.0
Other Disorders Teeth/Supporting Structures	16	3.2	0.06	0.8
Other Diseases Teeth Hard Tissue	14	2.8	0.05	0.7
Dentofacial Anomalies / Malocclusion	14	2.8	0.05	0.7
Gingivitis / Periodontal Diseases	9	1.8	0.03	0.4
Total 5–14 Years	2,103	420.6	7.87	100.0
15–24 Years				
Dental Caries	134	26.8	0.50	40.4
Embedded/Impacted Teeth	59	11.8	0.22	17.8
Dentofacial Anomalies / Malocclusion	43	8.6	0.16	13.0
Diseases Pulp/Periapical Tissue	40	8.0	0.15	12.0
Other Disorders Teeth/Supporting Structures	29	5.8	0.11	8.7
Other Diseases Teeth Hard Tissue	13	2.6	0.05	3.9
Gingivitis / Periodontal Diseases	10	2.0	0.04	3.0
Disorders Tooth Development/Eruption	3	0.6	0.01	0.9
Other Disorders Gingiva/Edentulous Alveolar Ridge	<3	s	s	s
Total 15–24 Years	332	66.4	1.24	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: s: suppressed due to small numbers.

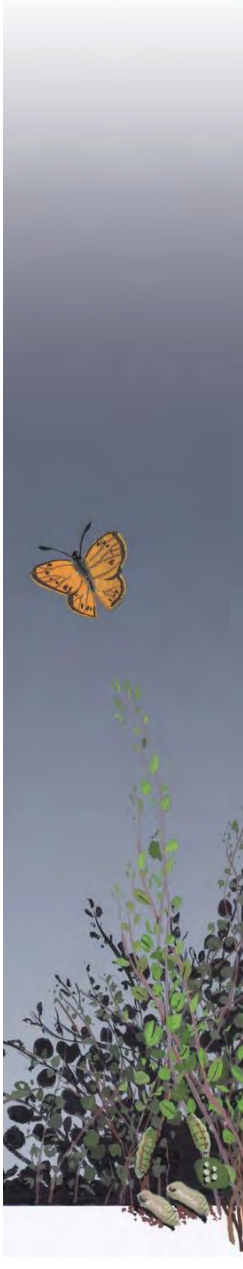


Table 121. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years, Bay of Plenty 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Bay of Plenty				
0–4 Years				
Dental Caries	581	116.2	8.50	81.7
Diseases Pulp/Periapical Tissue	105	21.0	1.54	14.8
Disorders Tooth Development/Eruption	10	2.0	0.15	1.4
Other Disorders Teeth/Supporting Structures	7	1.4	0.10	1.0
Dentofacial Anomalies / Malocclusion	3	0.6	0.04	0.4
Gingivitis / Periodontal Diseases	3	0.6	0.04	0.4
Other Disorders Gingiva/Edentulous Alveolar Ridge	<3	s	s	s
Other Diseases Teeth Hard Tissue	<3	s	s	s
Total 0–4 Years	711	142.2	10.4	100.0
5–14 Years				
Dental Caries	902	180.4	5.86	72.0
Diseases Pulp/Periapical Tissue	145	29.0	0.94	11.6
Disorders Tooth Development/Eruption	89	17.8	0.58	7.1
Embedded/Impacted Teeth	57	11.4	0.37	4.6
Dentofacial Anomalies / Malocclusion	26	5.2	0.17	2.1
Other Diseases Teeth Hard Tissue	13	2.6	0.08	1.0
Other Disorders Teeth/Supporting Structures	11	2.2	0.07	0.9
Gingivitis / Periodontal Diseases	6	1.2	0.04	0.5
Other Disorders Gingiva/Edentulous Alveolar Ridge	3	0.6	0.02	0.2
Total 5–14 Years	1,252	250.4	8.13	100.0
15–24 Years				
Dental Caries	110	22.0	0.87	44.9
Embedded/Impacted Teeth	45	9.0	0.36	18.4
Diseases Pulp/Periapical Tissue	40	8.0	0.32	16.3
Gingivitis / Periodontal Diseases	15	3.0	0.12	6.1
Dentofacial Anomalies / Malocclusion	10	2.0	0.08	4.1
Other Disorders Teeth/Supporting Structures	9	1.8	0.07	3.7
Other Diseases Teeth Hard Tissue	8	1.6	0.06	3.3
Disorders Tooth Development/Eruption	8	1.6	0.06	3.3
Total 15–24 Years	245	49.0	1.95	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population
Note: s: suppressed due to small numbers.

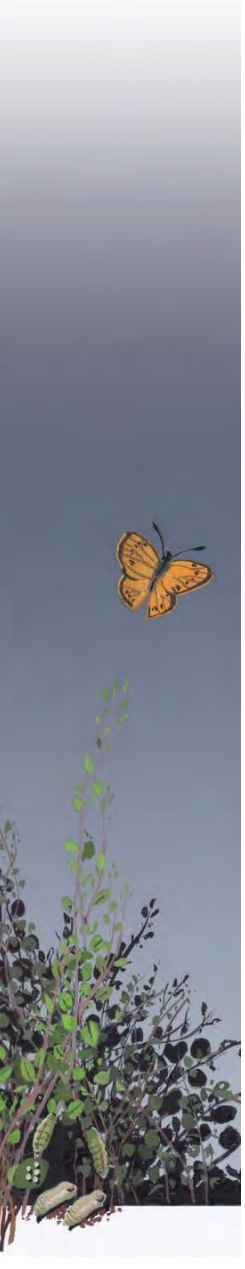


Table 122. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years, Lakes DHB 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Lakes DHB				
0–4 Years				
Dental Caries	506	101.2	13.2	93.2
Diseases Pulp/Periapical Tissue	29	5.8	0.76	5.3
Other Disorders Teeth/Supporting Structures	4	0.8	0.10	0.7
Gingivitis / Periodontal Diseases	<3	s	s	s
Other Diseases Teeth Hard Tissue	<3	s	s	s
Disorders Tooth Development/Eruption	<3	s	s	s
Total 0–4 Years	543	108.6	14.2	100.0
5–14 Years				
Dental Caries	462	92.4	5.68	87.3
Diseases Pulp/Periapical Tissue	44	8.8	0.54	8.3
Disorders Tooth Development/Eruption	9	1.8	0.11	1.7
Other Disorders Teeth/Supporting Structures	6	1.2	0.07	1.1
Gingivitis / Periodontal Diseases	3	0.6	0.04	0.6
Embedded/Impacted Teeth	<3	s	s	s
Other Diseases Teeth Hard Tissue	<3	s	s	s
Dentofacial Anomalies / Malocclusion	<3	s	s	s
Total 5–14 Years	529	105.8	6.50	100.0
15–24 Years				
Dental Caries	34	6.8	0.51	43.6
Diseases Pulp/Periapical Tissue	19	3.8	0.29	24.4
Other Disorders Teeth/Supporting Structures	8	1.6	0.12	10.3
Gingivitis / Periodontal Diseases	5	1.0	0.08	6.4
Dentofacial Anomalies / Malocclusion	4	0.8	0.06	5.1
Embedded/Impacted Teeth	4	0.8	0.06	5.1
Other Diseases Teeth Hard Tissue	<3	s	s	s
Other Disorders Gingiva/Edentulous Alveolar Ridge	<3	s	s	s
Total 15–24 Years	78	15.6	1.18	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: s: suppressed due to small numbers.

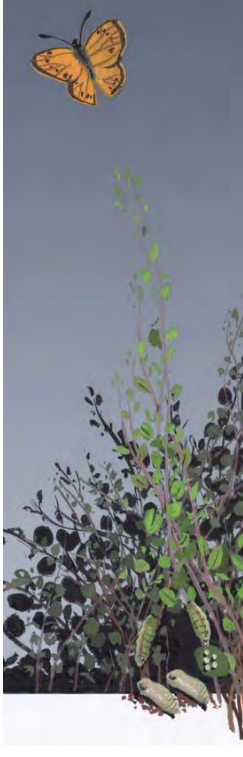


Table 123. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years, Tairawhiti 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tairawhiti				
0–4 Years				
Dental Caries	318	63.6	17.5	93.8
Diseases Pulp/Periapical Tissue	19	3.8	1.05	5.6
Gingivitis / Periodontal Diseases	<3	s	s	s
Dentofacial Anomalies / Malocclusion	<3	s	s	s
Total 0–4 Years	339	67.8	18.7	100.0
5–14 Years				
Dental Caries	315	63.0	7.92	88.2
Diseases Pulp/Periapical Tissue	25	5.0	0.63	7.0
Disorders Tooth Development/Eruption	12	2.4	0.30	3.4
Dentofacial Anomalies / Malocclusion	3	0.6	0.08	0.8
Other Disorders Teeth/Supporting Structures	<3	s	s	s
Total 5–14 Years	357	71.4	8.98	100.0
15–24 Years				
Dental Caries	14	2.8	0.44	28.0
Embedded/Impacted Teeth	13	2.6	0.41	26.0
Diseases Pulp/Periapical Tissue	10	2.0	0.32	20.0
Dentofacial Anomalies / Malocclusion	4	0.8	0.13	8.0
Other Diseases Teeth Hard Tissue	3	0.6	0.09	6.0
Other Disorders Teeth/Supporting Structures	3	0.6	0.09	6.0
Gingivitis / Periodontal Diseases	3	0.6	0.09	6.0
Total 15–24 Years	50	10.0	1.58	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: s: suppressed due to small numbers.

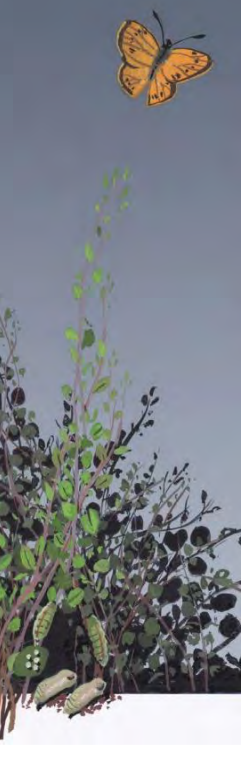


Table 124. Hospital Admissions for Dental Conditions in Children and Young People Aged 0–24 Years, Taranaki 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Taranaki				
0–4 Years				
Dental Caries	318	63.6	9.14	86.6
Diseases Pulp/Periapical Tissue	37	7.4	1.06	10.1
Disorders Tooth Development/Eruption	5	1.0	0.14	1.4
Embedded/Impacted Teeth	3	0.6	0.09	0.8
Other Disorders Teeth/Supporting Structures	<3	s	s	s
Dentofacial Anomalies / Malocclusion	<3	s	s	s
Total 0–4 Years	367	73.4	10.6	100.0
5–14 Years				
Dental Caries	362	72.4	4.70	58.8
Embedded/Impacted Teeth	103	20.6	1.34	16.7
Disorders Tooth Development/Eruption	65	13.0	0.84	10.6
Diseases Pulp/Periapical Tissue	63	12.6	0.82	10.2
Dentofacial Anomalies / Malocclusion	12	2.4	0.16	1.9
Other Disorders Teeth/Supporting Structures	8	1.6	0.10	1.3
Other Disorders Gingiva/Edentulous Alveolar Ridge	<3	s	s	s
Other Diseases Teeth Hard Tissue	<3	s	s	s
Gingivitis / Periodontal Diseases	<3	s	s	s
Total 5–14 Years	616	123.2	7.99	100.0
15–24 Years				
Embedded/Impacted Teeth	277	55.4	3.95	76.5
Dental Caries	33	6.6	0.47	9.1
Dentofacial Anomalies / Malocclusion	24	4.8	0.34	6.6
Diseases Pulp/Periapical Tissue	15	3.0	0.21	4.1
Gingivitis / Periodontal Diseases	5	1.0	0.07	1.4
Other Disorders Teeth/Supporting Structures	4	0.8	0.06	1.1
Disorders Tooth Development/Eruption	4	0.8	0.06	1.1
Total 15–24 Years	362	72.4	5.17	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: s: suppressed due to small numbers.

Midland DHBs vs. New Zealand

In the Midland Region during 2006–2010, hospital admissions for dental caries in children aged 0–4 and 5–14 years and young people aged 15–24 years were either similar to, or *significantly* higher than the New Zealand rate in all five DHBs. The only exception was in Taranaki, where admissions in children aged 5–14 years were *significantly* lower than the New Zealand rate (**Table 125**).

Midland Region Trends

In the Midland Region, hospital admissions for dental caries in children aged 0–4 and 5–14 years increased in all five DHBs during the early-mid 2000s although, with the exception of Waikato, rates began to taper off again during the late 2000s. Trends for young people were more variable from DHB to DHB (**Figure 125**).

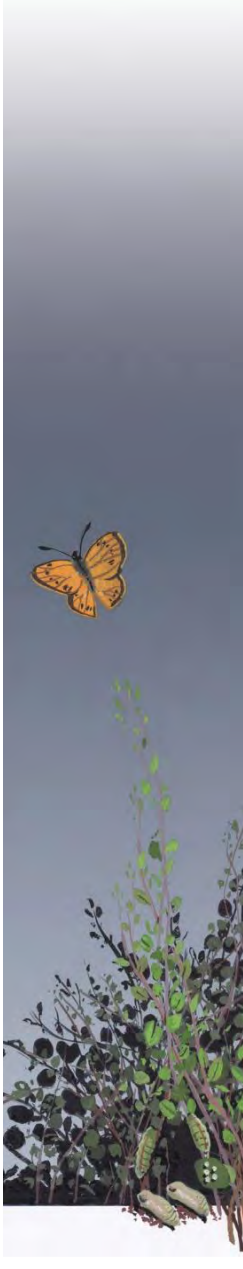


Table 125. Hospital Admissions for Dental Caries in Children and Young People Aged 0−24 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Dental Caries					
0–4 Years					
Waikato	1,301	260.2	10.4	1.25	1.18–1.32
Lakes	506	101.2	13.2	1.59	1.46–1.74
Bay of Plenty	581	116.2	8.50	1.02	0.94–1.11
Tairawhiti	318	63.6	17.5	2.11	1.89–2.36
Taranaki	318	63.6	9.14	1.10	0.98–1.23
New Zealand	11,965	2,393.0	8.31	1.00	
5–14 Years					
Waikato	1,891	378.2	7.08	1.31	1.25–1.38
Lakes	462	92.4	5.68	1.05	0.96–1.15
Bay of Plenty	902	180.4	5.86	1.09	1.02–1.16
Tairawhiti	315	63.0	7.92	1.47	1.31–1.64
Taranaki	362	72.4	4.70	0.87	0.79–0.97
New Zealand	16,300	3,260.0	5.39	1.00	
15–24 Years					
Waikato	134	26.8	0.50	1.12	0.94–1.34
Lakes	34	6.8	0.51	1.15	0.82–1.61
Bay of Plenty	110	22.0	0.87	1.96	1.61–2.37
Tairawhiti	14	2.8	0.44	0.99	0.59–1.68
Taranaki	33	6.6	0.47	1.05	0.75–1.49
New Zealand	1,415	283.0	0.45	1.00	

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Midland Region Distribution by Ethnicity

In the Midland Region during 2000–2010, hospital admissions for dental caries were generally higher for Māori than for European children. Small numbers precluded an analysis of ethnic differences for young people aged 15–24 years (**Figure 126**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, there were no consistent seasonal variations in hospital admissions for dental caries in children and young people (**Figure 127**).

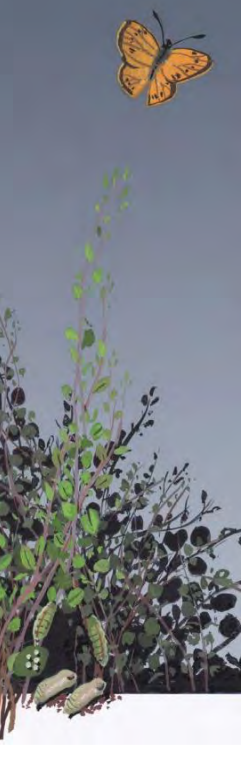
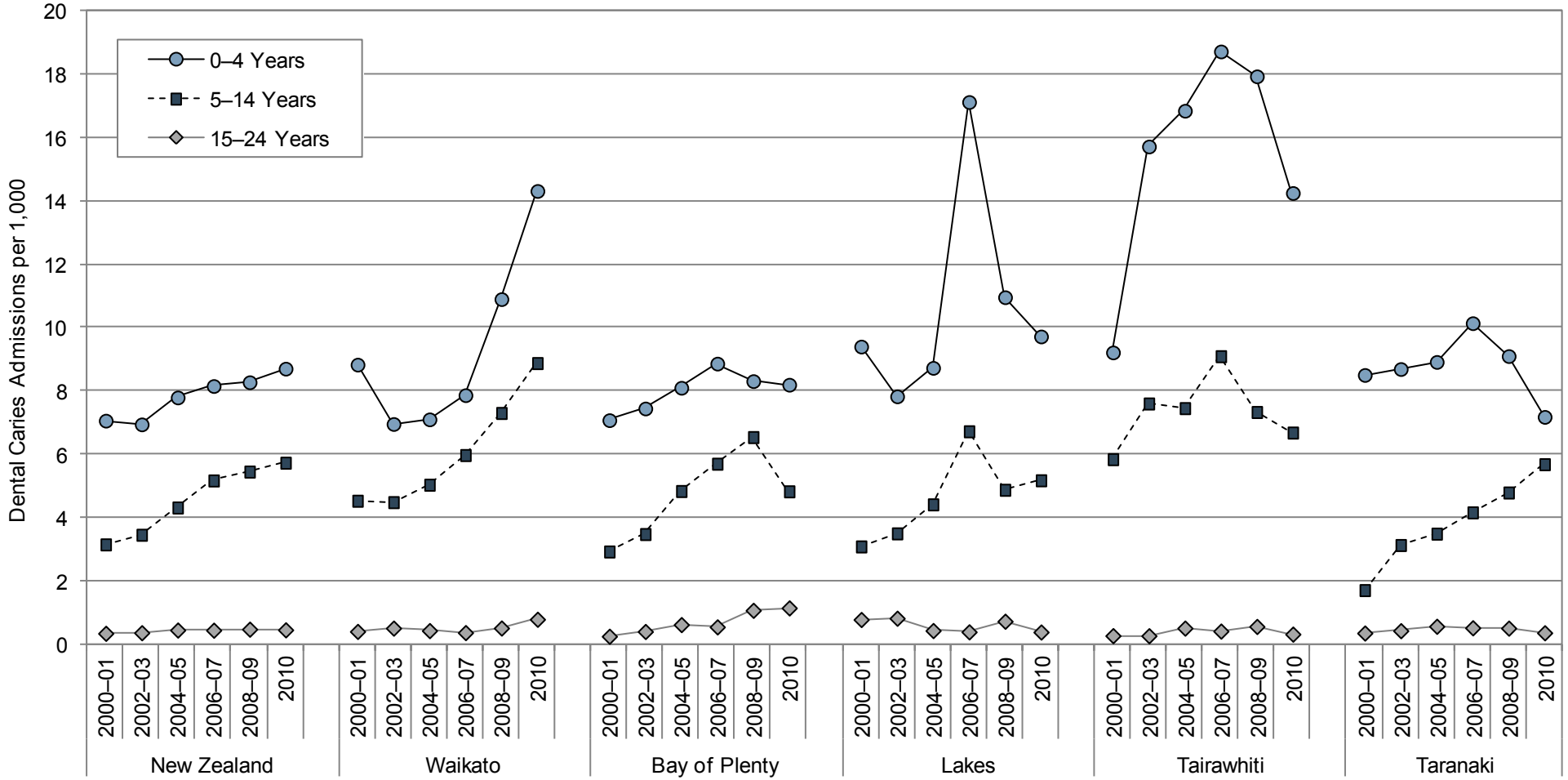
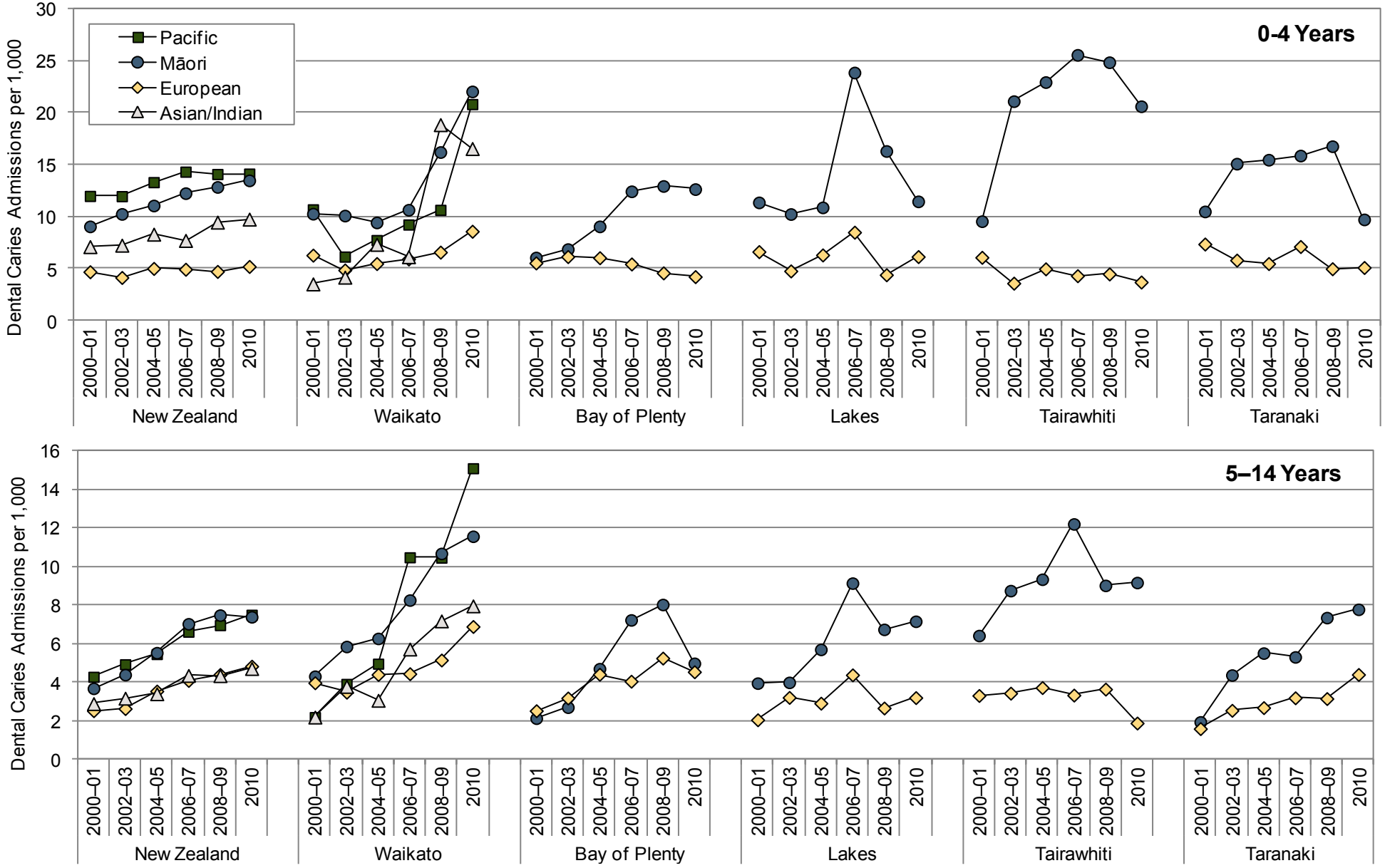


Figure 125. Hospital Admissions for Dental Caries in Children and Young People Aged 0–24 Years, Midland DHBs vs. New Zealand 2000–2010



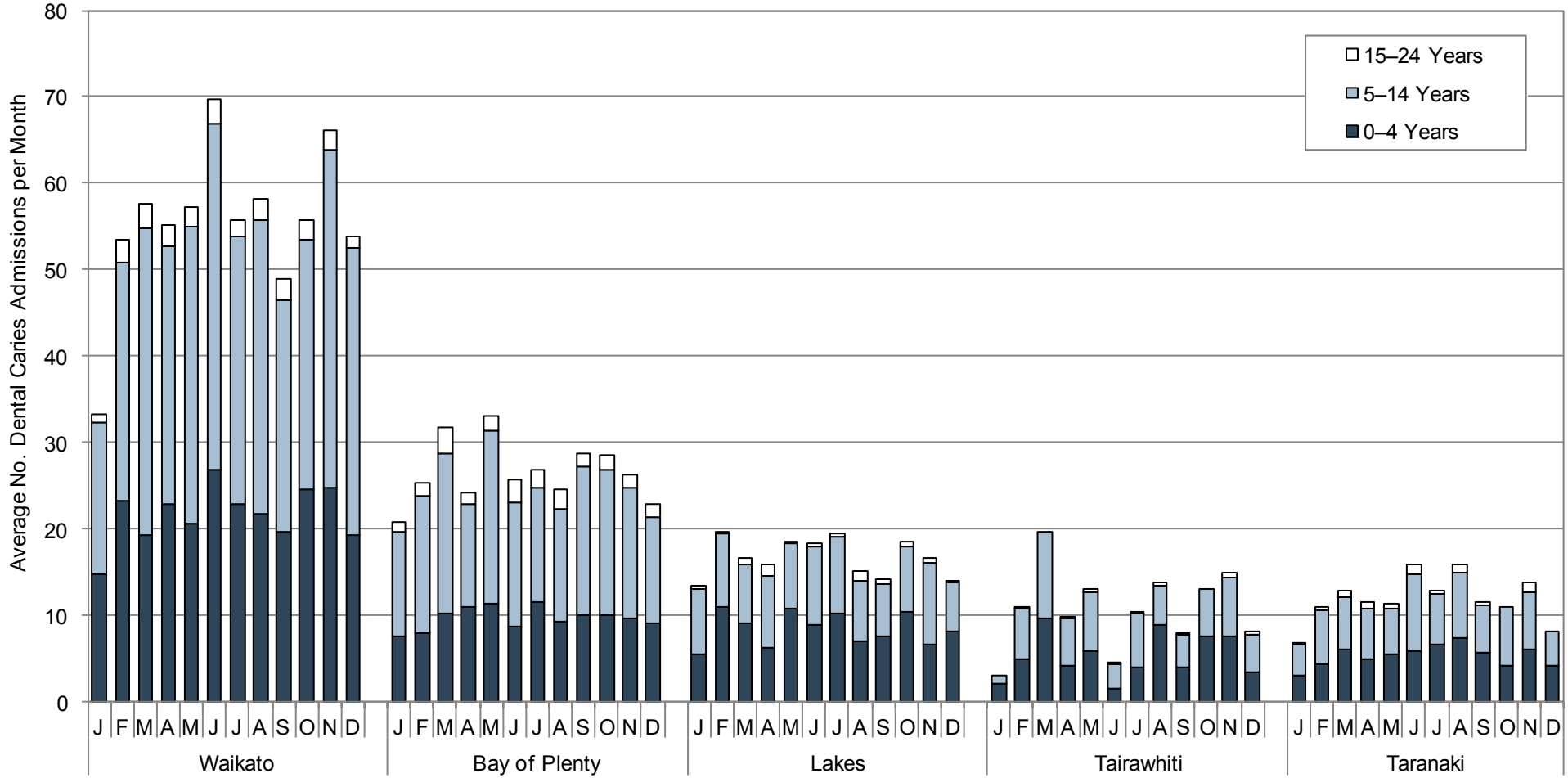
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 126. Hospital Admissions for Dental Caries in Children Aged 0–14 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised

Figure 127. Average Number of Hospital Admissions for Dental Caries in Children and Young People Aged 0–24 Years by Month, Midland DHBs 2006–2010



Source: National Minimum Dataset

Summary Hospital Admissions for Dental Caries

In New Zealand during 2006–2010, dental caries, followed by diseases of the pulp and periapical tissue, were the leading reasons for a dental admission in children 0–4 and 5–14 years. In contrast, embedded/impacted teeth, followed by dental caries were the leading reasons in young people 15–24 years. For dental caries, admissions were infrequent in infants <1 year, but rose rapidly thereafter, to reach a peak at 4 years of age. Rates then decreased, with admissions being relatively infrequent after 14 years of age.

Dental caries admissions in children 0–4 years were *significantly* higher for males, Pacific > Māori > Asian/Indian > European children and those from average-to-more deprived (NZDep decile 2–10) areas. Similarly, admissions for children 5–14 years were *significantly* higher for males, Māori and Pacific > Asian/Indian and European children and those from average-to-more deprived (NZDep decile 3–10) areas. In contrast, for young people 15–24 years, admissions were *significantly* higher for European and Māori > Pacific > Asian/Indian young people and those from more deprived (NZDep decile 5–10) areas.

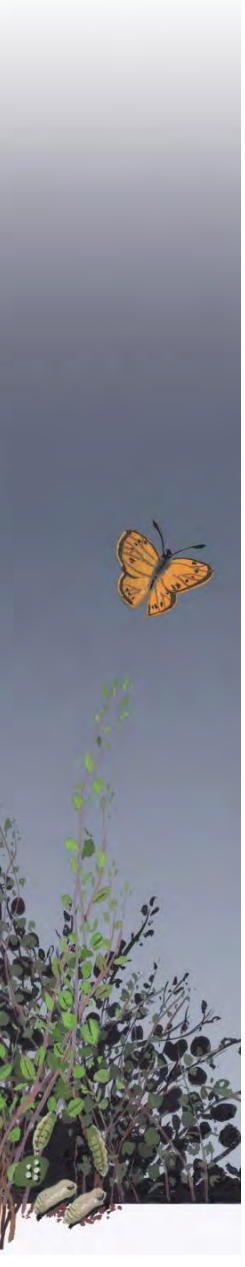
In the Midland Region, hospital admissions for dental caries in children aged 0–4 and 5–14 years increased in all five DHBs during the early-mid 2000s although, with the exception of Waikato, rates began to taper off again during the late 2000s. Trends for young people were more variable from DHB to DHB. During 2006–2010, admissions in children aged 0−4 and 5−14 years and young people aged 15–24 years were either similar to, or *significantly* higher than the New Zealand rate in all five DHBs. The only exception was in Taranaki, where admissions in children aged 5–14 years were *significantly* lower than the New Zealand rate. During 2000–2010, admissions were generally higher for Māori than for European children. Small numbers precluded an analysis of ethnic differences for young people aged 15–24 years.

Local Policy Documents and Evidence-Based Reviews Relevant to Oral Health in Children and Young People

In New Zealand, there are a number of policy documents which provide guidance to the health sector on the establishment of optimal oral health services, the identification of those most at risk of poor oral health, and the roles the Ministry of Health and DHBs are expected to play in improving oral health outcomes for children and young people. In addition, there are a large number of reviews in the international literature which consider the effectiveness of particular interventions in the prevention and management of dental caries in this age group. These publications are briefly summarised in **Table 126**.

Table 126. Local Policy Documents and Evidence-Based Reviews Relevant to Oral Health Issues in Children and Young People

Ministry of Health Policy Documents
New Zealand Guidelines Group. 2009. **Guidelines for the Use of Fluorides**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/9664/$File/guidelines-for-the-use-of-fluoride-nov09.pdf These guidelines, aimed at oral healthcare providers, specifically address the use of topical fluoride treatments i.e. fluoride containing toothpastes, varnishes, mouth rinse, gels and foams. They provide an evidence-based summary of New Zealand and overseas research to inform best practice use of fluoride.
Ministry of Health. 2008. **Early Childhood Oral Health: A toolkit for District Health Boards, primary health care and public health providers and for oral health services relating to infant and preschool oral health**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/7385/$File/early-childhood-oral-health-a-toolkit-feb08.pdf The objective of this toolkit for policy makers, funders, managers, clinical leaders and clinicians is to suggest a strategy of identifying children at greatest risk and targeting finite resources to those with the greatest need in order to reduce inequalities (while still maintaining universal access for all infants and pre-school children.) It recommends that Well Child/Tamariki Ora and other non-oral health providers conduct an enrolment and risk assessment process for all children at between 9 and 12 months of age and facilitate early contact with an oral health provider for examination and preventive and treatment services (if necessary) for those identified at highest risk of early childhood caries. This will require the development of a risk assessment tool (“Lift the Lip”) and training for non-oral health providers.



Ministry of Health. 2008. **Promoting Oral Health: A toolkit to assist the development, planning, implementation and evaluation of oral health promotion in New Zealand**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/7384/$File/promoting-oralhealth-a-toolkit-jan08.doc

This toolkit, written for policy makers, planners and funders, oral health professionals and other interested persons, is a practical guide for the design, delivery and implementation of oral health promotion programmes. It does not include a review of the evidence for oral health promotion interventions.

Ministry of Health. 2006. **Business Case Guidelines for Investment in Child and Adolescent Oral Health Services**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5016/$File/guidelines-investment-child-adolescent-oral-health.pdf

These guidelines were developed for DHBs to assist them with service planning and the preparation of business cases for submission to the Ministry of Health. They followed the Government's decision to embark on a substantial upgrade of community-based oral health facilities for the delivery of child and adolescent oral health services.

Ministry of Health. 2006. **Community Oral Health Service: Facility Guideline**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5015/$File/community-oral-health-facility-guideline.pdf

The purpose of this guideline is to assist DHBs with planning new community oral health facilities. It covers planning, operational policies, facility location, functional areas and design, support areas, infection control, health & safety, building services & environmental design, mobile units, equipment and information and communication technology.

Ministry of Health. 2006. **Good Oral Health for All, for Life: The Strategic Vision for Oral Health in New Zealand**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5117/$File/good-oral-health-strategic-vision-2006.pdf

This publication outlines the Government's strategic vision for oral health in New Zealand. There are four key priority groups including children and adolescents and there are seven key action areas in the vision: reorienting child and adolescent oral health services, reducing inequalities in access and outcomes, promoting oral health, forging links with primary care, building the oral health workforce, developing oral health policy, and research, monitoring and evaluation.

Ministry of Health. 2004. **Child and Youth Health Toolkit**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/5411/$File/childandyouthhealthtoolkit.pdf

Chapter 12 of this publication, aimed at DHB funders and planners, doctors, nurses, managers, primary health organisations, community providers, DHB boards, and other groups and individuals wanting to improve child and youth health, provides guidance on the child oral health indicators and what needs to be done to improve child oral health.

International Guidelines

Scottish Intercollegiate Guidelines Network. 2005. **Prevention and management of dental decay in the pre-school child: A national clinical guideline**. http://www.sign.ac.uk/pdf/sign83.pdf

These guidelines aim to support evidence-based best practice in the prevention and management of dental decay in the pre-school child. Effective preventive measures relating to diet include promoting breastfeeding, discouraging bottle feeding of fruit juice and other drinks containing free sugars, restricting foods and drinks containing free sugars to mealtimes only, encouraging eating cheese as a snack food, and choosing confectionary and beverages containing sugar substitutes rather than those containing sugars. Tooth brushing with fluoride toothpaste should be encouraged at least twice a day but pre-school children should use only a smear or small pea-sized amount of a fluoride toothpaste containing only 1000ppmF. Tooth brushing should commence as soon as the primary teeth erupt and children should spit rather than rinse after brushing. Either manual or electric toothbrushes are effective for applying fluoride toothpaste. Dental or dietary health promotion is not of value as a community prevention approach in isolation. Environmental and/or policy change such as changes to school meals appear to be the most effective means of improving children's dietary intake. The use of fluoride toothpaste should be promoted but fluoride supplements are not recommended as a public health measure. It is important that those who provide oral health advice, including teachers, nurses, midwives and community workers are consistent with each other and with dental professionals in the advice they provide.

National Institute for Clinical Excellence. 2004. **Dental recall: Recall interval between routine dental examinations**. London: National Institute for Clinical Excellence. http://www.nice.org.uk/nicemedia/live/10952/29486/29486.pdf

Since the inception of the NHS it had been customary to provide six-monthly dental check-ups however following the publication of the Department of Health's strategy document *NHS Dentistry: Options for Change* (2002) dentists and their patients now discuss the patient's care needs and determine an appropriate recall interval based on an assessment of disease levels and risk of dental disease. This publication assists dentists (who provide the dental care for children In the U.K.) in the decision making process. The recommendations are accompanied by a grading scheme (as used by the Scottish Intercollegiate Guidelines Network.) There is no discussion of the research evidence or any references.

Scottish Intercollegiate Guidelines Network. 2000**. Preventing Dental Caries in Children at High Caries Risk: Targeted prevention of dental caries in the permanent teeth of 6-16 year olds presenting for dental care**. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/pdf/sign47.pdf

This guideline is primarily aimed at dentists but section 5 contains information for non-dental professionals. Issues discussed include dry mouth due to some drugs such as tricyclic antidepressants and some medical conditions e.g. Sjogren/Sicca syndrome, diabetes, ectodermal dysplasia, (dry mouth increases the risk of dental caries), the need for sugar free medicines, counselling those who do not see a dentist regularly to overcome their barriers to seeking dental care, medically compromised individuals for whom dental care may be more hazardous including those with cardiac disease, immunosuppression (including HIV), haemophilia and other bleeding disorders, and disability, and the need for patients wearing orthodontic appliances to have regular dental care.

Systematic and Other Reviews from the International Literature

Rogers J G. 2011. **Evidence-based oral health promotion resource**. Melbourne: Prevention and Population Health Branch, Government of Victoria, Department of Health. . http://docs.health.vic.gov.au/docs/doc/1A32DFB77FEFBE9CCA25789900125529/$FILE/Final%20Oral%20Health%20Resource%20May%202011%20web%20version.pdf

This publication is based on a systematic search of the literature for interventions to promote oral health. They key research questions were: 1) What are effective oral health promotion strategies for the Victorian population? 2) What innovative oral health promotion strategies show promise for the Victorian population? 3) What information and research gaps exist? The evidence for interventions is presented in sections for seven priority groups and settings. Section 5 relates to pregnant women, babies and young children, section 6 to children and adolescents and school settings, section 8 to Aboriginal and Torres Strait Islander people, section 9 to culturally and linguistically diverse communities, and section 10 to people with special needs. The strength of the evidence for interventions (i.e. their level of effectiveness) is indicated by a number on a seven point scale and the strength of the evidence (i.e. its quality) is graded according to the criteria of the National Health and Medical Research Council. In addition to interventions, programmes implemented in various parts of Victoria are also discussed in the report. Effective oral health promotion interventions for pregnant women, babies and young children are: targeted home visits by health workers, targeted fluoride varnish programs, targeted supervised tooth brushing and healthy food and drink policies in childhood settings, targeted provision of fluoride toothpaste and toothbrushes via mailing, home visits or clinics, integration of oral health into well child visits (including “lift the lip” screening), community action multi-strategy programmes and community-based preventive programmes for expectant and new mothers. For school-aged children interventions are: targeted school-based tooth brushing and fluoride mouth-rinsing programmes, school-based oral health education, orally healthy school policies including integration of oral health promotion into the school curriculum, community school and clinic based programmes and targeted chewing gum programmes.

Deacon SA, Glenny A-M, Deery C, et al. 2010. **Different powered toothbrushes for plaque control and gingival health**. Cochrane Database of Systematic Reviews 2010(12) Art. No.: CD004971. DOI:10.1002/14651858.CD004971.pub2.

This review, which included 17 trials, 10 of which received funding from the manufacturer of one of the toothbrushes in the trial, aimed to compare powered toothbrushes with different modes of action in relation to 1) removal of plaque, 2) health of the gingivae (gums) and 3) adverse effects. It found that no mode of action was consistently superior across all outcomes and time periods studied. There was some evidence, from seven trials of up to 3 months duration that rotation oscillation brushes reduce plaque and gingivitis more than side to side brushes but the difference was small.

Marinho VC. 2009. **Cochrane reviews of randomized trials of fluoride therapies for preventing dental caries**. European Archives of Paediatric Dentistry: Official Journal of European Academy of Paediatric Dentistry 10(3)183-91.

This article summarises seven Cochrane reviews evaluating the effectiveness of four topical fluoride treatments (toothpastes, gels, varnishes and mouth rinses) in preventing dental caries in adolescents and children, two Cochrane reviews evaluating other fluoride modalities (slow-release devices, milk), one comparing fluoride varnishes versus sealants in occlusal surfaces and one evaluating fluorides for white spot lesions in orthodontic patients. The seven reviews on topical fluoride treatments indicate that they are all of clear and similar effectiveness and that additional caries reduction can be expected when another topical fluoride is combined with fluoride toothpaste. There is insufficient evidence for the effectiveness of slow release fluoride devices and fluoridated milk. It is also uncertain whether there is any difference between different modes of delivering fluoride to orthodontic patients. Fissure sealants seem to be more effective than fluoride varnish for preventing occlusal caries however the size of the difference is unclear. The author concludes that “The benefits of topical fluorides are firmly established based on a sizeable body of evidence from randomized controlled trials. The size of the reductions in caries increment in both the permanent and the primary dentitions emphasizes the importance of including topical fluoride delivered through toothpastes, rinses, gels or varnishes in any caries preventive program” and she highlights areas where further research is needed.

Department of Health (U.K.), British Association for the Study of Community Dentistry. 2009. **Delivering Better Oral Health An evidence-based toolkit for prevention**. London Department of Health. http://www.dh.gov.uk/dr_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_102982.pdf

This publication provides practical, evidence-based guidance to assist dental practitioners to promote oral health and prevent oral disease in their patients. Each piece of advice or suggested intervention is accompanied by an evidence grade indicating the strength of the evidence on which it is based. Sections in the guidelines cover summary guidance for the prevention of caries in children and adults and the prevention of periodontal disease and oral cancer, principles of tooth brushing, increasing fluoride availability, healthy eating advice, identifying sugar-free medicines, improving periodontal health, stopping smoking, alcohol misuse, and prevention of erosion.

Ahovuo-Saloranta A, Hiiri A, Nordblad A, et al. 2008. **Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents**. Cochrane Database of Systematic Reviews 2008(4) Art. No.: CD001830. DOI:10.1002/14651858.CD001830.pub3.

This review included 16 RCTs or quasi-RCTs comparing sealants with no sealants or resin based sealants /composites with other sealants. Three of these 16 trials used a parallel group design and the others were split mouth studies in which two interventions were randomly allocated to pairs of teeth in the same child. In meta-analyses based on six studies comparing resin sealants with no sealant the reductions in caries ranged from 87% at 12 months (RR 0.13, 95% CI 0.09-0.20) to 60% (RR 0.40, 95% CI 0.31-0.51) at 48-54 months. The results from the studies which compared different sealant materials were conflicting. The authors concluded that sealing can be recommended to prevent caries of the occlusal surfaces of permanent molars and that the benefits are obvious where the risk of caries is high but that there is a lack of data on the benefits of sealing at different levels of caries risk.

Australian Government National Health and Medical Research Council. 2007. **A systematic review of the efficacy and safety of fluoridation Part A: Review Methodology And Results**. Canberra: Australian Government. http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/eh41_1.pdf

This systematic review considers the evidence relating to the efficacy and safety of fluoride interventions particularly those which are delivered as part of a widespread public health initiative. The findings are used to answer a series of questions under the headings of benefits, harms, cancer and other adverse effects. The evidence strongly supported water fluoridation and there was some low level evidence for the benefits of milk fluoridation. There was no evidence for the benefits of salt fluoridation. There was consistent level I (best) evidence for the benefits of topical fluoride agents in reducing caries in children and that some combinations of topical fluoride agents are more effective than single agents. There was consistent level III/IV evidence that water fluoridation (and, in one study each only, milk fluoridation and salt fluoridation) leads to dental fluorosis although the majority of dental fluorosis was mild and of no aesthetic concern. There was no good evidence that topical fluorides lead to fluorosis of aesthetic concern but one study showed that fluoride toothpaste may be associated with “any fluorosis”. The authors of three existing systematic reviews agreed that water fluoridation had little effect on bone fracture risk. There was no evidence on the effect of milk or salt fluoridation or topical fluorides on fracture risk or on cancer risk or on risk of other adverse effects. Regarding water fluoridation and the risk of cancer, a 2000 systematic review concluded that there was no clear association between it and cancer incidence or mortality either for “all cause” cancer or for osteosarcoma. Of four later studies investigating this issue, one case-control study suggested water fluoridation was associated with an increased risk of osteosarcoma in young males (but not females) however co-investigators noted in a Letter to the Editor (in the same journal issue that published the study) that they were unable to replicate these results in the wider study the osteosarcoma study was part of, so caution was needed. Two systematic reviews and three fair to poor original studies did not provide evidence sufficient to reach a conclusion about other possible negative effects of water fluoridation.

Watt RG. 2005. **Strategies and approaches in oral disease prevention and health promotion**. Bull World Health Organ 83(9) 711-8. http://www.scielosp.org/scielo.php?pid=s0042-96862005000900018&script=sci_arttext&tlng=en

This publication includes a useful table summarising the evidence base for various oral health interventions including water fluoridation, topical fluorides, fissure sealants, dental health education, periodontal health and screening for oral cancer. Two systematic reviews of low to moderate quality studies suggested that water fluoridation produces about a 14% reduction in caries and that the effect is greatest on the primary dentition. The findings of the Cochrane reviews on topical fluorides led to estimates that specific reductions in caries rates were 24% for fluoride toothpaste, 26% for mouth rinses, 28% for gels and 46% for varnishes with an overall estimate of benefit for topical fluorides of 26% in permanent dentition and 33% in primary dentition. The one Cochrane review on fissure sealants (see below) found that the level of caries reduction was dependant on the baseline caries rate and that caries reductions ranging from 86% at 12 months to 57% at 48 months were achieved. Five effectiveness reviews on dental education found that it was generally ineffective and that study design and evaluation quality was generally poor. Interventions studied included school-based tooth brushing campaigns, dietary interventions and mass media campaigns. While education may result in short term improvements in oral health knowledge there is little effect on long term behaviour or clinical outcomes.

Kay E, Locker D. 1998**. A systematic review of the effectiveness of health promotion aimed at improving oral health**. Community Dent Health 15(3) 132-44.

This review examined the effectiveness of oral health promotion on caries, oral hygiene, and oral health-related knowledge, attitudes and behaviours. The authors state that the available evidence allows very few conclusions to be drawn about the effectiveness of oral health promotion but that oral health promotion which leads to the use of fluoride is effective for reducing caries and chairside oral health promotion has been more consistently shown to be effective than other methods. Mass media education campaigns have not been demonstrated to be effective and the quality of research evaluating oral health promotion needs improving.

Centre for Reviews and Dissemination. 2011. **A systematic review of the effectiveness of health promotion aimed at improving oral health** (Structured abstract). Database of Abstracts of Reviews of Effects. 2011;2011(4).

In their commentary on the above review the CRD stated that this a was an average review based on a reasonable literature search but that the review authors did not explain the validity assessment they performed or relate it to the results presented. For this reason it was difficult to interpret the reliability of each of the studies included in the review. The commentary states “Given the heterogeneity in the studies in terms of intervention, design, populations and outcomes, it does not appear to have been appropriate to have pooled the results, especially as heterogeneity was not formally assessed. The pooled results should, therefore, be interpreted with extreme caution”. Overall, the CRD considers that “the authors' conclusions appear to be supported by the results presented.

Robinson PG, Deacon SA, Deery C, et al. 2005. **Manual versus powered toothbrushing for oral health**. Cochrane Database of Systematic Reviews 2005(2) Art. No.: CD002281. DOI:10.1002/14651858.CD002281.pub2.

This review included 42 RCT, with a total of 3855 participants, comparing manual with powered toothbrushes. 67% of the trials were funded by toothbrush manufacturers, with funding in the remainder unclear. In the short term brushes with a rotation oscillation action reduced plaque and reduced gingivitis more than manual toothbrushes (11% vs. 6%) but the clinical significance is unclear. The trials were too short to assess the effects on destructive periodontal disease.

Two other reviews considered aspects of oral health care, but found insufficient evidence to draw firm conclusions:

Pereira-Cenci T, Cenci MS, Fedorowicz Z, et al. 2009. **Antibacterial agents in composite restorations for the prevention of dental caries**. Cochrane Database of Systematic Reviews 2009(3) Art. No.: CD007819. DOI: 10.1002/14651858.CD007819.pub2.

Beirne P, Clarkson JE, Worthington HV. 2007. **Recall intervals for oral health in primary care patients**. *Cochrane Database of Systematic Reviews* 2007(4) Art. No.: CD004346. DOI: 10.1002/14651858.CD004346.pub3.

Other Relevant Publications

Ministry of Health. 2011. **Evaluation of the Māori Oral Health Providers Project**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/10686/$File/evaluation-maori-oral-health-providers.pdf

In 2007 five Māori health providers received Ministry of Health funding to purchase facilities in order to deliver oral health services. They then signed contracts with DHBs for the support and delivery of new oral health services and/or the maintenance and expansion of existing services. This publication reports on the evaluation of this project. Overall, the project enhanced the ability of Māori health providers to deliver oral health services within their communities and DHBs gained greater understanding of Māori health providers' capabilities and capacity.

Ministry of Health. 2010. **Our Oral Health: Key findings of the 2009 New Zealand Oral Health Survey**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/10514/$File/our-oral-health-2010.pdf

This publication reports on the clinical and self-reported results of the 2009 nationwide survey of New Zealand adults and children in the course of which 4906 people were interviewed and 3196 people received a dental examination. Key findings included that, while dental decay is still the most prevalent chronic disease in New Zealand, the oral health of New Zealanders has improved over time and, among children the proportion of 12-13 year olds who are caries-free increased from 29% in 1988 to 51% in 2009. Māori and Pacific children and young people had poorer access than other children and these groups had worse oral health outcomes, as did those in areas of high socio-economic deprivation.

Murdoch Children's Research Institute. 2009. **Maternal and Child Oral Health - Systematic Review and Analysis: a report for the New Zealand Ministry of Health**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/9418/$File/maternal-infant-oral-healthv2-aug09.pdf

This report reviewed the evidence concerning the impact of the oral health of pre-and post-natal women on the oral health of their children. Early childhood caries has its origins in the first year so interventions need to occur early, possibly before birth. The report addresses the evidence in five key areas and concludes with recommendations for the Ministry: further good quality NZ research, routine surveillance of the <5 age group to provide a baseline for measuring progress, community based, targeted interventions for oral health promotion aimed at socially disadvantaged women and those from high risk populations, and integrating oral health promotion with existing services such as Well Child / Tamariki Ora services or primary health services. It emphasises that any proposed oral health promotion programme needs to include an evaluation plan, incorporate significant community involvement, and be culturally appropriate and that there may be a place for home visiting. The core of any intervention should be primary prevention by tooth brushing with fluoride toothpaste and the provision of primary dental care. If the programme is to include identification of dental treatment needs then this should be provided as part of a comprehensive prevention and health promotion strategy, with direct links between screening and treatment providers. Appendices include summaries of the relevant research.

DHBNZ. 2006. **National School Dental Service Review Final Report**, December 2004. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/4754/$File/dhbnz-national-school-dental-service-review-final-report.pdf

In 2004, the Ministry of Health commissioned District Health Boards to undertake a review of school dental services in their regions. Project management for the review was provided by DHBNZ who summarised the reports into one document. This report provides a summary of the key points raised by the DHBs and the various ideas for future service configurations, acknowledging that different DHBs serve different populations with different service needs.

Mauri Ora Associates. 2004. **Review of Māori Child Oral Health Services**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/4755/$File/review-of-maori-child-oral-health.pdf

This is the report of a review commissioned by the Ministry of Health and produced by Mauri Ora Associates who reviewed 16 Māori providers to evaluate their operations and experiences. It discusses the ways services are being delivered and provides twelve recommendations for reducing inequalities.

National Health Committee. 2003. **Improving Child Oral Health and Reducing Child Oral Health Inequalities**. Wellington: National Advisory Committee on Health and Disability. http://www.nhc.health.govt.nz/sites/www.nhc.health.govt.nz/files/documents/publications/chldoralhth.pdf

This report to the Minister of Health from the Public Health Advisory Committee (PHAC) provides advice on how to improve child oral health and reduce oral health inequalities. The PHAC identified seven areas where they believed chances or improvements could be made: influencing socioeconomic determinants; improving Māori oral health; encouraging fluoridation; reorienting oral health services; developing a responsive and skilled workforce; obtaining better information about child oral health and inequalities, and using child oral health as an indicator of health inequalities. Each of these areas is discussed in detail and recommendations are made regarding appropriate action.

PERMANENT HEARING LOSS

In New Zealand each year, it is estimated that 135–170 babies are born with mild to profound permanent congenital hearing loss, representing an incidence of 3 per 1,000 births [198]. In response to concerns regarding the late age of diagnosis of congenital hearing losses (average age 35.1 months when screening was based on the presence of risk factors [199]), the Government in its 2006 Budget, announced a funding package ($16 million over four years) to establish a Universal Newborn Hearing Screening and Early Intervention Programme (UNHSEIP). The Programme has been rolled out over a three year period (2007–2010) [200] and now that the Programme is fully implemented, the Ministry of Health has recently begun producing Programme monitoring reports. These reports describe the proportion of babies undergoing newborn hearing screening in each DHB, as well as the proportion referred for further audiological investigation [201].

The following section reviews the most recent data available on newborn hearing screening in New Zealand. Because at the time of writing, time series information on the number of babies diagnosed with permanent hearing loss is not available from UNHSEIP data, the section begins by briefly reviewing some historical and contemporary data from the Deafness Notification Database, the only other national source of information on the number of children and young people with permanent hearing loss in New Zealand.

Deafness Notification Database

Background

The main purpose of the Deafness Notification Database (DND), which was funded by the Ministry of Health between 1982 and 2005, was to collect and report on new cases of hearing loss diagnosed in New Zealand-born children and young people. The database was not operational during 2006–2009, but in 2010 it was re-launched by the NZ Audiological Society. Although a number of changes have been made to the way in which the data are collected and reported, the Society has tried to maintain as much continuity as possible between the two periods [202].

Old and New Notification Criteria

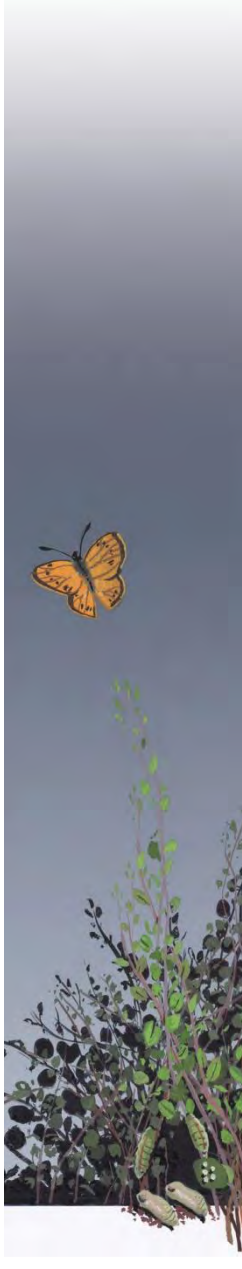
During 1982–2005, when the DND was managed by the National Audiology Centre, it collected information on children meeting the following criteria [199]:

1. Children needed to be <18 years of age, with congenital hearing losses or any hearing loss not remediable by medical or surgical means which required hearing aids and/or surgical intervention.
2. Children needed to have an average bilateral hearing loss (over 4 audiometric frequencies 500–4000 Hz) of >26 dBHL in the better ear.
3. Children were excluded if their hearing loss was<26 dBHL, unilateral, acquired or they were born overseas.

In 2010 the DND was re-launched by the NZ Audiological Society, with audiologists being encouraged to notify newly diagnosed hearing losses via a new online form. Following consultation, the database was extended to also include [202]:

1. Children with an average hearing loss (over 4 audiometric frequencies 500–4000 Hz) of >26 dBHL in ONE ear (i.e. unilateral losses).
2. Children who were born outside of New Zealand [202].

Additional audiological guidance also suggested that while hearing losses arising from atresia, congenital ossicular fixation, meningitis and other acquired hearing losses should be included, hearing losses which could be fixed by the use of grommets (e.g. hearing losses associated with otitis media) should be excluded. This led to 180 notifications meeting the new criteria in 2010. Indications from previous DND data suggest that the



2010 dataset was likely to have captured 50–80% of new cases of hearing loss diagnosed in New Zealand children aged 0–17 years during 2010 [202].

Data Sources and Methods

Indicator

1. *Notifications to the New Zealand Deafness Notification Database*

Numerator: Children Aged 0–17 Years notified to the Deafness Notification Database who met the Database's notification criteria (see text above for criteria used).

All of the data in this section was derived from the National Audiology Centre's Annual Deafness Notification Database Reports 1998–2004 [199] or from the Deafness Notification Report 2010 produced by Digby et al for the NZ Audiological Society [202].

Notes on Interpretation

Note 1: The hearing loss severity scale used by the DND during 1996–2005, and the likely clinical implications of such hearing losses are briefly outlined below.

**Mild Loss (26–40 dBHL):* This may result in some difficulties in hearing soft speech and conversations (persons sound as if mumbling) but children can often manage in quiet situations with clear voices. Speech and language usually develop normally if the child is fitted early with hearing aids [203].

* *Moderate Loss (41–65 dBHL):* This may result in difficulty understanding conversational speech, particularly in the presence of background noise. The volume of the TV and radio will need to be turned up to be heard. Speech and language will generally be affected if a hearing aid is not provided early. A hearing aid will assist most hearing difficulties if speech discrimination is good and the listening environment is not too noisy [203].

* *Severe Loss (66–95 dBHL):* This will result in normal conversational speech being inaudible and only raised voices at close distance being understood. Speech and language will not develop spontaneously in children with severe hearing loss. Hearing aids will amplify many speech sounds and will greatly assist children in developing speech, although speech quality is likely to be affected. Some children may benefit from a cochlear implant [203].

* *Profound (96+ dBHL):* Learning to speak without significant support is very difficult, although there is individual variation. There is greater inconsistency in benefit derived from hearing aids: some children can understand clear speech in quiet conditions when wearing a hearing aid, while others derive little benefit. Children with losses in this range should be considered for cochlear implants, with benefits being evident, especially if implanted at a young age [203].

Note 2: DND data are presented by year of notification, rather than year at first identification, with the degree of hearing loss assessed using the dBHL ranges outlined above. As notification is not mandatory, these statistics may undercount the number of children with permanent hearing loss. In addition, the DND's notification criteria changed during the reporting period (as outlined above) and this must be taken into account when interpreting the data in this section.

Note 3: Tests of statistical significance have not been applied to the data in this section, and thus the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution of Hearing Loss by Type

In New Zealand during 2010, a total of 120 notifications were received by the DND for children with bilateral hearing losses of >26dB in the better ear. In addition, 60 notifications were received for children with unilateral losses, which previously would not have met DND criteria. While a number of notifications were also received for children with slight losses, these were not included in the analysis of DND data (**Table 127**).

Table 127. Deafness Notification Database Notifications by Type of Hearing Loss, New Zealand 2000–2005 and 2010

Type of Hearing Loss	Original Database						Re-Launched Database
	2000	2001	2002	2003	2004*	2005	2010
Bilateral Loss – Better Ear >26dB	**92**	**202**	**113**	**144**	**155**	**93**	120
Unilateral Loss	14	54	38	51	68	51	60

Source: Deafness Notification Database via Digby et al [202]; Note: 2001 figures include 44 retrospective notifications. In addition, as the result of an audit, 288 retrospective notifications were made in 2004, with 157 meeting the new criteria. They are not included here as they cannot be attributed to any one year; Numbers in bold indicate totals previously reported using old DND criteria.

New Zealand Distribution by Severity of Loss

In New Zealand during 2010, 15% of notifications to the DND were for children with profound losses. A further 6% were for children with severe losses, 37% were for children with moderate losses and 42% were for children with mild losses (**Table 128**).

Table 128. Notifications to Deafness Notification Database by Degree of Hearing Loss Using Old Criteria, New Zealand 2001–2004 and 2010

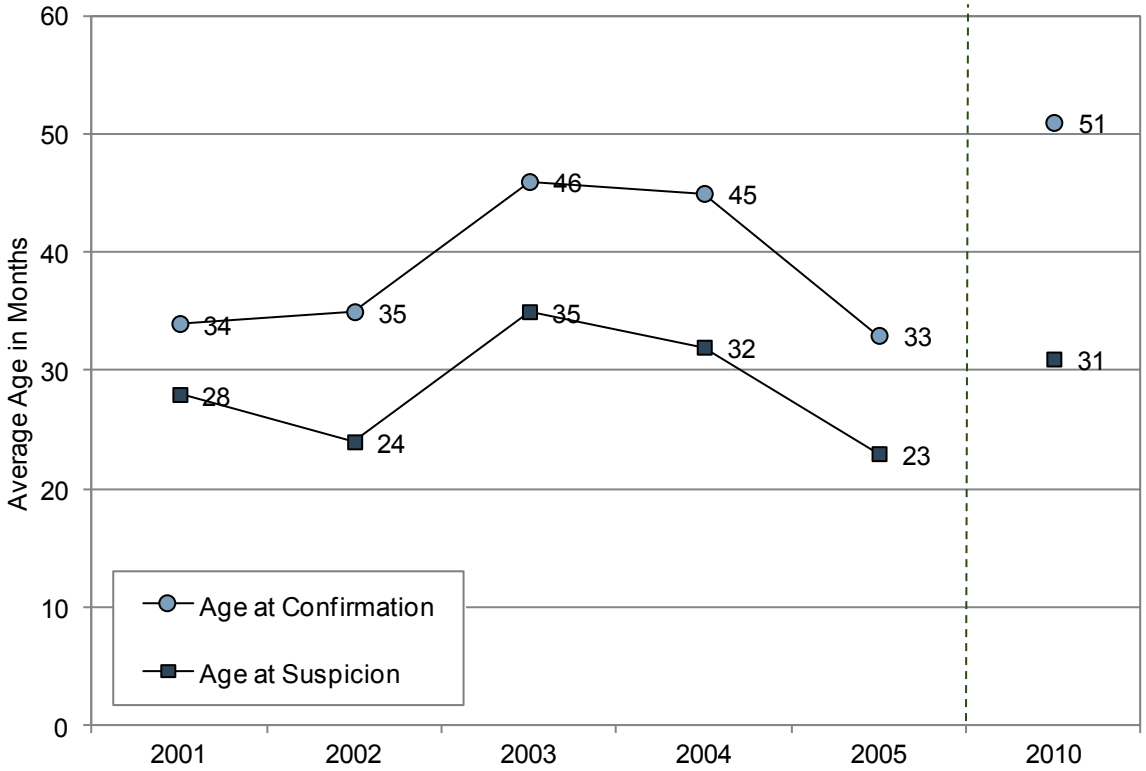
Degree of Hearing Loss	Proportion of Cases Notified (%)				
	2001	2002	2003	2004	2010
Mild	47	47	56	43	42
Moderate	35	39	33	34	37
Severe	10	9	6	15	6
Profound	8	5	5	7	15
Total	100	100	100	100	100

Source: Deafness Notification Database via Digby et al [202]

Average Age at Suspicion and Confirmation of Hearing Loss

In New Zealand during 2010, when unilateral, acquired and overseas born cases were excluded (in order to ensure comparability with previous years) the average age at confirmation of a hearing loss was 51 months, although the average age of suspicion was much earlier (31 months) (**Figure 128**). It is unclear however the extent to which changes in hearing screening (both newborn and at 4–5 years) and year to year differences in the completeness of the DND contributed to the variations in age of confirmation seen during this period.

Figure 128. Average Age of Suspicion and Confirmation of Hearing Losses, New Zealand Deafness Notification Database 2001–2005 and 2010



Source: Deafness Notification Database via Digby et al [202]. Note: In order to ensure comparability, 2010 cases were only included if they met earlier DND criteria (i.e. acquired, unilateral and overseas cases excluded)

New Zealand Distribution by Ethnicity

In New Zealand during 2010, 101 children notified to the DND identified as European, 59 as Māori, 18 as Pacific, 13 as Asian/Indian and 5 as Middle Eastern/Latin American/African. As total response ethnicity was used, it was not possible to provide an overall breakdown of the proportions of children notified from each ethnic group [202].

Distribution by Region

Table 129 reviews the number of notifications received by the Deafness Notification Database by region using its old criteria during 1998–2004, while **Table 130** reviews the number of notifications received by DHB using the new criteria during 2010.

In the Midland Region during 2010, a total of 38 children were notified to the Deafness Notification Database (**Table 130**).

Table 129. Number of Notifications Meeting the Old Criteria for Inclusion in Deafness Notification Database by Region of Residence, New Zealand 1998–2004

Region of Residence	Notification Year						
	1998	1999	2000	2001*	2002	2003	2004*
Northland	10	8	11	10	5	7	10
Auckland Region	21	35	40	74	36	52	37
Waikato	7	13	9	19	10	9	15
Lakeland	3	<3	0	3	3	3	6
Bay of Plenty	10	6	4	21	6	12	9
Tairawhiti	3	0	<3	3	<3	<3	5
Taranaki	<3	<3	<3	<3	3	3	8
Hawke's Bay	<3	<3	<3	31	5	4	5
Manawatu	3	3	0	12	7	12	24
Wellington	3	10	5	8	12	17	5
Nelson Marlborough	<3	3	<3	<3	3	4	4
West Coast	0	0	0	0	<3	<3	<3
Canterbury	0	3	7	10	12	9	10
South Canterbury	0	<3	<3	4	<3	3	3
Otago	0	<3	8	5	5	3	7
Southland	<3	3	<3	0	3	4	6
New Zealand Total	65	90	92	202	113	144	155

Source: National Audiology Centre [199]; Note: 2001 figures include 44 retrospective notifications; During 2004 an additional 157 retrospective cases which had not been notified over an 11-year period were added to the database, but are not included in this total.

Deafness Notification Database Summary

In New Zealand during 2010, 120 notifications were received by the Deafness Notification Database for children with bilateral hearing losses of >26dB in the better ear and 60 notifications were received for children with unilateral losses. During 2010, 15% of children notified to the DND had profound losses, 6% had severe losses, 37% had moderate losses and 42% had mild losses. When unilateral, acquired and overseas born cases were excluded, the average age at confirmation of a hearing loss in 2010 was 51 months, although the average age of suspicion was much earlier (31 months).

In the Midland Region during 2010, a total of 38 children were notified to the Deafness Notification Database.

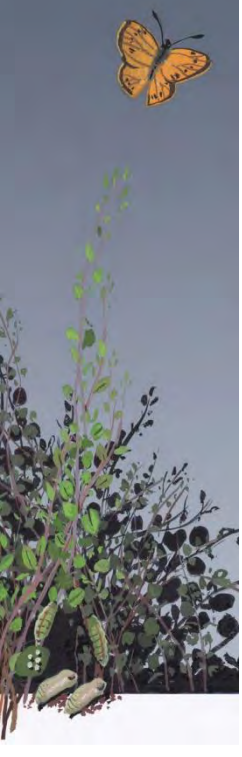


Table 130. Number of Notifications Meeting New Criteria for Deafness Notification Database by District Health Board, New Zealand 2010

DHB	Number of Notifications	Percent of Notifications
Northland	12	6.7
Waitemata	4	2.2
Auckland	10	5.6
Counties Manukau	25	13.9
Waikato	15	8.3
Bay of Plenty	13	7.2
Lakes	<3	1.1
Hawke's Bay	9	5
Tairawhiti	<3	1.1
Taranaki	6	3.3
MidCentral	4	2.2
Whanganui	0	0
Wairarapa	0	0
Hutt	5	2.8
Capital and Coast	24	13.3
Nelson Marlborough	<3	0.6
Canterbury	44	24.4
South Canterbury	<3	0.6
West Coast	<3	1.1
Southern	<3	0.6
New Zealand	180	100

Source: Deafness Notification Database via Digby et al [202]

Newborn Hearing Screening

Background

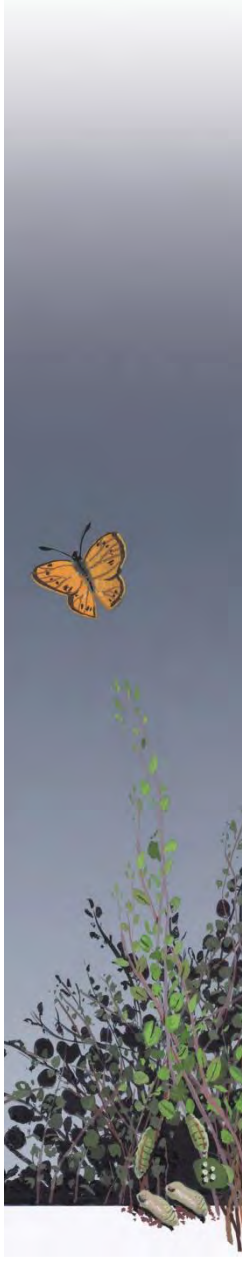
In response to concerns regarding the late age of diagnosis of congenital hearing losses, in 2006 the Government announced funding for the development of the Universal Newborn Hearing Screening and Early Intervention Programme (UNHSEIP). The goals of the Programme were to ensure that [201]:

- Babies were screened for hearing loss by 1 month of age
- Audiology assessments were completed by 3 months of age
- Initiation of appropriate medical, audiological and early intervention services occurred by 6 months of age.

As a result, for babies born in hospital, screening is now offered in most cases before the baby goes home, with those born elsewhere, or not managing to be screened prior to discharge, being able to access screening on an outpatient basis.

Screening is usually undertaken while the baby is asleep or quietly resting, with two types of screening being available:

- *Automated Otoacoustic Emissions (AOAE):* Sensory cells in the cochlea of the inner ear oscillate in response to an external sound, with these oscillations generating an 'echo', which passes from the inner ear to the ear canal, and which can be detected as sound. These sounds, known as otoacoustic emissions (OAEs), are a sign that the ear is functioning normally and the measurement of OAEs can be used to test normal cochlear function in the newborn. Testing involves placing a small earphone and microphone in the ear, playing a sound and recording the response from the ear. If a



baby has a normal functioning inner ear, an OAE is produced and this can be picked up by the microphone in the ear-canal [203].

- *Automated Auditory Brainstem Response (AABR):* The AABR is a series of electrical waves that can be recorded from electrodes on the scalp, in response to brief sounds being played into the ear. The presence of these waves with changing sound intensity is highly correlated with different hearing thresholds, with the AABR being used to assess the integrity of the ear and auditory nerve pathways to the brainstem in newborn babies [203].

During 2007–2010, the UNHSEIP was rolled out progressively across all DHBs, with the Ministry of Health being responsible for screening, the audiological diagnosis of hearing loss and medical interventions, and the Ministry of Education being responsible for Early Intervention Services [204]. The following section presents data from the UNHSEIP's most recent monitoring report, which reviews newborn hearing screening in participating DHBs for the period 1st April–30th September 2011.

Data Sources and Methods

Indicators

1. Proportion of eligible newborns whose parents/guardians consent to newborn hearing screening

Numerator: Number of eligible newborns whose parents/guardians consent to newborn hearing screening

Denominator: Number of eligible live births

2. *The proportion of eligible newborns that complete the UNHS screening protocol by one month of age*

Numerator: Number of eligible newborns who completed newborn hearing screening by one month of age

Denominator: Number of eligible newborns who completed newborn hearing screening

3. Proportion of newborns who do not pass hearing screening and are referred to audiology

Numerator: Number of eligible newborns who complete screening with a referral for audiology assessment

Denominator: Number of eligible newborns who complete screening

4. Proportion of newborns that pass screening but have risk factors for developing late onset or progressive hearing loss

Numerator: Number of newborns that pass screening but have risk factors for developing late onset or progressive hearing loss (e.g. family history, craniofacial anomalies, jaundice, NICU >5 days, intrauterine infections, meningitis)

Denominator: Number of eligible newborns who passed screening.

Notes on Interpretation

Note 1: All of the data in this section are derived from the UNHSEIP's second monitoring report [205], which covers the six month period from 1 April 2010 to 30 September 2010. All but one DHB (Southern) had implemented newborn hearing screening by the beginning of this period, and by the end of the period all DHBs were offering screening. Thus while reporting includes data from all 20 DHBs, data for Southern DHB is only from August 2010 onwards.

Note 2: All denominators in UNHSEIP reports are derived from the Birth Registration Dataset and include live births for the relevant period.

Note 3: Tests of statistical significance have not been applied to the data in this section, and thus the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

Distribution by DHB

In New Zealand during 1 April 2010–30 September 2010, the caregivers of 77.8% of eligible babies consented to newborn hearing screening, although this proportion varied considerably by DHB. Of those completing screening 94.0% did so within one month, with on average 2.4% of babies completing screening receiving an audiology referral. Of those babies who passed screening, a further 7.4% were deemed to have risk factors for delayed onset/progressive hearing loss (e.g. family history, craniofacial anomalies, intrauterine infections) which warranted follow up over time (**Table 131**).

In the Midland Region, the proportion of babies consenting to screening was ≥99% in all 5 DHBs, with the proportion being referred for audiology assessment ranging from 0.9% to 2.3%. In addition the proportion being targeted for follow up ranged from 5.4% to 11.1% (**Table 131**).

Table 131. Newborn Hearing Screening Indicators by District Health Board, New Zealand 1 April 2010 to 30 September 2010

DHB	Number of Births in Period	Consenting to Screening (%)	Completed Screening ≤1 Month*(%)	Referrals to Audiology* (%)	Targeted for Follow Up* (%)
Newborn Hearing Screening					
Northland	1,157	46.4	66.0	4.6	14.6
Waitemata	3,862	48.8	93.5	1.2	6.3
Auckland	3,179	96.9	94.4	4.4	4.7
Counties Manukau	4,231	49.3	97.6	6.3	8.7
Waikato	2,675	101.0	95.7	1.7	7.1
Lakes	738	109.6	95.1	1.9	6.9
Bay of Plenty	1,394	99.0	95.9	0.9	5.4
Tairawhiti	341	105.3	97.7	0.9	6.3
Taranaki	764	100.3	88.4	2.3	11.1
Hawke's Bay	1,058	106.0	98.2	1.9	8.8
Whanganui	424	96.0	87.8	2.2	9.6
Mid Central	1,168	54.1	83.1	2.2	12.3
Hutt Valley	1,038	105.6	99.5	1.1	13.8
Capital & Coast	1,930	96.3	98.4	0.5	7.7
Wairarapa	247	78.5	97.4	0.5	7.3
Nelson Marlborough	844	94.8	90.9	1.0	8.6
West Coast	209	60.8	95.2	<0.1	10.4
Canterbury	3,231	94.9	93.5	2.1	4.4
South Canterbury	318	98.7	98.7	1.3	4.6
Southern*	1,753	38.0	85.9	2.8	8.3
New Zealand	30,694	77.8	94.0	2.4	7.4

Source: National Screening Unit 2011 [205]. Note: Data for Southern DHB is from August 2010 onwards; Consent rates in excess of 100% may arise as live birth denominators are based on DHB of domicile, while screening in a small number of cases may be carried out in a different DHB (see Monitoring Report [205] for further detail); See Methods for Indicator Definitions.

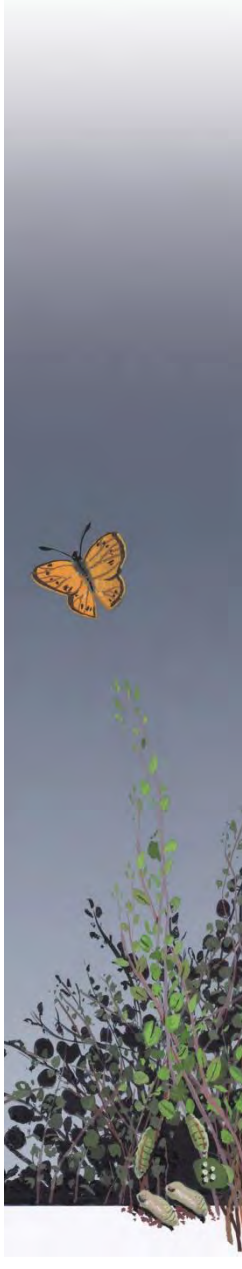
Distribution by Ethnicity, NZDep Index Decile and Birth Location

In New Zealand during 1 April 2010–30 September 2010, there were no marked differences by ethnicity or NZDep decile in the proportion of babies who completed screening within one month, although those who were born at home had lower completion rates than those born elsewhere. While there were some variations in audiology referrals and those targeted for follow up by ethnicity, NZDep decile and birth location, the significance of these differences remains unclear, as no assessments of statistical significance were available for these data (**Table 132**).

Outcome of Audiology Referrals

Of babies referred to audiology during April–September 2010, 40.5% started audiology assessment, although this varied by DHB (range 0% to 75%). This proportion should be interpreted with caution however, as some DHBs did not submit audiology forms to the National Screening Unit (NSU) and there were delays in entering some data into the national database due to missing information. Of 563 babies who did not pass screening and were referred to audiology, audiology information was recorded in the national database for just 228 [205].

Of those babies with information in the national database, all that started audiology assessment completed the assessment, with 64% of those completing doing so by three



months of age. Eleven babies (4.8% of those completing assessment) had a permanent / congenital hearing loss identified, with only one being a Neonatal Intensive Care Unit/Special Care Baby Unit (NICU/SCBU) baby. A higher proportion was identified with a conductive or mixed hearing loss (24.1% of those who completed assessment). In terms of the age at which hearing loss was identified, in 9 cases this was by 4 weeks, in 13 cases by 8 weeks, in 16 cases by 12 weeks and the remaining 27 cases by over 12 weeks [205].

Table 132. Newborn Hearing Screening Indicators by Ethnicity, NZ Deprivation Index Decile and Birth Location, New Zealand 1 April 2010 to 30 September 2010

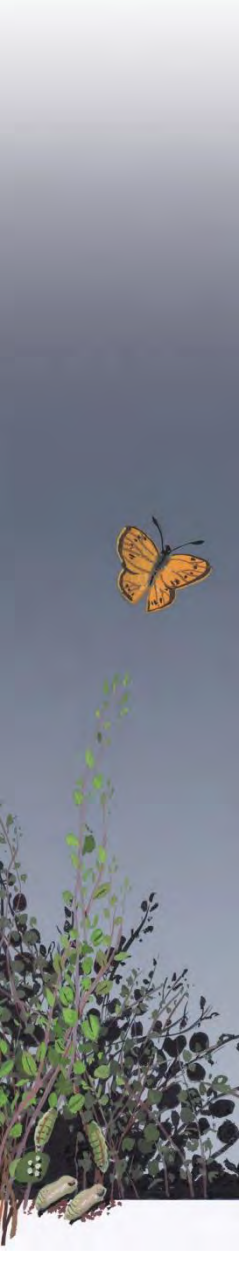
Variable	Completed Screening ≤1 Month* (%)	Referrals to Audiology* (%)	Targeted for Follow Up* (%)
Newborn Hearing Screening			
Ethnicity			
Māori	92.8	2.8	9.2
Pacific	95.5	4.4	6.6
Asian/Indian	96.2	2.7	4.4
European	93.8	1.7	7.3
Other	95.7	2.9	6.3
NZ Deprivation Index Decile			
Decile 1–2	95.2	1.7	7.1
Decile 3–4	93.7	1.9	6.3
Decile 5–6	94.0	1.9	6.6
Decile 7–8	93.4	2.4	7.9
Decile 9–10	94.2	3.3	8.2
Birth Location			
Public Hospital	94.4	2.4	7.4
Private Hospital	95.6	1.1	3.3
Home	74.0	2.7	8.1
Other Location	88.2	<0.1	17.6
New Zealand Total	94.0	2.4	7.4

Source: National Screening Unit 2011 [205]. Note: See Methods for indicator definitions

Newborn Hearing Screening Summary

In New Zealand during 1 April 2010–30 September 2010, the caregivers of 77.8% of eligible babies consented to newborn hearing screening, although this proportion varied considerably by DHB. Of those completing screening 94.0% did so within one month, with on average 2.4% of babies completing screening receiving an audiology referral. Of those babies who passed screening, a further 7.4% were deemed to have risk factors for delayed onset/progressive hearing loss which warranted follow up over time.

In the Midland Region, the proportion of babies consenting to screening was ≥99% in all 5 DHBs, with the proportion being referred for audiology assessment ranging from 0.9% to 2.3%. In addition the proportion being targeted for follow up ranged from 5.4% to 11.1%.



Local Policy Documents and Evidence-Based Reviews Relevant to the Management of Permanent Hearing Loss

In New Zealand a range of policy documents focus on the early identification of permanent hearing loss, and these are briefly summarised in **Table 133**, along with a number of evidence-based and other reviews which consider the identification or management of permanent hearing loss in the child and youth population.

Table 133. Policy Documents and Evidence-Based Reviews Relevant to the Early Detection and Management of Permanent Hearing Loss in Children and Young People

Ministry of Health Policy Documents
Universal Newborn Hearing Screening Advisory Group. 2005. **Universal Newborn Hearing Screening for New Zealand 2005: A Report of the Universal Newborn Hearing Screening Advisory Group to the National Screening Unit**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/0/D71ADADE4D79E24ECC2571210075DD7B/$File/universalnewbornfeb06.pdf This report contains the findings and recommendations of the Universal Newborn Hearing Screening Advisory Group to the National Screening Unit regarding high-level policy and implementation issues for a (then) future universal newborn hearing screening programme for New Zealand. It contains background information on congenital hearing loss and New Zealand statistics, and summarises the benefits of lowering the average age of detection of hearing loss. It also addresses issues relevant to intervention services and the design and operation of screening services.
Ali W, O'Connell R. 2007. **The effectiveness of early cochlear implantation for infants and young children with hearing loss**. NZHTA Technical Brief June 2007, 6(5). http://nzhta.chmeds.ac.nz/index.htm This Technical Brief produced by New Zealand Health Technology Assessment (NZHTA) was commissioned by the Ministry of Health. It aimed to compare the effectiveness of cochlear implantation at earlier and later ages. No eligible systematic reviews were found so 15 studies that were cross-sectional, case control or cohort studies were appraised. Implantation at less than 24 months of age was found to be more effective in terms of audiological performance, communication outcomes, educational achievement and quality of life than implantation at more than 24 months but it was unclear whether implantation at less than 12 months was more effective than implantation at more than 12 months.
Project HIEDI. 2004. **Improving outcomes for children with permanent congenital hearing impairment. The case for a national newborn hearing screening and early intervention programme for New Zealand**. Auckland: Project HIEDI. http://www.nfd.org.nz/?t=56 This very comprehensive report (with 435 references) includes information on hearing loss in general, the effects of permanent congenital hearing loss, New Zealand data, and issues relating to universal newborn hearing screening and early intervention programmes and international experience with them. The authors state “This proposal is well supported within the sector, with both professional and consumer groups unified around its value, across health and education, deaf and hearing-impaired, Māori and non-Māori.”
Systematic and Other Reviews From the International Literature
King AM. 2010. **The national protocol for paediatric amplification in Australia**. International Journal of Audiology, 49 Suppl.1, S64-9.http://informahealthcare.com/doi/abs/10.3109/14992020903329422?genre=article&id=doi%3A10.3109%2F14992020903329422 This is the Australian national protocol for amplification for hearing impaired children. It gives guidelines for selecting candidates for hearing aid fitting or referral to cochlear implant programmes and also covers management of children who have auditory neuropathy spectrum disorder and children who have mild and unilateral hearing loss. It describes the protocol for selection of hearing aids, hearing aid fitting and verification procedure and hearing-aid evaluation and also the criteria for supplying personal frequency modulated (FM) systems.
American Academy of Pediatrics, Joint Committee on Infant Hearing. 2007. **Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs**. Pediatrics, 120(4), 898-921. http://www.pediatrics.org/cgi/content/full/120/4/898 The position statement of the Joint Committee on Infant Hearing endorses screening of all newborns so that infants with hearing loss can receive the earliest possible intervention to maximise their opportunities to develop linguistic, literary, cognitive and social-emotional competence, so that their educational and vocational attainment in adulthood can be as good as that of their hearing peers. It provides guidelines on screening protocols, evaluation of hearing impaired children detected by screening programmes, early intervention programmes, continued surveillance of infants and toddlers, protection of infant and family rights, information infrastructure, benchmarks and quality indicators and reports on current challenges, opportunities, and future directions in the field.

McKay S, Gravel JS, Tharpe AM. 2008. **Amplification considerations for children with minimal or mild bilateral hearing loss and unilateral hearing loss**. Trends in Amplification, 12(1), 43-54.

This review suggests there is limited evidence on which to base the decision as to whether or not to provide hearing technology for children who have minimal or mild bilateral hearing loss or unilateral hearing loss. These children have a greater risk for academic, speech-language, and social-emotional difficulties than their normal hearing peers but it is unknown how to identify those at greatest risk for these difficulties and whether the provision of early amplification assistance will help prevent them. The current hearing technology options for these children are also reviewed.

Centre for Allied Health Evidence review team. 2007. **A Systematic Review of the Literature on Early Intervention for Children with a Permanent Hearing Loss Volumes I and 2**. Brisbane: Queensland Health. http://www.health.qld.gov.au/healthyhearing/pages/publications.asp

The Centre for Allied Health Evidence was commissioned by Queensland Health to identify variables associated with successful early intervention for children aged 0–3 years with permanent hearing loss. The review found good evidence for the influence of age at detection of hearing loss, age at implantation (whether of hearing aids or cochlear implants), age at onset of hearing loss, and duration of hearing loss on outcomes. It states that whether children use hearing aids or cochlear implants they should be adequately supported through high quality, intensive programs to develop communication skills. It found a lack of high level, high quality research investigating the effectiveness of one particular communication approach over another. It identifies significant areas of ongoing research.

Corabian P, Eng K, Lier D, et al. 2007. **Screening Newborns for Hearing**. Edmonton: Institute of Health Economics. http://www.ihe.ca/publications/library/2007/screening-newborns-for-hearing/

This Canadian review considered three aspects of Universal Newborn Hearing Screening (UNHS) using Automatic Otoacoustic Emissions and/or Automated Auditory Brainstem Response: the social considerations, the published evidence of efficacy/effectiveness and safety, and cost effectiveness (via a review of the economic literature).The authors concluded that such screening is effective in detecting moderate to profound permanent congenital hearing loss but that there is as yet limited evidence for the safety and clinical efficacy of UNHS from well designed clinical trials or that early detection leads to more effective habilitation.

Puig T, Municio A, Meda C. 2005. **Universal neonatal hearing screening versus selective screening as part of the management of childhood deafness**. Cochrane Database of Systematic Reviews, 2005(2), Art. No.: CD003731. DOI:10.1002/14651858.CD003731.pub3.

This review compares the effectiveness of a universal neonatal screening and early intervention program with two alternatives: screening and treatment of high risk neonates only and opportunistic screening and treatment. The authors found no randomised controlled trials comparing universal newborn hearing screening with either of the other two options and concluded that the effectiveness of universal newborn hearing screening programs had not yet been established. This Review was withdrawn from Issue 1, 2010 of The Cochrane Library onwards because the review authors were unable to continue updating.

Other Relevant Publications

Grewal S, Merchant T, Reymond R, et al. 2010. **Auditory late effects of childhood cancer therapy: A report from the Children's Oncology Group**. Pediatrics, 125(4), e938-50.

Some forms of therapy for childhood cancer can cause hearing loss, particularly platinum compounds (used to treat neuroblastoma, hepatoblastoma, osteosarcoma, and germ-cell tumours) and radiation (for head and neck tumours).This report from the Auditory/Hearing Late Effects Task Force of the Children's Oncology Group had four aims: to review ototoxicity from childhood cancer therapy, to describe the cochlear pathophysiology and genetics of cisplatin-related hearing loss, to explain the impact of chemotherapy and radiation induced hearing loss and to provide recommendations for the evaluation and management of children at risk of hearing loss due to cancer treatment.

Lieu JE. 2004. **Speech-language and educational consequences of unilateral hearing loss in children**. Archives of Otolaryngology -- Head & Neck Surgery, 130(5), 524-30.

This review considered the effects of unilateral hearing loss on the development of speech and language and educational achievement. It found that for school age children with unilateral hearing loss there appeared to be increased rates of grade failures, need for extra educational help and perceived behavioural issues in the classroom. Some of these children had delays in speech and language and it was unclear whether these lessened with increasing age. It recommended further research in these areas.

Systematic and Other Reviews on Cochlear Implants

Vlastarakos PV, Candiloros D, et al. 2010. **Diagnostic challenges and safety considerations in cochlear implantation under the age of 12 months**. International Journal of Pediatric Otorhinolaryngology, 74(2), 127-32.

This review considers the current knowledge on cochlear implantation in children aged less than 12 months, including diagnostic, surgical and anaesthetic challenges. The studies reviewed included 3 meta-analyses, 4 prospective controlled studies, 25 prospective studies, 21 retrospective studies, 1 guideline, 8 review articles and 4 books. Based on a meta analysis of 125 infants the authors conclude that there is not an increased anaesthetic or surgical risk associated with infancy. Detection of other developmental issues which may affect the likelihood of developing normal speech and language is challenging but there are appropriate evaluation techniques for reliable assessment of the prelexical domains of infant development.

Bond M, Elston J, Mealing S, et al. 2009. **Effectiveness of Multi-Channel Unilateral Cochlear Implants for Profoundly Deaf children: A systematic review**. Clinical Otolaryngology, 34(3), 199-211.

This review considered the evidence comparing the effectiveness of unilateral cochlear implants with non-technological support or acoustic hearing aids in children with profound bilateral hearing loss. 15 suitable studies were identified but the degree of heterogeneity in design and outcomes precluded meta-analysis. However, all studies reported that for all outcomes measured, unilateral cochlear implants produced improvement. Five economic evaluations found that unilateral cochlear implants were cost-effective for profoundly deaf children at UK implant centres. The authors considered that the systematic review process gave greater weight to the positive findings of the15 papers reporting on this subject and noted that an RCT to prove the effectiveness of cochlear implants would be unethical.

Johnston JC, Durieux-Smith A, Angus D, et al. 2009. **Bilateral paediatric cochlear implants: A critical review**. International Journal of Audiology, 48(9), 601-17.

This review evaluated the research on bilateral cochlear implants. Of the 29 studies that met the inclusion criteria there were no RCTs, 4 reviews, 1 national survey of Cochlear Implant centres in the US, 15 cohort studies, 2 case control studies and 7 case series or case studies. All of the studies had small sample sizes (<50). The authors found that sound localisation and speech recognition in noise seemed to be improved with bilateral cochlear implants compared to a unilateral implant and that the greatest benefits occurred when the second implant was done early. They recommended further research on cost-effectiveness, quality of life, speech, language & psycho-educational measures.

Papsin BC, Gordon KA. 2008**. Bilateral cochlear implants should be the standard for children with bilateral sensorineural deafness**. Current Opinion in Otolaryngology & Head & Neck Surgery, 16(1), 69-74.

This review considered the literature on bilateral cochlear implantation in children and recommended simultaneous bilateral implantation when possible and if not then the shortest possible interval between implantation of the first and second ears. It recommended further research to determine the interval after which bilateral cochlear implantation provides so little benefit that it is not cost-effective.

Papsin BC, Gordon KA. 2007. **Cochlear implants for children with severe-to-profound hearing loss**. New England Journal of Medicine, 357(23), 2380-7. http://content.nejm.org/cgi/content/full/357/23/2380

In this review on cochlear implants, the authors state: “To our knowledge, large, randomized trials comparing cochlear implants with other forms of hearing assistance have not been performed.” However young children receiving a cochlear implant have normally been previously fitted with hearing aids and found to have received no benefit from them. There is a strong correlation between the successful development of language in children with early-onset deafness and cochlear implantation between 12 and 24 months of age. In the absence of auditory stimulation, changes occur in the central auditory system, which mean that the longer the child waits for a cochlear implant the less satisfactory the outcomes are. There is some uncertainty about the youngest safe age at which to perform implantation but interest in early implantation (<1 year) is increasing. There is evidence that bilateral implantation provides extra benefits with better hearing in noisy situations, an ability to discriminate between sounds at different locations, and evidence of binaural processing in the brainstem. Parental commitment to post operative therapy programs focusing on the development of auditory skills is important. Minor perioperative complications are relatively common (15-20%) and include peri-lymphatic fistula or cerebrospinal fluid leak, tinnitus, vertigo, facial-nerve weakness or paralysis, epidural hematoma, and cellulitis of the surgical flap. Major complications requiring further surgery, which tend to occur later, are rarer (2-5%) and include flap necrosis, otitis media, cholesteatoma formation, non-auditory stimulation of the facial nerve, and electrode extrusion. Long term device failure can occur for various reasons requiring re-implantation which although challenging to perform produces results as good as or better than the original implantation.

Bond M, Mealing S, Anderson R, et al. 2009. **The effectiveness and cost-effectiveness of cochlear implants for severe to profound deafness in children and adults: A systematic review and economic model**. Health Technology Assessment, 13(44), 1-96.

This review considered two issues: whether it is clinically effective and cost-effective to provide a unilateral cochlear implant for severely to profoundly deaf people (who do or do not use hearing aids); and whether it is clinically effective and cost-effective to provide bilateral cochlear implants for severely to profoundly deaf people who have a single cochlear implant (who do or do not use a hearing aid as well). This systematic review found 33 suitable papers of which only 2 were randomised controlled trials. The authors also developed a state-transition (Markov) model of the main care pathways deaf people might follow and the main complications and device failures. All of the studies reviewed found that for children, there were gains on all outcome measures when comparing one cochlear implant with non-technological support, or an acoustic hearing aid. Earlier implantation produced the greatest benefits. From the Markov model base-case analysis the authors estimated that, for prelingually profoundly deaf children, the incremental cost-effectiveness ratio (ICER) for unilateral implantation compared with no implantation was 13,413 pounds per quality-adjusted life-year (QALY). The best evidence for the benefits of bilateral cochlear implants was in understanding speech in noisy conditions. The authors conclude that unilateral cochlear implantation for children and adults is cost effective but state “decisions on the cost-effectiveness of bilateral cochlear implants should take into account the high degree of uncertainty within the model regarding the probable utility gain.”

Barton GR, Stacey PC, Fortnum HM, et al. 2006. **Hearing-impaired children in the United Kingdom. IV: Cost-effectiveness of pediatric cochlear implantation**. Ear and Hearing, 27(5), 575-88

This study, based on a health utility questionnaire completed by the parents of 403 implanted children, and 1863 non-implanted children, looked at cost-effectiveness of cochlear implantation in hearing-impaired children considering 8 clinical and demographic variables. The authors concluded that in the U.K. implantation was a cost effective strategy with the greatest benefits associated with younger children and greater degrees of preoperative hearing loss.

This paper was part of a series of four by the authors in the same journal issue. The other papers considered the costs incurred by families, the costs to the education system, and auditory performance, communication skills, educational achievements, and quality of life.

Centre for Reviews and Dissemination. 2011. **Hearing-impaired children in the United Kingdom. IV: Cost-effectiveness of pediatric cochlear implantation** (Structured abstract). NHS Economic Evaluation Database (NHSEED), 2011(4).

The authors at the CRD reported that the methodology appears to have been generally appropriate although few details were given for the cost analysis and that the authors' conclusions appear to be valid within the limits of the study design. The study was based on children implanted before 2000 and therefore more recent improvements in cochlear implantation are not considered.

Other Relevant Publications on Cochlear Implants

Bird P, Botting A, Milburn J, et al. 2010. **An audit of referrals to the Southern Cochlear Implant Paediatric Programme**. New Zealand Medical Journal, 123(1313), 10-4. http://journal.nzma.org.nz/journal/123-1313/4077/content.pdf

This paper reports on a review of 75 paediatric referrals the Southern Cochlear Implant Programme from March 2003-March 2008 (before the introduction of the newborn hearing screening programme). The mean age at referral was 17 months with a range of 1 to 203 months. The authors state that the age of referral has been unacceptably high and that children with known risk factors for significant sensorineural hearing loss have not been receiving early diagnosis.

Bird PA, Murray D. 2008. **Cochlear Implantation: a panacea for severe hearing loss?** Journal of the New Zealand Medical Association, 121(1280). http://journal.nzma.org.nz/journal/121-1280/3220/

This article provides a local perspective on the issue and points out that there is an increasing body of evidence on the benefits of bilateral implants in children. (Currently only one implant per child is normally publicly funded.)

Battmer RD, O'Donoghue GM, Lenarz T. 2007. **A multicenter study of device failure in European cochlear implant centres**. Ear & Hearing, 28(2 Suppl), 95S-99S.

This study reports on cochlear implant failure in 27 European centres and noted that while overall cochlear implant systems are satisfactory there is considerable variation in the reliability of different systems. A common industry independent failure database using uniform reporting protocols would be beneficial to users and clinicians.

ISSUES MORE COMMON IN YOUNG PEOPLE

IN DEPTH TOPIC: MODELS OF PRIMARY HEALTH CARE DELIVERY FOR YOUNG PEOPLE

Introduction

New Zealand research suggests that over three quarters of New Zealand young people access primary healthcare in any one year [206], [207] and while most report they are treated with dignity and respect [206], a significant proportion also report barriers to accessing the services they require [206], [207].

This in-depth topic reviews models of primary healthcare delivery to New Zealand young people with a view to answering the following questions:

1. What types of health issues are frequently experienced by young people?
2. What are the normal developmental milestones occurring during adolescence and do they have any implications for primary healthcare service delivery?
3. What models of primary healthcare are currently available to New Zealand young people?
4. Have any of these models been evaluated, and if so what were the key findings?
5. What does the literature tell us about the key elements required to ensure effective primary healthcare for young people?
6. What implications do these findings have for the provision of primary healthcare to young people in New Zealand?

In answering these questions, this in-depth topic begins with a brief overview of the health issues most commonly encountered by New Zealand young people before exploring the normal developmental milestones which occur during adolescence, and the implications these have for the delivery of primary healthcare. The three most frequent models of primary healthcare available to young people are then reviewed:

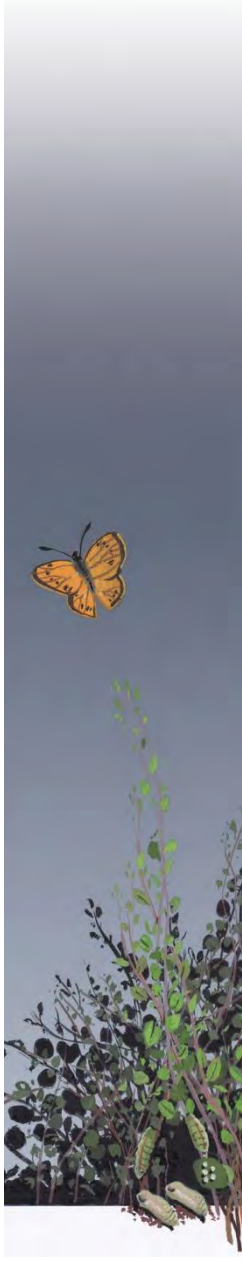
1. General Practitioners / Primary Health Organisations (PHOs)
2. School-Based Health Services
3. Youth One Stop Shops

For each model of care, a brief description of the degree to which it has been implemented in the New Zealand context is provided, before the findings of any local evaluations are reviewed. Each section concludes with a brief review of the overseas literature to identify evidence of effective service delivery, or seek guidance as to how optimal services might be developed. The review concludes with a brief discussion of the implications of these findings for the delivery of primary healthcare to young people in New Zealand.

The Health Status of New Zealand's Young People

In New Zealand most young people experience good health with 66.2% of students in the Youth'07 Survey, a survey of 9,107 New Zealand secondary school students aged 13–17 years, indicating that their health was either excellent, or very good and a further 25.7% indicating that their health was good [207]. Similarly, in the 2006/07 NZ Health Survey [206], which included a sample of 1,663 young people aged 15–24 years, 61.3% said their health was either excellent or very good, while a further 30.8% said their health was good. However, in the Youth'07 Survey [207], 16.5% of students also reported that they had a chronic health condition, and 5.0% reported having a chronic disability. In the 2006/07 NZ Health Survey [206], 45.9% of young people reported being diagnosed with a chronic health condition which was expected to last 6 months or more.

Despite the relatively high prevalence of self-reported chronic health conditions, there have been few recent reviews of the reasons why young people access primary healthcare. A recent evaluation of school-based health services [208] however, noted that the most

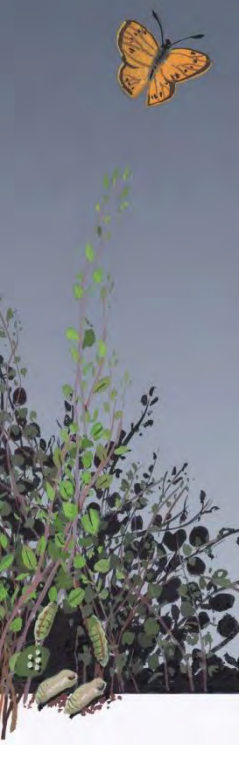


frequent reasons for attendance at secondary school-based clinics were for advice on sexual matters, contraception and sexually transmitted diseases, followed by the treatment of injuries or general sickness (e.g. skin conditions, sprains, headaches, asthma). Other reasons included to talk about mental health issues (e.g. depression, anxiety) or coping with family problems; bullying or violence; advice on healthy eating, fitness and weight loss; and for advice on alcohol or drugs. Similarly, in the Youth'07 survey [207], when young people were asked which health issues they had experienced difficulties getting help with in the past 12 months, the most frequently listed were injuries/accidents; emotional worries; a short term illness (e.g. a cold); contraception or sexual health; assistance with stopping smoking or drug and alcohol use; a long term health condition (e.g. asthma); and for pregnancy or a pregnancy test. Of note, 16.8% of young people in this survey reported being unable to access healthcare when they needed it in the previous 12 months [207].

Research suggests that such difficulties in accessing primary healthcare may in turn lead to potentially avoidable hospital admissions [101], with a number of these being evident in the *Most Frequent Causes of Hospital Admissions and Mortality in Young People* commencing on page 412. The tables in this section also provide useful insights into young people's secondary healthcare utilisation more generally, with **Table 136** suggesting that sexual and reproductive health issues are of particular importance, with conditions associated with pregnancy and childbirth being the leading reasons for hospital admission in those aged 15–24 years. However, injuries and mental health issues also feature prominently, as do a range of infectious and respiratory diseases (e.g. skin infections, gastroenteritis, and asthma). In terms of mortality, mental health issues and injuries are again important, with intentional self-harm and vehicle occupant injuries being the leading causes of mortality in young people aged 15–24 years (**Table 137**).

Given the high burden of potentially avoidable morbidity and mortality, ensuring young people have access to high quality primary healthcare, including health screening and preventive counselling in areas such as emotional wellbeing, contraception, sexual and reproductive health, injuries, violence and substance use, is of prime importance [209]. Before considering the available models of healthcare in the New Zealand context however, the section which follows briefly considers the key developmental milestones young people attain as they progress through adolescence, and the implications these have for primary healthcare delivery to this age group.

Normal Adolescent Development and its Implications for Primary Care Practitioners



Adolescence is a period associated with rapid physical, psychological and social development that may predispose young people to a range of health issues, and which also poses unique communication and management challenges for primary healthcare providers. As a young person enters adolescence, their parents are largely responsible for their healthcare, but by the end of adolescence, most young people will have taken over responsibility for this aspect of their lives. The challenge for healthcare providers is to maintain effective clinical relationships while this transition occurs [210].

Christie and Viner [210] suggest that the primary challenges of adolescence are: the achievement of biological and sexual maturation, the development of a personal identity, the development of intimate sexual relationships with an appropriate peer, and the establishment of independence and autonomy in the context of their socio-cultural environment. In meeting these challenges, a number of developmental tasks need to be undertaken including: negotiating puberty and the completion of growth; developing new cognitive skills including abstract thinking; developing a clearer sense of personal and sexual identity; and developing a degree of emotional, personal and financial independence from their parents (**Table 134**).

Table 134. Developmental Tasks of Adolescence

	Biological	Psychological	Social
Early Adolescence	Girls: Breast bud and pubic hair development, start of growth spurt. Boys: Testicular enlargement, start of genital growth	Concrete thinking but early moral concepts Sexual orientation/identity development Possible homosexual peer interest Reassessment of body image	Emotional separation from parents Start of strong peer identification Early exploratory behaviours (smoking, violence)
Mid Adolescence	Girls: First period, development of female body shape and fat deposition Boys: Spermarche and nocturnal emissions, voice breaking, start of growth spurt	Abstract thinking but still see self as "bullet proof" Growing verbal abilities Identification of law with morality Start of fervent ideology (religious, political)	Emotional separation from parents Strong peer identification Increased health risk taking (smoking, alcohol) Heterosexual peer interest Early vocational plans
Late Adolescence	Boys: Continued increase in muscle bulk and body hair	Complex abstract thinking Differentiation between law and morality Increased impulse control Further development of personal identity and political and religious ideology	Development of social autonomy Intimate relationships Development of vocational capability and financial independence

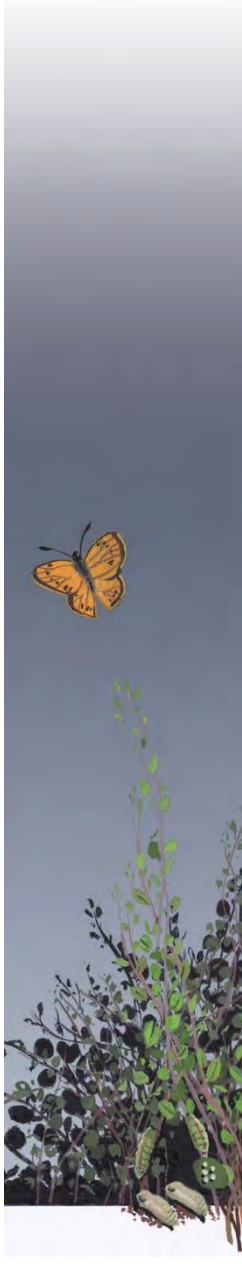
Source: Christie and Viner [210].

While most young people negotiate these tasks successfully, such transitions may pose a number of challenges for the primary care practitioner. Common issues include:

Confidentiality and Capacity to Give Informed Consent: During adolescence young people begin to develop abstract thinking, which enables them to think hypothetically about the future and assess multiple outcomes. It is essential for primary care practitioners to assess where on the continuum from concrete to abstract thinking a young person is, as this significantly impacts on their ability to give informed consent for treatment, or to manage treatment regimes for chronic conditions [210].

In New Zealand, the Care of Children Act 2004 [211] allows young people aged 16 years and over to consent to, or refuse, medical treatment as if they were an adult. Young people are also deemed to be an adult (irrespective of age) if they are married, in a civil union, or living with a de-facto partner. An exception is also granted in the case of terminations of pregnancy, where a young person of any age may provide their own consent to undergo a termination. However, Peters [212] notes that the law is silent on the position of minors under 16 years and that in such cases, some favour a functional approach, which is based on a young person's ability to understand the nature, purpose and possible consequences of any proposed treatment, and to provide informed consent in this context [213]. In such cases, Peters [212] notes that individual health practitioners must elect whether or not to accept a functionally competent minor's treatment choices.

Such issues also have implications for confidentiality, which Larcher [214] notes exists independently from the competence to consent to treatment. In Larcher's view confidentiality is one of the most important aspects of medical care for young people, as it underpins future relationships with professionals and is based on mutual trust. New Zealand research would support this notion, with one review finding that concerns about

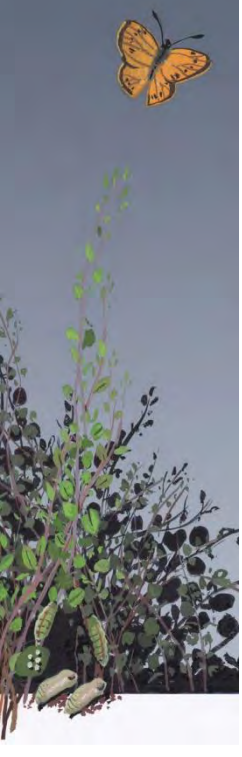


confidentiality were one of the commonest reasons why young people didn't seek healthcare from their own family health practitioner [208].

Larcher [214] also notes a number of situations where confidentiality is especially important, but where issues of competence to consent become intertwined. These include issues such as contraception, terminations of pregnancy, sexually transmitted infections, drug use and mental health issues. In the case of young people seeking contraception, Larcher suggests that a young person may be competent to consent if: they understand the doctor's advice and the doctor cannot persuade them to inform their parents; they are likely to begin, or continue to have sexual intercourse without contraception; their physical or mental health is likely to deteriorate if they do not receive contraception; and their best interests require the doctor to give contraception without parental consent. In contrast, Larcher lists a number of situations where confidentiality should not be kept when dealing with young people. For a competent young person these include: disclosure of a history of or current sexual abuse; disclosure of current or recent suicidal thoughts or significant self-harming behaviour; and disclosure of homicidal intent. For incompetent young people, any situation where there is significant risk of harm to the adolescent or others is also a reason for disclosure [214].

Need for Age Specific Health Screening and Preventive Counselling: Christie and Viner [210] also note that as abstract thinking develops it often interacts with an adolescent's sense of uniqueness, to create an awareness of outcomes for others, but a belief in personal invulnerability. This feeling of being "bullet proof" may lead to young people taking risks (e.g. substance use, personal safety, non-compliance with treatment) in the belief that any negative outcomes will not apply to them [210]. It is possible that such factors play a role in shaping some of the health outcomes (e.g. hospital admissions for injuries and sexually transmitted infections) seen in this year's report. In this context, primary healthcare practitioners have an important role to play in adolescent health screening and the provision of preventive counselling in areas such as sexual and reproductive health, substance use, injuries, violence, and emotional wellbeing and relationship issues [209]. In one New Zealand study health screening and preventive counselling (e.g. smoking, alcohol use, violence, contraceptive use) by primary healthcare providers was found to be low, although youth specific services (e.g. school-based services) were more likely to provide confidential care and preventive screening to adolescents than other providers [209].

Young People's Preferences for Youth Specific and Culturally Appropriate Services: Adolescence is a time when young people begin to identify strongly with their peers, and to develop their own social autonomy [210]. In this context, a review of research [215] on youth specific services found that of the New Zealand studies which had explicitly explored these issues, the vast majority of youth respondents (80% across three studies) expressed a strong preference for youth specific services, with three studies also noting the importance of culturally appropriate services for Māori and Pacific young people. The review also found that for some young people, the type of health issue influenced their preferences, with the GP being seen as appropriate for relatively straight forward issues (e.g. injuries and abdominal pain), but a school nurse, sexual health clinic or family planning clinic being preferable for issues of a more personal nature. Finally, some young people also expressed a preference for services that were staffed by people who were non-judgemental [215].



New Zealand Models of Primary Care Service Delivery

In New Zealand a range of primary healthcare services have been developed to address the issues raised above, with the sections that follow briefly reviewing the three models of care most commonly utilised by young people. These are General Practice / PHOs, School-Based Health Services and Youth One Stop Shops. For each model of care, its implementation in the New Zealand context is described, along with any local evaluations of its effectiveness. Each section concludes with a brief review of the overseas literature, which seeks to identify the key elements underpinning effective service delivery.

General Practice / PHOs

New Zealand's Current Service Delivery Model

New Zealand has a largely tax funded health system, with general practice based primary healthcare, which is 60% Government funded and 40% funded by patient co-payments. Patient co-payments however, coupled with a paucity of Māori and Pacific staff and the uneven distribution of general practitioners (GPs), have resulted in significant financial, cultural and geographic barriers to access in some regions [216].

New Zealand's Primary Healthcare Strategy [217] was designed to reduce these barriers, by creating networks of primary care providers (e.g. GPs, nurses, health promotion workers) called Primary Health Organisations (PHOs), which are funded on a capitation basis, to provide primary healthcare to enrolled populations. In the early 2000s, two different types of PHOs were created, Access PHOs which had enrolled populations where >50% of their patients were identified as being high need (i.e. Māori or Pacific or living in NZDep decile 9–10 areas), and Interim PHOs, which covered the remainder. Higher subsidy rates were initially paid to those enrolled in Access PHOs, with the roll out of subsidies to all age groups being completed by July 2007. As a result, the levels of co-payment for primary care have reduced substantially (e.g. for those not previously subsidised, GP charges fell from on average $50 per GP visit, to $25 or less). In Access PHOs, pharmaceutical charges have also fallen, from a maximum of $15 per item, to $3. As PHOs receive funding based on enrolled populations however, patients are required to enrol with a PHO / GP, with un-enrolled patients being ineligible for fee subsidies [216].

Local Evaluations of Service Effectiveness

In New Zealand there have been few formal evaluations of the effectiveness of general practice care for young people. However a number of surveys have considered primary care utilisation patterns, and/or the barriers young people encounter when trying to access care. These surveys suggest that young people are frequent users of primary healthcare, and that general practitioners remain the first point of contact for most young people [206] [207]. Some of the key findings from these surveys are briefly outlined below.

Young People's Access to General Practitioners

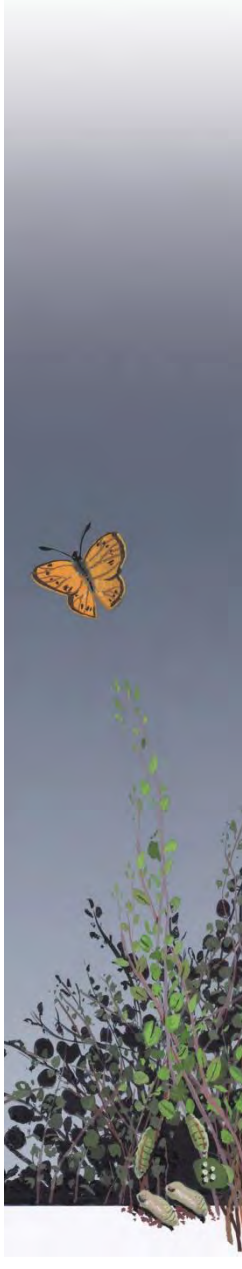
The Youth'07 Survey, a 2007 survey of 9,107 secondary school students aged 13–17 years, found that 62.1% of students had utilised healthcare in the past 6 months and 20.8% within 7–12 months. Of students accessing healthcare in the past 12 months, 92.7% had attended the family doctor/medical centre, 23.0% had used a school health centre, 15.6% had used an after-hours accident and emergency (A&E), 17.9% had used a hospital A&E, 2.1% had attended a youth centre, 5.1% had used a family planning/sexual health clinic and 13.0% had used an alternative health worker or other practitioner [207].

Similarly, the 2006/07 NZ Health Survey, which included a sample of 1,663 young people aged 15–24 years, found that 77.9% of young people had attended a primary healthcare provider in the past 12 months. Overall, 89.2% of young people had a health practitioner/service they usually went to first when unwell, with 91.1% indicating they usually went to the GP clinic first. A further 6.3% usually went to a student health service first, and 1.9% went to a 24 hour accident and medical centre [206].

Continuity of Care and Barriers to Access

When compared to the total population however, the 2006/07 NZ Health Survey found that young people aged 15–24 years were *significantly* less likely to have a health practitioner/ service they usually went to when unwell. Further, they were *significantly* less likely to go to a GP clinic first when unwell, but s*ignificantly* more likely to go to a student health service, or accident and medical/24 hour centre [206].

In the same survey, only 72.2% of young people said that they usually saw the same GP every time they attended primary care, with 10.5% indicating they had changed their primary healthcare provider in the past 12 months. Reasons for changing provider included moving to a new area (49.8%), the doctor retiring/leaving the practice (13.2%), wanting a higher standard of care/professionalism (11.7%), the provider being unavailable when



needed (4.9%), and finding a provider they felt more comfortable with (4.7%). When compared with the total population, a significantly lower proportion of young people saw the same GP every time they attended their provider, although the proportion changing providers in the last 12 months was similar [206].

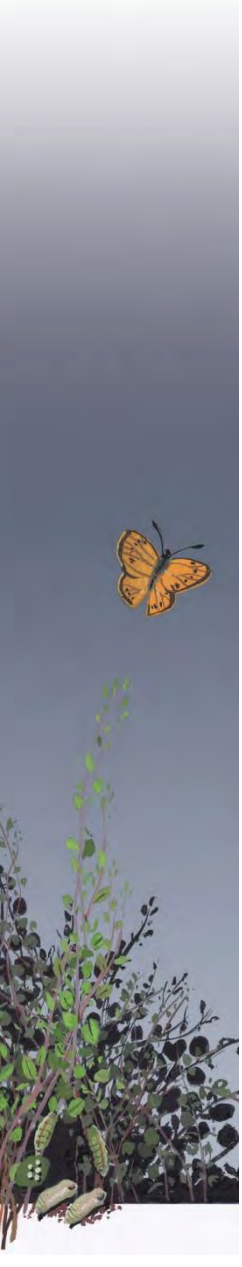
In terms of the quality of care received, 89.5% of young people attending primary care in the past 12 months said that they were treated with dignity and respect *all of the time*, 72.3% said they were listened to carefully *all of the time*, and 71.8% said that their primary health practitioner discussed healthcare and treatment as much as they wanted, *all of the time*. Less than 1% indicated that these things happened *none of the time*, with these findings being *not significantly* different from the total population [206]. However, 16.3% indicated that their primary healthcare provider had not been available within 24 hours when needed [206].

Similarly the Youth 2007 survey found that 16.8% of students had been unable to access healthcare when they needed it in the past 12 months, with barriers to access including: didn't know how to (21.8%), couldn't get an appointment (23.1%), didn't want to make a fuss (55.0%), couldn't be bothered (39.1%), had no transport (26.9%), cost too much (32.2%), couldn't contact the health professional (9.8%), didn't feel comfortable with the person (21.4%), too scared (29.9%), and worried it wouldn't be kept private (28.2%) [207].

Similar issues have been raised in other studies with a recent review of school nursing services [208] finding that many students preferred school-based services over their family doctor due to concerns about privacy, and in particular, not wanting to be seen by family or family friends at the local GP's rooms. Other issues included a lack of transport, parents' inability to pay for services, and students not knowing how to access services.

Concerns about the quality of primary healthcare provided to young people have also been raised, with issues such as privacy, confidentiality and a lack of youth specific health screening and preventive counselling being of particular concern. In a 2003 survey of 343 secondary students at a school which had recently established a school-based health service, Denny et al [209] found that 82% had accessed healthcare from their family doctor in the past 12 months, while 40% had accessed the school-based health centre. Of those accessing health care, only 52% had spoken to a doctor or nurse in a private setting, and 55% had had confidentiality explained to them, with only 36% reporting they had received both private and confidential care in the last 12 months (47.3% at the school-based health centre vs. 23.8% in other primary health care settings). Further, the proportion who reported receiving health screening or preventive counselling (e.g. smoking, alcohol use, violence, contraceptive use) was low irrespective of the setting, with <50% receiving health counselling on any health topic and only 25% receiving counselling on substance abuse, violence, injuries, emotional wellbeing or sexual health. When students did receive counselling on specific health issues however, the majority felt it was helpful. The authors concluded that improvements were needed in the delivery of preventive healthcare to adolescents in primary care, including training for health care providers on youth health issues, particularly around consent and confidentiality, and structural changes which allowed for longer consultation times [209].

Finally, another New Zealand study suggested that cost may be a significant barrier to access, with Jatrana and Crampton [216] in their analysis of data from Statistics NZ's Survey of Family, Income and Employment (a longitudinal survey of 22,000 adults, followed annually since 2002) finding that 20.3% of young people aged 15–24 years had deferred a doctor's visit because of cost, 7.8% had deferred a prescription, and 20.6% had deferred a dentist's visit. The authors found that GP and prescription deferral rates for young people were *significantly* higher than for older (45+ years) people even once other socio-demographic factors (e.g. ethnicity, NZDep, education) were taken into account. They concluded that in many cases, access to primary care was being compromised by an inability to pay the costs of doctors and dentists visits and the price of prescription drugs [216].



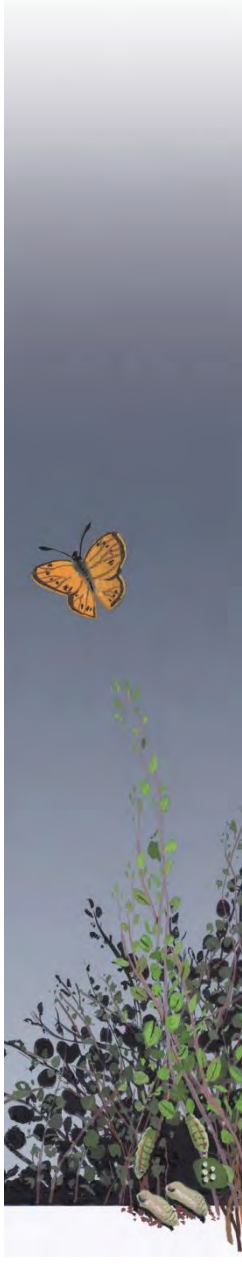
Overseas Evaluations of General Practice Based Care

The paucity of formal evaluations of the effectiveness of general practice care for young people is also mirrored in the overseas literature, with Mathias [215], in her 2002 review of youth health services, finding no studies evaluating adolescent clinics in primary care (the majority of research was US based and focused on school health services). Similarly, in their recent review for Waitemata DHB, Fleming and Elvidge [218] found little research on the effectiveness of GP based primary care for young people, although there was a significant body of research on barriers to access, or the impact of youth specific services (e.g. school-based health clinics) on improving primary care access. The authors also noted that a number of studies had focused on particular interventions to improve access, or to make primary care more youth friendly.

Similarly while finding few evidence-based evaluations of service delivery models, an Australian review [219] noted a number of barriers to youth friendly service provision amongst GPs. These barriers included inadequate time, issues with skills and confidence when working with young people, and poor linkages with other relevant services. Cost and time were intertwined, with many GPs saying they needed longer consultations to build relationships and allow young people to identify the purpose of their visit. However, long consultations were not cost-efficient or feasible due to excessive workloads. Confidentiality and the role of parents in consultations were other areas of concern. GP training needs included better knowledge of, and skills in adolescent health requirements, working with adolescents and working with other services [220]. In contrast, barriers to access cited by young people included fear of confidentially breaches, a lack of trust in the service provider, embarrassment about discussing personal issues, a lack of awareness of the services available, and cost [219]. In terms of service delivery models, the authors described two GP initiatives to improve youth access to primary care. The first was *GPs in Schools*, where interested GPs were put though a rigorous process of training and practice review in order to become 'youth friendly'. GPs were then visited in their practices by a project officer and the GP's practice was assessed using a survey and checklist. A list of 'youth friendly' GPs who had agreed to bulk bill young people (i.e. charge no up-front fees) was then made available to schools and other services, along with information about their location, opening hours and bulk billing status. Later in the project, GPs developed education programmes for schools to inform students about the services they offered and how they could access them. The reviewers noted that process evaluations invariably demonstrated improvements in participating GPs' knowledge and confidence, and one evaluation showed an increase in "intention to seek help" by students. No studies operating at the time of a review in 2005 however, had yet demonstrated increases in GP attendance by young people or improved health outcomes although such reviews were planned. A further initiative involved GPs working in youth health services on a sessional basis, with a view to creating relationships which might increase the likelihood that young people would subsequently attend the GPs' usual practice [219].

The most comprehensive review of this area is probably that undertaken by Tylee et al in 2007 [221]. In it, the authors noted that while much had been written about youth-friendly models of service provision, little evidence was available on the effects of such models of care on young people's health. They outlined three main approaches that had been used, to try and improve provider's performance in caring for young people. These were [221]:

1. **The Provision of Guidelines**: Standards and guidelines for youth health care have been developed by a range of organisations. The authors noted however that the limitations of issuing guidelines in isolation, in terms of bringing consistent change in practitioner's performance, had been well described.
2. **Provider Training**: Primary practitioner surveys consistently report the need for additional training in adolescent health, with evidence from a number of studies suggesting that provider performance could be improved with appropriate training. In one study, 108 general practitioners were randomly assigned to an educational programme (2.5 hours per week x 6 weeks, plus 2 hour follow up) on the principles of adolescent health care, or to a control group. The intervention group showed



significantly greater improvements across a range of outcomes including knowledge, skills and self-perceived competency, which were sustained after 12 months [222]. Other non-randomised studies have demonstrated similar improvements following provider training in areas such as adolescent screening and counselling for sexual and reproductive health issues, mental health issues and/or drug and alcohol issues.

3. **Quality Improvement Strategies Incorporating Providing Training**: The National Adolescent Friendly Clinic Initiative (NAFCI) established in South Africa in the early 2000s is cited as an example of quality improvement. NAFCI was an accreditation programme designed to improve the quality of adolescent health services at the primary care level. It aimed to do so by making health services more accessible and acceptable to young people, establishing national standards and criteria for adolescent health care in clinics throughout the country, and building the capacity of health care providers to provide quality services [223]. NAFCI was implemented through provincially based coordinators, who worked closely with clinic based staff to ensure compliance with NAFCI standards. A recognition system was also developed, with clinics scoring bronze, silver or gold depending on how well they meet the standards. Preliminary evaluations of 32 NAFCI clinics during 2002–2004 indicated a significant increase in average monthly clinic utilisation (340 in 2002 to 420 in 2004), and that the longer NAFCI was implemented, the more clients were recorded in the clinics [223]. However, a more recent evaluation of one NAFCI clinic suggested that even though most adolescents used NAFCI services, the number of adolescents falling pregnant or contracting STIs did not decrease, and voluntary STI counselling and testing services were still underutilised, indicating that further work was required in these areas [224].

Tylee et al [221] concluded that although provider training and organisational system interventions appeared to be the logical first steps in improving health outcomes for adolescents in primary care, more well designed studies were needed to assess the effect of screening and counselling on both access and health outcomes. While clinician's behaviour and clinic systems could be altered to incorporate preventive health, they also noted that more evidence was needed regarding the sustainability and responsiveness of these systems to health issues. Further, while higher level principles lent support to the development of youth friendly services, they noted that the evidence for the effectiveness of youth friendly services beyond improving access was still insufficient and that the cost benefit balance for implementing such youth friendly services also remained entirely unexplored. Finally they noted that initiatives to improve services might not be effective in reducing the burden of disease in the absence of broader public health responses to other issues such as socioeconomic conditions which also have a bearing on health.

In New Zealand, a number of guidelines and standards similar to the ones mentioned above have been developed to improve the quality of health care provided to young people and these are outlined in the text box below. The extent to which any have been implemented however remains unclear, and to date there have been no formal evaluations of their effectiveness published in the literature.

Kidz First Centre for Youth Health and the Youth Health Expert Working Group. 2006. **Draft Standards for Youth Health Services**. Auckland. Counties Manukau DHB
www.healthpoint.co.nz/download,205710.do;jsessionid

This draft set of standards for youth health services, developed for Counties Manukau DHB, is based on a review of best practice from the literature and consultation with providers in the youth health sector. The standards are divided into two parts, with the first being generic youth standards relevant to all health services that provide services to young people (including primary care), and the second designed specifically for youth specific services. The draft standards cover a number of areas including the Treaty of Waitangi; engagement with the community; youth focus and participation; an emphasis on positive youth development; strength based practices and multidisciplinary care; core clinical care and a minimum set of youth services; staff training and skills in youth health; addressing culture at all levels of service delivery and planning; population level health promotion targeting youth; and effective organisational and administrative structures. For each standard, a list of examples is provided as to how service providers may achieve the standard.

Royal NZ College of General Practitioners. 2006. **Health for Young People**
http://www.rnzcgp.org.nz/college-resources-3/

The Royal NZ College of General Practitioners has developed a guide to providing effective care for young people, with the areas covered including overcoming barriers, communication skills, preventive care and major health issues for young people. The guide is included in the College's Continuous Quality Improvement Activities Book, which is eligible for Maintenance of Professional Standards (MOPS) continuous quality improvement clinical audit credits.

New Zealand Guidelines Group. 2008. **Identification of Common Mental Disorders and the Management of Depression in Primary Care**. Wellington. Ministry of Health http://www.nzgg.org.nz/

The guideline has a specific section on young people, which suggests that young people with mild or moderate depression should typically be managed in primary care, that practitioners should consider involving support services such as school guidance counsellors or family services, and that if a young person with depression does not report substantial improvement after 6–8 weeks of treatment, they should be referred to secondary mental health services. Further, antidepressant treatment should not be initiated in primary care for a young person <18 years without consultation with a child and adolescent psychiatrist. The guidelines suggest that initial management for young people with mild-moderate depression should include active listening, problem identification, advice about simple self-management strategies and systematic follow up (e.g. 2 weekly monitoring by phone/text/email) and reassessment in 2–4 weeks. If improvements are reported, monitoring should continue 1–2 monthly until remission of symptoms, with an action plan being given for use if symptoms recur. If no improvement occurs at 2–4 weeks the young person should receive an extended appointment and offer of a simple psychological intervention (e.g. structured problem solving therapy). In terms of the strength of the evidence, most recommendations were Grade C i.e. based on international expert opinion (rather than evidence from RCT or other valid studies).

Standards New Zealand 2004. **Health and Disability Sector Standards (Children and Young People) Audit Workbook** SNZ HB 8134.4:2004. Wellington Standards New Zealand

This Audit Workbook is designed to evaluate organisational or service outcomes against those required by NZS 8134:2001 Health and Disability Sector Standards, which aim to ensure a high quality of care for children and young people across the health sector.

General Practice / PHOs Conclusions

The available research suggests that young people in New Zealand rely on general practice for the majority of their primary health care, and that most young people visit a general practitioner at least once a year. Significant barriers to primary care access exist however, with issues such as perceived confidentiality, privacy, accessibility, and cost being commonly cited by young people, and concerns about service quality (e.g. privacy, health screening and preventive counselling for youth specific issues) also being raised by local research. While there is little empirical evidence as to the initiatives which would lead to the greatest health gains for young people, research does suggest that provider training can improve general practitioners' confidence in dealing with common youth health issues, and that the implementation of national/practice level standards for adolescent health care and youth friendly services may lead to increased service utilisation by young people.

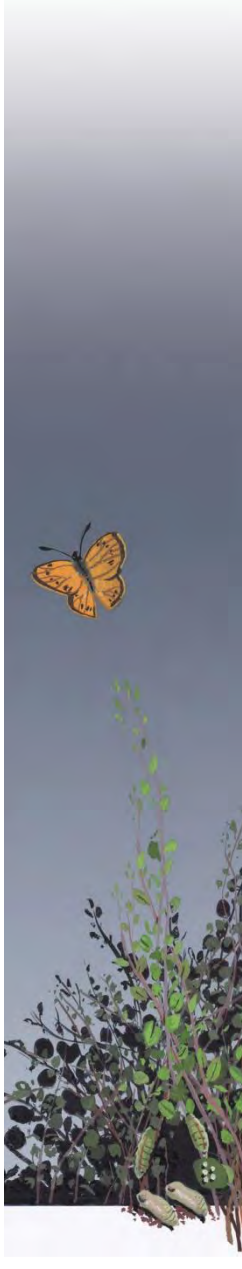
Before making any further recommendations in this area however, the following sections review other models of primary healthcare delivery to young people.

School-Based Health Services

New Zealand's Current Service Delivery Model

In 1912 the first school medical inspectors were appointed within the Department of Education. In 1917 nurses were appointed to the School Health Service, which was transferred to the Department of Health in 1921, and became part of the Public Health Nursing Service in 1953 [208]. By 1991 there were many different organisational arrangements for school health services [208], with some schools employing their own nurses and developing wellness centres providing a range of services from alcohol and drug counselling and social work, to physiotherapy and general practice care; others having visits from public health nurses, family planning nurses and GPs; and still others having no services at all [208] [225].

Among schools that have health services, many have been developed as local initiatives with parents and local GPs (often parents themselves) collaborating with school principals and boards of trustees to organise some level of healthcare provision [226]. While the Ministry of Health [226] released a set of guidelines for the establishment of healthcare



services in secondary schools in 2004, Bagshaw [225] notes that we still have a long way to go before we have a consistent, comparable, high standard of service in all schools. Further, school health services may not be able to address all of the health needs of young people as they are not available in all schools, they do not operate during school holidays or after-hours, the students with the highest health needs often leave school early, and they are unable to cater for the needs of those aged 16–24 years who have left school but are not yet ready for adult-focused healthcare [208].

Local Evaluations of Service Effectiveness

There have been two recent evaluations of school-based health services in New Zealand, both commissioned by the Ministry of Health. One reviewed the scope and effectiveness of nursing services in secondary schools [208], while the other evaluated the effectiveness of the Healthy Community Schools initiative, which sought to expand health and social services to nine Decile 1 schools [227].

Review of School Nursing Services

In 2008 the Ministry of Health commissioned a review of nursing services in secondary schools, which considered the range of school nursing services provided, how these were funded, and some of the issues experienced by school nurses [208]. The review included in-depth interviews with nurses working in schools (n=16), and surveys of secondary school principals (n=154 or 46% of NZ's secondary school principals) and school nurses (n=235).

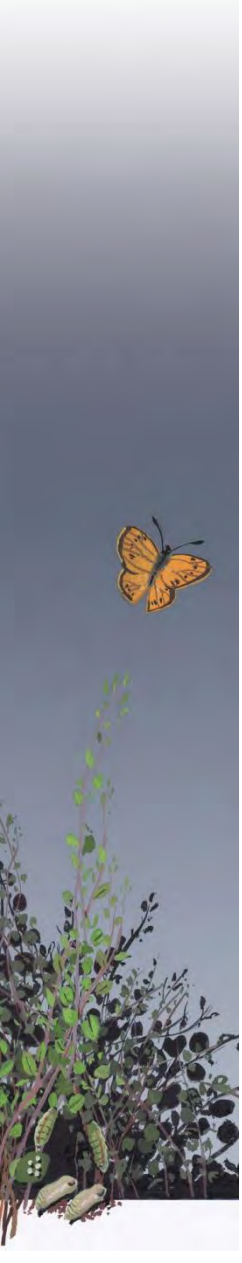
The review found that 75% of the secondary schools surveyed either had a nurse in attendance or who visited the school. The proportion of nurses who were employed by the school itself vs. the local DHB, public health service or PHO, varied from region to region. Most nurses had access to a clinic area within the school, although a sizeable proportion (30%) had to make use of the school hall, unoccupied offices or other spaces. Many did not have access to a computer and used paper-based files for clinical notes, with those that did have access to a computer using a variety of different databases to record consultations [208].

The roles of nurses varied and included first aid, the provision of personal health services, health education and promotion, administering medication and assisting schools with the development of health plans and health classes. Nurses also made referrals to a wide range of other providers including GPs, counsellors, family planning clinics and medical specialists. Hours varied, with most DHB and public health employed nurses only holding brief clinics and undertaking <20 consultations per week. In contrast school employed nurses, who were available for consultation >25 hours a week often saw >120 students each week [208].

The most frequent reasons for consultation were advice on sexual health/contraception, and for the treatment of injuries or general sickness, with less common reasons including seeking help for mental health issues (e.g. depression, anxiety or family issues). A number of nurses noted that students almost never sought advice on fitness, weight loss, nutrition or advice on alcohol, drugs or smoking cessation. When asked why students accessed services, the most frequent reasons given (by nurses) were proximity and confidentiality (e.g. students wanting to access services independently of their families), a lack of transport to other services, parents being unable to pay for other services, and students not knowing how to access other services [208].

When asked about the effectiveness of services, around two thirds of principals thought that the scope of the nursing services met the health needs of their students, with most of the remainder feeling that an increase in nursing hours was required, Some also indicated the need for additional funding to improve their school's facilities, while others also raised the need for more doctors and additional sexual health/family planning and mental health services [208].

Other issues raised by the review included the fact that many school-employed nurses did not receive clinical oversight or report to anyone in a professional capacity, with pay parity and ongoing professional development also being of concern. There was also a need for



extra staff and extended clinic hours in most schools, with nurses often experiencing difficulties in accessing outside help for students, particularly from over-stretched mental health and Child Youth and Family services. As a consequence, better access to social workers, psychologists, drug and alcohol counsellors and access to sexual health nurses, were recommended [208].

The reviewers concluded that the health services currently available in schools had evolved from earlier public health provision, from schools' own initiatives and from DHBs' and PHOs' responses to perceived health needs. However, the absence of an overarching policy framework concerning school-based health services had resulted in ad-hoc development resulting in discrepancies in the availability of, and access to, services. The reviewers suggested that one way forward might be for DHBs to take over responsibility for school health services, and to foster links between them, PHOs and youth health centres, so that school nurses were better able to link their students with these services [208].

Review of the Healthy Community Schools Initiative in AIMHI Schools

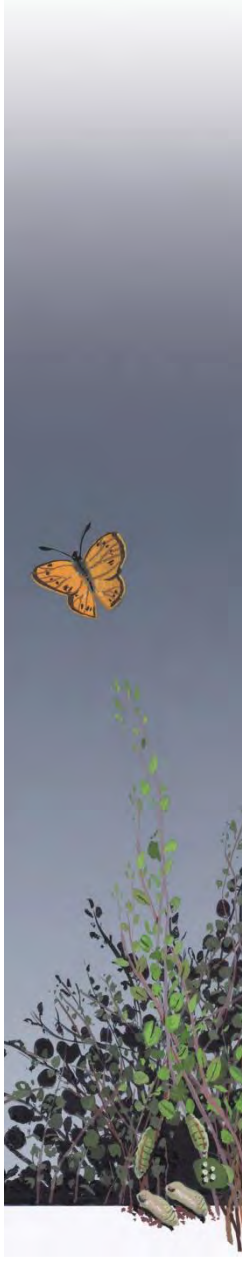
In 2001 the Ministry of Education funded a pilot programme, the Healthy Community Schools (HCS) initiative, to explore how achievement in nine Achievement in Multi-Cultural High Schools (AIMHI) could be enhanced [227]. Students in AIMHI schools came from some of the most deprived areas in New Zealand where family incomes were low, housing was poor, and English was not always the first language. Such factors meant that students were at risk of poorer health outcomes and delays in seeking medical care, both of which are likely to impact on their ability to learn and achieve academically. The specific goal of AIMHI, which was established in 1996 by the Ministry of Education, was to improve educational outcomes by [227]:

1. Increasing effective learning time
2. Reducing barriers to learning
3. Improving health and social support services within the schools
4. Gaining greater connectivity and congruency of the school with its community.

Eight AIMHI schools were located in Auckland and one in Porirua. During the pilot, funding was given to these schools to support health and social support services. The Ministries of Health and Social Development (MSD) took over funding of these services in 2007. At the school level, some schools augmented the funding received with money from their own budgets to employ nurses, or to improve nurse-to-student ratios. In addition, from mid-2008 full time social workers were funded by the MSD and employed by NGOs, who were contracted by the schools for service delivery. Additional supports in AIMHI schools included community liaison officers, skill development programmes, tutor periods with smaller teacher-to-student ratios, more effective tracking of student attendance, and more effective ways of dealing with student behaviour issues [227].

Two formal evaluations of the HCS initiative have been undertaken, with an initial 3-phase evaluation occurring during 2002–2004, and a second evaluation conducted in 2008–2009. The initial evaluation tracked the development of the iniative and demonstrated that AIMHI schools had made signficant gains over other Decile 1 schools between 2002 and 2004, with AIMHI students expressing greater satisfaction with their schools, feeling better supported to achieve and also feeling that ethnic diversity was more supported. In terms of their educational attainment, AIMHI students increased their educational achievement, which was comparable to national results for their respective ethnic groups drawn from all decile schools [227].

The 2008–2009 evaluation was designed to assess whether the HCS initiative was improving access to health and social services for students, as well as their educational outcomes. The evaluation involved desktop research on the HCS initiative, observational visits to schools, data collection and interviews with health providers, staff and students, a structured survey of the experiences of students, staff and parents and an analysis of education and health performance trends for AIMHI schools, Decile 1 schools and all schools nationally [227].



The evaluation found that the student health and social service facilities within AIMHI schools varied considerably, with the lowest level of resource comprising 7 hours of nursing time and 3 hours of doctor time per week, coupled with a community liaison office during school hours, a full time (but not fully qualified) social worker and a full time school counsellor. In contrast, other schools had purpose built facilities with a receptionist who could triage students, a mixture of full and part time nurses, a full time social worker and a guidance counsellor, a community liaison worker, Cops in Schools and youth workers. Interviews with staff and students and an analysis of educational data found that [227]:

Students' Perceptions: Students were positive about their school health services and indicated that they were easy to access; private and confidential; that staff were supportive, professional and non-judgemental; that they provided an opportunity to consult a nurse or doctor without their parents' involvement; that they allowed them to learn about their own health and wellbeing; and that they assisted them to develop confidence in accessing other health services.

Teachers' Perceptions: Teachers viewed student support services as an essential part of the school and believed the school would not be able to function as effectively without them. Such services enabled students' health issues to be dealt with more effectively and that this had a positive impact on learning. They also relieved teachers of having to manage health issues for which they were ill equipped, and enabled them to focus more on teaching and students to focus on learning. They also reduced truancy and resulted in students staying in school longer, and also contributed to the health education syllabus.

Parents' Perceptions: Only limited feedback was available from parents. Of parents who did give feedback, 91% said they were pleased that the school had a health service, and thought that the service was accessible and improved the health of their children. None expressed any concerns about their children using school-based health services.

Practitioners' Perspectives: Nurses acknowledged that the health needs of students would be largely unmet without a school-based clinic. This included both issues of which students and parents were aware and those they were not (e.g. vision and hearing issues). They saw their roles as providing early intervention, and preventing normal teenage risk-taking behaviour escalating to a point where it impacted on students' health and wellbeing. Social workers and school counsellors saw their roles as complimenting those of school nurses, but highlighted the need to understand each other's roles and to work collaboratively to provide the types of services which met students' needs.

Educational Outcomes: Compared with their peers in other Decile 1 schools, students in AIMHI Schools had higher achievement rates at NCEA Levels 2 and 3 and lower proportions of students leaving school with little academic attainment. They also had higher retention rates at 16.5 years for Pacific students and lower truancy rates. However, it was not possible to determine whether these effects were due to the health services themselves, or to other interventions developed as part of the AIMHI initiative.

The reviewers concluded that the provision of student support services in schools significantly improved student's access to health and social services, and impacted positively on their educational achievement, and that students and staff also viewed these services in positive terms. However, the range of services offered and the degree to which these services were integrated with others in the community varied from school to school.

Overseas Evaluations of School-Based Health Services

While the evaluations reviewed above found that school-based health services were viewed in positive terms by staff and students, and that they were being well utilised, the qualitative research methodologies used meant that it was difficult to determine the extent to which the services improved access to primary care, or achieved health gains for students. Such issues are not unique to New Zealand, with Cowell in an recent review [228] noting that while the gold standard for evidence-based practice is the randomised controlled trial, most evaluations of school health services utilise a case study design, focus groups, pre-test vs. post-test designs or surveys. In addition, sample sizes are often small, without randomisation or comparison groups, and in many cases the focus of the

evaluation is on the cultural or community acceptability of a service, or technical or system issues rather than the effectiveness of the service per se [228].

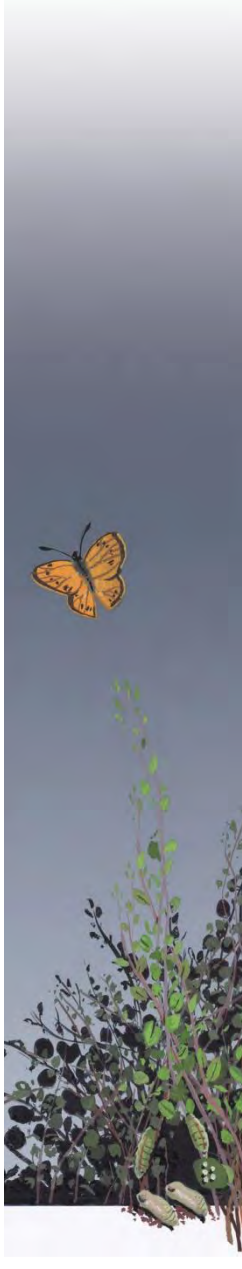
The following section thus briefly summaries a number of reviews of the New Zealand and overseas literatures which consider the effectiveness of school-based health services, with a view to answering the following questions:

1. Is there any evidence that school-based health services can improve access to primary healthcare, or achieve health gains for young people?
2. Is there any evidence regarding optimal service configurations for the delivery of school-based health services?

In New Zealand there have been three recent reviews of the local/overseas literature on school-based health services. The first was by Mathias, [215], who undertook a systematic review of the literature on youth specific primary healthcare in 2002. Mathias found that of seven studies which reviewed health service utilisation by users of school-based health clinics (SBHC), all found significantly greater utilisation (mean annual visits) by students with access to SBHC, compared to those without. Some studies found that the students who benefited the most were females, rural youth and those from socioeconomically disadvantaged areas. The evidence for improved access for ethnic minorities however was more mixed [215]. Four studies evaluating the impact of SBHC on access to mental health services also reported significantly greater use by those who had access to SBHC. In one case, use of mental health services was 10 times higher and in another, it was 45 times higher for those with access to SBHC vs. those with traditional primary care only. However, two studies found no significant association between use of SBHC and self-reported mental health variables. Of four studies which evaluated SBHC access and emergency department (ED) use, two found significant reductions in ED use in those with access to SBHC, while two found no difference (although Mathias notes the latter two studies were less methodologically robust). While such findings suggest that SBHC can improve access to primary healthcare and mental health services, and reduce ED use in young people, Mathias cautioned that the majority of the research reviewed was from the U.S, where the configuration of services was somewhat different from New Zealand [215].

Taking a different approach, in 2005 Winnard et al [229] reviewed best practice for adolescent healthcare in school settings. The review, which was based on the New Zealand and overseas literatures, consensus statements and expert opinion, aimed to build on the Ministry of Health's Guidelines for School-based Healthcare [226]. It described four important components of an effective school-based health service:

1. **Wide Engagement with the School and Community**: A close working relationship between health providers, pastoral care team members and teaching staff was seen as important, particularly for students who were persistently absent because of sickness or truancy. Further, community participation was essential for ensuring that services were appropriate and acceptable and delivered in a manner which reflected the socioeconomic and cultural diversity of the school's community.
2. **Youth Focus and Participation**: Youth friendly staff and facilities, the assurance of confidentiality (while respecting family values and connections) and youth participation in planning and service delivery were seen as key components of an effective school health service.
3. **Delivery of High Quality Comprehensive Care**: Ensuring high quality comprehensive care was seen as important, with the authors noting the need for a team of multidisciplinary practitioners who worked to high standards and competencies (as defined by their professional organisations), were trained in youth health, were able to deal with complex psychological issues, and who could communicate with students from a wide range of backgrounds and cultures. Key elements included addressing the importance of culture, taking a multidisciplinary approach, providing screening and preventive care, engaging adolescent males, and appropriate staffing.
4. **Effective Administrative / Clinical Systems and Governance to Support Service Delivery**: Effective administrative/clinical systems (adequate funding, efficient systems



of documentation, coordinated case management), ongoing professional development of staff, appropriate governance arrangements (e.g. a school health committee, with appropriate Māori partnerships), and the appropriate and ongoing evaluation of services were all seen as essential components of an effective service.

The most recent local review of the literature was undertaken in 2010 by Fleming and Elvidge [218] for the Waitemata DHB. It found that access to school-based health services (SBHS) that were provided for all, or nearly all of school hours, increased access to health services, including primary health care, mental health care and other specialist services like drug and alcohol services. Access to SBHS in some studies also increased school attendance, school retention and academic achievement, and reduced truancy and absence for some students (e.g. those with chronic health issues). While SBHS also reduced emergency department usage, the authors noted they had not been conclusively shown to achieve gains in health status for young people. In terms of optimal service delivery models, the authors suggested that the model outlined in the evaluation of the AIMHI initiative was the most useful starting point, with key elements including [227]:

1. Support from the school principal, board of trustees and staff
2. A youth friendly, confidential and private service that the students could trust
3. Student input in the provision of health services and initiatives
4. A committed partnership between health and education to ensure appropriate resources and support
5. Experienced and mature practitioners who were qualified and confident in their role with youth and within the education system
6. A ratio of nurses to students that accommodated need
7. Practitioners who embraced opportunities to actively promote and support the health of young people, as opposed to taking a passive “band aid” approach
8. Ready access, preferably on site, to a medical practitioner at least once a week
9. A purpose built and designed facility that ensured the privacy and safety of students and staff
10. A supportive infrastructure both within the school and externally, from the provision of receptionists and governing bodies, to professional development and collegial support.

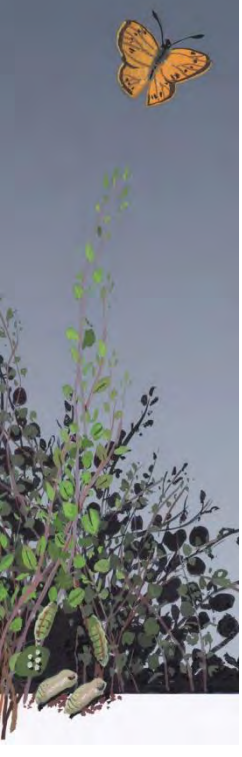
School-Based Health Services Conclusions

The available evidence suggests that SBHS are viewed in positive terms by students, staff and school health practitioners, and that they may increase access to primary health care. However, school-based services are unable to meet the needs of those leaving school early, or older young people, and most are unavailable outside of school hours, on weekends, or during the holidays. Further, while qualitative evaluations suggest that they are an acceptable form of health delivery for students, caution is necessary given that, to date, research has not been undertaken to assess the effectiveness of these services in achieving health gains or reducing risk taking behaviours. In the New Zealand context, there is also no overarching framework for the delivery of school-based health services. Different organisational arrangements (e.g. funding, governance, facilities) have evolved in different parts of the country, with the scope of services available ranging from comprehensive to none at all. For DHBs considering establishing school-based health services however, a number of documents may provide useful guidance and these are listed in the text box below.

Ministry of Health. 2004. **Improving the Health of Young People: Guidelines for School-Based Healthcare**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/pagesmh/3206

Winnard D, Denny S, Flemming T. 2005. **Successful School Health Services for Adolescents. Best Practice Review**. Auckland: Kidz First Community Health - Centre for Youth Health. www.healthpoint.co.nz/download,205699.do;jsessionid

Ministry of Health. 2009. **Evaluation of Healthy Community Schools Initiative in AIMHI Schools**. Wellington. http://www.moh.govt.nz/moh.nsf/indexmh/aimhi-081009?Open



Youth One Stop Shops

New Zealand's Current Service Delivery Model

Youth One Stop Shops (YOSS) are community based facilities which offer a range of services to young people using a holistic model of care [230] which takes into account young people's physical, mental, emotional, and social needs [225]. All work within a youth development paradigm, which aims to be responsive to the needs of young people and to involve them in the running of the service [225].

In New Zealand the first community based youth health service, the Youth Advice Centre, opened in Bay of Plenty in 1994. The Service was started by a public health nurse who drew on other services (e.g. the local GP, the Family Planning Association, the Sexual Health Service, the Child and Adolescent Mental Health Service and the Alcohol and Drug Service) to provide sessions at the centre [225]. The following year, the Youth Health Trust in Christchurch opened the 198 Youth Health Centre. Since then more than a dozen additional services have been established nationwide, each with their own operational model and funding sources [225].

YOSS offer a range of health services including primary healthcare, sexual and reproductive health, family planning, vaccinations, health promotion and education, counselling, mental health services and alcohol and other drug services. Other services may include social work and youth transition services, youth development programmes, mentoring programmes, and advice on accommodation, training and education, budgeting, and employment [225], [230]. A number also provide recreation programmes or are linked to services that provide art and recreation activities. Some also provide outreach clinics to schools, and all make referrals to other agencies when required [225]. In many cases, demand exceeds capacity, and a number of services have waiting lists for counselling and other mental health services, including alcohol and drug services [230].

Services at YOSS are usually provided free or charge or at a reduced cost, to those aged 10–24 years, with the hours of operation (e.g. 20–45 hours) and the age of eligibility varying from service to service in accordance with individual contracts [230]. Staffing levels also vary from service to service, with most employing a nurse and many employing a part time doctor. A number of services also employ part time counsellors, and/or social workers, and some also employ young people themselves [225].

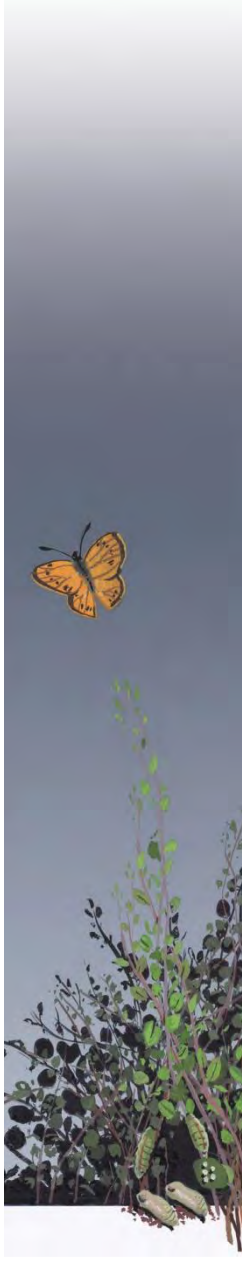
Local Evaluations of Service Effectiveness

In New Zealand there have been three reviews of Youth One Stop Shops, with the most recent being commissioned by the Ministry of Health with a view to "*gathering baseline information and providing an informed assessment of YOSS health-related activities"* [230]. In addition, in 2006 Youthline [231] was commissioned by Counties Manukau DHB to identify key learnings from existing YOSS in New Zealand and to make recommendations to the DHB on the most appropriate service delivery models for Pacific young people in the region. Finally in 2005, Bagshaw [225] undertook a survey of YOSS providers, with a view to assessing the most common funding models for YOSS.

Ministry of Health Review of Youth One Stop Shops

In 2009 the Ministry of Health contracted Communio to evaluate 12 YOSS [230]. The evaluation combined a literature and document review with surveys of YOSS managers, clients and stakeholders. Site visits to meet with managers, staff, and stakeholders also occurred and a series of focus groups with clients were held. The evaluation was limited however, as no comparable control groups, pre- and post- implementation data, or time series health data were available. This made it very difficult to assess the effectiveness of YOSS in improving access to services, or achieving health gains for the young people in their catchments [230].

The review found that nationally, around 28,000–34,000 young people were registered with YOSS (out of an eligible population in the combined YOSS catchments of 328,000). The majority of clients also accessed services from other providers. Access was often opportunistic, and dependent on young people's current situation, and service availability



and accessibility, a pattern managers referred to as *grazing* or *snacking*. A small proportion of clients accessed services solely from One Stop Shops [230].

The majority of YOSS clients were female (70–75%) and aged between 15 and 24 years. One fifth of clients accessed services once or twice, one third used services 3–5 times and just under half used services 6–9 or 10 times or more. Repeat utilisation was dependent on the continuity of staff and the provision of appropriate and timely services, with high frequency usage also being associated with the uptake of counselling services. The YOSS services most commonly accessed were general practitioners, sexual and reproductive health and counselling services, followed by mental health, family planning and alcohol and drug services [230].

Funding models varied from service to service, with many YOSS operating as Trusts which allowed them to contract directly with the Ministry of Health, DHBs or PHOs for the delivery of services. The majority also tapped into other funding sources such as the City Council, Charitable Trusts, WINZ and other Charities [225]. Most YOSS had their own governance board/board of trustees, whose members donated their time free of charge. Most also had a three tier structure, with a board overseeing strategy, managers dealing with operational issues and other staff participating in service delivery and with various defined projects [230].

While no data were available on the effectiveness of YOSS in improving young people's access to services, staff listed a range of strategies their organisations had used to try and improve access. These included youth friendly opening hours to accommodate study and work commitments, facilities being located close to public transport, outreach and mobile services, culturally appropriate services and staff cultural competency training, and services being made available at no or little cost.

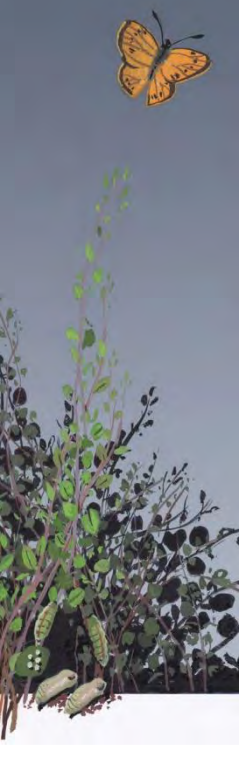
When asked if the YOSS had *"helped young people to get the health services they need?"* 91% of managers, 95% of clients and 90% of stakeholders agreed or strongly agreed the service had been effective in achieving this goal. Similarly, while no data were available to assess the effectiveness of YOSS in achieving health gains, 100% of managers, 94% of clients and 89% of stakeholders felt that the YOSS was either very or moderately effective in "*improving young people's health and wellbeing*" [230]. The lack of comparable data for those not utilising YOSS' services however, made it difficult to determine whether services were meeting the needs of all young people within the service's catchment, rather than just those who had elected to register with the service.

Looking to the future, the reviewers made a series of recommendations for changes in key areas including networking, workforce development, central reporting, organisational governance, outcome measurement and evaluation, service funding models, and service gaps [230].

Youthline Evaluation of Youth One Stop Shops for Counties Manukau DHB

In 2006, Youthline [231] was contracted by Counties Manukau DHB to identify key learnings from existing YOSS in New Zealand, and to make recommendations to the DHB on the most appropriate service delivery models for Pacific young people. The review used a qualitative methodology involving semi-structured interviews with representatives from seven YOSS nationally. Key issues emerging from these interviews were then grouped into the following 10 themes: [231]:

1. **Location and Physical Environment**: Services needed to be easily accessible to young people (i.e. in a central location with a high density of young people, and good transport access). It was also important to ensure that visits to the centre were not extremely visible, and that good relationships were maintained with neighbouring businesses and residents.
2. **Cost**: Services needed to be affordable for young people.
3. **Staff**: Staff who were able to engage young people were essential, with staff needing to be flexible, diverse, supportive of each other, and able to work effectively as a team.



4. **Youth Participation**: Young people needed to be actively involved in the planning, implementation and evaluation of the service.
5. **Youth Friendly**: Services needed to be provided in a youth friendly manner (e.g. displays on walls, music) with confidentiality being clearly explained. It was also important to ensure that one youth sub-culture did not displace others from the service.
6. **Activities** needed to match the desires and needs of young people in the community.
7. **Funding:** Relationships needed to be built and maintained with funders, with the expectations of both parties needing to be acknowledged, and any changing needs made clear.
8. **Coordination of Services:** Strong governance and continued leadership were also necessary, as were networks between different youth agencies to ensure that young people were supported during any referral process.
9. **Advertising:** Building and maintaining relationships with the community, local schools and other service providers, was important, as was ensuring that young people had positive experiences of staff and the service. Ensuring that any advertising matched the capacity of the service was also necessary.
10. **Sustainability and Consistently:** Ensuring that a strong base of services was created before adding additional services was important. Services provided needed to be sustainable in light of current and possible future funding.

The review had a number of limitations however, including a small sample size (n=7 services), the heterogeneity of service delivery models included, an inability to assess the extent to which services were being used by young people within each YOSS catchment, and an inability to determine whether the services were meeting the needs of all young people in the area (as opposed to those who attended the service on any given day) [231].

Bagshaw's 2005 Survey of Youth One Stop Shops

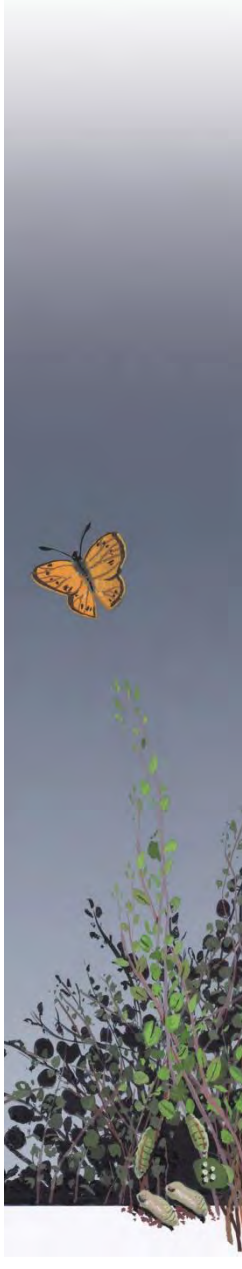
In 2005, Bagshaw [225] undertook a survey of YOSS to determine the most common funding models underpinning service delivery. Nine services completed questionnaires, with a further five failing to respond. Bagshaw found a range of service delivery configurations, with staffing levels and the services offered varying considerably around the country. All services had a contract with the Ministry of Health or DHBs, and most also had additional funding sources such as PHOs, the City Council and charitable trusts. Bagshaw concluded that while youth specific health services showed great potential, service delivery was currently patchy, and in some places nonexistent [225].

Overseas Evaluations of Youth One Stop Shops

While there is a reasonable literature, largely US based, on School-based Health Services, when Mathias [215] reviewed youth specific primary healthcare in 2002, she found no overseas reviews of community based youth health services/YOSS. She did note there had been one evaluation of a New Zealand service but it had focused on client opinion and had not involved a comparator population.

Similarly in their review of YOSS for the Ministry of Health, MacFarlane et al [230] noted that the literature on youth-focused primary care was in its early stages, with a number of observational studies describing demographic and service features and some authors providing theoretical hypotheses on successful models of care. However, they noted there was a dearth of empirical literature on interventions, specific outcomes, or the contexts in which successful care was provided. The authors noted that some of the difficulties arose from trying to prove effects in the context of multiple interacting interventions, in a transient population where individuals sought care from a range of different providers, and where the absence of disease was the desired outcome. They concluded there was an overall lack of robust scientific evidence regarding the benefits of community-based youth services.

These conclusions were similar to those of Fleming and Elvidge [218] in their review of youth specific health services. The authors were unable to identify any trials, systematic



reviews or cost benefit analyses of community based youth health services, with most research being descriptive, and calling for further research, or advocating for YOSS on the basis of expert or youth opinion. They concluded that as YOSS were relatively recent innovations, there was little empirical research in the area.

Internationally, a recent review of youth specific health services [221] noted that while there had been much research on barriers to accessing primary care, this evidence had not yet been translated into the design of youth-friendly services in a comprehensive way. Neither had the benefits of youth friendly initiatives on the health of young people been appropriately shown. While a number of principles had been developed to guide the development of youth friendly services, further evidence was required to support them, with such principles needing to be incorporated into the design of services for young people and these services then needing to be evaluated in well designed studies.

Youth One Stop Shop Conclusions

The available evidence suggests that YOSS are seen as an effective service delivery model by youth health professionals and their clients, and that they meet the needs of a diverse range of young people, including those too old for school-based services, and those with more sensitive health issues (e.g. sexual and reproductive health, alcohol and drug issues) who prefer a more youth-focused model of primary care. Local evaluations however suggest that in the absence of an over-arching framework, YOSS have evolved variably around the country, with the range of services offered, and the funding and governance arrangements for each YOSS varying considerably from service to service. Further, while most young people using YOSS feel that the services are effective, there is little empirical research on the impact of YOSS on health outcomes or the most optimal models of care. For those wishing to establish a YOSS in their region, it is recommended that they familiarise themselves with the most recent reviews (see text box below) and, importantly, incorporate an adequate evaluation framework into the service from the outset, so that over time, we can build up a more comprehensive overview of the models of community based health service which best meet the needs of New Zealand's young people.

MacFarlane M, Harris M, Michael S, et al. 2009. **Evaluation of Youth One Stop Shops**. Wellington: Communio. http://www.moh.govt.nz/moh.nsf/indexmh/evaluation-of-youth-one-stop-shops

Youthline. 2006. **Counties Manukau Pacific Youth One Stop Shop. A Review of Research, Best Evidence and Youth Opinion**. Auckland: Youthline. http://www.cmdhb.org.nz/funded-services/pacific-health/servicedevelopment/youth/youthlinereport.pdf

Milne S, McBride P. 2008. **Are We Doing a Good Job? Providing Evidence of the Effectiveness of Youth One Stop Shops: The Development of Self-Evaluation Capacity and an Evaluation Framework.** Auckland. http://www.cmdhb.org.nz/funded-services/Youth-Health/docs/default.htm

Conclusions

The available evidence suggests that young people are frequent users of primary health care, with most accessing health services at least once a year. While many young people express a preference for youth specific services, for most young people the first point of contact with the health system remains their general practitioner. However, young people use a variety of other services including school-based clinics, family planning clinics and youth one stop shops, with the choice of service depending both on availability and on the nature of their health concern at the time.

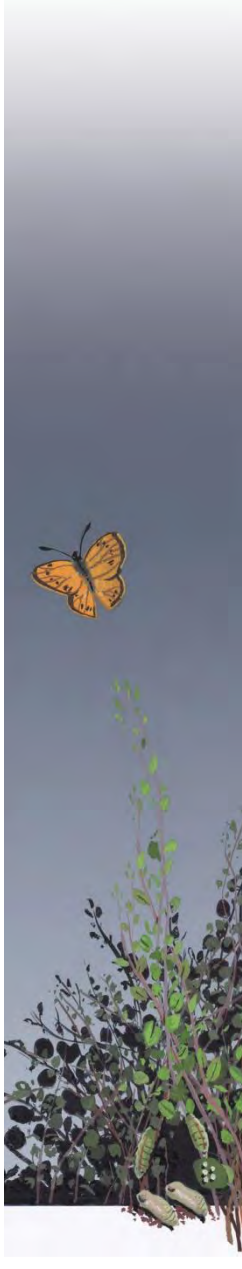
The available literature however was unable to provide any empirical evidence regarding the effectiveness of one type of service delivery over another, although local research suggests that different models of delivery may better meet the needs of different groups of young people. For example, while secondary school students value the confidentiality and ease of access of school-based services, such services are of limited utility to older young people, or those who have left school early. Further, the roll-out of YOSS remains variable across the country, meaning that for many older young people their general practitioner must remain their first point of contact with the health system. Finally, there was some

evidence that young people's preferences varied with the nature of the health problem, with the family GP being seen as appropriate for simple issues such as injuries and abdominal pain, but a youth-focused service being preferred for more personal matters such as sexual and reproductive health issues, and drug and alcohol problems.

Thus it is likely that at the regional level, DHBs will need to ensure the most appropriate balance across all three models of care, with the types of quality improvements required varying from service to service. Specific issues DHBs may like to consider for each of the main models of care include:

1. **General Practice / PHOs**: Given that the GP remains the first point of contact for most young people, improving the quality of care delivered by GPs remains a high priority, with local research suggesting that issues such as privacy/confidentiality, health screening and preventive counselling may need to be addressed. In this context, research suggests that practitioner training in communication and the management of common adolescent health issues may improve practitioners' confidence and knowledge in these areas, while quality improvements along the lines of those recommended by the Kidz First Draft Youth Service Standards [232], may make services more youth friendly, and as a consequence may potentially lead to increased utilisation by young people.
2. **School-Based Health Services**: Local research suggests that school-based health services are viewed in positive terms by students, and may increase access to primary care. However there is no overarching national framework for the delivery of school-based services, and the scope of services available varies considerably from school to school. Thus at the DHB level, there may be some utility in reviewing of the services available in local secondary schools, consulting with key stakeholders, and then weighing up whether further investments in this area are required. For those wishing to undertake such a process, the Ministry of Health's *Guidelines for School-Based Health Care* [226] provide a logical starting point.
3. **Youth One Stop Shops**: Similarly, local research suggests that YOSS are viewed positively by service users and staff, and may increase young people's access to primary healthcare. However, as with School-Based Services, there is no overarching national framework for the provision of community based youth health services, and coverage remains patchy around the country. Further stable ongoing funding remains a problem for many services. Thus, as with school-based services, there may be merit in DHBs undertaking a review of community based youth health services, with a view to assessing whether further investment is required in this area. For those wishing to undertake such a process, MacFarlane's recent review of YOSS for the Ministry of Health [230] is a useful starting point, as it provides an excellent overview of many of the issues arising in the current environment.

Finally within the DHB, it is likely that any systematic approach to the improvement of youth health services will require the involvement of local youth health experts, and key stakeholders, including Māori, with a multidisciplinary team also potentially being required to oversee the process. For those considering such an approach, the recent review by Fleming and Elvidge for Waitemata DHB [218] provides a useful starting point, with its recommendations section outlining the steps which may need to be undertaken at the DHB level. While the approach taken is likely to vary from region to region, depending on local health needs, stakeholder views, and pre-existing service configurations, the delivery of high quality health services to young people should remain a high priority for all DHBs.



MOST FREQUENT CAUSES OF HOSPITAL ADMISSION AND MORTALITY IN YOUNG PEOPLE

Introduction

Before considering any of the more detailed analyses in the other sections of this report, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality amongst Midland's young people during the past five years. It is hoped that the brief summary tables presented below will provide an overall context, within which to consider the relative importance of the various health issues experienced by the region's young people in recent years.

Data Sources and Methods

Indicator

1. *Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for young people aged 15–24 years by primary diagnosis (acute and arranged admissions) or primary procedure (waiting list admissions).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Most Frequent Causes of Mortality in Young People Aged 15–24 Years*

Numerator: National Mortality Collection: Mortality for young people aged 15–24 years by main underlying cause of death.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Primary Diagnoses/ Cause of Death: Acute URTI (J00-J04, J050, J051, J06); Bronchiolitis (J21); Asthma (J45, J46); Bacterial / Viral / Other Pneumonia (J12-J18, J100, J110); Gastroenteritis (A00-A09, R11, K529); Skin Infections (L00-L04, L050, L08, H000, H010, J340, L980); Meningococcal Disease (A39); Bacterial Meningitis (G00-G01); Dental Conditions (K00-K08); Neoplasm/Chemotherapy/Radiotherapy (C00-D48, Z510, Z511); Mental Health (F00-F99); Abdominal/Pelvic Pain (R10); Viral Infection NOS (B349); Renal Failure (N17-N19); Immune Disorders (D80-D89); Metabolic Disorders (E70-E89); Haemolytic Anaemias (D55-D59); Fever of Unknown Origin (R508, R509); Removal of Internal Fixation Device (Z470); Dialysis (Z49); Appendicitis (K35-K37); Injury / Poisoning (S00-T79 Excluding ED Cases); Urinary Tract Infection (N10, N11, N12, N300, N301, N302, N303, N308, N309, N390); Constipation (K590); Therapeutic/Other/Unspecified Abortion (O04-O08); Spontaneous Abortion/Other Early Pregnancy Loss (O00-O03); Pregnancy/Delivery/Postnatal (O09-O99); STI/Pelvic Inflammatory Disease (N70-N77, A50-A64, I980, M031, M730, M731, N290, N341).

Injuries (Mortality): Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34).

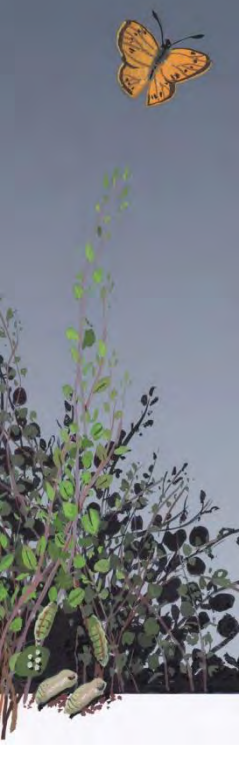
Procedures (Procedure or Block Code): Grommets (4163200, 4163201); Tonsillectomy +/− Adenoidectomy (4178900, 4178901); Adenoidectomy without Tonsillectomy (4180100); Procedures on Extraocular Muscles (block 215-220); Myringoplasty (block 313); Procedures on Nose (block 370-381); Dental Procedures (block 450-490); Inguinal Hernia Repair (block 990); Gastrointestinal Procedures (block 850-1011); Haemodialysis (block 1059); Orchidopexy (block 1186); Circumcision (3065300); Hypospadias Repair (block 1198); Procedures on the Cervix (block 1274-1278); Musculoskeletal Procedures (block 1360-1579); Procedures on Skin / Subcutaneous Tissue (block 1600-1660); Chemotherapy / Radiation Oncology (block 1780-1799); CT Scan 1952-1966); Magnetic Resonance Imaging (MRI)(block 2015).

Notes on Interpretation

Note 1: Because of regional differences in the booking of hospital admissions for pregnancy and childbirth (DHBs vary in their use of acute/arranged/waiting list codes), in this analysis a separate reproductive category has been used, which includes all admissions with a primary diagnosis in the ICD-10-AM O00–O99 range. For the purposes of rate calculations, only females aged 15–24 years have been included in the denominator (as compared to the other admission categories, where both genders have been included).

Note 2: Coverage of therapeutic abortions in the NMDS is partial (as many terminations are undertaken in private facilities which do not report to the NMDS). As a result, the figures presented here may significantly underestimate the number of terminations undertaken during the period.

Note 3: In order to maintain consistency with the injury section, all injury admissions with an Emergency Medicine Specialty Code (M05–M08) on discharge were excluded (see **Appendix 3** for rationale).



Note 4: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary.

New Zealand Distribution

New Zealand Mortality

In New Zealand during 2004–2008, intentional self-harm, vehicle occupant transport injuries and neoplasms were the leading causes of mortality in young people aged 15–24 years (**Table 135**).

Table 135. Most Frequent Causes of Mortality in Young People Aged 15–24 Years by Main Underlying Cause of Death, New Zealand 2004–2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
New Zealand				
Mortality in Young People Aged 15–24 Years				
Intentional Self-Harm	550	110.0	18.2	27.3
Transport: Vehicle Occupant	538	107.6	17.8	26.7
Transport: Pedestrian	52	10.4	1.72	2.6
Transport: Motorbike	54	10.8	1.79	2.7
Transport: Cyclist	10	2.0	0.33	0.5
Transport: Other	40	8.0	1.32	2.0
Neoplasms	169	33.8	5.59	8.4
Congenital Anomalies	60	12.0	1.98	3.0
Assault	51	10.2	1.69	2.5
Accidental Poisoning	49	9.8	1.62	2.4
Drowning / Submersion	48	9.6	1.59	2.4
Falls	43	8.6	1.42	2.1
Epilepsy / Status Epilepticus	36	7.2	1.19	1.8
Undetermined Intent	31	6.2	1.03	1.5
Mechanical Forces: Inanimate	15	3.0	0.50	0.7
Asthma	15	3.0	0.50	0.7
Electricity / Fire / Burns	12	2.4	0.40	0.6
Other Causes	244	48.8	8.07	12.1
New Zealand Total	2,017	403.4	66.7	100.0

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

New Zealand Hospital Admissions

In New Zealand during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people. In terms of other admission types, injury/poisoning and abdominal/pelvic pain were the leading reasons for acute admissions, injury/poisoning and neoplasms/chemotherapy/radiotherapy the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures the leading reasons for waiting list admissions in those aged 15–24 years (**Table 136**).

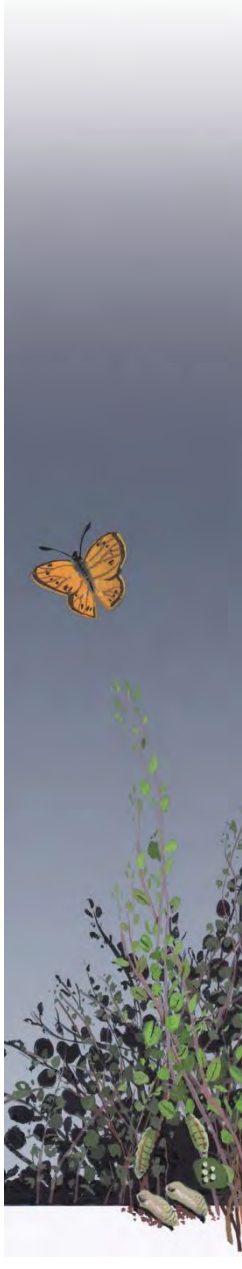
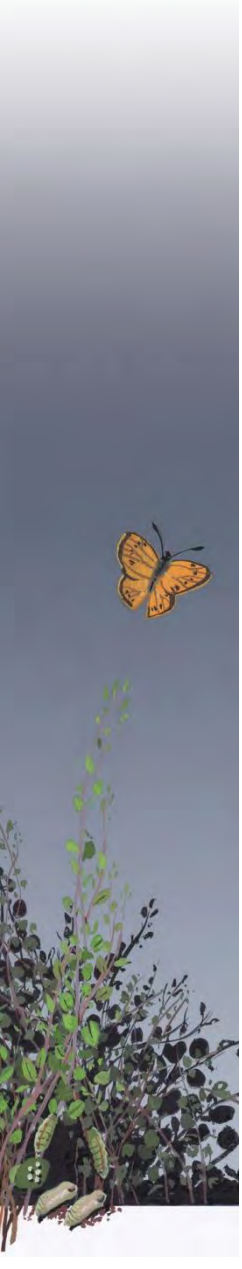


Table 136. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, New Zealand 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	116,502	23,300	74.26	77.4
*Therapeutic/Other/Unspecified Abortion	24,923	4,985	15.89	16.6
Spontaneous Abortion / Other Early Pregnancy Loss	9,009	1,802	5.74	6.0
Total Reproductive Admissions	150,434	30,087	95.9	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	44,723	8,945	14.12	22.7
Abdominal/Pelvic Pain	16,363	3,273	5.17	8.3
Mental Health	15,701	3,140	4.96	8.0
Skin Infections	10,254	2,051	3.24	5.2
Appendicitis	7,214	1,443	2.28	3.7
Gastroenteritis	7,057	1,411	2.23	3.6
Urinary Tract Infection	5,855	1,171	1.85	3.0
Total Acute URTI	4,379	876	1.38	2.2
Asthma	4,266	853	1.35	2.2
STI / Pelvic Inflammatory Disease	3,706	741	1.17	1.9
Other Diagnoses	77,337	15,467	24.42	39.3
Total Acute Admissions	196,855	39,371	62.2	100.0
Arranged Admissions by Primary Diagnosis				
Injury / Poisoning	6,025	1,205	1.90	10.9
Neoplasm / Chemotherapy / Radiotherapy	3,681	736	1.16	6.7
Dialysis	2,572	514	0.81	4.7
Mental Health	1,672	334	0.53	3.0
Other Diagnoses	41,255	8,251	13.03	74.7
Total Arranged Admissions	55,205	11,041	17.4	100.0
Waiting List Admissions by Primary Procedure				
Musculoskeletal Procedures	8,456	1,691	2.67	17.7
Gastrointestinal Procedures	6,856	1,371	2.17	14.3
Procedures on Skin/Subcutaneous Tissue	4,188	838	1.32	8.7
Tonsillectomy +/− Adenoidectomy	4,185	837	1.32	8.7
Dental Procedures	3,785	757	1.20	7.9
No Procedure Listed	2,478	496	0.78	5.2
Procedures on the Cervix	1,435	287	0.45	3.0
Procedures on Nose	1,269	254	0.40	2.7
Inguinal Hernia Repair	652	130	0.21	1.4
Myringoplasty	618	124	0.20	1.3
Other Procedures	13,944	2,789	4.40	29.1
Total Waiting List Admissions	47,866	9,573	15.1	100.0
New Zealand Total	450,360	90,072		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.



Midland Region Distribution

Midland Region Mortality

In the Midland Region during 2004–2008, vehicle occupant transport injuries, intentional self-harm and neoplasms were the leading causes of mortality in young people aged 15−24 years in all five DHBs (**Table 137**–**Table 138**).

Table 137. Most Frequent Causes of Mortality in Young People Aged 15–24 Years by Main Underlying Cause of Death, Waikato, Bay of Plenty and Lakes DHBs 2004–2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Mortality in Young People Aged 15–24 Years				
Waikato				
Intentional Self-Harm	46	9.2	17.8	21.9
Transport: Vehicle Occupant	76	15.2	29.5	36.2
Transport: Pedestrian	8	1.6	3.10	3.8
Transport: Motorbike	4	0.8	1.55	1.9
Transport: All Other Causes	6	1.2	2.33	2.9
Neoplasms	14	2.8	5.43	6.67
Drowning / Submersion	8	1.6	3.10	3.8
Accidental Poisoning	6	1.2	2.33	2.9
Epilepsy / Status Epilepticus	6	1.2	2.33	2.9
Congenital Anomalies	4	0.8	1.55	1.9
Undetermined Intent	4	0.8	1.55	1.9
Assault	3	0.6	1.16	1.4
Other Causes	25	5.0	9.69	11.9
Waikato Total	210	42.0	81.4	100.0
Bay of Plenty				
Intentional Self-Harm	19	3.8	15.9	18.6
Transport: Vehicle Occupant	38	7.6	31.8	37.3
Transport: Pedestrian	4	0.8	3.34	3.9
Transport: Motorbike	6	1.2	5.01	5.9
Neoplasms	8	1.6	6.69	7.8
Accidental Poisoning	3	0.6	2.51	2.9
Undetermined Intent	3	0.6	2.51	2.9
Other Causes	21	4.2	17.6	20.6
Bay of Plenty Total	102	20.4	85.2	100.0
Lakes DHB				
Intentional Self-Harm	12	2.4	18.2	20.0
Transport: Vehicle Occupant	22	4.4	33.4	36.7
Transport: All Other Causes	5	1.0	7.60	8.3
Neoplasms	7	1.4	10.6	11.7
Other Causes	14	2.8	21.3	23.3
Lakes DHB Total	60	12.0	91.2	100.0

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

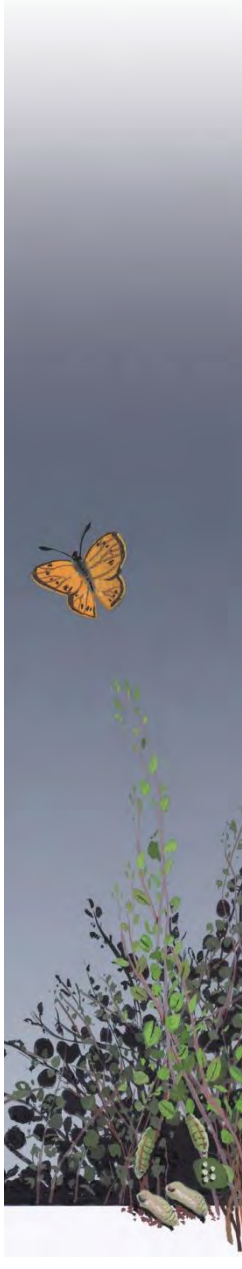


Table 138. Most Frequent Causes of Mortality in Young People Aged 15–24 Years by Main Underlying Cause of Death, Tairawhiti and Taranaki DHBs 2004–2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	Percent (%)
Mortality in Young People Aged 15–24 Years				
Tairawhiti				
Intentional Self-Harm	13	2.6	42.2	39.4
Transport: Vehicle Occupant	5	1.0	16.2	15.2
Neoplasms	4	0.8	13.0	12.1
Other Causes	11	2.2	35.7	33.3
Tairawhiti Total	33	6.6	107.2	100.0
Taranaki				
Intentional Self-Harm	12	2.4	17.5	23.5
Transport: Vehicle Occupant	12	2.4	17.5	23.5
Transport: All Other Causes	5	1.0	7.29	9.80
Neoplasms	7	1.4	10.2	13.7
Other Causes	15	3.0	21.9	29.4
Taranaki Total	51	10.2	74.3	100.0

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Midland Region Hospital Admissions

In the Midland Region during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people in all five DHBs. In terms of other admission types, injury/poisoning, abdominal/pelvic pain and mental health issues were the leading reasons for acute admissions, while dialysis, neoplasm / chemotherapy / radiotherapy, injury / poisoning and mental health issues the leading reasons for arranged admissions. Gastrointestinal and musculoskeletal procedures, dental procedures and tonsillectomy +/− adenoidectomy were the leading reasons for waiting list admissions in Midland DHBs (**Table 139**–**Table 143**).

Summary

In New Zealand during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people. In terms of other admission types, injury/poisoning and abdominal/pelvic pain were the leading reasons for acute admissions, injury/poisoning and neoplasms/chemotherapy/radiotherapy the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures the leading reasons for waiting list admissions. During 2004–2008, intentional self-harm, vehicle occupant transport injuries and neoplasms were the leading causes of mortality in young people aged 15–24 years.

In the Midland Region during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people in all five DHBs. In terms of other admission types, injury/poisoning, abdominal/pelvic pain and mental health issues were the leading reasons for acute admissions, while dialysis, neoplasm / chemotherapy / radiotherapy, injury / poisoning and mental health issues the leading reasons for arranged admissions. Gastrointestinal and musculoskeletal procedures, dental procedures and tonsillectomy +/− adenoidectomy were the leading reasons for waiting list admissions in Midland DHBs. During 2004–2008, vehicle occupant transport injuries, intentional self-harm and neoplasms were the leading causes of mortality in young people aged 15–24 years in all five DHBs.

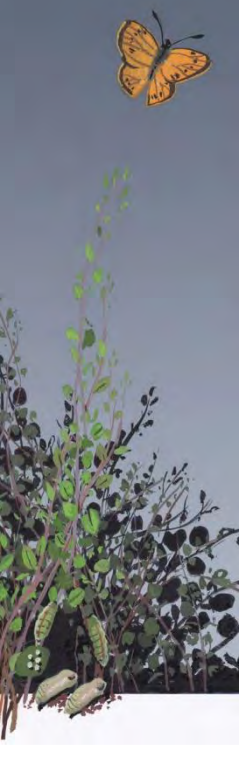


Table 139. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, Waikato 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Waikato 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	11,750	2,350.0	88.7	73.6
*Therapeutic/Other/Unspecified Abortion	3,442	688.4	26.0	21.6
Spontaneous Abortion / Other Early Pregnancy Loss	769	153.8	5.81	4.8
Total Reproductive Admissions	15,961	3,192.2	120.6	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	3,420	684.0	12.8	20.6
Abdominal/Pelvic Pain	1,942	388.4	7.26	11.7
Mental Health	1,528	305.6	5.72	9.2
Skin Infections	738	147.6	2.76	4.4
Appendicitis	650	130.0	2.43	3.9
Urinary Tract Infection	543	108.6	2.03	3.3
Gastroenteritis	525	105.0	1.96	3.2
Total Acute URTI	360	72.0	1.35	2.2
Asthma	336	67.2	1.26	2.0
STI / Pelvic Inflammatory Disease	302	60.4	1.13	1.8
Other Diagnoses	6,286	1,257.2	23.5	37.8
Total Acute Admissions	16,630	3,326.0	62.2	100.0
Arranged Admissions by Primary Diagnosis				
Dialysis	654	130.8	2.45	8.5
Neoplasm / Chemotherapy / Radiotherapy	601	120.2	2.25	7.8
Injury / Poisoning	583	116.6	2.18	7.6
Immune Disorders	288	57.6	1.08	3.8
Other Diagnoses	5,551	1,110.2	20.8	72.3
Total Arranged Admissions	7,677	1,535.4	28.7	100.0
Waiting List Admissions by Primary Procedure				
Gastrointestinal Procedures	826	165.2	3.09	21.7
Musculoskeletal Procedures	430	86.0	1.61	11.3
Tonsillectomy +/− Adenoidectomy	360	72.0	1.35	9.4
Procedures on Skin/Subcutaneous Tissue	337	67.4	1.26	8.8
No Procedure Listed	290	58.0	1.08	7.6
Dental Procedures	193	38.6	0.72	5.1
Procedures on the Cervix	117	23.4	0.44	3.1
Procedures on Nose	59	11.8	0.22	1.5
Myringoplasty	59	11.8	0.22	1.5
Grommets	52	10.4	0.19	1.4
Other Procedures	1,089	217.8	4.07	28.6
Total Waiting List Admissions	3,812	762.4	14.3	100.0
Waikato Total	44,080	8,816.0		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.

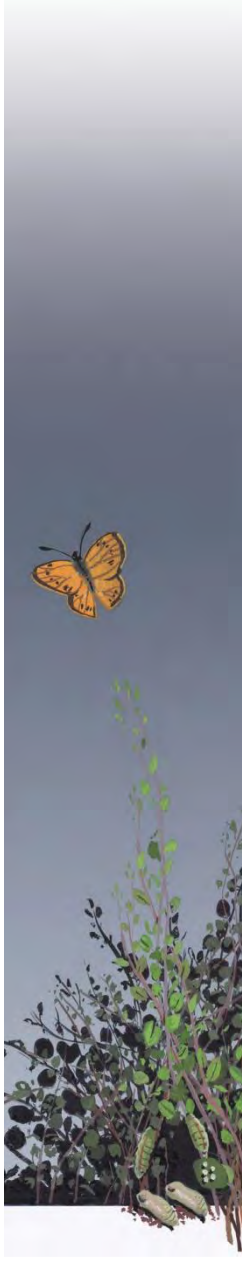


Table 140. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, Bay of Plenty 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Bay of Plenty 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	5,729	1,145.8	92.5	74.0
*Therapeutic/Other/Unspecified Abortion	1,609	321.8	26.0	20.8
Spontaneous Abortion / Other Early Pregnancy Loss	399	79.8	6.44	5.2
Total Reproductive Admissions	7,737	1,547.4	125.0	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	2,296	459.2	18.2	24.7
Mental Health	809	161.8	6.43	8.7
Abdominal/Pelvic Pain	674	134.8	5.36	7.3
Skin Infections	539	107.8	4.28	5.8
Gastroenteritis	388	77.6	3.08	4.2
Appendicitis	333	66.6	2.65	3.6
Urinary Tract Infection	254	50.8	2.02	2.7
Total Acute URTI	192	38.4	1.53	2.1
Asthma	189	37.8	1.50	2.0
STI / Pelvic Inflammatory Disease	133	26.6	1.06	1.4
Other Diagnoses	3,474	694.8	27.6	37.4
Total Acute Admissions	9,281	1,856.2	73.7	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	223	44.6	1.77	10.7
Injury / Poisoning	209	41.8	1.66	10.1
Mental Health	133	26.6	1.06	6.4
Metabolic Disorders	87	17.4	0.69	4.2
Other Diagnoses	1,425	285.0	11.3	68.6
Total Arranged Admissions	2,077	415.4	16.5	100.0
Waiting List Admissions by Primary Procedure				
Gastrointestinal Procedures	440	88.0	3.50	18.5
Musculoskeletal Procedures	334	66.8	2.65	14.0
Procedures on Skin/Subcutaneous Tissue	201	40.2	1.60	8.4
Tonsillectomy +/− Adenoidectomy	190	38.0	1.51	8.0
Dental Procedures	189	37.8	1.50	7.9
Procedures on the Cervix	141	28.2	1.12	5.9
No Procedure Listed	135	27.0	1.07	5.7
Procedures on Nose	37	7.4	0.29	1.6
Inguinal Hernia Repair	32	6.4	0.25	1.3
Myringoplasty	30	6.0	0.24	1.3
Other Procedures	650	130.0	5.16	27.3
Total Waiting List Admissions	2,379	475.8	18.9	100.0
Bay of Plenty Total	21,474	4,294.8		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population
Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.

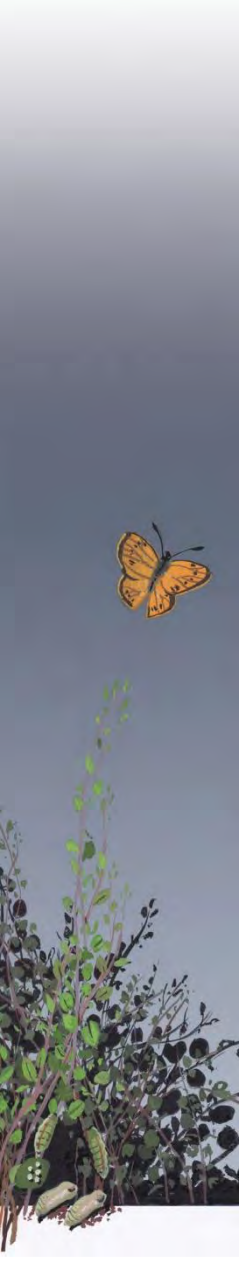


Table 141. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, Lakes DHB 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Lakes DHB 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	4,010	802.0	123.3	75.3
*Therapeutic/Other/Unspecified Abortion	1,015	203.0	31.2	19.1
Spontaneous Abortion / Other Early Pregnancy Loss	302	60.4	9.29	5.7
Total Reproductive Admissions	5,327	1,065.4	163.9	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	1,440	288.0	21.7	24.2
Abdominal/Pelvic Pain	491	98.2	7.40	8.2
Mental Health	382	76.4	5.76	6.4
Skin Infections	317	63.4	4.78	5.3
Appendicitis	206	41.2	3.11	3.5
Gastroenteritis	202	40.4	3.04	3.4
Urinary Tract Infection	164	32.8	2.47	2.8
Total Acute URTI	128	25.6	1.93	2.1
STI / Pelvic Inflammatory Disease	122	24.4	1.84	2.0
Asthma	122	24.4	1.84	2.0
Other Diagnoses	2,386	477.2	36.0	40.0
Total Acute Admissions	5,960	1,192.0	89.8	100.0
Arranged Admissions by Primary Diagnosis				
Dialysis	130	26.0	1.96	8.6
Injury / Poisoning	113	22.6	1.70	7.5
Neoplasm / Chemotherapy / Radiotherapy	61	12.2	0.92	4.1
Immune Disorders	57	11.4	0.86	3.8
Other Diagnoses	1,142	228.4	17.2	76.0
Total Arranged Admissions	1,503	300.6	22.7	100.0
Waiting List Admissions by Primary Procedure				
Gastrointestinal Procedures	198	39.6	2.98	17.7
Musculoskeletal Procedures	172	34.4	2.59	15.4
Tonsillectomy +/− Adenoidectomy	108	21.6	1.63	9.7
Procedures on the Cervix	104	20.8	1.57	9.3
No Procedure Listed	85	17.0	1.28	7.6
Procedures on Skin/Subcutaneous Tissue	84	16.8	1.27	7.5
Dental Procedures	39	7.8	0.59	3.5
Procedures on Nose	32	6.4	0.48	2.9
Myringoplasty	25	5.0	0.38	2.2
Inguinal Hernia Repair	10	2.0	0.15	0.9
Other Procedures	262	52.4	3.95	23.4
Total Waiting List Admissions	1,119	223.8	16.9	100.0
Lakes DHB Total	13,909	2,781.8		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.

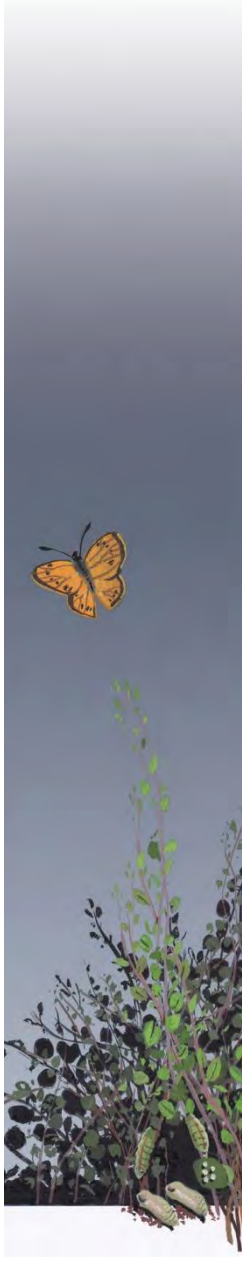


Table 142. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, Tairawhiti 2006–2010

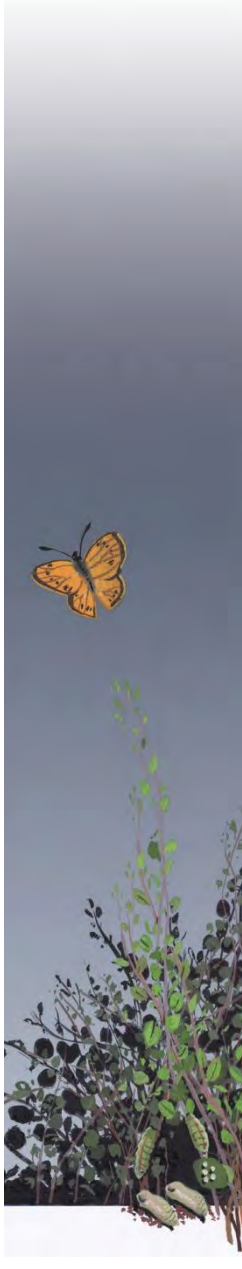
Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tairawhiti 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	1,970	394.0	125.9	86.3
*Therapeutic/Other/Unspecified Abortion	184	36.8	11.8	8.1
Spontaneous Abortion / Other Early Pregnancy Loss	128	25.6	8.18	5.6
Total Reproductive Admissions	2,282	456.4	145.8	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	997	199.4	31.5	31.8
Mental Health	258	51.6	8.16	8.2
Abdominal/Pelvic Pain	244	48.8	7.71	7.8
Skin Infections	162	32.4	5.12	5.2
Gastroenteritis	94	18.8	2.97	3.0
Appendicitis	92	18.4	2.91	2.9
Urinary Tract Infection	89	17.8	2.81	2.8
Total Acute URTI	84	16.8	2.66	2.7
STI / Pelvic Inflammatory Disease	80	16.0	2.53	2.5
Constipation	47	9.4	1.49	1.5
Other Diagnoses	991	198.2	31.3	31.6
Total Acute Admissions	3,138	627.6	99.2	100.0
Arranged Admissions by Primary Diagnosis				
Injury / Poisoning	91	18.2	2.88	13.3
Neoplasm / Chemotherapy / Radiotherapy	64	12.8	2.02	9.4
Mental Health	38	7.6	1.20	5.6
Skin Infections	10	2.0	0.32	1.5
Other Diagnoses	480	96.0	15.2	70.3
Total Arranged Admissions	683	136.6	21.6	100.0
Waiting List Admissions by Primary Procedure				
Musculoskeletal Procedures	145	29.0	4.58	22.0
Gastrointestinal Procedures	91	18.2	2.88	13.8
Procedures on Skin/Subcutaneous Tissue	73	14.6	2.31	11.1
Tonsillectomy +/− Adenoidectomy	50	10.0	1.58	7.6
Dental Procedures	40	8.0	1.26	6.1
No Procedure Listed	33	6.6	1.04	5.0
Procedures on the Cervix	25	5.0	0.79	3.8
Procedures on Nose	22	4.4	0.70	3.3
Myringoplasty	10	2.0	0.32	1.5
Grommets	9	1.8	0.28	1.4
Other Procedures	162	32.4	5.12	24.5
Total Waiting List Admissions	660	132.0	20.9	100.0
Tairawhiti Total	6,763	1,352.6		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.

Table 143. Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years by Admission Type, Taranaki 2006–2010

Primary Diagnosis/Procedure	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Taranaki 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy / Delivery / Postnatal	3,175	635.0	94.1	72.1
*Therapeutic/Other/Unspecified Abortion	1,039	207.8	30.8	23.6
Spontaneous Abortion / Other Early Pregnancy Loss	190	38.0	5.63	4.3
Total Reproductive Admissions	4,404	880.8	130.5	100.0
Acute Admissions by Primary Diagnosis				
Injury / Poisoning	1,061	212.2	15.1	20.1
Mental Health	531	106.2	7.58	10.0
Abdominal/Pelvic Pain	398	79.6	5.68	7.5
Skin Infections	242	48.4	3.45	4.6
Appendicitis	173	34.6	2.47	3.3
Gastroenteritis	152	30.4	2.17	2.9
Urinary Tract Infection	111	22.2	1.58	2.1
Total Acute URTI	100	20.0	1.43	1.9
Asthma	93	18.6	1.33	1.8
STI / Pelvic Inflammatory Disease	81	16.2	1.16	1.5
Other Diagnoses	2,348	469.6	33.5	44.4
Total Acute Admissions	5,290	1,058.0	75.5	100.0
Arranged Admissions by Primary Diagnosis				
Neoplasm / Chemotherapy / Radiotherapy	104	20.8	1.48	6.2
Injury / Poisoning	60	12.0	0.86	3.6
Removal of Internal Fixation Device	50	10.0	0.71	3.0
Mental Health	19	3.8	0.27	1.1
Other Diagnoses	1,445	289.0	20.6	86.1
Total Arranged Admissions	1,678	335.6	24.0	100.0
Waiting List Admissions by Primary Procedure				
Gastrointestinal Procedures	313	62.6	4.47	18.9
Dental Procedures	313	62.6	4.47	18.9
Musculoskeletal Procedures	211	42.2	3.01	12.7
Tonsillectomy +/− Adenoidectomy	143	28.6	2.04	8.6
Procedures on Skin/Subcutaneous Tissue	113	22.6	1.61	6.8
No Procedure Listed	83	16.6	1.18	5.0
Procedures on Nose	55	11.0	0.79	3.3
Inguinal Hernia Repair	25	5.0	0.36	1.5
Myringoplasty	19	3.8	0.27	1.1
Grommets	13	2.6	0.19	0.8
Other Procedures	368	73.6	5.25	22.2
Total Waiting List Admissions	1,656	331.2	23.6	100.0
Taranaki Total	13,028	2,605.6		100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Note: Reproductive Rates are per 1,000 females thus overall DHB rate not provided due to use of gender-specific denominator for Reproductive Admissons; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.



INJURIES IN YOUNG PEOPLE

Introduction

Injury is the leading cause of mortality among young people aged 15-24 years, with the rate at which these events occur being far higher than for other age groups [233]. During 2000-2004, on average, 290 young people each year died as the result of an injury, as compared to 98 children per year during the same period [22]. When compared to children, a different set of causes are also seen, with more than a third of all injury deaths in young people being the result of self-harm. An equivalent proportion of deaths arise when young people are the occupants in a vehicle in a crash, many of which are traffic related events on public roads. Further deaths result from motorcycle and pedestrian crashes both on and off road. Considerable concern has been focused on the high rate of mortality and morbidity from MVTC in this age group [234].

Hospitalisation for injury among this age group is also comparatively high, with the top four reasons for admission being the result of inanimate mechanical forces (for example, being struck by or caught between objects), falls, as occupants of vehicles, and from assault [234]. Risk factors among those hospitalised included age, gender, ethnicity and deprivation. Risk factors evident for vehicle occupants are being male, Māori and from an area of higher deprivation [97]. Motorcycle and pedal cycle risk factors include being male and European, with pedal cyclists also more likely to be from less deprived areas. Pedal cyclists are also more commonly younger than motorcyclists and vehicle occupants. Among non-transport injury events, with the exception of gender, risk factors are less evident [234].

The following section reviews injuries in young people using data from the National Minimum Dataset and the National Mortality Collection. The section concludes with a brief overview of local policy documents and evidence-based reviews which consider the prevention of childhood injuries at the population level.

Data Sources and Methods

Indicator

1. *Hospital Admissions for Injuries in Young People Aged 15–24 Years*

Numerator: National Minimum Dataset: Hospital admissions in young people aged 15–24 years with a primary diagnosis of Injury (ICD-10-AM S00–T79). Causes of injury were assigned using the ICD-10-AM primary external cause code (E code). The following were excluded: 1) Admissions with an E code in the Y40–Y89 range (complications of drugs/medical/surgical care and late sequelae of injury). 2) Admissions with an Emergency Medicine Specialty code (M05–M08) on discharge.

Causes of injury were assigned using the primary E code (hospital admissions) or the main underlying cause of death as follows: Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34). Broader Categories included Land Transport Injuries (V01–V89) and Unintentional Non-Transport Injuries (W00–W74, W85–X19)

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

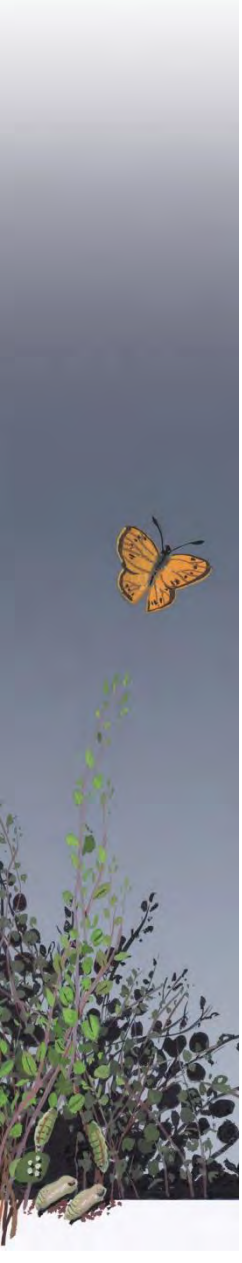
2. Mortality from Injuries in Young People Aged 15–24 Years

Numerator: National Mortality Collection; Deaths in young people aged 15–24 years where the main underlying cause of death was an injury (V01–Y36). Causes of injury were assigned using the codes listed above.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Because of regional inconsistencies in the uploading of Emergency Department cases to the National Minimum dataset (see **Appendix 3**) all hospital admissions with an Emergency Department specialty code on discharge have been excluded. In addition, because of the potential for these inconsistencies to impact significantly on time series analysis, any reviews of long term trends have been restricted to mortality data, with hospital admission data being used to explore cross sectional associations between demographic factors and different injury types. Despite these restrictions, the reader must bear in mind the fact that differences in the



way different DHBs upload their injury cases to the NMDS may also impact on the regional vs. New Zealand analyses presented (see **Appendix 3** for a fuller explanation of these issues).

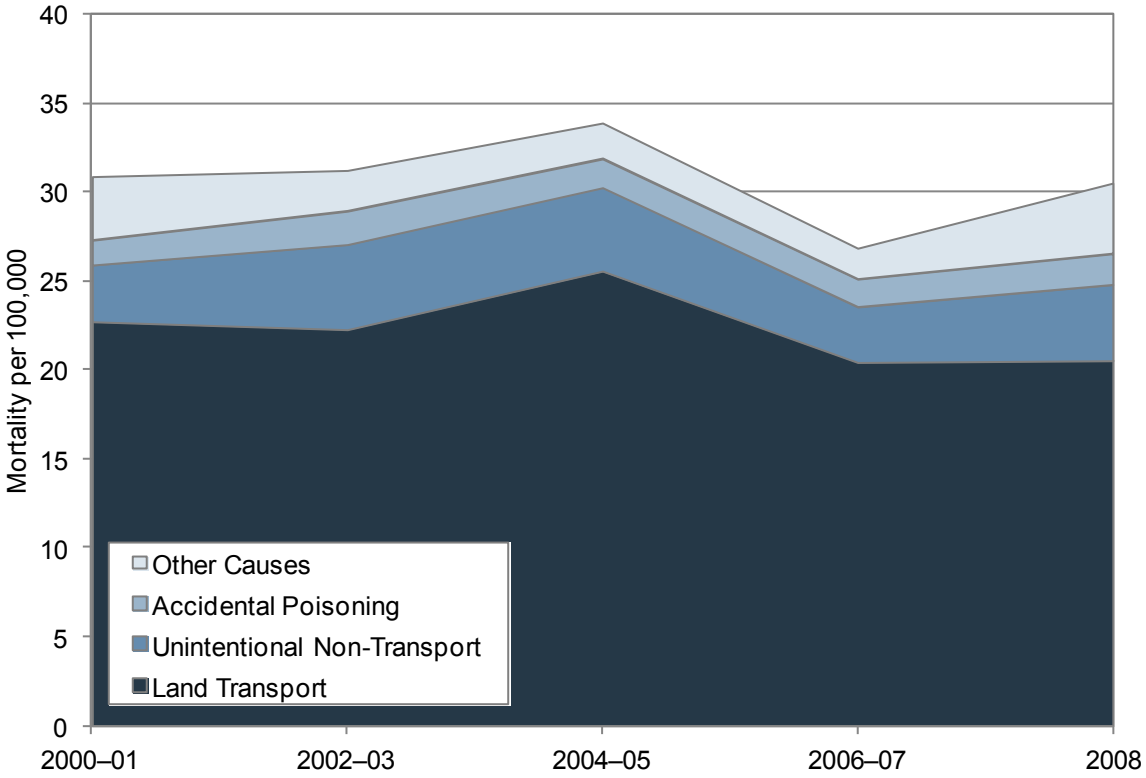
Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

All Injuries

New Zealand Trends

In New Zealand during 2000–2008, mortality from land transport injuries fluctuated, while mortality from unintentional non-transport injuries and accidental poisoning remained relatively static (**Figure 129**).

Figure 129. Mortality from Unintentional Injuries in Young People Aged 15–24 Years by Main Underlying Cause of Death, New Zealand 2000–2008



Source: Numerator: National Mortality Collection (Assault and suicide excluded); Denominator: Statistics NZ Estimated Resident Population.

New Zealand Distribution by Cause

In New Zealand during 2006–2010, inanimate mechanical forces and falls were the leading causes of injury admissions in young people, although as a group transport injuries also made a significant contribution. In contrast, during 2004–2008, intentional self-harm and vehicle occupant injuries were the leading causes of injury related mortality in young people (**Table 144**).

Midland Region Distribution by Cause

In the Midland Region during 2006–2010, inanimate mechanical forces and falls were also the leading causes of injury admissions in young people in all five DHBs, although as a group transport injuries again made a significant contribution. In contrast, during 2004−2008 vehicle occupant injuries and intentional self-harm were the leading causes of injury related mortality in all five DHBs (**Table 145**–**Table 149**).

Table 144. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in New Zealand Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
New Zealand				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	11,539	2,307.8	364.4	22.3
Mechanical Forces: Animate	3,575	715.0	112.9	6.9
Falls	9,913	1,982.6	313.0	19.2
Transport: Vehicle Occupant	5,293	1,058.6	167.1	10.2
Transport: Motorbike	2,886	577.2	91.1	5.6
Transport: Cyclist	1,409	281.8	44.5	2.7
Transport: Pedestrian	709	141.8	22.4	1.4
Transport: Other Land Transport	1,222	244.4	38.6	2.4
Transport: Other Transport	257	51.4	8.12	0.5
Electricity / Fire / Burns	778	155.6	24.6	1.5
Accidental Poisoning	597	119.4	18.9	1.2
Accidental Threat to Breathing	25	5.0	0.79	<0.1
Drowning / Submersion	51	10.2	1.61	0.1
Assault	5,490	1,098.0	173.4	10.6
Intentional Self-Harm	3,221	644.2	101.7	6.2
Undetermined Intent	762	152.4	24.1	1.5
No External Cause Listed	15	3.0	0.47	<0.1
Other Causes	3,994	798.8	126.1	7.7
New Zealand Total	51,736	10,347.2	1,633.8	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	550	110.0	18.19	36.3
Transport: Vehicle Occupant	538	107.6	17.79	35.5
Transport: Motorbike	54	10.8	1.79	3.6
Transport: Pedestrian	52	10.4	1.72	3.4
Transport: Cyclist	10	2.0	0.33	0.7
Transport: Other Land Transport	24	4.8	0.79	1.6
Transport: Other Transport	16	3.2	0.53	1.1
Assault	51	10.2	1.69	3.4
Accidental Poisoning	49	9.8	1.62	3.2
Drowning / Submersion	48	9.6	1.59	3.2
Falls	43	8.6	1.42	2.8
Mechanical Forces: Inanimate	15	3.0	0.50	1.0
Mechanical Forces: Animate	<3	s	s	s
Electricity / Fire / Burns	12	2.4	0.40	0.8
Accidental Threat to Breathing	12	2.4	0.40	0.8
Undetermined Intent	31	6.2	1.03	2.0
Other Causes	10	2.0	0.33	0.7
New Zealand Total	1,517	303.4	50.17	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

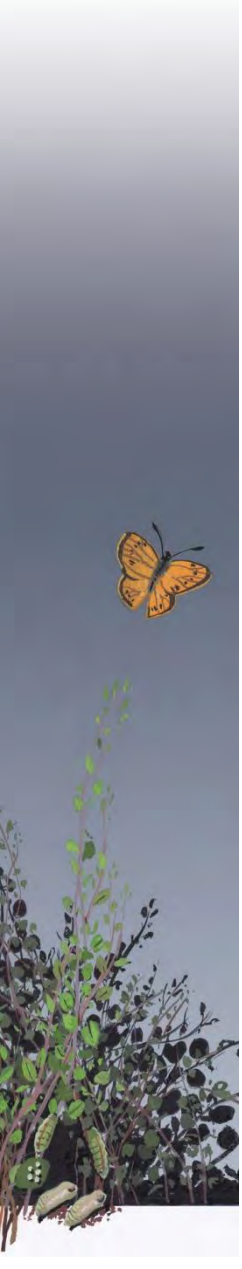


Table 145. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Waikato Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Waikato				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	1,033	206.6	386.4	25.2
Mechanical Forces: Animate	266	53.2	99.5	6.5
Falls	708	141.6	264.8	17.3
Transport: Vehicle Occupant	433	86.6	162.0	10.6
Transport: Motorbike	331	66.2	123.8	8.1
Transport: Cyclist	111	22.2	41.5	2.7
Transport: Pedestrian	55	11.0	20.6	1.3
Transport: Other Land Transport	118	23.6	44.1	2.9
Transport: Other Transport	13	2.6	4.86	0.3
Electricity / Fire / Burns	64	12.8	23.9	1.6
Accidental Poisoning	39	7.8	14.6	1.0
Drowning / Submersion	7	1.4	2.62	0.2
Assault	319	63.8	119.3	7.8
Intentional Self-Harm	206	41.2	77.1	5.0
Undetermined Intent	44	8.8	16.5	1.1
No External Cause Listed	<3	s	s	s
Other Causes	352	70.4	131.7	8.6
Waikato Total	4,100	820.0	1,533.5	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	46	9.2	17.8	27.5
Transport: Vehicle Occupant	76	15.2	29.5	45.5
Transport: Motorbike	4	0.8	1.55	2.4
Transport: Pedestrian	8	1.6	3.10	4.8
Transport: All Other Causes	6	1.2	2.33	3.6
Assault	3	0.6	1.16	1.8
Accidental Poisoning	6	1.2	2.33	3.6
Drowning / Submersion	8	1.6	3.10	4.8
Undetermined Intent	4	0.8	1.55	2.4
All Other Causes	6	1.2	2.33	3.6
Waikato Total	167	33.4	64.8	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

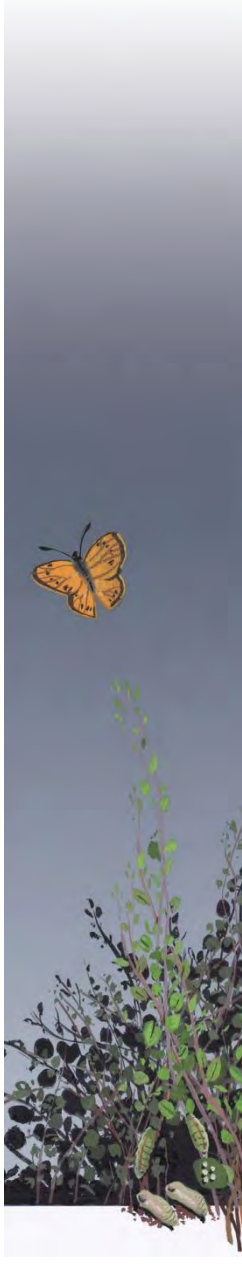


Table 146. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Bay of Plenty Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Bay of Plenty				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	494	98.8	392.5	19.4
Mechanical Forces: Animate	150	30.0	119.2	5.9
Falls	432	86.4	343.3	16.9
Transport: Vehicle Occupant	326	65.2	259.0	12.8
Transport: Motorbike	198	39.6	157.3	7.8
Transport: Cyclist	88	17.6	69.9	3.5
Transport: Pedestrian	45	9.0	35.8	1.8
Transport: Other Land Transport	58	11.6	46.1	2.3
Transport: Other Transport	9	1.8	7.15	0.4
Electricity / Fire / Burns	43	8.6	34.2	1.7
Accidental Poisoning	29	5.8	23.0	1.1
Accidental Threat to Breathing	<3	s	s	s
Drowning / Submersion	3	0.6	2.38	0.1
Assault	319	63.8	253.5	12.5
Intentional Self-Harm	158	31.6	125.5	6.2
Undetermined Intent	31	6.2	24.6	1.2
Other Causes	166	33.2	131.9	6.5
Bay of Plenty Total	2,550	510.0	2,026.2	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	19	3.8	15.9	23.8
Transport: Vehicle Occupant	38	7.6	31.8	47.5
Transport: Motorbike	6	1.2	5.01	7.5
Transport: Pedestrian	4	0.8	3.34	5.0
Accidental Poisoning	3	0.6	2.51	3.8
Undetermined Intent	3	0.6	2.51	3.8
All Other Causes	7	1.4	5.85	8.8
Bay of Plenty Total	80	16.0	66.9	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

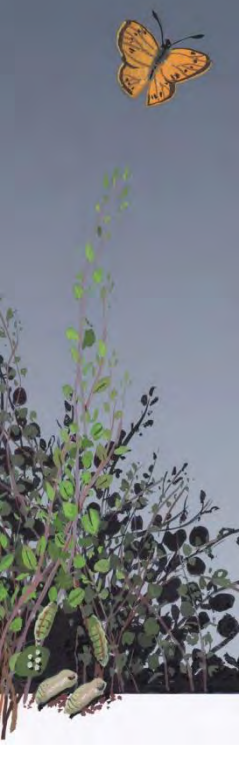


Table 147. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Lakes DHB Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Lakes DHB				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	291	58.2	438.6	18.6
Mechanical Forces: Animate	88	17.6	132.7	5.6
Falls	252	50.4	379.9	16.1
Transport: Vehicle Occupant	225	45.0	339.2	14.3
Transport: Motorbike	122	24.4	183.9	7.8
Transport: Cyclist	50	10.0	75.4	3.2
Transport: Pedestrian	12	2.4	18.1	0.8
Transport: Other Land Transport	41	8.2	61.8	2.6
Transport: Other Transport	6	1.2	9.04	0.4
Electricity / Fire / Burns	36	7.2	54.3	2.3
Accidental Poisoning	21	4.2	31.7	1.3
Accidental Threat to Breathing	<3	s	s	s
Assault	207	41.4	312.0	13.2
Intentional Self-Harm	87	17.4	131.1	5.5
Undetermined Intent	11	2.2	16.6	0.7
Other Causes	118	23.6	177.9	7.5
Lakes DHB Total	1,568	313.6	2,363.6	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	12	2.4	18.2	27.3
Transport: Vehicle Occupant	22	4.4	33.4	50.0
Transport: All Other Causes	5	1.0	7.60	11.4
All Other Causes	5	1.0	7.60	11.4
Lakes DHB Total	44	8.8	66.9	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

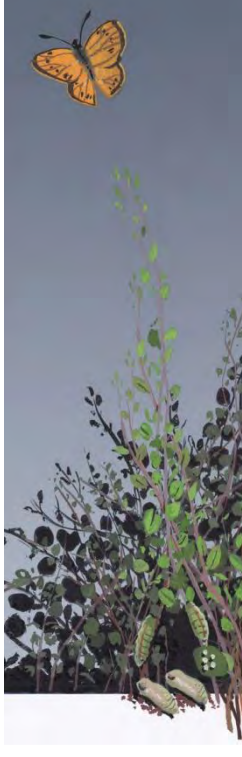


Table 148. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Tairawhiti Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Tairawhiti				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	228	45.6	720.7	20.1
Mechanical Forces: Animate	79	15.8	249.7	7.0
Falls	211	42.2	667.0	18.6
Transport: Vehicle Occupant	124	24.8	392.0	10.9
Transport: Motorbike	41	8.2	129.6	3.6
Transport: Cyclist	25	5.0	79.0	2.2
Transport: Pedestrian	7	1.4	22.1	0.6
Transport: Other Land Transport	50	10.0	158.1	4.4
Transport: Other Transport	5	1.0	15.8	0.4
Electricity / Fire / Burns	9	1.8	28.5	0.8
Accidental Poisoning	17	3.4	53.7	1.5
Assault	153	30.6	483.6	13.5
Intentional Self-Harm	58	11.6	183.3	5.1
Undetermined Intent	33	6.6	104.3	2.9
Other Causes	93	18.6	294.0	8.2
Tairawhiti Total	1,133	226.6	3,581.5	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	13	2.6	42.2	56.5
Transport: Vehicle Occupant	5	1.0	16.2	21.7
All Other Causes	5	1.0	16.2	21.7
Tairawhiti Total	23	4.6	74.7	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

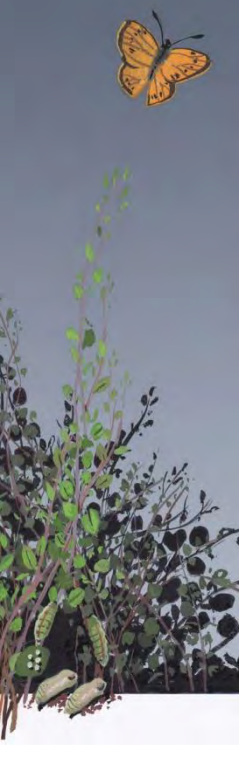


Table 149. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Injuries in Taranaki Young People Aged 15–24 Years by Main External Cause of Injury

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Taranaki				
Injury Admissions 15–24 Years, 2006–2010				
Mechanical Forces: Inanimate	275	55.0	392.5	24.1
Mechanical Forces: Animate	58	11.6	82.8	5.1
Falls	189	37.8	269.8	16.6
Transport: Vehicle Occupant	107	21.4	152.7	9.4
Transport: Motorbike	118	23.6	168.4	10.3
Transport: Cyclist	30	6.0	42.8	2.6
Transport: Pedestrian	16	3.2	22.8	1.4
Transport: Other Land Transport	28	5.6	40.0	2.5
Transport: Other Transport	5	1.0	7.14	0.4
Electricity / Fire / Burns	26	5.2	37.1	2.3
Accidental Poisoning	10	2.0	14.3	0.9
Drowning / Submersion	<3	s	s	s
Assault	88	17.6	125.6	7.7
Intentional Self-Harm	73	14.6	104.2	6.4
Undetermined Intent	16	3.2	22.8	1.4
No External Cause Listed	<3	s	s	s
Other Causes	100	20.0	142.7	8.8
Taranaki Total	1,141	228.2	1,628.7	100.0
Injury Mortality 15–24 Years, 2004–2008				
Intentional Self-Harm	12	2.4	17.5	34.3
Transport: Vehicle Occupant	12	2.4	17.5	34.3
Transport: All Other Causes	5	1.0	7.29	14.3
All Other Causes	6	1.2	8.74	17.1
Taranaki Total	35	7.0	51.0	100.0

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Land Transport Injuries

Midland DHBs vs. New Zealand Distribution

In the Midland Region during 2006–2010, hospital admissions for land transport injuries in young people were *significantly* higher than the New Zealand rate in all five DHBs. Similarly during 2004–2008, mortality from land transport injuries was *significantly* higher than the New Zealand rate in Waikato, Lakes and the Bay of Plenty, but not *significantly* different from the New Zealand rate in Tairawhiti and Taranaki (**Table 150**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, hospital admissions for land transport injuries in young people were generally lower during winter months (**Figure 131**).

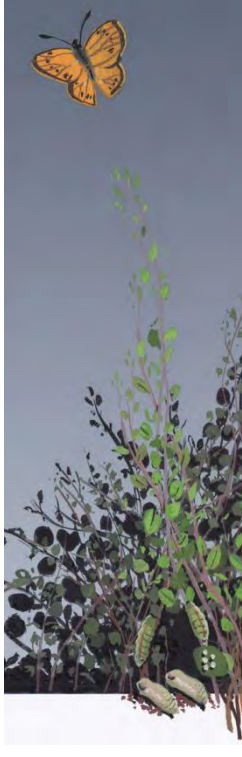
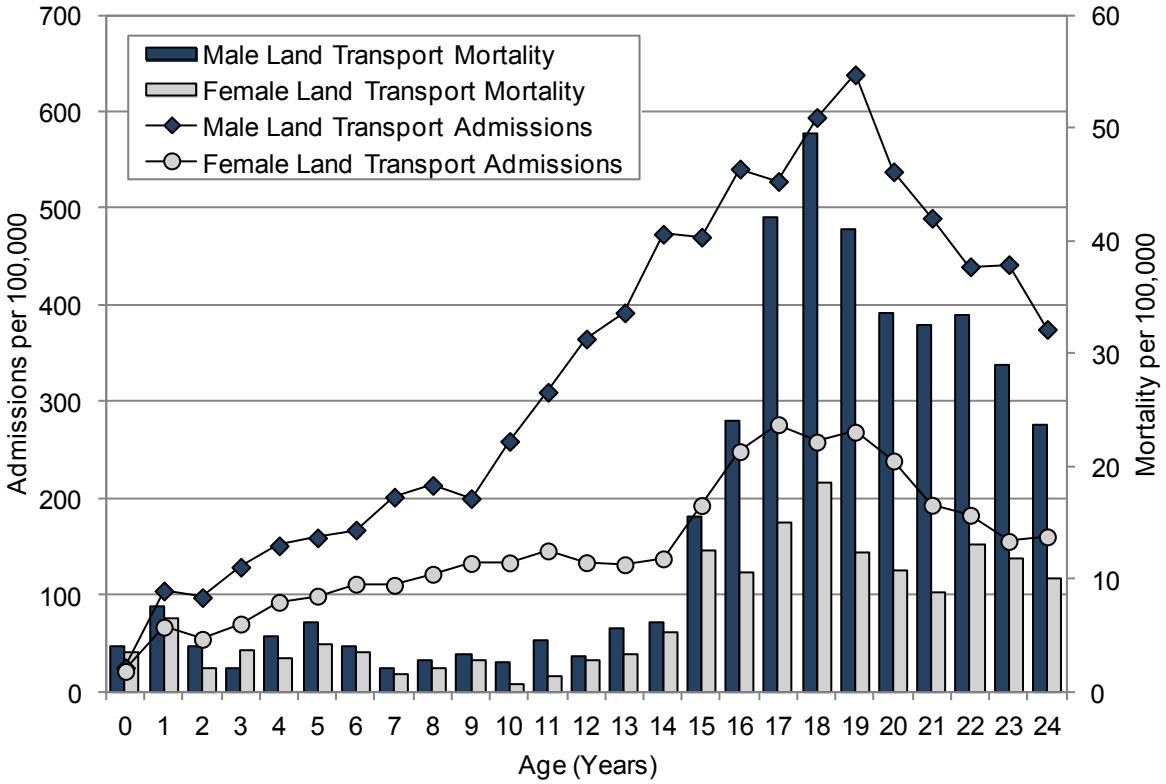


Table 150. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Land Transport Injuries in Midland's Young People Aged 15–24 Years, vs. New Zealand

DHB	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Land Transport Injuries					
Hospital Admissions in Young People Aged 15–24 Years, 2006–2010					
Waikato	1,048	209.6	392.0	1.08	1.01–1.15
Lakes	450	90.0	678.3	1.86	1.70–2.05
Bay of Plenty	715	143.0	568.1	1.56	1.45–1.68
Tairawhiti	247	49.4	780.8	2.15	1.89–2.43
Taranaki	299	59.8	426.8	1.17	1.05–1.32
New Zealand	11,519	2,303.8	363.8	1.00	
Mortality in Young People Aged 15–24 Years, 2004–2008					
Waikato	93	18.6	36.1	1.61	1.29–2.00
Lakes	27	5.4	41.0	1.83	1.25–2.69
Bay of Plenty	48	9.6	40.1	1.79	1.34–2.40
Tairawhiti	7	1.4	22.7	1.01	0.48–2.14
Taranaki	17	3.4	24.8	1.10	0.68–1.79
New Zealand	678	135.6	22.4	1.00	

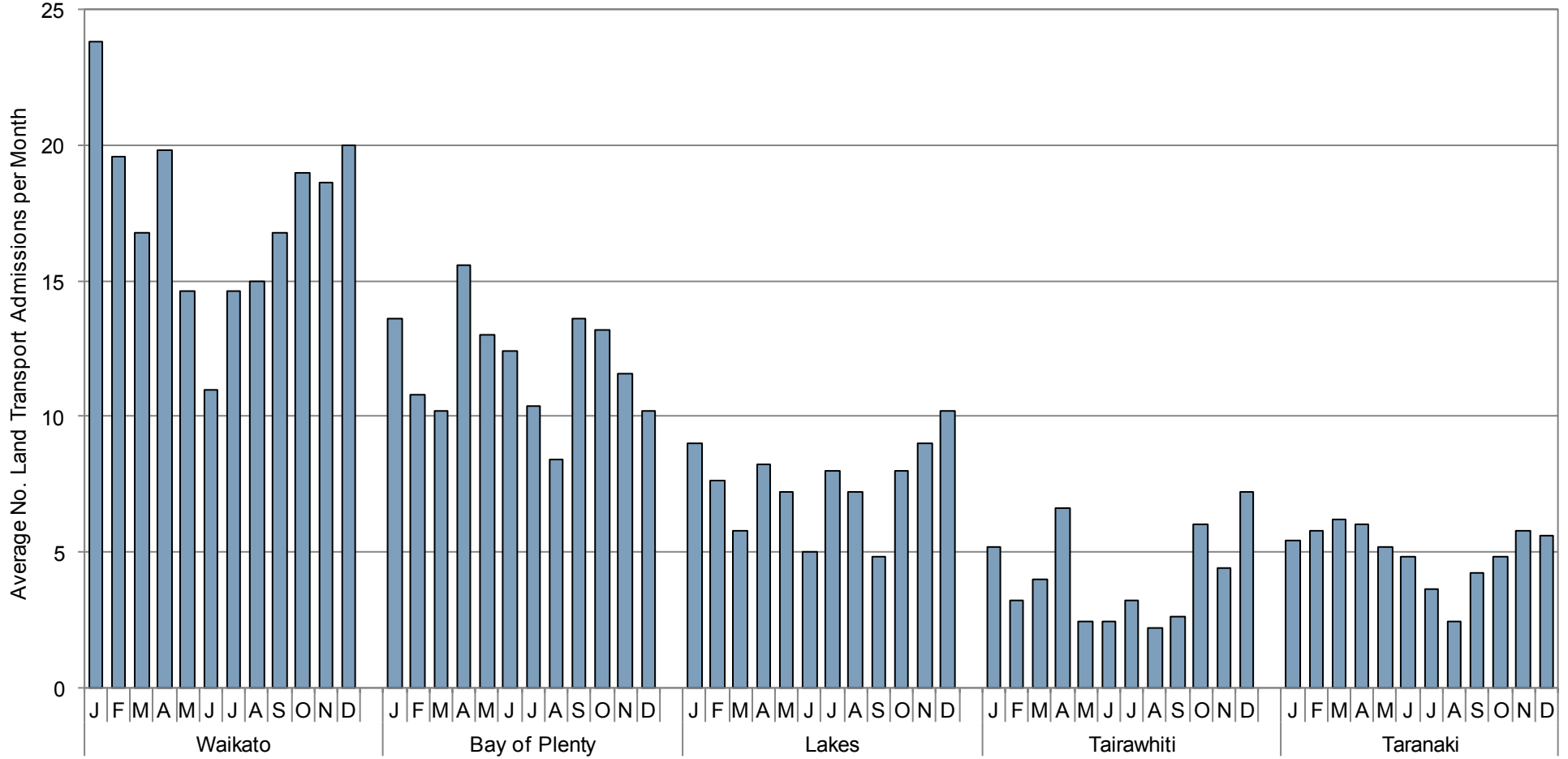
Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.

Figure 130. Hospital Admissions (2006–2010) and Deaths (2004–2008) from Land Transport Injuries in New Zealand Children and Young People 0–24 Years by Age and Gender



Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 131. Average Number of Hospital Admissions for Land Transport Injuries per Month in Young People Aged 15−24 Years, Midland DHBs 2006−2010



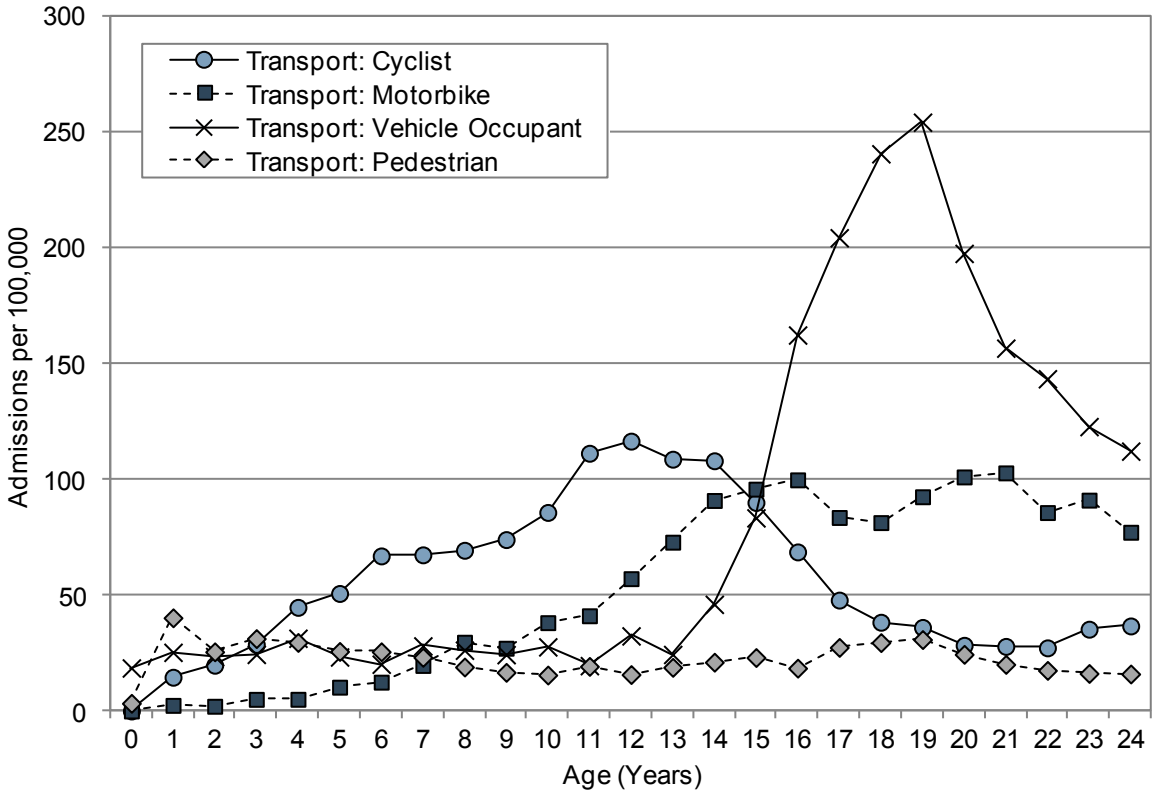
Source: National Minimum Dataset

New Zealand Distribution by Age

Age and Gender: In New Zealand during 2006–2010, hospital admissions for land transport injuries in males increased rapidly during late childhood and adolescence, to reach a peak at 19 years of age. While similar patterns were evident for females, the rate of increase was much slower prior to fifteen years of age, At all ages (with the exception of infants <1 year) admission rates were higher for males than for females. Mortality during 2004–2008 demonstrated a similar pattern, with rates peaking at 18 years in both genders (**Figure 130**).

Age and Cause: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries increased rapidly after 13 years of age, with rates reaching a peak at 19 years, before declining again. Motorbike injury admissions also increased during adolescence, with rates being highest amongst those in their late teens and early twenties. In contrast, cycle injury admissions increased during childhood to reach a peak amongst those aged 11–14 years, while pedestrian injuries were more evenly distributed across childhood/adolescence/early adulthood (**Figure 132**).

Figure 132. Hospital Admissions for Transport Injuries in Children and Young People 0–24 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

Pedestrian Injuries: In New Zealand during 2006–2010, hospital admissions for pedestrian injuries were *significantly* higher for males, for Māori > European > Asian/Indian young people and those from more deprived (NZDep deciles 7–8 and 10) areas (**Table 151**).

Cyclist Injuries: In New Zealand during 2006–2010, hospital admissions for cycle injuries were *significantly* higher for males and European > Māori > Pacific > Asian/Indian young people. Admissions were also *significantly* higher in those from the least deprived (NZDep decile 1) areas, when compared to those from more deprived (NZDep decile 8–10) areas (**Table 151**).

Table 151. Hospital Admissions for Pedestrian and Cyclist Injuries in Young People 15–24 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Pedestrian Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	16.4	1.00		Decile 1–2	15.7	1.00	
Decile 2	15.1	0.92	0.60–1.41	Decile 3–4	16.3	1.04	0.77–1.39
Decile 3	16.1	0.99	0.65–1.51	Decile 5–6	21.8	1.39	1.05–1.83
Decile 4	16.4	1.01	0.67–1.52	Decile 7–8	27.2	1.73	1.34–2.23
Decile 5	21.7	1.33	0.89–1.97	Decile 9–10	25.6	1.63	1.27–2.10
Decile 6	21.9	1.34	0.91–1.96	Prioritised Ethnicity			
Decile 7	28.7	1.76	1.22–2.53	European	22.6	1.00	
Decile 8	25.9	1.58	1.10–2.26	Māori	29.6	1.31	1.10–1.56
Decile 9	21.4	1.31	0.91–1.88	Pacific	22.5	1.00	0.75–1.31
Decile 10	30.7	1.88	1.32–2.67	Asian/Indian	9.11	0.40	0.30–0.55
Gender							
Female	14.9	1.00					
Male	29.8	2.01	1.72–2.35				
Cyclist Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	54.4	1.00		Decile 1–2	52.3	1.00	
Decile 2	50.4	0.93	0.73–1.17	Decile 3–4	47.5	0.91	0.77–1.07
Decile 3	51.8	0.95	0.75–1.20	Decile 5–6	45.2	0.86	0.73–1.02
Decile 4	43.5	0.80	0.63–1.02	Decile 7–8	41.9	0.80	0.68–0.94
Decile 5	42.7	0.79	0.61–1.01	Decile 9–10	34.4	0.66	0.56–0.78
Decile 6	47.3	0.87	0.69–1.09	Prioritised Ethnicity			
Decile 7	50.9	0.94	0.75–1.17	European	61.8	1.00	
Decile 8	34.5	0.63	0.50–0.80	Māori	29.1	0.47	0.40–0.55
Decile 9	39.5	0.73	0.58–0.91	Pacific	14.6	0.24	0.17–0.33
Decile 10	28.2	0.52	0.40–0.67	Asian/Indian	7.29	0.12	0.08–0.16
Gender							
Female	12.4	1.00					
Male	76.0	6.11	5.26–7.11				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised. Decile is NZDep2001.

Motorbike Injuries: In New Zealand during 2006–2010, hospital admissions for motorbike injuries were *significantly* higher for males, and for European > Māori > Pacific and Asian/Indian young people. No consistent social gradients were evident however by NZDep index decile (**Table 152**).

Vehicle Occupant Injuries: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries were *significantly* higher for males, Māori > European > Pacific > Asian/Indian young people and those from average-to-more deprived (NZDep decile 4–10) areas (**Table 152**).

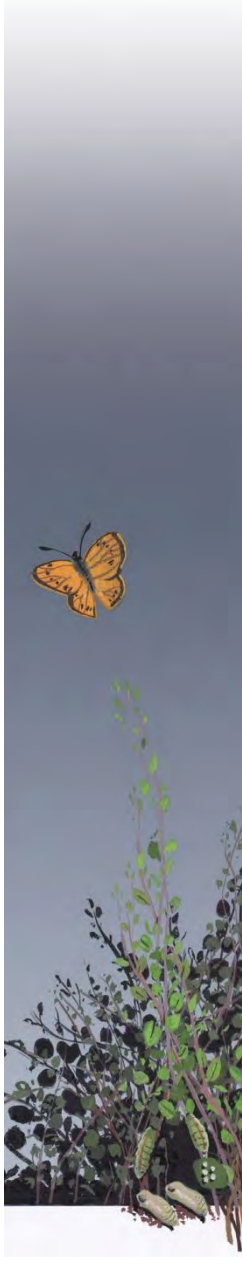


Table 152. Hospital Admissions for Motorbike and Vehicle Occupant Injuries in Young People Aged 15–24 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Motorbike Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	83.7	1.00		Decile 1–2	89.9	1.00	
Decile 2	95.7	1.14	0.96–1.37	Decile 3–4	105.8	1.18	1.04–1.33
Decile 3	111.1	1.33	1.12–1.58	Decile 5–6	100.1	1.11	0.99–1.26
Decile 4	101.0	1.21	1.01–1.44	Decile 7–8	84.6	0.94	0.83–1.06
Decile 5	94.9	1.13	0.95–1.36	Decile 9–10	76.7	0.85	0.76–0.96
Decile 6	104.3	1.25	1.05–1.48	Prioritised Ethnicity			
Decile 7	95.6	1.14	0.96–1.36	European	129.8	1.00	
Decile 8	75.4	0.90	0.76–1.08	Māori	67.0	0.52	0.46–0.57
Decile 9	84.6	1.01	0.86–1.19	Pacific	13.0	0.10	0.07–0.14
Decile 10	67.1	0.80	0.67–0.96	Asian/Indian	9.31	0.07	0.05–0.10
Gender							
Female	16.3	1.00					
Male	164.6	10.09	8.87–11.47				
Vehicle Occupant Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	104.2	1.00		Decile 1–2	113.3	1.00	
Decile 2	122.0	1.17	1.00–1.37	Decile 3–4	135.9	1.20	1.08–1.33
Decile 3	121.6	1.17	0.99–1.37	Decile 5–6	166.6	1.47	1.33–1.63
Decile 4	149.0	1.43	1.23–1.66	Decile 7–8	169.4	1.49	1.36–1.65
Decile 5	157.1	1.51	1.29–1.76	Decile 9–10	207.3	1.83	1.67–2.01
Decile 6	174.4	1.67	1.45–1.93	Prioritised Ethnicity			
Decile 7	181.5	1.74	1.51–2.01	European	164.8	1.00	
Decile 8	159.4	1.53	1.33–1.77	Māori	256.4	1.56	1.46–1.65
Decile 9	185.3	1.78	1.55–2.04	Pacific	133.1	0.81	0.72–0.90
Decile 10	233.9	2.24	1.96–2.57	Asian/Indian	57.3	0.35	0.31–0.39
Gender							
Female	135.4	1.00					
Male	198.3	1.47	1.39–1.55				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

New Zealand Mortality Trends by Ethnicity

In New Zealand during 2000–2008, mortality from land transport injuries was consistently higher for Māori young people than for young people of other ethnic groups (**Figure 133**).

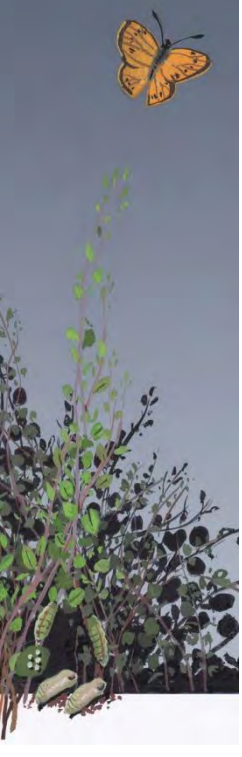
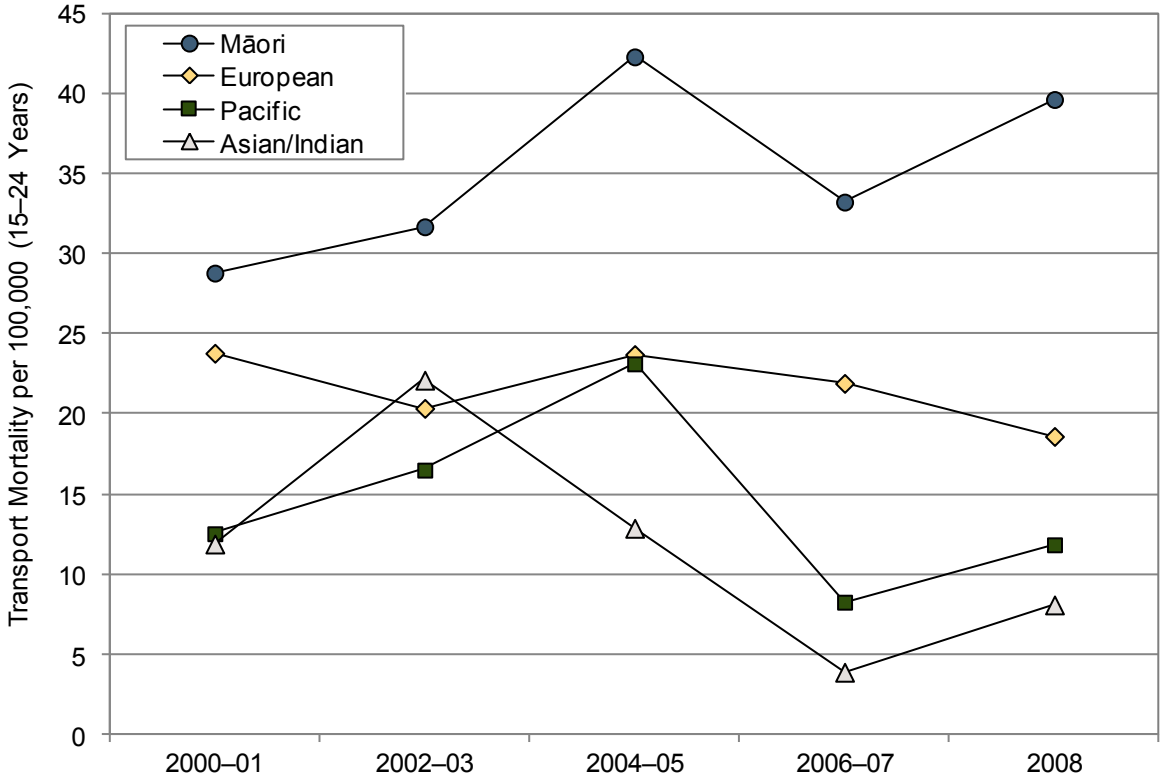


Figure 133. Mortality from Land Transport Injuries in Young People Aged 15–24 Years by Ethnicity, New Zealand 2000–2008



Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised

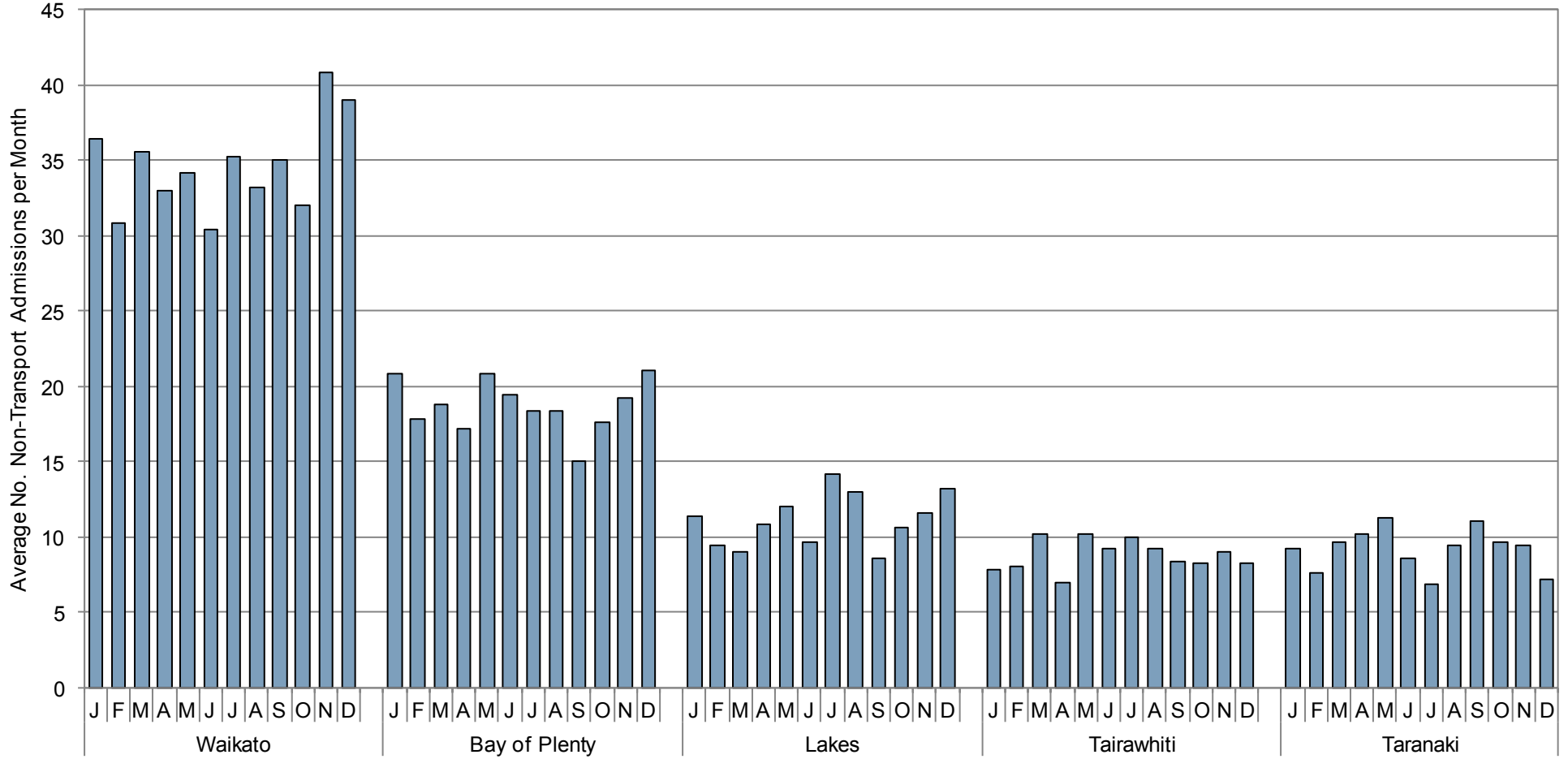
Unintentional Non-Transport Injuries

Table 153. Hospital Admissions (2006–2010) and Mortality (2004–2008) from Unintentional Non-Transport Injuries in Young People Aged 15–24 Years, Midland DHBs vs. New Zealand

DHB	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Unintentional Non-Transport Injuries					
Hospital Admissions in Young People Aged 15–24 Years, 2006–2010					
Waikato	2,078	415.6	777.2	0.95	0.91–1.00
Lakes	667	133.4	1,005.4	1.23	1.14–1.33
Bay of Plenty	1,122	224.4	891.5	1.09	1.03–1.16
Tairawhiti	527	105.4	1,665.9	2.04	1.87–2.22
Taranaki	549	109.8	783.7	0.96	0.88–1.04
New Zealand	25,856	5,171.2	816.5	1.00	
Mortality in Young People Aged 15–24 Years, 2004–2008					
Waikato	12	2.4	4.65	1.17	0.65–2.12
Lakes	<3	s	s	s	s
Bay of Plenty	<3	s	s	s	s
Tairawhiti	<3	s	s	s	s
Taranaki	3	0.6	4.37	1.10	0.35–3.46
New Zealand	120	24.0	3.97	1.00	

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Figure 134. Average Number of Hospital Admissions for Unintentional Non-Transport Injuries per Month in Young People 15−24 Years, Midland DHBs 2006−2010



Source: National Minimum Dataset

Midland DHBs vs. New Zealand Distribution

In Lakes, the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for unintentional non-transport injuries in young people were *significantly* higher than the New Zealand rate, while in the Waikato and Taranaki admissions were similar. Mortality from unintentional non-transport injuries in the Waikato and Taranaki during 2004–2008 was not *significantly* different from the New Zealand rate, while in Lakes, the Bay of Plenty and Tairawhiti small numbers precluded a valid analysis (**Table 153**).

Midland Region Distribution by Season

In the Midland Region during 2006–2010, there were no consistent seasonal patterns in hospital admissions for unintentional non-transport injuries in young people (**Figure 134**).

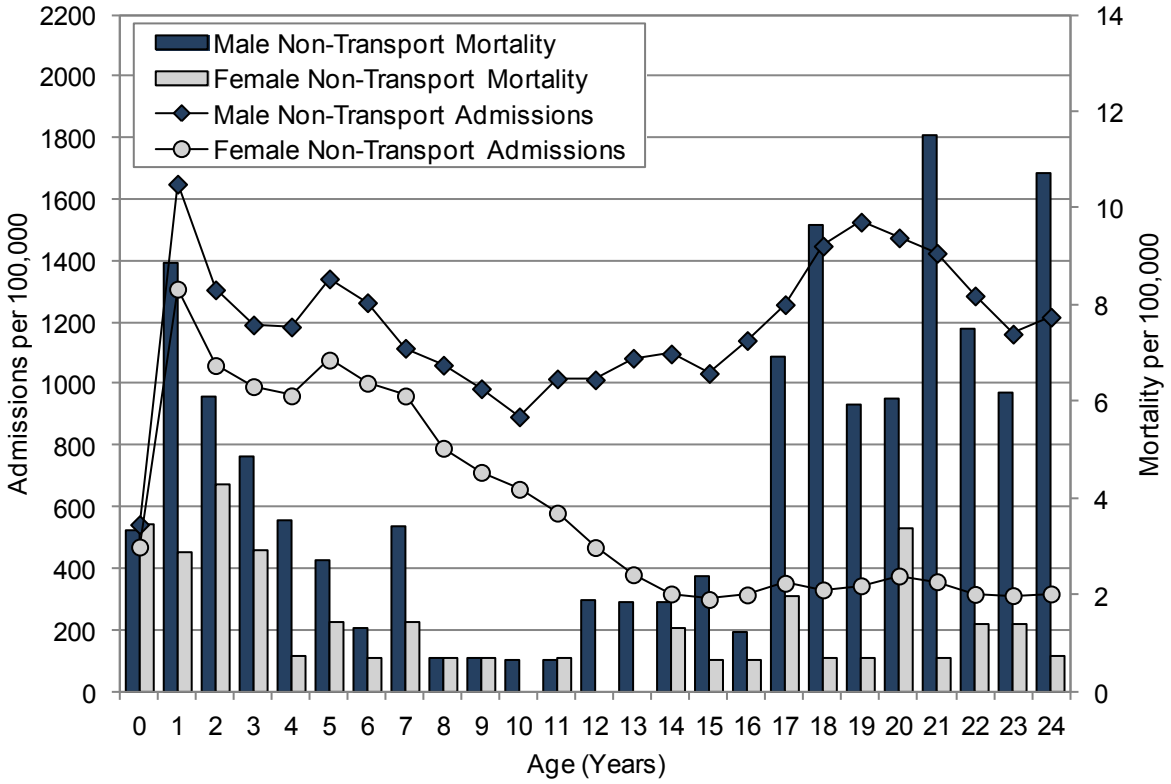
New Zealand Distribution by Age

In New Zealand during 2006–2010, after peaking at one year of age and again at five years, hospital admissions for unintentional non-transport injuries declined in both males and females. For males, admissions reached a nadir at ten years of age, before increasing again, to reach a further peak at 19 years. For females, rates continued to decline until around fifteen years, after which time they became static. Mortality during 2004–2008 demonstrated a similar pattern, with rates for males being consistently higher than for females from 12 years onwards (as they were during the preschool years) (**Figure 135**). While admissions for injuries arising from inanimate mechanical forces and falls tended to be higher in children, they were also prominent causes of injury admission in young people aged 15–24 years (**Figure 136**).

New Zealand Mortality Trends by Ethnicity

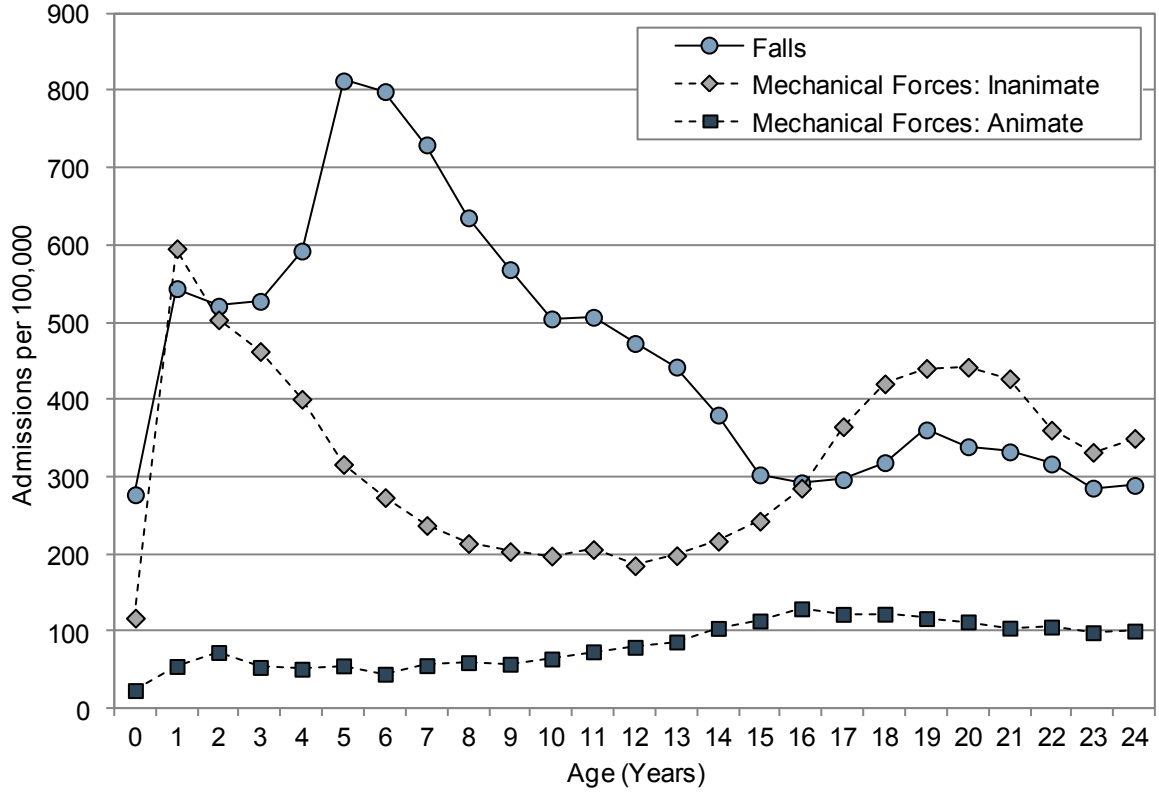
In New Zealand during 2000–2008, there were no consistent ethnic differences in mortality from unintentional non-transport injuries in young people (**Figure 137**).

Figure 135. Hospital Admissions (2006–2010) and Deaths (2004–2008) from Unintentional Non-Transport Injuries in New Zealand Children and Young People 0–24 Years by Age and Gender



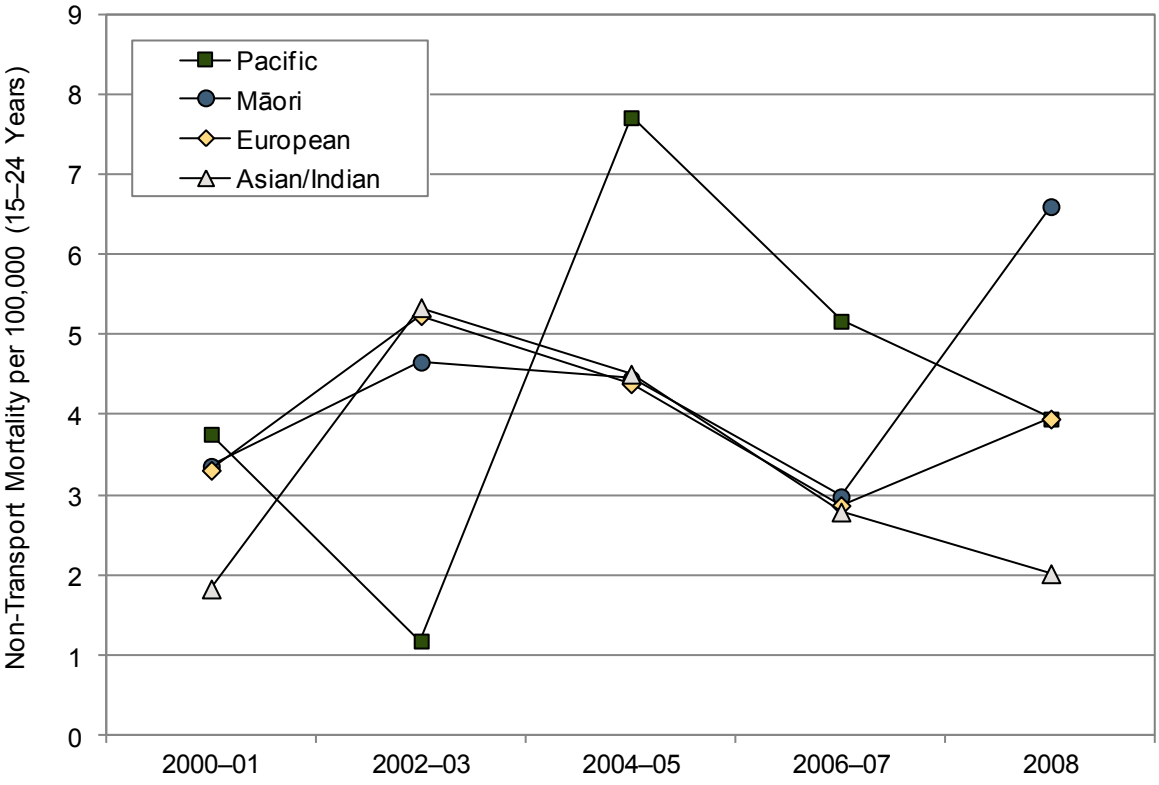
Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 136. Hospital Admissions for Falls and Mechanical Force Type Injuries in Children and Young People 0–24 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 137. Mortality from Unintentional Non-Transport Injuries in Young People Aged 15−24 Years by Ethnicity, New Zealand 2000−2008



Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.
Note: Ethnicity is Level 1 Prioritised

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

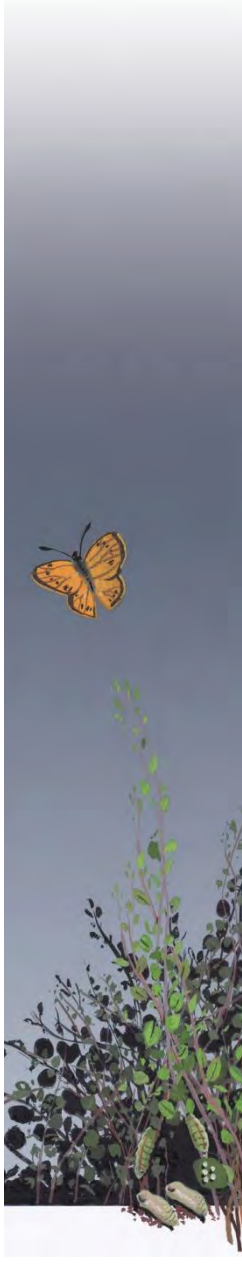
Falls: In New Zealand during 2006–2010, hospital admissions for falls were *significantly* higher for males, Pacific > European and Māori > Asian/Indian young people and those from more deprived (NZDep deciles 7 and 9–10) areas (**Table 154**).

Electricity/Fire/Burns: In New Zealand during 2006–2010, hospital admissions for injuries arising from electricity/fire/burns were *significantly* higher for males, Māori > European > Pacific > Asian/Indian young people and those from more deprived (NZDep decile 5–10) areas (**Table 154**).

Table 154. Hospital Admissions for Falls and Electricity/Fire/Burn Injuires in Young People 15−24 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Falls 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	274.6	1.00		Decile 1–2	275.1	1.00	
Decile 2	275.6	1.00	0.91–1.11	Decile 3–4	292.1	1.06	0.99–1.14
Decile 3	313.0	1.14	1.03–1.26	Decile 5–6	281.4	1.02	0.95–1.10
Decile 4	273.0	0.99	0.90–1.10	Decile 7–8	299.9	1.09	1.02–1.17
Decile 5	293.2	1.07	0.96–1.18	Decile 9–10	343.7	1.25	1.17–1.33
Decile 6	271.5	0.99	0.90–1.09	Prioritised Ethnicity			
Decile 7	305.5	1.11	1.01–1.23	European	339.4	1.00	
Decile 8	295.2	1.07	0.98–1.18	Māori	322.8	0.95	0.90–1.00
Decile 9	337.9	1.23	1.13–1.34	Pacific	439.3	1.29	1.21–1.38
Decile 10	350.7	1.28	1.17–1.40	Asian/Indian	85.2	0.25	0.23–0.28
Gender							
Female	144.9	1.00					
Male	478.2	3.30	3.15–3.46				
Electricity / Fire / Burn Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	13.3	1.00		Decile 1–2	14.4	1.00	
Decile 2	15.5	1.16	0.74–1.82	Decile 3–4	16.7	1.15	0.85–1.56
Decile 3	15.8	1.18	0.76–1.85	Decile 5–6	24.9	1.73	1.31–2.28
Decile 4	17.5	1.31	0.85–2.02	Decile 7–8	30.4	2.11	1.62–2.74
Decile 5	26.3	1.98	1.32–2.97	Decile 9–10	30.9	2.15	1.66–2.77
Decile 6	23.8	1.79	1.20–2.67	Prioritised Ethnicity			
Decile 7	32.6	2.45	1.67–3.60	European	25.7	1.00	
Decile 8	28.5	2.14	1.46–3.14	Māori	33.8	1.32	1.12–1.56
Decile 9	32.0	2.41	1.66–3.48	Pacific	17.8	0.69	0.51–0.94
Decile 10	29.6	2.22	1.52–3.25	Asian/Indian	7.9	0.31	0.22–0.43
Gender							
Female	11.3	1.00					
Male	37.6	3.31	2.80–3.91				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001



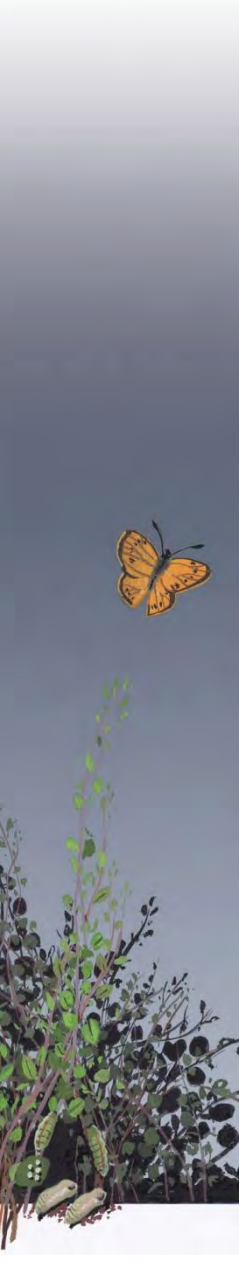
Inanimate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from inanimate mechanical forces were *significantly* higher for males, Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 155**).

Animate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from animate mechanical forces were *significantly* higher for males, Pacific > Māori > European > Asian/Indian young people and those from more deprived (NZDep decile 8–10) areas (**Table 155**).

Table 155. Hospital Admissions for Injuries Arising from Inanimate and Animate Mechanical Forces in Young People Aged 15–24 Years by Gender, Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Mechanical Forces: Inanimate Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	249.1	1.00		Decile 1–2	251.3	1.00	
Decile 2	253.3	1.02	0.91–1.13	Decile 3–4	294.4	1.17	1.09–1.26
Decile 3	282.9	1.14	1.02–1.26	Decile 5–6	338.7	1.35	1.26–1.44
Decile 4	304.8	1.22	1.11–1.35	Decile 7–8	364.9	1.45	1.36–1.55
Decile 5	341.3	1.37	1.24–1.51	Decile 9–10	491.6	1.96	1.84–2.08
Decile 6	336.5	1.35	1.23–1.49	Prioritised Ethnicity			
Decile 7	355.5	1.43	1.30–1.57	European	346.0	1.00	
Decile 8	372.7	1.50	1.36–1.64	Māori	519.8	1.50	1.44–1.57
Decile 9	426.8	1.71	1.57–1.87	Pacific	548.3	1.58	1.50–1.68
Decile 10	569.6	2.29	2.09–2.50	Asian/Indian	88.9	0.26	0.23–0.28
Gender							
Female	135.9	1.00					
Male	588.8	4.33	4.13–4.54				
Mechanical Forces: Animate Injuries 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	104.2	1.00		Decile 1–2	96.3	1.00	
Decile 2	88.9	0.85	0.72–1.01	Decile 3–4	93.1	0.97	0.86–1.09
Decile 3	91.9	0.88	0.74–1.05	Decile 5–6	103.9	1.08	0.96–1.21
Decile 4	94.2	0.90	0.76–1.07	Decile 7–8	111.4	1.16	1.03–1.29
Decile 5	98.8	0.95	0.80–1.12	Decile 9–10	141.1	1.47	1.32–1.63
Decile 6	108.2	1.04	0.89–1.22	Prioritised Ethnicity			
Decile 7	98.6	0.95	0.80–1.11	European	106.2	1.00	
Decile 8	122.0	1.17	1.01–1.36	Māori	146.9	1.38	1.28–1.50
Decile 9	137.2	1.32	1.14–1.52	Pacific	219.3	2.06	1.88–2.27
Decile 10	145.9	1.40	1.21–1.62	Asian/Indian	19.8	0.19	0.15–0.23
Gender							
Female	38.6	1.00					
Male	185.9	4.82	4.42–5.26				

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.



Summary

In New Zealand during 2006–2010, inanimate mechanical forces and falls were the leading causes of injury admissions in young people, although as a group transport injuries also made a significant contribution. In contrast, during 2004–2008, intentional self-harm and vehicle occupant injuries were the leading causes of injury related mortality. During 2000–2008, mortality from land transport injuries fluctuated, while mortality from unintentional non-transport injuries and accidental poisoning remained relatively static.

In the Midland Region during 2006–2010, inanimate mechanical forces and falls were also the leading causes of injury admissions in young people in all five DHBs, although as a group transport injuries again made a significant contribution. In contrast, during 2004–2008 vehicle occupant injuries and intentional self-harm were the leading causes of injury mortality in all five DHBs.

Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Injuries in Young People

In New Zealand, the *NZ Injury Prevention Strategy* provides the broad strategic direction in the area of unintentional injury. The multi-factorial nature of unintentional injuries and the range of contexts in which they occur however, means that a range of initiatives may be required, if injury rates are to be reduced. **Table 156** provides an overview of local policy documents and evidence-based reviews which consider the most effective approaches to injury prevention in young people, while **Table 115** on **Page 347** considers a range of initiatives relevant to children. (Note: Reviews on the effectiveness of cycle helmets, the prevention on pedestrian injuries and the effectiveness of smoke alarms are considered in the child injury section).

Table 156. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention Unintentional Injuries in Young People

New Zealand Policy Documents
Minister for Accident Compensation Corporation. **New Zealand Injury Prevention Strategy.** Wellington, 2003. http://www.nzips.govt.nz/documents/strategycolour.pdf New Zealand's first national injury prevention strategy was published in 2003. It sets out goals and objectives for achieving a positive safety culture and creating safe environments. It also defines principles by which the process will operate. Injury to those less than 25 years is included in all priority areas: namely, road safety, falls, drowning, assault, suicide and work related injury.
Ministry of Transport. **Safer Journeys: New Zealand's Road Safety Strategy 2010-2020** http://www.transport.govt.nz/saferjourneys/Documents/SaferJourneyStrategy.pdf Increasing the safety of young drivers is a major priority in the Road Safety Strategy 2010-2020. The aim is to reduce road fatality rates for young people from 21 per 100,000 to a rate similar to Australia (13 per 100,000). Proposed strategies include multiple policy and practice initiatives across four key areas: safe roads and roadsides, safe speeds, safe vehicles and safe road use. The strategy reflects a programme designed to address some of the risk factors that research has identified but also to actively engage the community in acting positively to increase road safety.
Department of Labour, 2011. **Workplace Health and Safety Strategy for New Zealand to 2015: National Action Agenda 2010–2013**. Wellington, Department of Labour. http://www.dol.govt.nz/whss/action-agenda/National%20Action%20Agenda%202011.pdf While this document does not specifically mention young workers, much of the proposed action has direct implications for this age group. The industries identified as being of most concern for health and safety are construction, agriculture, forestry, manufacturing and fishing. All of these industries rely on the under 25 year old workforce, leaving this age group exposed to the risk of injury.
Drowning Prevention Strategy: Towards a Water Safe New Zealand 2005-2015. Accident Compensation Corporation, Wellington, 2005. http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_ip/documents/guide/wcm2_020949.pdf The Drowning Prevention Strategy was intended to provide a framework for people, groups, organisations and communities to work coherently to prevent drowning and to improve water safety. The focus in this document is on identified priority population groups: males 15-24 years and children aged 0-4 years.
New Zealand Government**. Land Transport (Road Safety and Other Matters) Amendment Act 2011**. http://www.legislation.govt.nz/act/public/2011/0013/latest/viewpdf.aspx?search=qs_act_age+driver+licence_resel&p=1 This amendment to the Land Transport Act raises the minimum age for holding a driver's licence to 16 years.

Systematic Reviews: Road Safety
Russell, K. F., B. Vandermeer, et al. **Graduated driver licensing for reducing motor vehicle crashes among young drivers.** Cochrane Database of Systematic Reviews. (2011) (10). Young drivers are more likely to be involved in motor vehicle crashes than older drivers. One intervention that has been introduced in New Zealand and elsewhere is the graduated drivers licence (GDL). This systematic review examines 34 studies that evaluate GDL programmes implemented in the US, Canada, New Zealand and Australia. The authors concluded that GDL is effective in reducing crash rates among young drivers. However, as there was considerable variation in the restrictions on young drivers, the review was unable to determine from the studies critiqued which components of the GDL have had the most effect.
Roberts IG, Kwan I. **School-based driver education for the prevention of traffic crashes**. Cochrane Database of Systematic Reviews 2001, Issue 3. Art. No.: CD003201. DOI: 10.1002/14651858.CD003201 This review aimed to quantify the effect of school-based driver education on licensing and road traffic crashes. While school-based driver education has been promoted as a strategy to reduce road crashes among teenagers who are at high risk of road death and serious injury, the evidence is that driver education in schools leads to early licensing. The studies included found no evidence that road crash involvement diminished with school-based education. Rather this training potentially may increase the proportion of teenagers involved in traffic crashes.
Kardamanidis K, Martiniuk A, Ivers RQ, Stevenson MR, Thistlethwaite K. **Motorcycle rider training for the prevention of road traffic crashes.** Cochrane Database of Systematic Reviews 2010, Issue 10. Art. No.: CD005240. DOI: 10.1002/14651858.CD005240.pub2 This review considered evaluations of the effectiveness of motorcycle rider courses in reducing the number of traffic offences, crashes, injuries and death. There was a variety of content and delivery within the 23 research studies included in the review. The evidence was unclear as to whether training reduces any of these outcomes, and what kind of training is most effective. The authors concluded they could not recommend a particular type of rider training. They did note that some form of rider training was necessary for learning basic motorcycle handling techniques and to ride a motorcycle safely and that further research was required.
Systematic Reviews: Sport, Recreational and Workplace Injury
Abernethy, L., & Bleakley, C. (2007). **Strategies to prevent injury in adolescent sport: a systematic review**. British Journal of Sports Medicine, 41(10), 627-638. Effective strategies for reducing sport injury were identified as needing to focus on preseason conditioning, functional training, education, balance and sport specific skills that were continued throughout a season. Evidence was inconclusive regarding the role of protective equipment for injury prevention. Further research is required. Care is needed in interpreting the review as it excluded the following sports: equestrian, water, snow boarding and skiing, ice hockey, skating and motorised.
Rautiainen R, Lehtola MM, Day LM, Schonstein E, Suutarinen J, Salminen S, Verbeek JH. **Interventions for preventing injuries in the agricultural industry**. Cochrane Database of Systematic Reviews 2008, Issue 1. Art. No.: CD006398. DOI: 10.1002/14651858.CD006398.pub2 Six studies were included in this review which assessed the effectiveness of interventions to prevent occupational injuries among workers in the agricultural industry compared to no interventions or to alternative interventions. Two of these studies included evaluations of educational interventions for children and adolescents. The interventions were educational, financial and legislative (regarding pesticide and tractor use). No evidence was found that educational interventions were effective in reducing injury rates, but financial incentives may reduce injury rates and the legislation to ban pesticides could be effective. Requiring the use of ROPS on tractors was associated with decreased mortality.
van der Molen H, Lehtola MM, Lappalainen J, Hoonakker PLT, Hsiao H, Haslam RA, Hale AR, Verbeek JH. **Interventions for preventing injuries in the construction industry.** Cochrane Database of Systematic Reviews 2007, Issue 4. Art. No.: CD006251. DOI: 10.1002/14651858.CD006251.pub2 Five studies were eligible for inclusion in this review that examined effects of interventions for preventing injuries among workers at construction sites. Three studies evaluated the effect of regulations, one evaluated a safety campaign, and one a drug-free workplace program on fatal or non-fatal injuries compared to no drug-free workplace program. The overall quality of the studies was considered to be poor. The authors concluded that the regulatory interventions were less likely to be effective in preventing injury, and that it was urgent that more effort should be directed to evaluating the considerable number of 'technical, human factors and organisational interventions which are recommended by standard texts of safety, consultants and safety courses'.
Relevant New Zealand Publications and Websites
Brookland, R. and Begg, D. **Adolescent, and their parents, attitudes towards graduated driver licensing and subsequent risky driving and crashes in young adulthood.** Journal of Safety Research 2011; **42**(2): 109-115. The introduction of the graduated drivers licence system (GDLS) in New Zealand has had a positive impact on youth road safety but young people continue to be over represented in road traffic crashes injury statistics. This article examines contextual issues around driving related to the attitudes of the young drivers and their parents to the GDLS and provides insights for developing interventions to reduce the risky driving behaviours and crash risk in young drivers.
Statistics New Zealand**. Injury Information Portal** http://search.stats.govt.nz/browse_for_stats/health/injuries.aspx This website provides links to various websites that provide data on New Zealand injury.

TEENAGE PREGNANCY

Introduction

New Zealand's teenage pregnancy rates are high by international standards [235]. Further, in the Youth'07 Survey, a survey of 9,107 New Zealand secondary school students, 2,620 students reported having 'ever had' sexual intercourse. Of these 2,620 students, 11.6% reported that they had been pregnant, while 9.9% reported that they had caused a pregnancy. Foregoing health care was common amongst sexually experienced students (24.2%), with students with self-reported pregnancies reporting greater difficulty accessing healthcare (41.7% vs. 20.6%). Barriers to access included concerns about privacy, uncertainty as to how to access healthcare and a lack of transport [236].

Such findings are of concern, as in New Zealand teenage pregnancy has been shown to increase the risk of both preterm birth and small for gestational age [6]. Further, young maternal age is associated with an increased risk of neonatal and post-neonatal mortality and sudden unexpected death in infancy (SUDI) (see *Infant Mortality* section). There is currently debate, however, as to whether it is the social or biological factors that play the greatest role, with risk of preterm birth amongst teens disappearing in a number of studies, once the effects of socioeconomic disadvantage are taken into account [237].

In addition to its biological effects, teenage pregnancy may also influence social outcomes, with the Christchurch Health and Development Study, which followed a cohort of 515 women to age 25 years, finding that early motherhood (having a baby <21 years and not adopting it out) was associated with poorer mental health outcomes (depression, anxiety, suicidal ideation and suicide attempts), educational outcomes (the attainment of any qualifications, tertiary qualifications, or a university degree) and economic circumstances (welfare dependency, paid employment and family income). Risk of young motherhood, however, was in turn influenced by previous family circumstances (e.g. having parents without formal qualifications, low family living standards during childhood) and once these factors were taken into account, the associations between early motherhood and poorer mental health outcomes disappeared. Significant associations remained however between early motherhood and poorer educational outcomes and economic circumstances at age 25 [238]. Such findings potentially suggest that further effort is required, to ensure that all young mothers are able to realise their full educational potential and to create a secure economic base for themselves and their children.

The following section explores teenage birth rates using information from the Birth Registration Dataset. Policy documents and evidence-based reviews which consider how teenage mothers might better be supported are considered at the end of this section.

Data Sources and Methods

Indicator

1. *Teenage Births: Live Births to Women Aged<20 Years*

Numerator: Birth Registration Dataset: All live births to women aged <20 years

Denominator: Statistics NZ Estimated Resident Population: All women aged 15–19 years (with linear extrapolation being used to calculate denominators between Census years).

2. Terminations of Pregnancy in Women <20 Years of Age

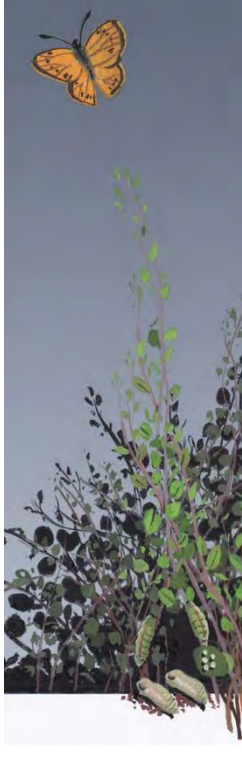
Numerator: Abortion Supervisory Committee via Statistics NZ: Induced abortions registered with the Abortion Supervisory Committee for women aged <20 years.

Denominator: Statistics NZ Estimated Resident Population: All women aged 15–19 years (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: In the analysis of total teenage pregnancy rates, miscarriage rates were estimated at 10% of induced abortions and 20% of live births [239].

Note 2: The teenage birth rates presented here may vary slightly from previous years, as the Ministry of Health no longer provides stillbirth data in the Birth Registration Dataset due to concerns about data quality. Thus the



current analysis is restricted to teenage live births (as compared to total teenage birth rates (including stillbirths) which were presented in previous years).

Note 3: **Appendix 4** provides an overview of the strengths and limitations of the Birth Registration Dataset.

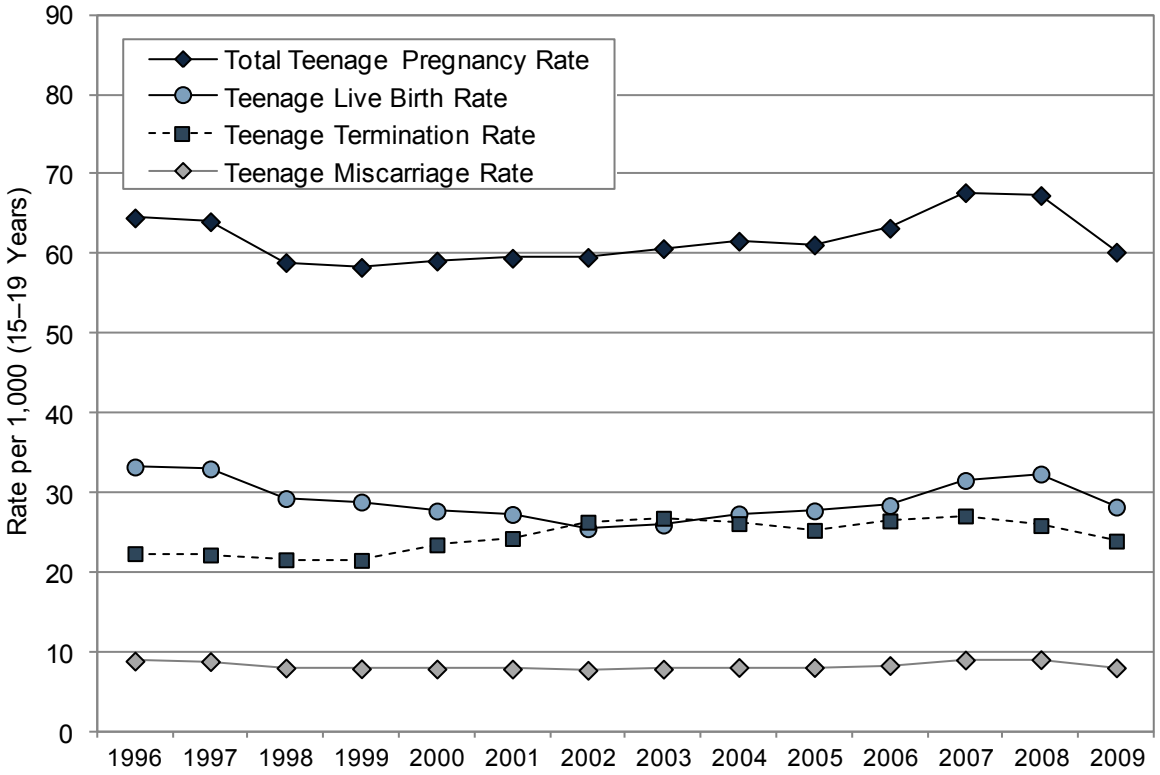
Note 4: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, teenage live births declined during the late 1990s and early 2000s, to reach their lowest point, at 25.5 per 1,000, in 2002. Birth rates then gradually increased again, reaching a peak of 32.4 per 1,000 in 2008. In contrast, teenage terminations of pregnancy increased during the late 1990s and early 2000s, reached a plateau between 2002 and 2007, and then declined. Teenage birth and termination rates were thus roughly equivalent during 2002–2004 (i.e. for every woman giving birth in her teenage years, there was one corresponding termination of pregnancy) (**Figure 138**).

Figure 138. Teenage Pregnancy Rates, New Zealand 1996–2009



Source: Numerators: Birth Registration Dataset (Live births only) and Statistics NZ; Denominator: Statistics NZ Estimated Resident Population. Note: Miscarriages were estimated at 10% of induced abortions and 20% of live births [239].

New Zealand Distribution by Ethnicity and NZDep Decile

In New Zealand during 2006–20010, teenage live birth rates were *significantly* higher for Māori > Pacific > European >Asian/Indian women and those from average-to-more deprived (NZDep decile 2–10) areas (**Table 157**). Similar ethnic differences were seen during 2000–2010 (**Figure 139**).

Total Birth Rates by Maternal Age and Ethnicity

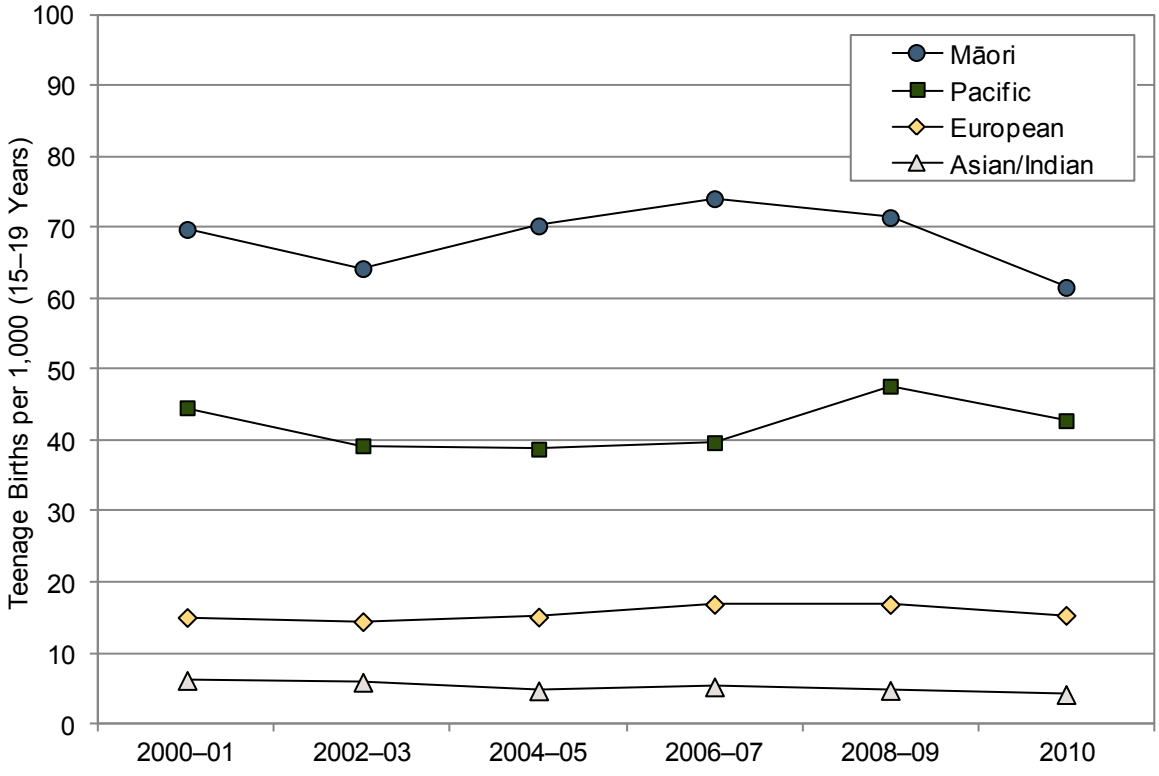
The higher teenage live birth rates for Māori and Pacific women outlined above however, must be seen in the context of the maternal age distribution (i.e. birth at a younger age), as well as the higher overall fertility rates (at all ages) for Māori and Pacific women (**Figure 140**).

Table 157. Teenage Birth Rates by Ethnicity and NZ Deprivation Index Decile, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
New Zealand							
Teenage Births							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	8.45	1.00		Decile 1–2	9.57	1.00	
Decile 2	10.7	1.27	1.14–1.41	Decile 3–4	15.8	1.65	1.55–1.76
Decile 3	13.6	1.60	1.45–1.77	Decile 5–6	25.9	2.71	2.55–2.88
Decile 4	17.9	2.11	1.92–2.32	Decile 7–8	36.1	3.77	3.56–3.99
Decile 5	22.0	2.61	2.38–2.86	Decile 9–10	50.9	5.31	5.03–5.61
Decile 6	29.3	3.46	3.17–3.78	Prioritised Ethnicity			
Decile 7	35.3	4.17	3.83–4.55	European	16.6	1.00	
Decile 8	36.8	4.35	4.00–4.73	Māori	70.3	4.25	4.13–4.37
Decile 9	42.0	4.97	4.57–5.40	Pacific	43.6	2.63	2.53–2.74
Decile 10	59.9	7.09	6.53–7.68	Asian/Indian	4.82	0.29	0.26–0.32

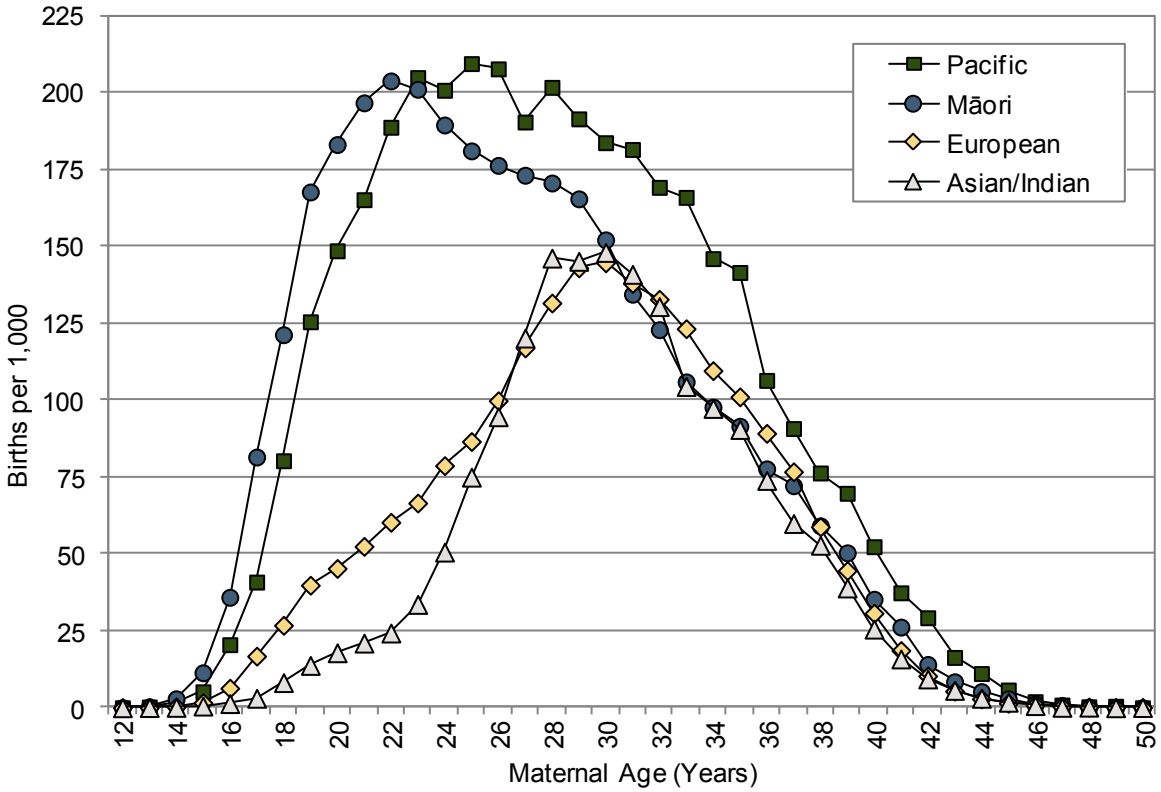
Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000, Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

Figure 139. Teenage Birth Rates by Ethnicity, New Zealand 2000–2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 140. Live Birth Rates by Maternal Age and Ethnicity, New Zealand 2006−2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Census Population Counts. Note: Ethnicity is Level 1 Prioritised.

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In the Midland Region during 2006–2010, teenage live birth rates were *significantly* higher than the New Zealand rate in all five DHBs (**Table 158**).

Table 158. Teenage Birth Rates, Midland DHBs vs. New Zealand 2006–2010

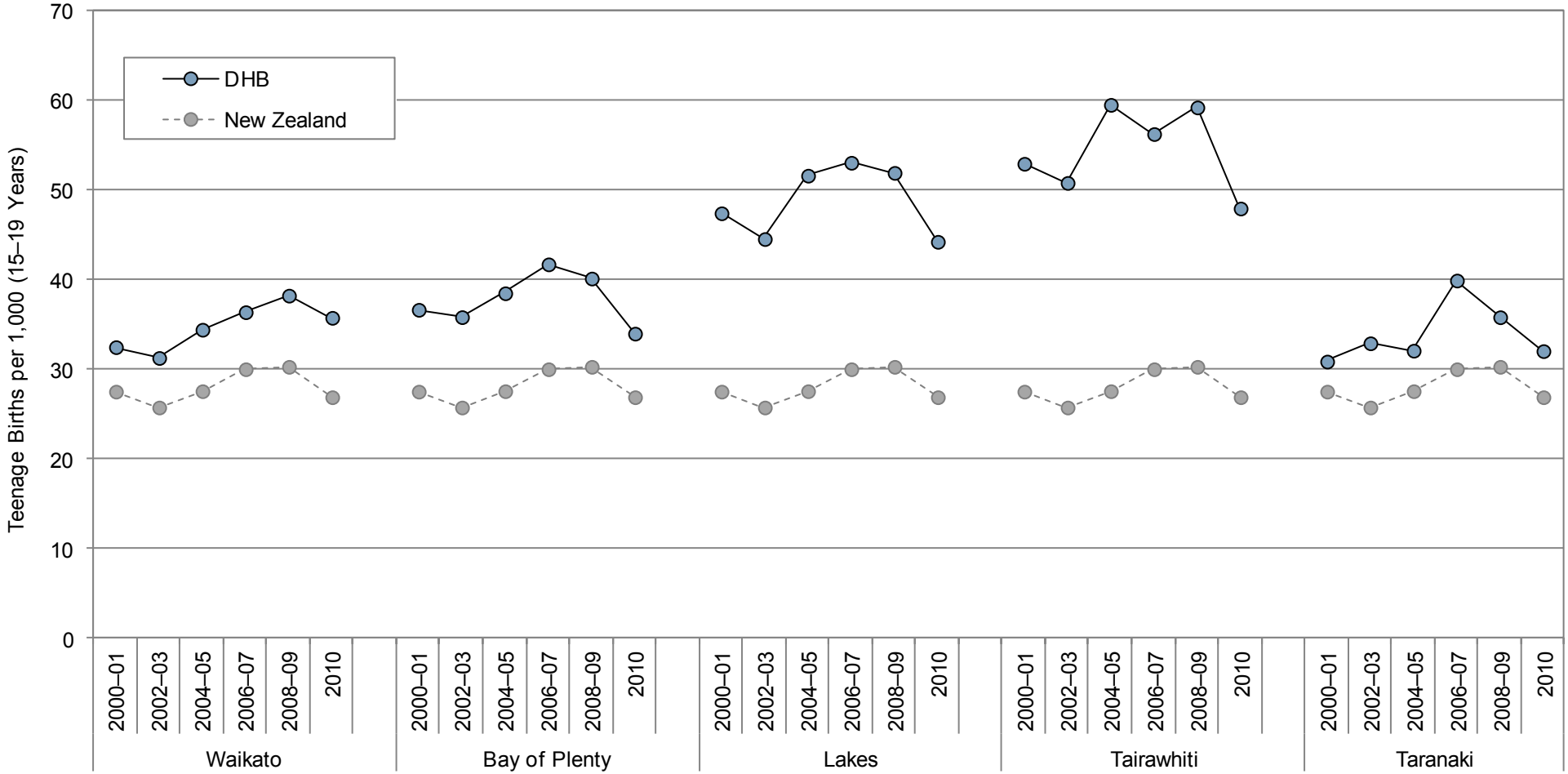
DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Teenage Births					
Waikato	2,589	517.8	37.0	1.26	1.21–1.31
Lakes	962	192.4	50.8	1.72	1.62–1.83
Bay of Plenty	1,438	287.6	39.4	1.34	1.27–1.41
Tairawhiti	501	100.2	55.7	1.89	1.74–2.06
Taranaki	729	145.8	36.6	1.24	1.16–1.34
New Zealand	23,775	4,755.0	29.5	1.00	

Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population

Midland Region Trends

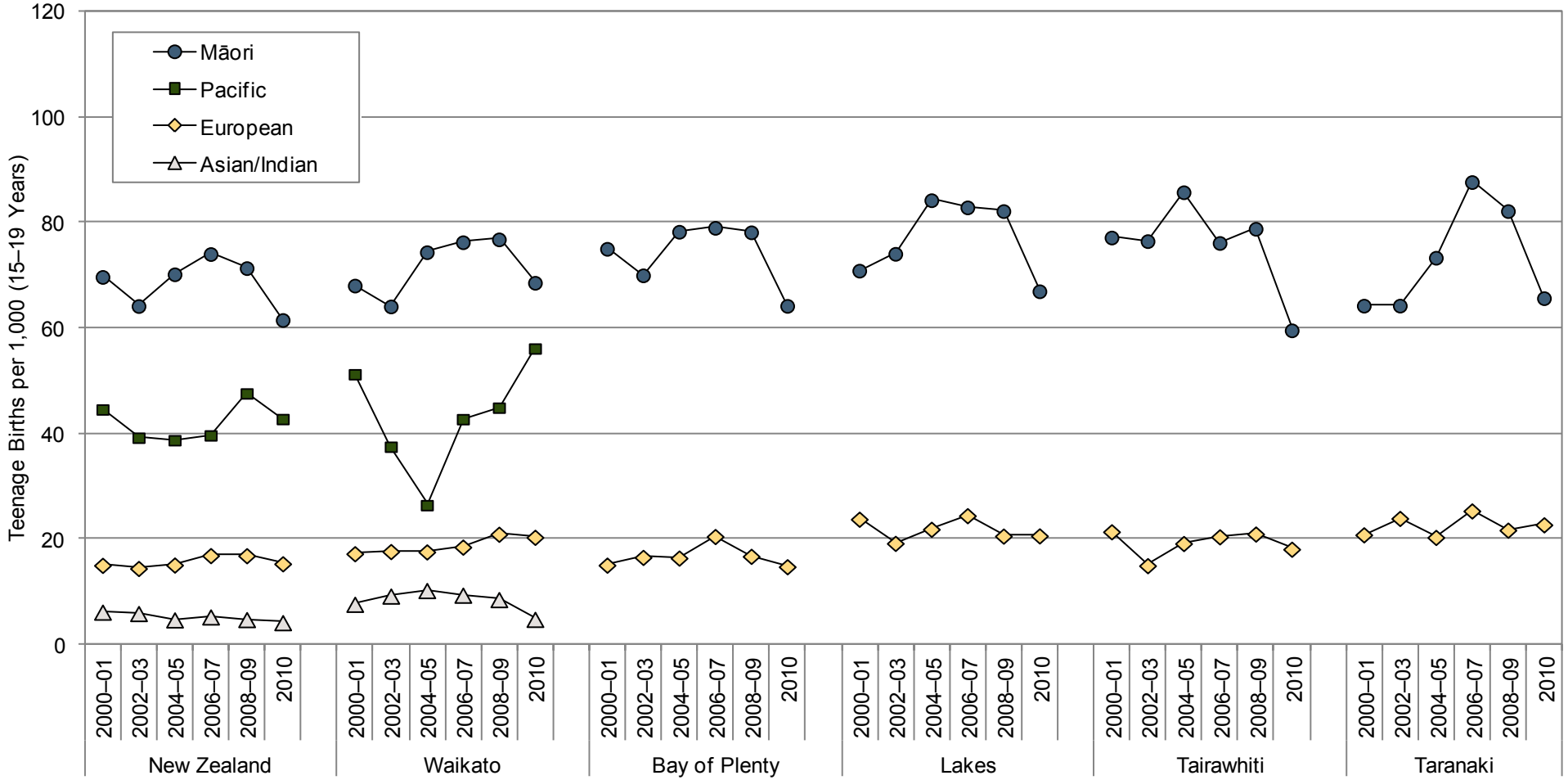
In all five of the Midland DHBs, teenage live birth rates increased during the mid-2000s and then declined during the late 2000s, with rates being higher than the New Zealand rate throughout 2000–2010 (**Figure 141**).

Figure 141. Teenage Birth Rates, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population

Figure 142. Teenage Birth Rates by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Midland Region Distribution by Ethnicity

In the Waikato during 2000–2010, teenage live birth rates were higher for Māori > Pacific > European > Asian/Indian women, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki teenage birth rates were higher for Māori than for European women (**Figure 142**).

Summary

In New Zealand, teenage live births declined during the late 1990s and early 2000s, to reach their lowest point in 2002. Birth rates then gradually increased again, reaching a peak of 32.4 per 1,000 in 2008. In contrast, teenage terminations increased during the late 1990s and early 2000s, reached a plateau during 2002–2007, and then declined, with teenage live birth and termination rates being roughly equivalent during 2002–2004.

During 2006–2010, teenage live birth rates were *significantly* higher for Māori > Pacific > European >Asian/Indian women and those from average-to-more deprived (NZDep decile 2–10) areas. Higher teenage live birth rates for Māori and Pacific women however, must be seen in the context of higher overall fertility rates (at all ages) for Māori and Pacific women.

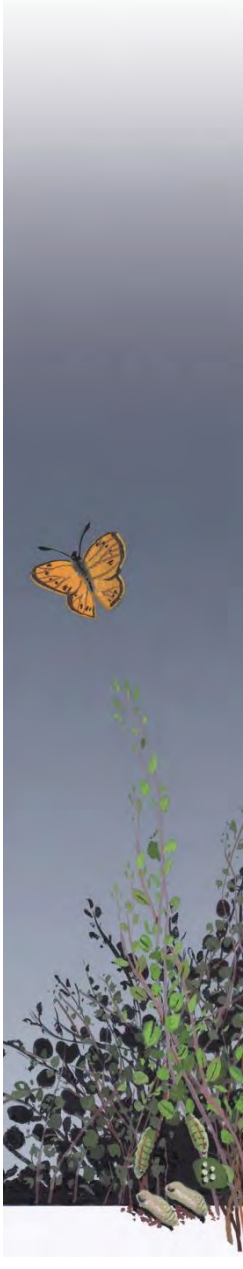
In the Midland Region during 2006–2010, teenage birth rates were *significantly* higher than the New Zealand rate in all five DHBs. In the Waikato, rates were higher for Māori > Pacific > European > Asian/Indian women, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki rates were higher for Māori than for European.

Local Policy Documents and Evidence-Based Reviews Relevant to the Support of Teenage Parents

In New Zealand a number of policy documents are relevant to the support of teenage parents and these are considered in **Table 159**, along with a range of guidelines and evidence-based reviews which consider these issues in the overseas context. In addition **Table 162** in the *Terminations of Pregnancy* section considers publications relevant to the prevention of unintentional teenage pregnancy.

Table 159. Local Policy Documents and Evidence-Based Reviews Relevant to the Support of Teenage Parents

Government Policy and Other Documents
Ministry of Education. 2011. **Teen Parents Unit Policy**. http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PolicyAndStrategy/SchoolingInNewZealand/TeenParentUnitsPolicy.aspx This web page sets out the policy for Teen Parents Units in schools. Additional more general information about Teen Parent Units can be found at: http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/PolicyAndStrategy/SchoolingInNewZealand/TeenParentUnitsFAQ.aspx
Family and Community Services. 2011. **Teen Parent Initiatives**. http://www.familyservices.govt.nz/working-with-us/programmes-services/early-intervention/teen-parent-initiatives.html#TeenParentIntensiveCaseWorkers1 This web page provides brief information about services for teen parents that are initiatives of the Ministry of Social Development's Family and Community Services.
Ministry of Social Development. 2010. **Budget 2010 - Supporting teen parents.** http://www.msd.govt.nz/about-msd-and-our-work/newsroom/factsheets/budget/2010/teenparents.html This web page outlines the Government's three initiatives aimed at supporting teen parents and their children: Teen parent intensive case workers and volunteer supporters, supported housing for teen parents and children and parenting support for teen fathers.



Family and Community Services. 2010. **Teenage Parent Intensive Case Worker Practice Guidelines** Wellington: Ministry of Social Development. http://www.familyservices.govt.nz/documents/working-with-us/funding-and-contracting/service-guidelines/teenage-parent-intensive-case-worker-guidel.pdf

These practice guidelines are a legal part of the Agreements with Providers for the delivery of the MSD's Teenage Parent Intensive Case Worker initiative (TPCWI). They are intended to assist stakeholders by providing:

- Detailed information about service delivery
- A resource tool to help stakeholders deliver the TPCWI consistently and in line with national goals
- A means for Family and Community Services and the MSD to improve responsiveness to feedback concerning changes to the service delivery component of the agreement

The practice guidelines should be seen as setting the minimum standard, from which each service provider can develop a service in line with their own philosophy and local need and culture.

Ministry of Social Development. 2010. **Supporting Teen Fathers: a resource for service providers**. Wellington: Ministry of Social Development. http://www.msd.govt.nz/documents/about-msd-and-our-work/publications-resources/planning-strategy/teen-fathers/teen-fathers.pdf

This publication was developed to support the delivery of services for teen fathers. It is organised in three parts: Part One discusses what is known about teen fathers in New Zealand, Part Two covers things to consider when working with teen fathers and Part Three contains profiles of five providers currently delivering services to teen fathers in New Zealand. All of the parts include discussion of insights gained from the New Zealand and international research literature and lists of resources for each section. There is also a very comprehensive list of references at the end.

International Guidelines

National Collaborating Centre for Women's and Children's Health. 2010. **Pregnancy and complex social factors. A model for service provision for pregnant women with complex social factors**. London (UK): National Institute for Health and Clinical Excellence (NICE). http://www.nice.org.uk/nicemedia/live/13167/50861/50861.pdf

These guidelines are based on a comprehensive review of the available evidence, and are complementary to the NICE guidance *Antenatal care: routine care for the healthy pregnant woman.* http://guidance.nice.org.uk/CG62 Chapter 6 deals with service provision for young women under the age of 20. It outlines ways healthcare providers can encourage young women to use antenatal services (e.g. offering age-appropriate services, help with other social problems, transport to and from appointments, care in the community, and providing opportunities for the father to be involved). There are recommendations for service organisations including working in partnership with other agencies, providing antenatal care in a variety of settings (e.g. GP surgeries, children's centres and schools, offering antenatal education in peer groups at the same time and location as clinic appointments and providing a direct-line telephone number for a named midwife who provides the majority of antenatal care). There is also guidance on training for healthcare staff and providing suitable information to pregnant young women. The appendices for this publication which contain the evidence tables for the included studies and details of the excluded studies, can be downloaded from: http://guidance.nice.org.uk/CG110/Guidance/Appendices

Department for Children, Schools and Families (U.K.). 2007. **Teenage Parents Next Steps: Guidance for Local Authorities and Primary Care Trusts**. London: Department for Children, Schools and Families. http://www.changeforchildren.co.uk/uploads/Teenage_Pregnancy_Next_Steps_For_LAs_And_PCTs.pdf

This British publication discusses services for teen parents in the U.K. and sets out what needs to happen at both the local and National level so that all agencies work together to achieve the best outcomes for teenage parents.

Systematic and Other Reviews from the International Literature

Barlow J, Smailagic N, Bennett C, et al. 2011. **Individual and group based parenting programmes for improving psychosocial outcomes for teenage parents and their children**. Cochrane Database of Systematic Reviews, 2011(3), Art. No.: CD002964. DOI: 10.1002/14651858.CD002964.pub2.

This review evaluated the effectiveness of programmes for teenage parents in improving psychosocial outcomes for the parents and developmental outcomes in their children. It included eight RCTs with 513 participants. Across all the studies there were 47 different outcomes compared between intervention and control groups, and in 19 of these there were statistically significant differences, all in favour of the intervention group. The authors conducted nine meta-analyses, each of which used data from two studies (data from four different studies was used in the meta-analyses). Of the meta-analyses, four showed statistically significant findings in favour of the intervention. The outcomes improved by the interventions were: parent responsiveness to the child (standard mean difference (SMD) -0.91, 95% CI -1.52 to -0.30, P=0.04), infant responsiveness to mother at follow-up (SMD -0.65, 95% CI -1.25 to -0.06, p= 0.03); and an overall measure of parent-child interactions post-intervention (SMD -0.71, 95% CI -1.31 to -0.11, p = 0.02), and at follow-up (SMD -0.90, 95% CI -1.51 to -0.30, p = 0.004). The authors concluded that, due to variations in the study populations, the interventions and the measures used, there were limits to the conclusions that could be drawn however they considered that there was some evidence that parenting programmes may be effective in improving a number of aspects of parent-child interaction. They stated that more research is needed.

Savio Beers LA, Hollo RE. 2009. **Approaching the adolescent-headed family: a review of teen parenting**. Current Problems in Pediatric & Adolescent Health Care, 39(9), 216-33.

This review notes that many of the same psychosocial, environmental, and educational factors that lead to teen pregnancy continue to play a role in the teens' ability to parent effectively. It explores the impact of, and factors influencing, the involvement of fathers, and also the effects of multigenerational relationships. It notes that successful interventions and programmes take various forms but they are usually comprehensive and multi-disciplinary and consider the development of both the parent and the child. It states that practitioners should understand the psychosocial, developmental, educational, and relationship issues that affect adolescent parenting.

Harden A, Brunton G, Fletcher A, et al. 2006. **Young people, pregnancy and social exclusion: A systematic synthesis of research evidence to identify effective, appropriate and promising approaches for prevention and support**. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. http://eppi.ioe.ac.uk/EPPIWebContent/hp/reports/TPPR/TPPR%20final.pdf

This report presents the findings from a systematic review of the literature relating to teenage pregnancy, parenthood and social exclusion, particularly research relating to policy initiatives. It included 38 studies in the in-depth review of parenting support, 18 on interventions and 20 on young people's views. Ten of the intervention studies provided sound evidence for the value of particular interventions: two looking at welfare sanctions or bonuses, four looking at the effects of educational and career development programmes, three examining holistic, multi-agency support, and one on the effects of day-care. A meta-analysis using a random effects model suggested that educational and career development interventions were associated with a 213% increase in the number of young parents in education or training in the short term (RR 3.13, 95% CI 1.49 - 6.56). Welfare sanction/bonuses programmes and day-care also had positive short term effects. None of these interventions had any long term effects. The authors concluded that the provision of day-care appears to be the most promising approach for the prevention of repeat pregnancy. The qualitative research included in the review highlighted the diversity of needs and preferences among teen parents, the struggles against negative stereotypes, the heavy reliance on family support, the continuation of problems that existed before parenthood, and the wider costs and benefits of education and employment.

Letourneau NL, Stewart MJ, Barnfather AK. 2004. **Adolescent mothers: support needs, resources, and support-education interventions**. Journal of Adolescent Health, 35(6), 509-25.

This review by Canadian authors describes the challenges faced by adolescent parents and their children, their support needs, and the supports available and accessed by these parents. It also reviews existing support-education intervention studies published before 2003, which frequently suffered from small sample sizes, attrition, lack of suitable comparison groups and measurement inconsistencies. Categories of support-education interventions reviewed included social support, contraceptive knowledge and behaviour, employability, parental confidence and psychosocial wellbeing, parenting skills and knowledge and child health and development. Important considerations in planning support interventions include content, duration, intensity, mode, level, intervention agents and targets.

American Academy of Pediatrics. Committee on Adolescence and Committee on Early Childhood, Adoption, and Dependent Care. 2001. **American Academy of Pediatrics: Care of adolescent parents and their children**. Pediatrics, 107(2), 429-34.

This review discusses the medical and psychological risks specific to adolescent parents and their children and also particular challenges, mitigating circumstances and protective factors for the adolescent mother and her partner. It also includes suggestions for paediatricians on models for intervention and care. It notes that there are a number of factors associated with improved outcomes: having completed school before becoming pregnant, active participation in a programme for pregnant adolescents, staying in school and not having another pregnancy at 26 months post-partum, having as sense of control over one's life, not being socially isolated, and having only one or two more children after adolescent pregnancy. Family support is important but if the grandmother is too helpful this can increase the likelihood of a repeat pregnancy. Quality child care is needed so mothers can stay in school. The review concludes with a list of twelve recommendations for paediatricians.

Akinbami LJ, Cheng TL, Kornfeld D. 2001. **A review of teen-tot programs: comprehensive clinical care for young parents and their children**. Adolescence, 36(142), 381-93.

This paper reviewed four published evaluations of teen-tot programmes. Studies were included if they described a programme including clinical health supervision, family planning and support for teenage parents (e.g. assistance with staying in school or obtaining community services). Each of the included studies had multidimensional interventions (e.g. well-child health visits; 24-hour on call system to an interdisciplinary team; individual counselling about financial management, school and work; and social worker review of family planning methods with referrals to a birth control clinic). While there was limited evidence upon which to judge the effectiveness of teen-tot programmes, the authors concluded teen-tot programmes had moderate success in preventing repeat pregnancies, helping teenage mothers continue their education, and improving parent and infant health over 6 to 18 months. It was acknowledged that study weaknesses may have impacted on the observed effectiveness.

Useful Websites and Other Publications
Barbara C. 2010. **Resilience in teenage mothers: A follow-up study**. Wellington: Ministry of Social Development. http://www.msd.govt.nz/documents/about-msd-and-our-work/publications-resources/research/sole-parenting/resilience-in-teenage-mothers.pdf This is the report of a study which involved interviewing, in 2008, thirteen of the original eighteen teenage mothers who participated in a 2001 study on young women's views and experiences of teenage motherhood. It includes a literature review which is organised under a number of headings: risks associated with teenage motherhood, resilience research, and new perspectives on resilience and teenage mothers. The author concluded that "where policies and programmes help teenage mothers to develop their skills and competencies, provide social support, and encourage further education and suitable employment, resilience can be enhanced. Such an approach helps them to feel strengthened, rather than diminished, by teenage motherhood."
Boden JM, Fergusson DM, John Horwood L. 2008. **Early motherhood and subsequent life outcomes**. Journal of Child Psychology & Psychiatry & Allied Disciplines, 49(2), 151-60. This paper reports on data obtained as part of the Christchurch Health and Development Study which has followed a cohort of New Zealand children for over 25 years. Early motherhood was found to be associated with higher levels of mental health disorders, lower levels of educational achievement, higher levels of welfare dependence, lower levels of workforce participation, and lower income. After controlling for confounding factors the association between early motherhood and later mental health disorders was no longer statistically significant, but the association with later educational achievement and economic circumstances persisted. The authors concluded that early motherhood increases a mother's risk for educational underachievement and poor economic circumstances, but that links between early motherhood and later mental health difficulties can be largely explained by childhood, family and related circumstances that occurred before parenthood.
Loxton D, Stewart Williams J, Adamson L. 2007. **Barriers to Service Delivery for Young Pregnant Women and Mothers**. Canberra: The National Youth Affairs Research Scheme (NYARS). http://www.deewr.gov.au/Youth/Programs/NYARS/Documents/ServiceDeliveryBarriers_Report.pdf This is the report of a project which aimed to: 1. Identify the covert and overt structures that exist within services that operate to prevent young women from accessing those services 2. Identify the attitudes and beliefs that are perceived by young women to exist within services, policy, and the community and media, that deter them from accessing services 3. Identify and describe the experiences that young women have had when accessing services 4. Determine the barriers that service personnel perceive as acting to prevent young women from using their services 5. Determine any specific barriers to service use that occur for women from subgroups nominated by NYARS (the subgroups included those who: have experienced or are at risk of substance abuse; have been in foster care; have a disability; come from diverse cultural/linguistic backgrounds; are of Indigenous descent) 6. Describe models of best practice based on young women's experiences, and findings from the current literature. The authors concluded that the most striking aspect of successful service delivery was a trusting relationship between the young woman and her service providers. The report provides a list of recommendations based on the research.
Johnson R, Denny S J. 2007. **The Health and Wellbeing of Secondary School Students attending Teen Parent Units in New Zealand.** Auckland: The University of Auckland. http://www.youth2000.ac.nz/publications/reports-1142.htm This report describes the results of an anonymous survey of 220 teenage parents attending Teen parent Units in New Zealand. The survey focused on issues related to the health and wellbeing of these students. It was found that most teenage parents attending these units were well connected to their families and felt supported within the Teen Parent Units but it also identified a number of areas of concern including issues around sexual health, nutrition and physical activity, and mental health. The authors hope that the report will provide information for funders, planners, providers and schools that will help improve the health and wellbeing of teen mothers and their children.
Sawtell M, Wiggins M, Austerberry H, et al. 2005. **Reaching out to pregnant teenagers and teenage parents: Innovative practice from the Sure Start Plus pilot programmes**. London: Social Science Research Unit, Institute of Education, University of London. http://www.leavingcare.org/downloads/standards_links/Reaching%20out%20to%20pregnant%20teenagers%20-%20Surestart%20innovative%20practice.pdf This guide aims to provide information and inspiration to those working to develop services for teenagers who are pregnant or who are parents. It is intended for those involved in commissioning services and for practitioners. Sure Start Plus was a pilot initiative that aimed to reduce the risk of long term social exclusion resulting from teenage pregnancy through co-ordinated support to pregnant teenagers aged <18 years and teenage parents. Its core aspect was the provision of one-to-one support through an advisor who offered a holistic package of care.

Berrington A, Diamond I, Ingham R, et al. 2005. **Consequences of Teenage Parenthood: Pathways which minimise the long term negative impacts of teenage childbearing**. Southampton: University of Southampton. https://www.education.gov.uk/publications/eOrderingDownload/RW52.pdf

This project, which was done under a U.K. Department of Health contract, used data from two large longitudinal British cohort studies to explore aspects of teenage parenthood and its impact. The results confirmed the well-established relationship between teenage parenthood and social deprivation and the age at which cohort members' mothers had their first children. Mothers expressed aspirations for their daughters (or lack of them) were also influential. Teenage parenthood was found to be a key pathway for the intergenerational transmission of disadvantage. The authors state that the pattern of results suggests that important areas for action to prevent the adverse consequences of teenage parenthood are minimising workless families, improving housing and wider neighbourhood quality and encouraging the presence of a co-resident partner.

Jaffee S, Caspi A, Moffitt TE, et al. 2001. **Why are children born to teen mothers at risk for adverse outcomes in young adulthood? Results from a 20-year longitudinal study**. Development & Psychopathology, 13(2), 377-97.

This paper reports on data from the Dunedin Multidisciplinary Health and Development Study which has been following a cohort of children born during 1972-1973. The aim of this study was to determine how much the effects of teen motherhood on offspring outcomes could be accounted for by social selection (i.e. the characteristics of the mother that make her more likely to have become a teen parent) vs. social influence (in which the consequences of being born to a teen parent cause harm to the child, apart from any characteristics of the mother herself). Across all outcomes, about 39% of the effect of teen parenthood on offspring outcomes was due to maternal characteristics and family circumstances together. In agreement with a social selection hypothesis, 18% of the effect of teen parenthood on offspring outcomes was accounted for by maternal characteristics and in agreement with a social-influence hypotheses, family circumstances accounted for 21% of the teen childbearing effect after controlling for maternal characteristics. The authors say that their results suggest that public policy initiatives should aim not only to delay childbearing in the population but also to support individual at-risk mothers and their children.

TERMINATIONS OF PREGNANCY

Introduction

In New Zealand, approximately one quarter of all pregnancies end in a termination, with one in four women undergoing a termination in their lifetimes [240]. Terminations are part of core, publicly funded health services, with pregnancies that present a serious danger to the life of a woman, or to her physical or mental health, that result from incest, or have a fetal abnormality being amongst those which can be legally terminated. Women usually go first to a referring doctor (e.g. a GP or Family Planning doctor) to have the pregnancy confirmed, to undergo diagnostic tests and to be referred to an abortion clinic. Two certifying consultants must then individually review the woman and agree that the case fulfils the legal grounds for a termination [240].

When considering the factors contributing to terminations, the Dunedin Multidisciplinary Health and Development Study [241] found that amongst their birth cohort of 477 women aged 26 years in 1998/99, 36% had been pregnant before 25 years, and that in 60% of cases the pregnancy had been unwanted. In this cohort, 48% of unwanted pregnancies ended in termination, as compared to 2% of wanted pregnancies. Factors associated with unwanted pregnancy included shorter relationship duration and first or only pregnancies. Unwanted pregnancies were more likely to result from contraception not being used (55%) than it failing (40%), with reasons for non-use of contraception including "not thinking about it" (40%), the use of alcohol (25%), partners not wanting to use a condom (11%), and not being able to afford contraception (6%) [241].

Similarly, a 2002 study of women attending a New Zealand clinic for assessment prior to a termination found that 69.5% had either used no contraception or natural family planning prior to conception, as compared to 48.0% of clinic attendees in 1999 and 44.5% in 1995. The authors noted that while European women were the highest users of the contraceptive pill prior to conception (31% of European attendees in 2002 vs. 28% in 1999), the largest numerical increases in clinic attendance had been for Asian women, who as a group, also had much lower rates of contraception use (in 2002, 80% had used no contraception prior to conception, with a further 17% using condoms only). The authors concluded that accurate information on contraceptive methods, accompanied by access to reliable contraception could reduce the need for termination of unwanted pregnancies and that in particular, young Asian women required immediate access to such advice [242].

The following section reviews terminations of pregnancy using information from the Abortion Supervisory Committee (via Statistics New Zealand). Policy documents and evidence-based reviews which consider how the issue of unintended pregnancies might be addressed at the population level are considered at the end of this section.

Data Sources and Methods

Indicator

1. Legally Induced Terminations of Pregnancy

Numerator: Legally Induced Terminations of Pregnancy Registered in New Zealand by the Abortion Supervisory Committee

Denominator: Statistics New Zealand Estimated Resident Population

Notes on Interpretation

Note 1: In New Zealand, information on the domicile of women presenting for a termination of pregnancy has only been recorded by the Abortion Supervisory Committee since 2004, with an agreement existing between the Committee and Statistics NZ that the only geographical breakdown of termination data will be at regional council level. Thus information on terminations of pregnancy by DHB or NZDep Index decile is unavailable.

Note 2: In its reporting of terminations, Statistics NZ uses total response ethnicity, and thus women will appear in each ethnic group with which they identified (in both the numerator and denominator).

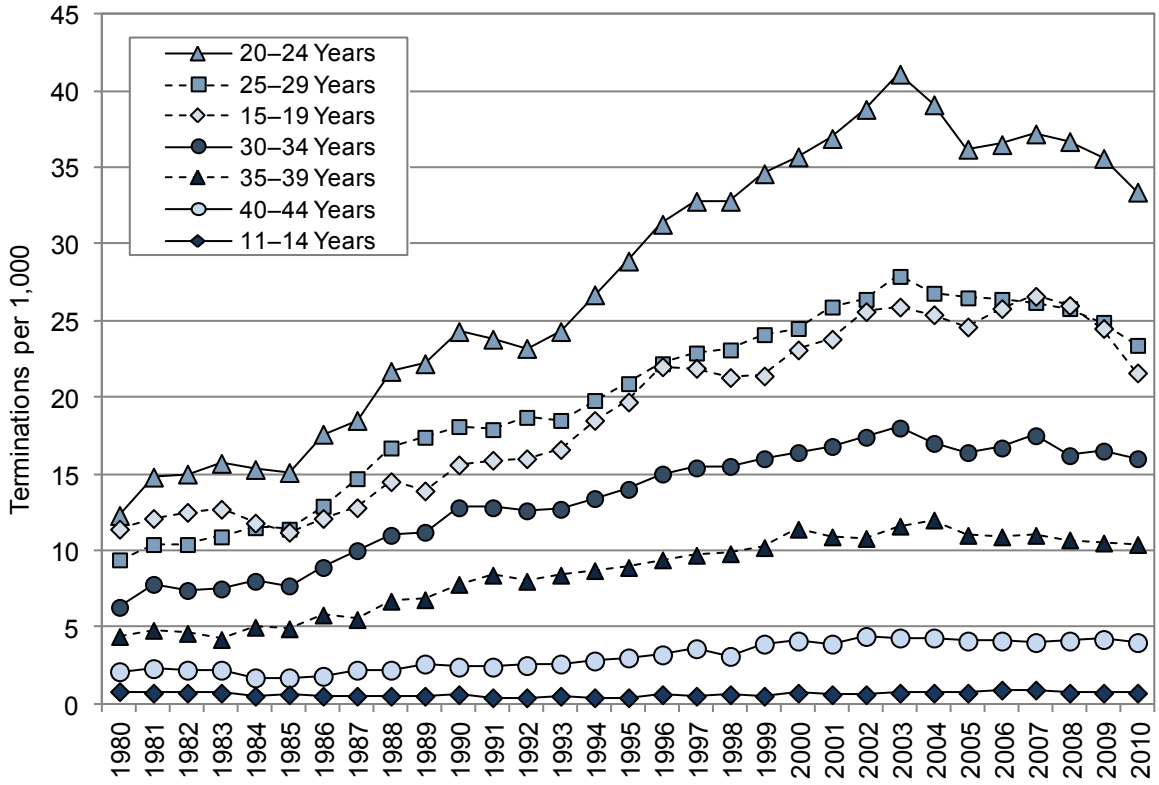
Note 3: Tests of statistical significance have not been applied to data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1980–2010, terminations of pregnancy were highest in women aged 20–24 years, followed by those 25–29 years and 15–19 years of age. Termination rates increased during the 1980s and 1990s, with rates reaching a peak for most age groups in the early 2000s and then beginning to gradually decline (**Figure 143**).

Figure 143. Terminations of Pregnancy by Age, New Zealand 1980–2010



Source: Abortion Supervisory Committee via Statistics New Zealand

New Zealand Distribution by Age and Ethnicity

In New Zealand during 2010, terminations of pregnancy were highest in women aged 20–24 years, followed by those aged 25–29 years and those aged 15–19 years (**Figure 144**). While similar patterns were seen for women from each of New Zealand's largest ethnic groups, amongst younger women (<35 years) termination rates were higher for Pacific and Māori women than for European women. While terminations for European teens were higher than for Asian teens, Asian women had higher termination rates than European women from 25 years of age onwards (**Figure 145**).

In New Zealand during 2006–2010, terminations of pregnancy were higher for Pacific and Māori > European > Asian teenagers, while amongst those 20–24 years, terminations of pregnancy were higher for Pacific > Māori > European and Asian women (**Figure 146**).

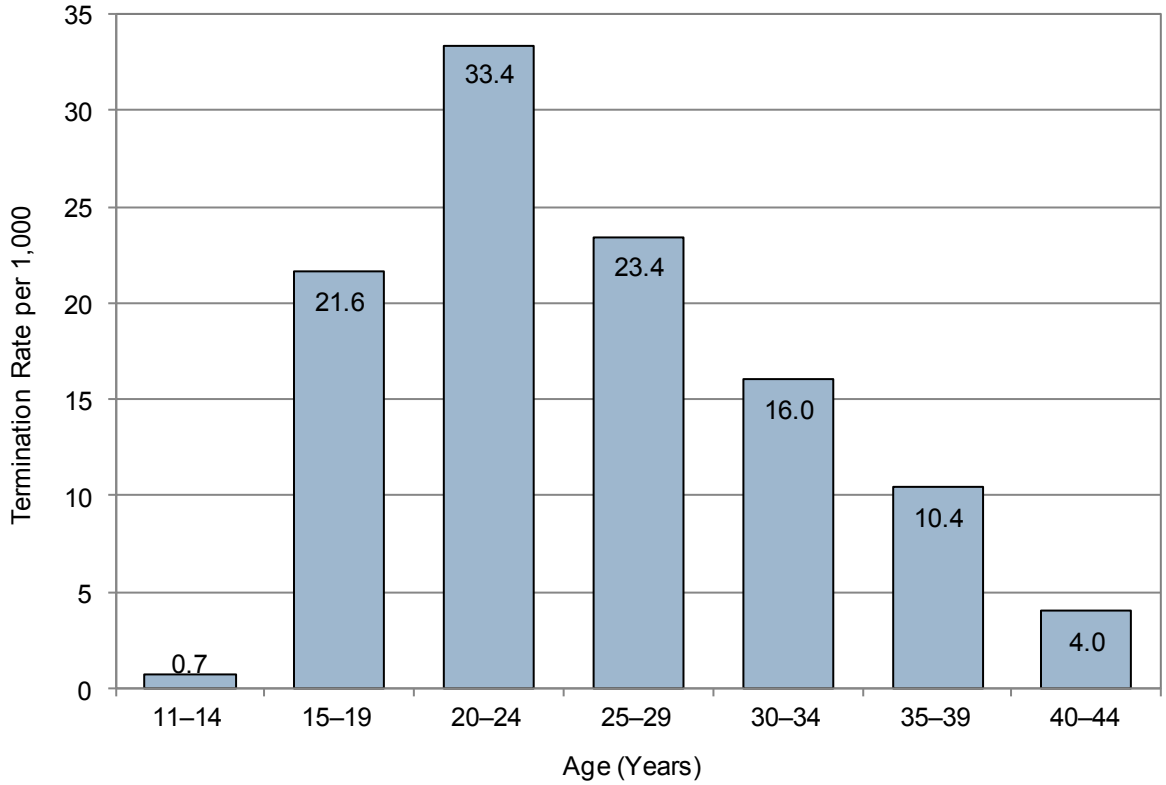
New Zealand Distribution by Age and Gestation

In New Zealand during 2009, the majority of terminations of pregnancy occurred between 8 and 12 weeks gestation, in all age groups. The next most frequent gestations were <8 weeks, followed by 13–16 weeks, with women aged 45+ years having a higher proportion of terminations > 12 weeks than those from other age groups (**Figure 147**).

New Zealand Distribution by Age and Previous Terminations

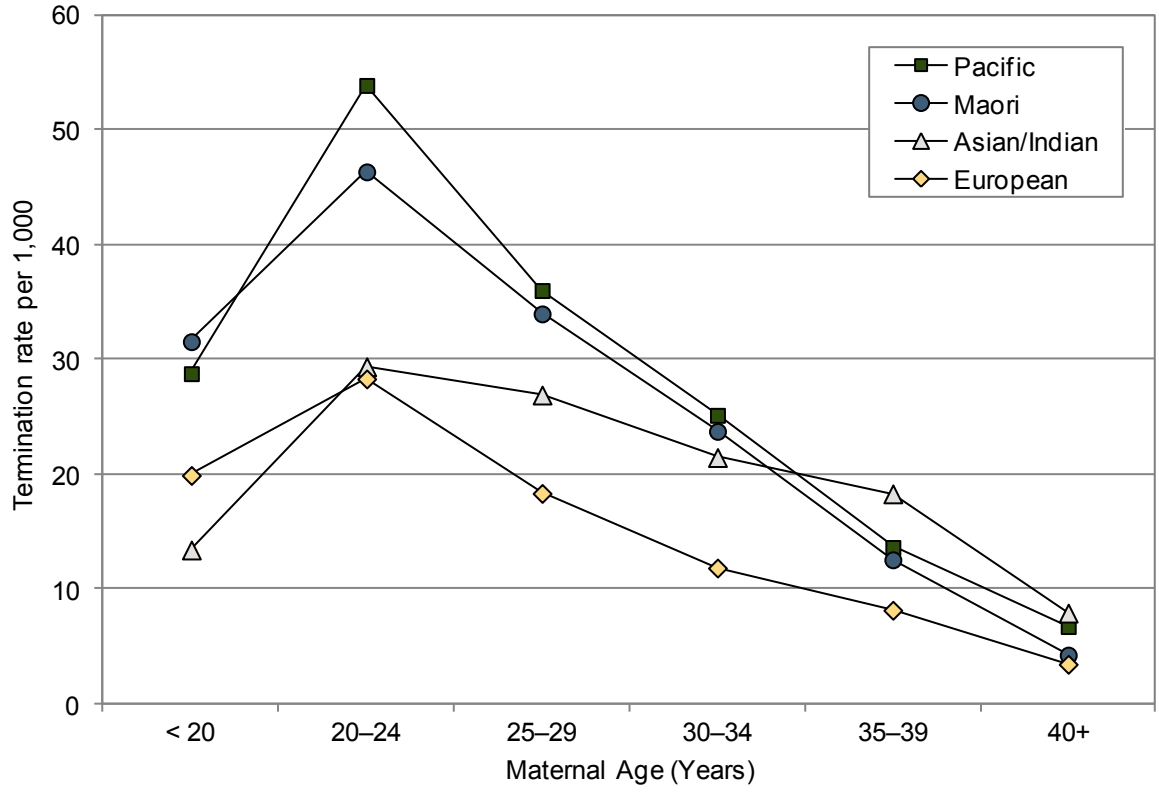
In New Zealand during 2009, the proportion of women who had not had a previous termination decreased with increasing age, with the highest number of previous terminations being amongst women in their late twenties to early forties (**Figure 148**).

Figure 144. Terminations of Pregnancy by Age, New Zealand 2010



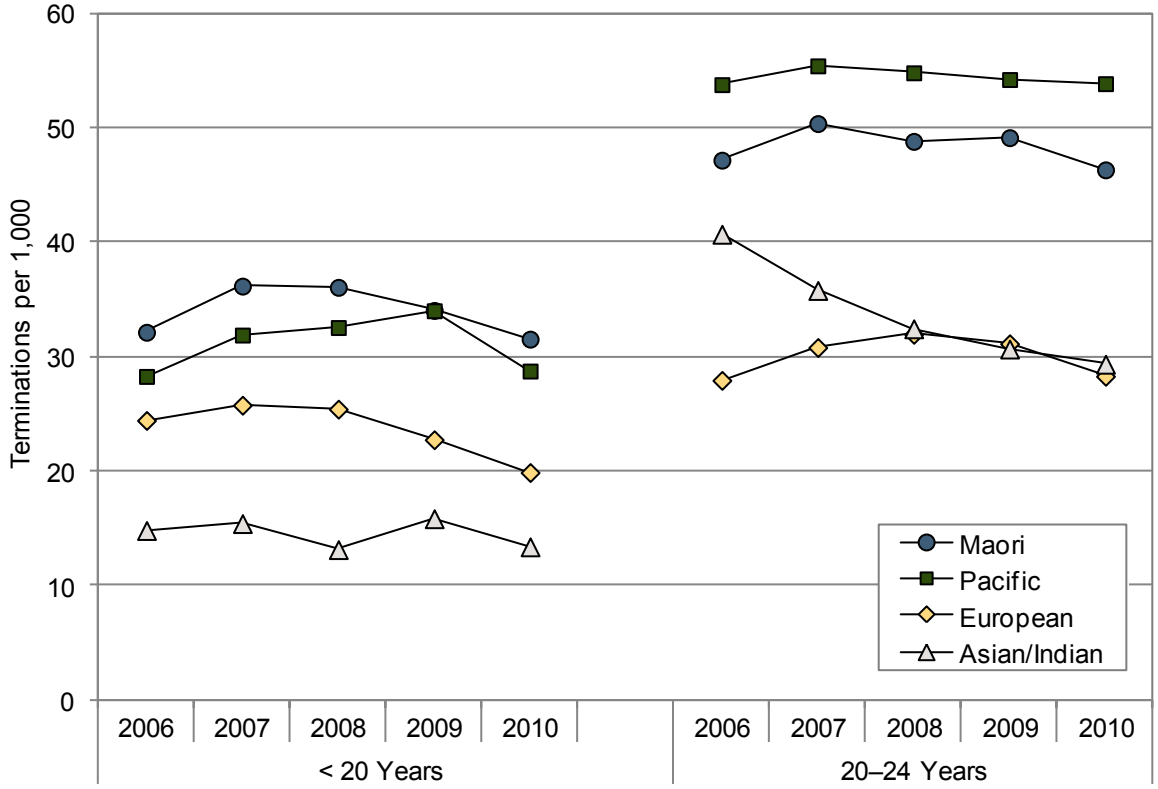
Source: Abortion Supervisory Committee via Statistics New Zealand

Figure 145. Terminations of Pregnancy by Age and Ethnicity, New Zealand 2010



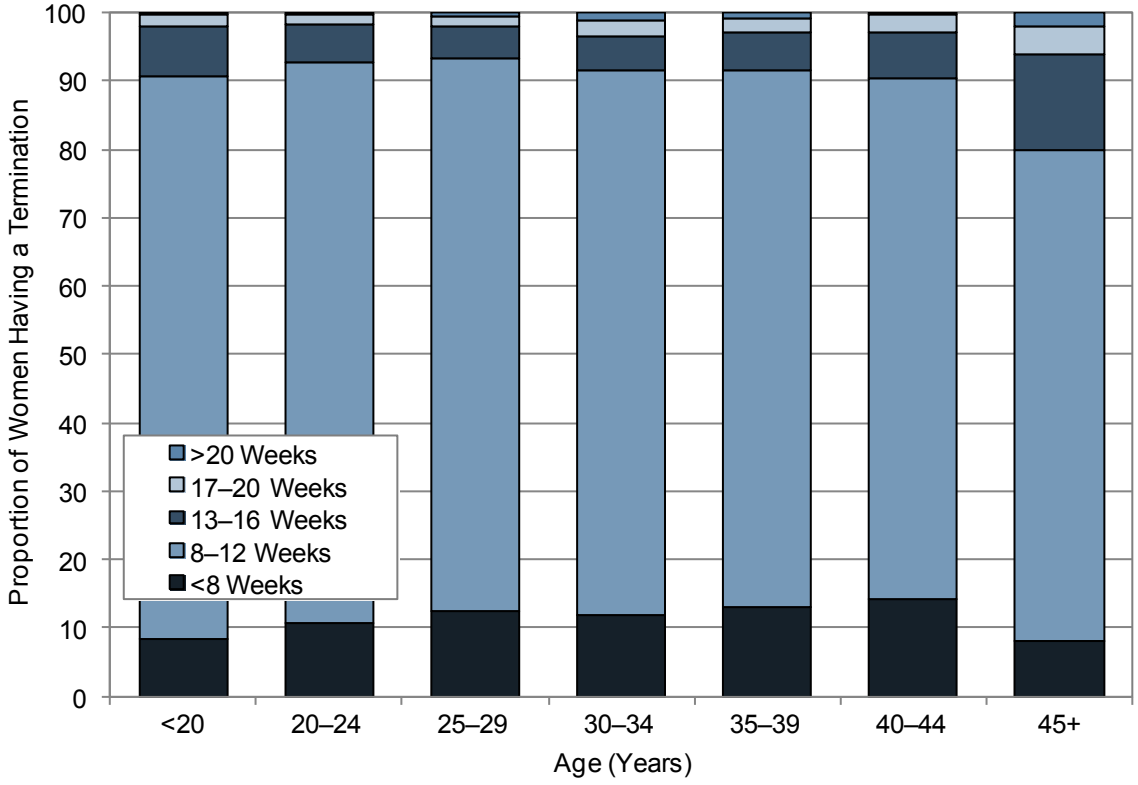
Source: Abortion Supervisory Committee via Statistics New Zealand. Note: Ethnicity is Total Response

Figure 146. Terminations of Pregnancy by Ethnicity in Young Women <25 Years, New Zealand 2006–2010



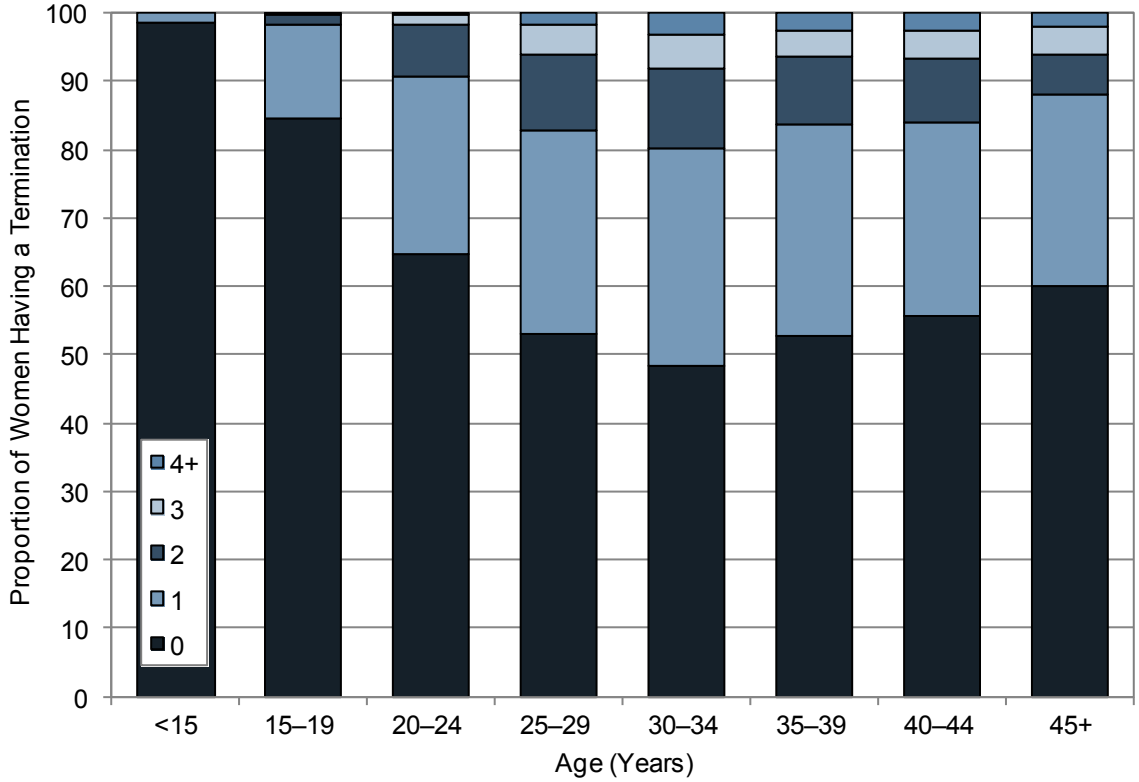
Source: Abortion Supervisory Committee via Statistics New Zealand. Note: Ethnicity is Total Response

Figure 147. Proportion of Women Who Had a Termination by Age and Gestation at Termination, New Zealand 2009



Source: Abortion Supervisory Committee [243]

Figure 148. Proportion of Women Who Had a Termination by Age and Number of Previous Terminations, New Zealand 2009



Source: Abortion Supervisory Committee [243]

Distribution by Health Facility and Region

Table 160. Terminations of Pregnancy by Regional Council of Residence, New Zealand 2004–2009

Regional Council	Number of Terminations					
	2004	2005	2006	2007	2008	2009
Northland	506	484	494	574	531	469
Auckland	7,238	7,181	7,225	7,299	7,146	6,981
Waikato	1,383	1,286	1,472	1,468	1,487	1,445
Bay of Plenty	819	756	905	951	800	905
Gisborne	136	142	121	158	134	122
Hawke's Bay	518	561	560	616	558	555
Taranaki	340	317	381	390	350	350
Manawatu-Whanganui	809	801	836	828	854	777
Wellington	2,199	2,160	2,193	2,318	2,185	2,189
Tasman	129	158	142	133	136	135
Nelson	196	191	215	216	206	190
Marlborough	109	133	138	164	143	131
West Coast	93	98	81	100	98	96
Canterbury	2,135	2,013	2,106	1,992	2,076	2,067
Otago	752	687	698	751	764	671
Southland	284	238	290	277	289	260

Source: Abortion Supervisory Committee Annual Reports via Statistics NZ

Distribution by Regional Council of Residence

During 2009, 1,445 terminations of pregnancy were recorded as occurring in women living in the Waikato Regional Council catchment, while 905 occurred in women resident in the Bay of Plenty, 122 in women resident in Gisborne, and 350 in women resident in Taranaki (**Table 160**).

Distribution by Health Facility

In New Zealand during 2003–2009, a large number of terminations were performed at different facilitates around the country, with 487 terminations being performed at Thames Hospital, 551 at Tokoroa Hospital, 1,071 at Waikato Hospital and 350 at Taranaki Base Hospital during 2009 (**Table 161**).

Table 161. Terminations of Pregnancy by Healthcare Facility, New Zealand 2003−2009

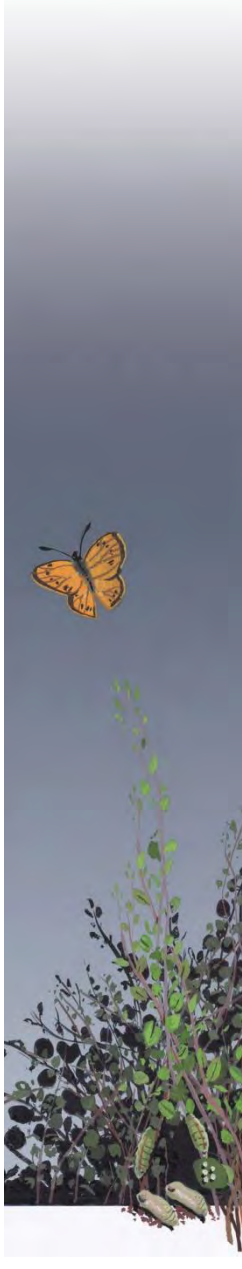
Institution	Number of Terminations						
	2003	2004	2005	2006	2007	2008	2009
Whangarei Area Hospital	454	474	461	461	533	495	460
National Women's Health		18	105	116	128	188	192
Clinical Centre Short Stay	549	537	469	500	474	461	487
Epsom Day Unit	5,908	5,735	5,543	5,524	5,594	5,500	5,380
Auckland Medical-Aid Trust	1,813	1,647	1,462	1,511	1,592	1,476	1,321
North Shore	10	12	20	26	23	26	31
Middlemore	19	38	21	28	20	20	25
Thames	505	538	511	535	526	494	487
Tokoroa	517	553	542	548	549	562	551
Waikato	1,007	938	967	1,055	1,097	1,061	1,071
Hawke's Bay Hospital	579	539	559	557	613	568	563
Taranaki Base	263	310	294	358	368	352	350
Masterton / Wairarapa	81	96	131	111	164	197	211
Wellington	3,126	3,004	2,882	2,962	3,075	2,867	2,774
Nelson	318	332	344	359	348	333	320
Wairau	127	123	139	126	160	140	141
Ashburton Public	15	12		16	11	12	26
Christchurch Women's	365	339	202	108	105	129	158
Lyndhurst	2,210	2,290	2,242	2,380	2,330	2,398	2,305
Dunedin	607	653	601	626	646	644	618
Other Hospitals	38	23	36	27	26	17	79

Source: Abortion Supervisory Committee Annual Reports and via Statistics NZ

Summary

In New Zealand during 1980–2010, terminations of pregnancy were highest in women aged 20–24 years, followed by those 25–29 years and 15–19 years. Termination rates increased during the 1980s and 1990s, with rates reaching a peak for most age groups in the early 2000s and then beginning to gradually decline. During 2006–2010, terminations were higher for Pacific and Māori > European > Asian teenagers, while amongst those 20–24 years, terminations were higher for Pacific > Māori > European and Asian women.

During 2009, 1,445 terminations of pregnancy were recorded as occurring in women living in the Waikato Regional Council catchment, while 905 occurred in women resident in the Bay of Plenty, 122 in women resident in Gisborne, and 350 in women resident in Taranaki.



Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Unintentional Pregnancies

In New Zealand, while no policy documents focus solely on unintentional pregnancies, a number of documents consider sexual and reproductive health issues more generally, and these are considered in **Table 162**, along with a range of reviews and other publications which consider these issues in the overseas context. In addition, **Table 159** in the *Teenage Pregnancy* section considers publications relevant to the support of teenage parents.

Table 162. Local Policy Documents and Evidence-Based Reviews Relevant to Unintentional Pregnancies in Adolescents

Ministry of Health Policy Documents
Ministry of Health. 2003. **Sexual and Reproductive Health: A resource book for New Zealand health care organisations**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/82f4780aa066f8d7cc2570bb006b5d4d/cffe42ce625d5a37cc256dec000dc097/$FILE/sexualReproHealthResource.pdf This publication supports the Sexual and Reproductive Health Strategy and is designed to help DHBs and PHOs find ways of improving the uptake of effective contraception and safe sex practices in their populations. It notes that compared to some other developed countries, New Zealand has high rates of both abortions and teenage births. There is information on designing services, strategies for action, strategies for Māori, strategies for Pacific peoples, unintended and unwanted pregnancies, sexually transmitted infections, HIV and AIDS.
Minister of Health. 2001. **Sexual and Reproductive Health strategy Phase One**. Wellington: Ministry of Health. http://www.moh.govt.nz/moh.nsf/0/E4F15D3A93CF5A48CC256AE90016EF56/$File/sexualreproductivehealthstrategyphase1.pdf This document outlines the Government's overall direction in 2001, to improve sexual and reproductive health outcomes. Key priority areas are sexually transmitted infections, unwanted/unintended pregnancy, youth, and Māori and Pacific peoples. The strategy recognises that different population groups have different needs and that sexual and reproductive issues are intertwined with issues of self-esteem, sexual identity, diversity and youth suicide. Four strategic directions provide a framework for the strategy: Societal attitudes, values and behaviour, personal knowledge, skills and behaviour, services and information.
Systematic and Other Reviews from the International Literature
Halpern Vera, Lopez L M, A GD, et al. 2011. **Strategies to improve adherence and acceptability of hormonal methods of contraception**. Cochrane Database of Systematic Reviews, 2011(4), Art. No.: CD004317. DOI: 10.1002/14651858.CD004317.pub3. Despite the theoretical effectiveness of hormonal contraceptives, effectiveness in typical use is lower because women have difficulty remembering to take their pills, or they stop taking them and women using injectable contraceptives do not keep appointments for repeat injections. This review considered the effectiveness of interventions to improve adherence to, and acceptability of, hormonal contraceptive methods. The review included eight RCTs comparing a variety of interventions vs. standard family planning advice. The interventions included group motivation, counselling, and reminder systems for dosing or appointments. The measured outcomes were discontinuation, reasons for discontinuation, number of missed pills, number of on-time injections, and pregnancy. Of the eight RCTs, only one showed a significant benefit from an intervention. In that trial, women who had received structured pre-treatment counselling involving audio-visual messages on the risks, benefits and overall characteristics of the injectable contraceptive depo-medroxyprogesterone acetate (DMPA) were less likely to have discontinued using it after 12 months compared to women who had received routine counselling (OR 0.27; 95% CI 0.16 to 0.44). Another study found that women in the intervention group were less likely to discontinue use because of dissatisfaction with the contraceptive method (OR 0.27; 95% CI 0.16 to 0.44) but were equally likely to discontinue overall. The authors concluded that, so far, most studies have not shown a benefit from strategies to improve adherence and continuation however they noted that the trials had a number of limitations. Three had small sample sizes, four had high losses to follow up and there was considerable variation in the types and intensities of the interventions. They stated that more high quality research is needed given the importance of adherence and continuation for successful contraception.
Ralph LJ, Brindis CD. 2010. **Access to reproductive healthcare for adolescents: establishing healthy behaviors at a critical juncture in the lifecourse**. Current Opinion in Obstetrics & Gynecology, 22(5), 369-74. http://www.nmtpc.org/docs/contraceptive%20use%20among%20adolescents.pdf This U.S. review provides an overview of recent research on adolescents' access to reproductive healthcare. It states that recent research has confirmed the need for diverse points of access to the healthcare system. Adolescents need high quality, confidential, and comprehensive reproductive health care which includes a wide range of counselling, clinical and preventive care. Removing barriers to care (e.g. concerns about confidentiality and cost) is important.

Owen J, Carroll C, Cooke J, et al. 2010. **School-linked sexual health services for young people (SSHYP): a survey and systematic review concerning current models, effectiveness, cost-effectiveness and research opportunities**. Health Technology Assessment, 14(30). http://www.hta.ac.uk/fullmono/mon1430.pdf

This report contains both the results of a survey of sexual health services linked to schools in the U.K. and a systematic review of the international literature. The aim of the project was to synthesise evidence about the effectiveness, acceptability and cost-effectiveness of these types of services and to identify areas where further research would be useful. Three broad types of sexual health provision were found: 1) School-based sexual health services (SBSHS) staffed by school nurses offering "minimal" or basic" services; 2) SBSHSs and school-linked sexual health services (SLHSs) staffed by a multi-disciplinary team not including a doctor offering "basic" or "intermediate" levels of service; 3) SBHSs and SLSHSs staffed by a multi-professional team including doctors which offered "intermediate" or "comprehensive" services. The literature review indicated that the provision of SBHSs was not associated with higher rates of sexual activity or earlier age of first intercourse among young people. There was evidence, primarily from U.S. studies, that the provision of such services was associated with fewer births to teenage mothers and lower rates of chlamydial infection in young men. The evidence suggested that broad-based, holistic service models, not restricted to sexual health, were best for maximising service uptake, protecting young people's privacy and confidentiality, countering perceived stigmatisation and offering the most comprehensive range of products and services. The U.K. survey indicated that both professionals and students preferred broad-based services provided by a multi-professional team including doctors. These types of services fit with the Every Child Matters framework and other similar policy initiatives in the U.K. but they have not been rigorously evaluated so there was no data which could be used for cost-effectiveness modelling.

Halpern V, Raymond E G, Lopez L M. 2010. **Repeated use of pre- and postcoital hormonal contraception for prevention of pregnancy**. Cochrane Database of Systematic Reviews, 2010(1), Art. No.: CD007595. DOI: 10.1002/14651858.CD007595.pub2.

It is not recommended that post-coital hormonal contraception (the "morning after" pill) be used repeatedly due to its higher risk of side effects and lower effectiveness compared to other modern contraceptive methods, however this form of contraception may appeal to women who have infrequent sex and it is convenient and private. This review considered the safety and effectiveness of pericoital hormonal contraception. The authors identified 21 trials (12,332 women) that evaluated pericoital use of levonorgestrel (LNG) and other hormonal drugs on a regular basis for the prevention of pregnancy. The use of LNG in this way was found to be reasonably efficacious and safe. For the 0.75 mg dose of LNG the pooled Pearl Index (number of pregnancies per 100 woman-years of use) was 5.1 (95% CI 3.8 to 6.7) and for all doses of LNG it was 4.9 (95% CI 4.3 to 5.5). The most common side effect was irregular menstrual bleeding. Most women reported satisfaction with the use of LNG. Other hormonal drugs appeared promising but most had not been studied extensively. The authors noted that the quality of the studies was not particularly high but that given the large number of study participants, the low rates of pregnancy and the consistency of the results the overall grade of evidence was moderate. They concluded that pericoital use of LNG was an effective, safe and acceptable method of contraception but that, in the absence of more rigorous research, it would be prudent to adhere to the WHO recommendation that post-coital use of LNG is unsuitable for regular contraception.

Lohan M, Cruise S, O'Halloran P, et al. 2010. **Adolescent men's attitudes in relation to pregnancy and pregnancy outcomes: a systematic review of the literature from 1980-2009**. Journal of Adolescent Health, 47(4), 327-45.

The authors of this review argue that a greater understanding of adolescent men's views on pregnancy and pregnancy outcomes would lead to adolescent pregnancy being regarded as an issue for adolescent men as well as adolescent women and that this would lead to more effective and gender-inclusive pregnancy prevention and counselling programmes. The authors summarise the results of fifty studies pertaining to adolescent men and pregnancy and pregnancy outcomes, from various countries including the U.S., the U.K., Ireland, Canada, Sweden, Australia and New Zealand. In general, adolescent men viewed an unintended teenage pregnancy negatively because of the adverse effect that having a baby would have on their future aspirations and life goals as well as on their current freedoms. Overall adolescent men endorsed a woman's right to have an abortion but there were differences between countries in trends over time: Australian males seem to becoming more conservative on this issue while those in Ireland are becoming more liberal. Regarding men's involvement in their partner's decision on pregnancy outcome the research was inconsistent but the female partner was recognised as controlling the degree to which the potential father is involved. Adolescent men expressed the need to be involved and kept informed and, when they had been given the opportunity to be involved in decision making, they reported the experience to have been positive. Male attitudes to adolescent pregnancy are influenced by social class (female partners of higher class men are more likely to have an abortion), ethnicity, religion, and attitudes to masculinity (some males from poorer backgrounds may view getting a girl pregnant as a means of validating their masculine identity). The authors suggest that an explicit focus on men's' "procreative consciousness" and "procreative responsibility" could make sex education programmes more effective.

Rowlands S. 2010. **Social predictors of repeat adolescent pregnancy and focussed strategies**. Best Practice & Research in Clinical Obstetrics & Gynaecology, 24(5), 605-16.

An adolescent who has had one pregnancy has a high probability of having another, either intentionally or not. Teenage mothers who manage to avoid having another baby within two years are more likely to avoid many of the negative consequences of early childbearing that often lead to chronic poverty and welfare dependence. This review focused on the social factors predicting repeat pregnancy including: a planned first pregnancy, not using long-acting reversible contraception, lack of family support, dropping out of school prior to first pregnancy, not returning to school and low socio-economic status. It notes that secondary prevention programmes have often been ineffective but that they are more likely to be effective if they include individual counselling, home visits, a multidisciplinary youth-oriented approach, teaching about contraception and easy access to services.

Harden A, Brunton G, Fletcher A, et al. 2009. **Teenage pregnancy and social disadvantage: systematic review integrating controlled trials and qualitative studies**. BMJ, 339, b4254.

The aim of this review was to determine the impact of interventions to address the social disadvantage associated with early parenthood on reducing rates of unintended teenage pregnancy. The review included ten controlled trials and five qualitative studies. Six of the controlled trials, all from the U.S., were judged to be methodologically sound and these evaluated two types of interventions: early childhood interventions aimed at young children and their parents (3 trials) and youth development programmes which aimed to promote self-esteem, aspirations and a sense of purpose (3 trials).The review authors calculated an overall pooled effect size showing that teenage pregnancy rates were 39% lower in those receiving an intervention than in those receiving standard practice or no intervention (relative risk 0.61, 95% CI 0.48 to 0.77). Some common themes were evident in the qualitative studies: early parenthood was associated with dislike of school, poor material circumstances, unhappy childhood and low expectations. The authors concluded that there was a small but reliable evidence base to support the effectiveness of early childhood interventions and youth development programmes for reducing unintended teenage pregnancy.

Oringanje C, Meremikwu M, Eko H, et al. 2009. **Interventions for preventing unintended pregnancies among adolescents**. Cochrane Database of Systematic Reviews, 2009(4), Art. No.: CD005215. DOI:10.1002/14651858.CD005215.pub2.

This review included 41 RCTs involving 95,662 adolescents in many different countries and a wide variety of interventions. There were both individual and cluster-randomised trials. The results indicated that combination interventions involving both education and contraceptive provision were effective in lowering rates of adolescent pregnancy. The evidence on the effect of interventions on secondary outcomes (age at first intercourse, use of birth control methods, abortion rates, childbirth rates and sexually transmitted diseases) was inconclusive. The variability in study populations, types of interventions, and outcomes measured and also the paucity of trials comparing different interventions made it impossible to draw a conclusion about which type of intervention is most effective.

Deans E, Grimes D. 2009. **Intrauterine devices for adolescents: a systematic review**. Contraception, 79(6), 418-23.

There is some debate about the appropriateness of IUDs for use in adolescents. The American College of Obstetricians and Gynaecologists and the WHO support the use of IUDs as first choice for nulliparous adolescents but the American Academy of Pediatrics considers that IUDs should be a second-line choice for use in adolescents who have already had an unplanned pregnancy using another contraceptive method and who are protecting themselves from sexually transmitted infections. The authors of this review considered six cohort studies and seven case-series reports on the use of IUDs in adolescents. (They could not find any RCTs.) None of the IUDs in the studies were ones in current use in the U.S. Overall cumulative pregnancy rates were low ranging from 2% at six months to 11% at 48 months, and continuation rates were high. Compared to oral contraceptives, IUDs were similarly effective and had similar or better continuation rates. There may be increased expulsion rates at younger ages. The authors concluded that published reports were generally reassuring but the literature on IUD use in adolescents was scanty and obsolete. They state that RCTs comparing contemporary IUDs with other method in adolescents are urgently needed.

Cheng L, Gülmezoglu A M, Piaggio G P, et al. 2008. **Interventions for emergency contraception**. Cochrane Database of Systematic Reviews, 2008(2), Art. No.: CD001324. DOI: 10.1002/14651858.CD001324.pub3.

Emergency contraception is the use of drugs or a copper intra-uterine device (Cu-IUD) after unprotected intercourse in order to prevent pregnancy. This review included 81 trials (45,842 women), comparing either different drugs or different doses of the same drug as “morning after” pills. Seventy-one of the trials were conducted in China. Mifepristone middle dose (25-50 mg) was found to be superior to other hormonal regimens. Mifepristone low dose (<25 mg) could be more effective than levonorgestrel 0.75 mg (two doses) but this was not conclusive. Levonorgestrel proved more effective than the Yuzpe regimen. The copper IUD is another effective emergency contraceptive that can provide on-going contraception but its comparative effectiveness has not been thoroughly investigated (only one small RCT). The review authors concluded that emergency contraception should be offered to all women who request it and that mifepristone should be the first choice for hormonal emergency contraception. Women should be warned that it may lead to a few days’ delay in the start of menstruation. Women who present too late for the emergency contraceptive pill and who are not at risk of sexually transmitted diseases, and would prefer long term contraception, can be offered Cu-IUD insertion.

Kirby D. 2007. **Emerging Answers 2007: Research Findings on Programs to Reduce Teen Pregnancy and Sexually Transmitted Diseases.** Washington, DC: National Campaign to Prevent Teen and Unplanned Pregnancy. http://www.thenationalcampaign.org/resources/pdf/pubs/EA2007_FINAL.pdf

This comprehensive review reports on studies of pregnancy and/or STD/HIV primary prevention programmes focussing on teens and conducted or published in the U.S. between 1990 and 2007. It summarises research on sexual behaviour and its consequences, it describes programmes and approaches that have reduced teen sexual risk taking and pregnancy or STDs, the characteristics of effective education programmes and promising strategies for organisations and communities wanting to select, adapt, design or implement pregnancy prevention programmes for their own teens. It does not assess the efficacy of various forms of contraception or consider same-sex aspects of STD and HIV prevention.

The American College of Obstetricians and Gynaecologists. 2007. **Strategies for Adolescent Pregnancy Prevention**. Washington, DC: The American College of Obstetricians and Gynaecologists. http://www.acog.org/departments/adolescentHealthCare/StrategiesForAdolescentPregnancyPrevention.pdf

This publication was designed for use by American doctors training in Obstetrics and Gynaecology. It summarises U.S. data related to adolescent pregnancy, it discusses various strategies for preventing adolescent pregnancy and models for effective programmes, and it provides a list of references, a categorised bibliography, and a list of useful websites.

Polis C B, Grimes D A, Schaffer K, et al. 2007. **Advance provision of emergency contraception for pregnancy prevention**. Cochrane Database of Systematic Reviews, 2007(2), Art. No.: CD005497. DOI: 10.1002/14651858.CD005497.pub2.

Since some women find it difficult to access emergency contraception (the "morning after pill") within the required timeframe it could be useful for them to be provided with a supply of pills for use if necessary after unprotected sex. This review considered RCTs comparing advance provision of emergency contraception with standard access. Eight trials (6389 women in the U.S., China and India) were included. Advance provision did not decrease pregnancy rates in studies with twelve months of follow up (OR 1.0, 95% CI 0.78 to 1.29, six months follow up (OR 0.91, 95% CI: 0.69 to 1.19) or three months follow up (OR 0.49, 95% CI 0.09 to 2.74) despite being associated with increased use: single use: OR 2.52; 95% CI 1.72 to 3.70; multiple use: OR 4.13; 95% CI 1.77 to 9.63) and faster use (weighted mean difference -14.6 hours; 95% CI -16.77 to -12.4 hours). Advance provision did not lead to increased rates of sexually transmitted infections, increased frequency of unprotected sex or changes in contraceptive methods. Women given emergency contraception in advance were just as likely to use condoms as other women. The authors concluded that women should have easy access to emergency contraception however advance provision of emergency contraception does not reduce pregnancy rates although it has no adverse effects on sexual and reproductive behaviour or outcomes.

Klerman L V. 2004. **Another Chance: Preventing Additional Births to Teen Mothers**. Washington DC: The National Campaign to Prevent Teen Pregnancy.
http://www.thenationalcampaign.org/resources/pdf/pubs/AnotherChance_FINAL.pdf

In 2002 in the U.S. 21% of all teen births were to teens who were already mothers. The aim of this review was to determine what types of programmes are most effective in preventing additional pregnancies and births to teen mothers. Nineteen studies of experimental or quasi-experimental design conducted in the U.S. since 1980 were included in the review. It appears that the most important factor in preventing subsequent pregnancies may be the relationship between the teenage mother and the person working with her so continuity of care from the first pregnancy is important as is home visiting. Little is known about the attitudes of teen mothers, their partners, peers, families and neighbours to second births but it may be that some communities do not share the belief of policy makers that closely-spaced pregnancies in teens are detrimental. It has been suggested that early childbearing is an adaptation made by poor urban African-Americans to structural constraints and reduced life-expectancy. The review concludes with a list of things that an effective and comprehensive pregnancy prevention programme should do.

Swann C, Bowe K, McCormick G, et al. 2003. **Teenage pregnancy and parenthood: a review of reviews Evidence briefing**. London: Health Development Agency.
http://www.nice.org.uk/niceMedia/documents/teenpreg_evidence_briefing.pdf

This evidence briefing is a review of 21 reviews (systematic reviews, meta-analyses and narrative reviews) published since 1996 that are either about interventions to prevent teenage pregnancy or about the effectiveness of interventions to improve outcomes for teenage parents. Twenty reviews were relevant to the issue of preventing teenage pregnancy and these were classified as category 1, 2, or 3 according to the level of evidence they provided. In each evidence category the individual reviews are summarised under a series of headings, usually data pool, findings and conclusions. There were only three reviews relating to interventions to support teen parents so these are summarised by review. There follows a discussion section summarising the strength of evidence for the various interventions and practices to prevent unwanted teenage pregnancies and to improve outcomes or teenage parents.

DiCenso A, Guyatt G, Willan A, et al. 2002. **Interventions to reduce unintended pregnancies among adolescents: systematic review of randomised controlled trials**. BMJ, 324(7351), 1426.

This systematic review included 26 RCTs, both published and unpublished, assessing the effectiveness of primary prevention strategies in delaying sexual intercourse, improving use of birth control and reducing unintended pregnancies in adolescents. Interventions did not delay first intercourse in either young women (pooled odds ratio (POR) 1.12, 95% CI 0.96 to 1.30), or young men (0.99, 0.84 to 1.16); did not increase use of birth control by young women at every intercourse (0.95, 0.69 to 1.30) or at last intercourse (1.05, 0.50 to 2.19), or by young men at every intercourse (0.90, 0.70 to 1.16) or at last intercourse (1.25, 0.99 to 1.59); and did not reduce pregnancy rates in young women (1.04, 0.78 to 1.40). Four abstinence programmes and one school-based sex education programme were associated with an increase in number of pregnancies among partners of young male participants (1.54, 1.03 to 2.29). One study found that there were significantly fewer pregnancies in young women who received a multifaceted programme (0.41, 0.20 to 0.83), but baseline differences between the control group and the intervention group in this study favoured the intervention. The authors concluded that primary prevention strategies that have been evaluated to date are not effective at delaying first intercourse, improving use of birth control or preventing pregnancy.

Useful Websites and Other Publications

Guide to Community Preventive Services. 2010. **Prevention of HIV/AIDS, other STIs and Pregnancy: group-based comprehensive risk reduction interventions for adolescents**. Atlanta, GA: Centers for Disease Control and Prevention. www.thecommunityguide.org/hiv/riskreduction.html

This CDC website reports briefly on systematic reviews evaluating comprehensive risk reduction interventions (those that promote behaviours which reduce the risk of pregnancy, HIV and other sexually transmitted infections) delivered to groups of adolescents in school or community settings. The Task Force on Community Preventive Services recommends these interventions based on the findings and meta-analysis results from the systematic reviews (which included 62 studies with 83 study arms). The website also reports the results of an economic review of ten studies.

Davis AJ. 2011. **Intrauterine devices in adolescents**. Current Opinion in Pediatrics, 23(5), 557-65.

This is an accessible article on IUDs and their use in adolescents. It explains that current data indicate that modern IUDs are highly effective and safe and do not affect long term fertility or increase sexually transmitted diseases.

Department for Children Schools and Families, Department of Health (U.K.). **Teenage pregnancy Strategy: Beyond 2010**. London: Department for Children, Schools and Families, Department of Health (U.K). https://www.education.gov.uk/publications/eOrderingDownload/00224-2010DOM-EN.pdf

This British strategy document is an update of the previous 1998 Teenage Pregnancy Strategy and it sets out ways to ensure that all young people:

- receive the information, advice and support they need – from parents, teachers and other professionals – to deal with pressure to have sex; enjoy positive and caring relationships; and experience good sexual health; and
- can access and know how to use contraception effectively when they do reach the stage that they become sexually active, so they can avoid unplanned pregnancies and sexually transmitted infections (STIs).

Appendix Two contains a series of case studies from various places in the U.K.

Meyrick Jane. 2002. **An evaluation resource to support the Teen Pregnancy Strategy**. London: Health Development Agency. http://www.nice.org.uk/niceMedia/documents/eval_teenpregnancy.pdf

The purpose of this publication is to provide guidance on project or programme evaluation for the following groups: Those directly involved in project planning and evaluation, those commissioning evaluations, and teenage pregnancy coordinators and others who have roles supporting or assisting project and strategy evaluation.

Health Development Agency. 2001. **Teenage pregnancy: an update on key characteristics of effective interventions**. London: Health Development Agency. http://www.nice.org.uk/niceMedia/documents/teenpreg.pdf

This concise bulletin draws on the research evidence to summarise what is known about the key characteristics of successful interventions and programmes for young people that aim to reduce the rate of teenage pregnancy. After a brief introduction on the target audience there is a discussion about ”what works” under the headings of community interventions, educational interventions, and health service interventions, followed by information on interventions that appear promising but have not, as yet, been fully evaluated.

THE CHILDREN'S SOCIAL HEALTH MONITOR: INTRODUCTION

INTRODUCTION TO THE CHILDREN'S SOCIAL HEALTH MONITOR

In New Zealand, there are currently large disparities in child health status, with Māori and Pacific children and those living in more deprived areas experiencing a disproportionate burden of morbidity and mortality [22]. These disparities were present even in the mid 2000s, when New Zealand experienced some of its lowest unemployment rates in recent decades.

New Zealand's macroeconomic environment began to change in 2008 however, in the context of a larger global downturn, with the country officially entering a recession at the end of June 2008, after two consecutive quarters of negative growth. While New Zealand technically left the recession at the end of June 2009 (when quarterly growth reached +0.1%[244]), progress since then has been variable, with unemployment rates, and the number of children reliant on benefit recipients remaining higher than in the mid-2000s.

During 2009, as economic conditions continued to deteriorate, a Working Group made up of health professionals from a range of organisations[1] formed, with a view to developing an indicator set to monitor the impact of the economic downturn on child wellbeing. The rationale was the concern that, as the downturn progressed and more families became reliant on Government assistance (e.g. unemployment benefits),some of the adaptations that families might make in response to constrained financial resources (e.g. house downsizing / increasing the number of occupants to meet rent payments, deferring heating costs to pay for groceries) might result in unintended health consequences for children (e.g. increases in infectious and respiratory diseases, exposure to family conflict). It was thus hoped that if any deterioration in child wellbeing did occur, it could be identified early, so that proactive policy responses could be put in place in a timely manner.

The indicator set developed by the Working group, the *New Zealand Children's Social Health Monitor* (NZCSHM), was launched for the first time in November 2009, and has been updated annually since then. It currently comprises five Economic and four Health and Wellbeing Indicators, which are usually presented in the following order.

Economic Indicators:	Gross Domestic Product (GDP) (**Page 471**)
	Income Inequality (**Page 473**)
	Child Poverty and Living Standards (**Page 476**)
	Unemployment Rates (**Page 485**)
	Children Reliant on Benefit Recipients (**Page 492**)
Health and Wellbeing Indicators:	Hospital Admissions and Mortality with a Social Gradient (**Page 501**)
	Infant Mortality and Sudden Unexpected death in Infancy (**Page 78**)
	Injuries Arising from the Assault, Neglect or Maltreatment of Children (**Page 520**)
	Ambulatory Sensitive Hospitalisations (**Page 139**)

The following sections review each of these indicators in turn, with a view to assessing how children in the region are faring in the current economic climate.

[1] The Paediatric Society of New Zealand, the Population Child Health Special Interest Group of the Royal Australasian College of Physicians, the New Zealand Child and Youth Epidemiology Service, TAHA (the Well Pacific Mother and Infant Service), the Māori SIDS Programme, the Te Tuia Well Child Consortium, the New Zealand Council of Christian Social Services, and academics from the Universities of Auckland and Otago.

THE CHILDREN'S SOCIAL HEALTH MONITOR: ECONOMIC INDICATORS

GROSS DOMESTIC PRODUCT (GDP)

Introduction

Gross Domestic Product (GDP) is defined as "*the total market value of goods and services produced within a given period, after deducting the cost of goods utilised in the process of production*" [245]. GDP is often used as a measure of the size of the economy, with nominal GDP being expressed in current dollar prices, and real GDP being expressed in constant dollar prices (i.e. the dollar value of a particular year, after adjustment for inflation).

Changes in real GDP are often used as a measure of economic growth, or the strength of the economy [245], with a recession typically being defined as two consecutive quarters of negative growth [246]. Recessions are often characterised by high unemployment, stagnant wages and a fall in retail sales, and though usually not lasting longer than a year [246], they may have significant implications for child wellbeing. New Zealand entered a recession at the end of June 2008 (after two consecutive quarters of negative growth), and technically left the recession at the end of June 2009 (although growth in the June quarter (0.1%) was extremely close to zero [244]).

The following section briefly reviews changes in New Zealand's GDP since June 2007.

Data Source and Methods

Definition

Gross Domestic Product (GDP): Percent Change from Previous Quarter

GDP is the total market value of all final goods and services produced in a country in a given year, equal to total consumer, investment and government spending, plus the value of exports, minus the value of imports. A recession is defined as two consecutive quarters of negative growth (as measured by GDP).

Data Source

Statistics New Zealand: The New Zealand System of National Accounts. Produced Quarterly

Indicator Category: Ideal B

Notes on Interpretation

Three approaches can be used to calculate GDP:

• *Production Approach*: This method calculates what each separate producer adds to the value of final output, by deducting intermediate consumption from gross output. Value added is summed for all producers.

• *Income Approach*: This approach measures the incomes received by the owners of the factors of production. These represent the returns to the labour and capital employed such as wages and salaries, and profits.

• *Expenditure Approach*: This method sums the values of all final demands, that is, final consumption expenditures (of households, government and private non-profit institutions serving households), changes in inventories, gross capital formation, and net exports.

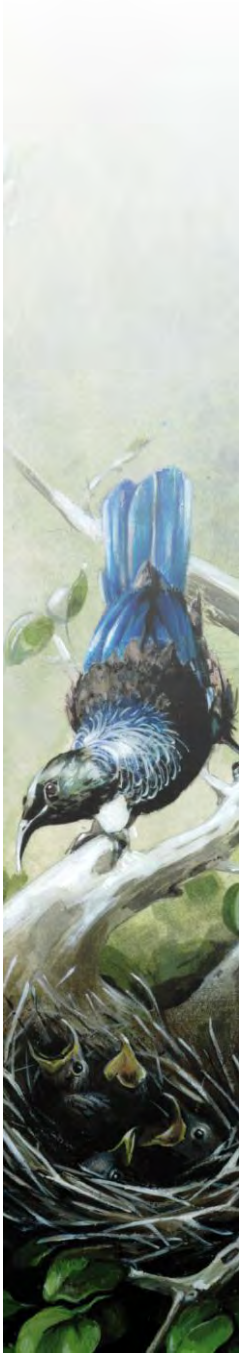
Conceptually, both the production and expenditure approaches of measuring GDP are the same. However, as each series uses independent data and estimation techniques, some differences between the alternative measures arise. The expenditure approach series has historically shown more quarterly volatility and is more likely to be subject to timing and valuation problems. For these reasons, the production-based measure is the preferred measure for short-term quarter-on-quarter and annual changes [247]

New Zealand Trends

Production-based Measure of GDP

In New Zealand, GDP decreased for five consecutive quarters from March 2008–March 2009, before increasing again, for five consecutive quarters, from June 2009–June 2010. GDP then briefly declined by 0.1% in the September quarter of 2010, before increasing again, by 0.6% in the December 2010 quarter, by 0.9% in the March 2011 quarter and by 0.1% in the June 2011 quarter. Economic activity for the year ending June 2011 increased by 1.5%, when compared to the year ending June 2010 [248] (**Figure 149**).

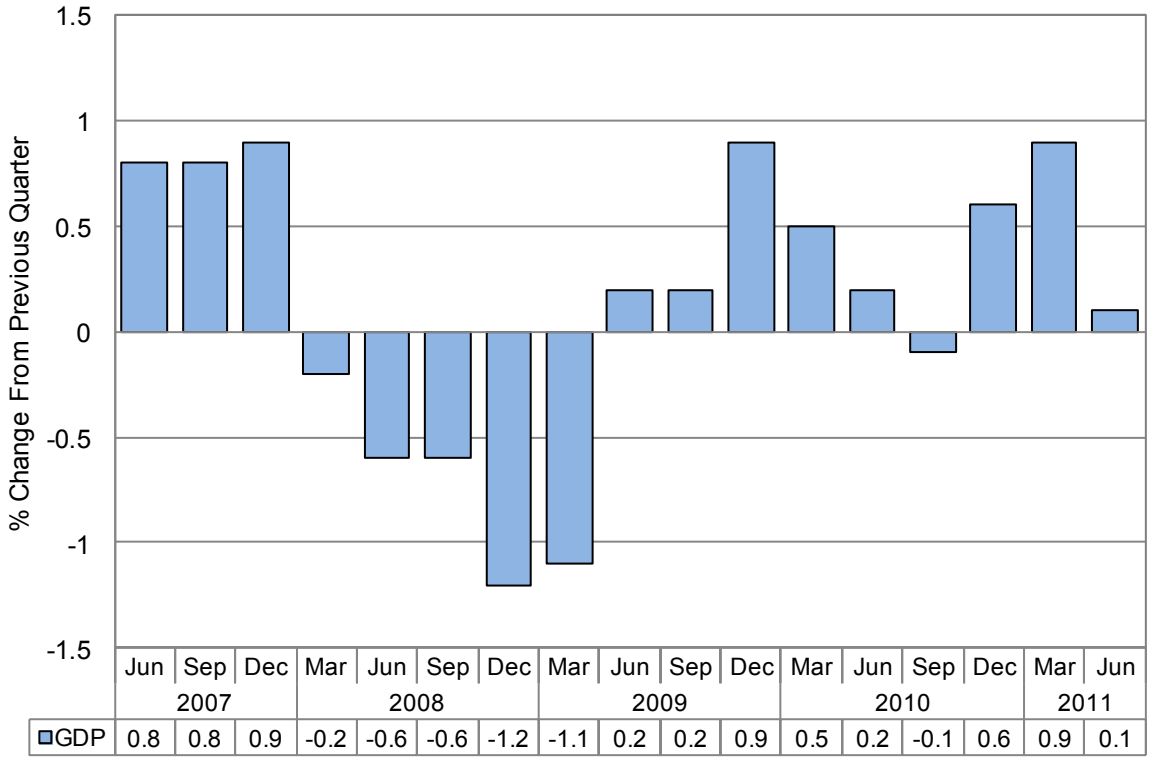
During the June 2011 quarter, finance, insurance and business services increased by 1.5%, and agriculture increased by 4.3%. Construction activity however fell by 4.3% [248].



Expenditure-based Measure of GDP

The expenditure-based measure of GDP, released concurrently with the production-based measure, increased by 0.1% in the June 2011 quarter. During this period, household consumption expenditure increased by 0.3%, while export volumes were down 0.5% and imports were up 1.7%. On an annual basis, expenditure on GDP for the year ending June 2011 increased by 1.6%, when compared to the year ending June 2010 [248].

Figure 149. Gross Domestic Product (GDP): Percentage Change from Previous Quarter, New Zealand June Quarter 2007 to June Quarter 2011



	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun	Sep	Dec	Mar	Jun
	2007			2008				2009				2010				2011	
GDP	0.8	0.8	0.9	-0.2	-0.6	-0.6	-1.2	-1.1	0.2	0.2	0.9	0.5	0.2	-0.1	0.6	0.9	0.1

Source: Statistics New Zealand: Seasonally adjusted chain volume series measured in 1995/96 prices.

Summary

In New Zealand, GDP decreased for five consecutive quarters from March 2008–March 2009, before increasing again, for five consecutive quarters, from June 2009–June 2010. GDP then briefly declined by 0.1% in the September quarter of 2010, before increasing again, by 0.6% in the December 2010 quarter, by 0.9% in the March 2011 quarter and by 0.1% in the June 2011 quarter. Economic activity for the year ending June 2011 increased by 1.5%, when compared to the year ending June 2010 [248].

INCOME INEQUALITY

Introduction

There has been much debate in recent years regarding the influence of income inequalities on population health. While it is widely acknowledged that poverty plays a crucial role in shaping health disparities, authors such as Wilkinson and Marmot [249] argue that income inequality itself also plays a role, via its links to psychosocial pathways associated with relative disadvantage. They cite the Whitehall studies of British civil servants, which found that mortality increased in a stepwise manner as relative socioeconomic status decreased, with social gradients being evident even amongst those who were not poor. In addition, they note that while health inequalities exist within societies, there is little association between average income (GDP per capita) and life expectancy across rich countries. Rather, there appears to be a strong correlation between income inequality and mortality. In Wilkinson and Marmot's view, such associations suggest that it is not absolute material deprivation which shapes health at the population level, but rather the effects such inequalities have on psychosocial outcomes such as the degree of control over work, anxiety, depression and social affiliations. In support of this argument, they cite a number of studies which demonstrate social gradients in the lack of control over work, low variety at work and a severe lack of social support, with animal experiments also suggesting that low social status, via its effects on neuroendocrine pathways, leads to atherosclerosis, unfavourable lipid profiles, central obesity, insulin resistance and raised basal cortisol [249].

Others such as Lynch [250] however, would argue that it is not the psychological effects of income inequality which play the greatest role, but rather the lack of material resources (e.g. differentials in access to adequate nutrition, housing and healthcare), coupled with a systematic underinvestment in human, physical, health and social infrastructure (e.g. the types and quality of education, health services, transportation, recreational facilities and public housing available). In Lynch's view, the combination of these negative exposures is particularly important for the health of the most disadvantaged (who have the fewest individual resources), and that in this context, the associations between income inequality and health are not inevitable, but rather are contingent on the level of public infrastructure and resources available. While debate on the precise pathways continues, both sides of the income inequality argument agree, that reducing income inequality by raising incomes for the most disadvantaged, will reduce inequalities and improve population health [251].

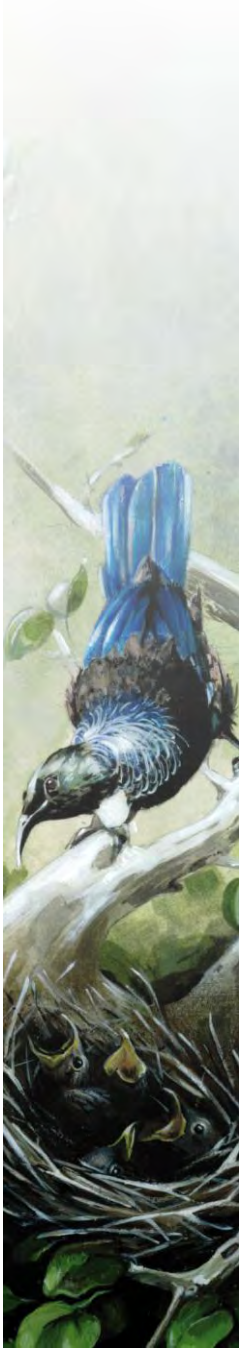
The following section explores income inequalities in New Zealand since 1984 using two different measures, the P80/P20 Ratio and the Gini Coefficient.

Definition
1. *Income Inequality as Measured by the P80/P20 Ratio*
2. *Income Inequality as Measured by the Gini Coefficient*

Data Source
Statistics New Zealand Household Economic Surveys (NZHES n=2,800–3,500 households per survey) via Perry 2011 [252].
Note: The P80/P20 Ratio and Gini coefficient are monitored by the Ministry of Social Development using NZHES data [253], which was available 2-yearly from 1982–1998, and 3-yearly thereafter. Since 2007, income data have become available annually through the new NZHES Incomes Survey. The full NZHES (including expenditure data) however remains 3-yearly. For more detail on methodology used see Perry 2011 [252].

Indicator Category Proxy B

Notes on Interpretation
P80/P20Ratio: When individuals are ranked by equivalised household income and then divided into 100 equal groups, each group is called a percentile. If the ranking starts with the lowest income, then the income at the top of the 20th percentile is denoted P20 and the income at the top of the 80th percentile is called P80. The ratio of the value at the top of the 80th percentile to the value at the top of the 20th percentile is called the P80/20 ratio and is often used as a measure of income inequality (e.g. a P80/20 ratio of 3.0 indicates that those at the top of the 80th percentile have incomes 3.0x higher than those at the top of the 20th percentile). In general, the higher the ratio, the greater is the level of inequality [253].



Gini Coefficient: The Lorenz curve is a graph with the horizontal axis showing the cumulative % of people in a population ranked by their income. The vertical axis shows the corresponding cumulative % of equivalised disposable household income (i.e. the graph shows the income share of any selected cumulative proportion of the population). The diagonal line represents a situation of perfect equality (i.e. all people having the same income). The Gini coefficient is derived from the Lorenz curve and is the ratio of the area between the actual Lorenz curve and the diagonal (or line of equality), compared to the total area under the diagonal. When the Gini coefficient = 0 all people have the same level of income. When it approaches 1, one person receives all the income (i.e. it is an overall measure of income inequality: the higher the number, the greater the level of inequality) [254]. When comparing changes in income distributions over time, the Gini coefficient is more sensitive to changes in the more dense low-to-middle parts of the distribution, than it is to changes towards the ends of the distribution [253].

New Zealand Trends

Income Inequality: P80/P20 Ratio

In New Zealand during 1984–2010, income inequality as measured by the P80/P20 ratio, was higher after adjusting for housing costs than prior to this adjustment. The most rapid rises in income inequality occurred during 1988–1992. While income inequality also rose during 1994–2004, the rate of increase was slower. During 2004–2010, the P80/P20 ratio fell, a decline in income inequality which Perry attributes firstly to the Working for Families package (2004–2007), and secondly to a fall in higher incomes and a small rise in lower incomes (2007–2010) [252](Figure 150).

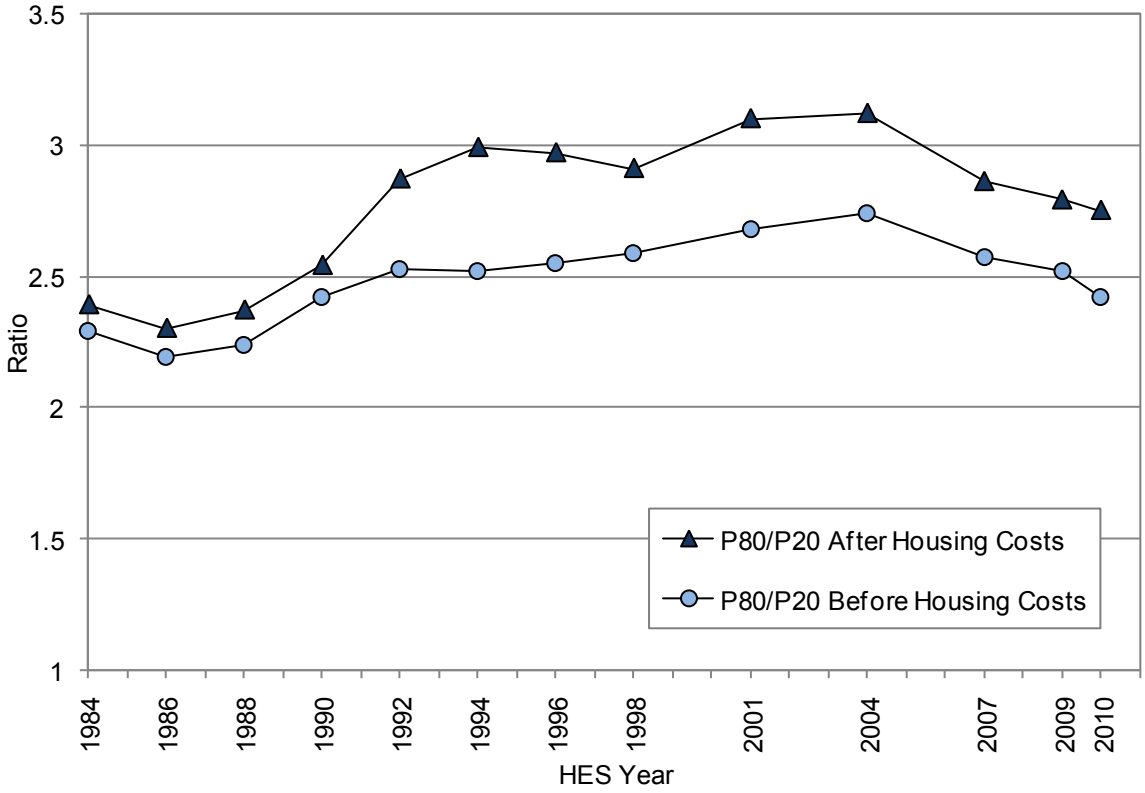
Income Inequality: Gini Coefficient

In New Zealand during 1984–2010, income inequality as measured by the Gini Coefficient, was also higher after adjusting for housing costs than prior to this adjustment. The most rapid rises in income inequality also occurred between the late 1980s and early 1990s. Using both the before and after housing cost measures, the Gini Coefficient declined between 2001 and 2007, a decline which Perry again attributes to the impact of the Working for Families package. There was a further decline in 2010, which Perry attributes to a fall in higher incomes, coupled with small gains for lower income households [252](Figure 151).

Summary

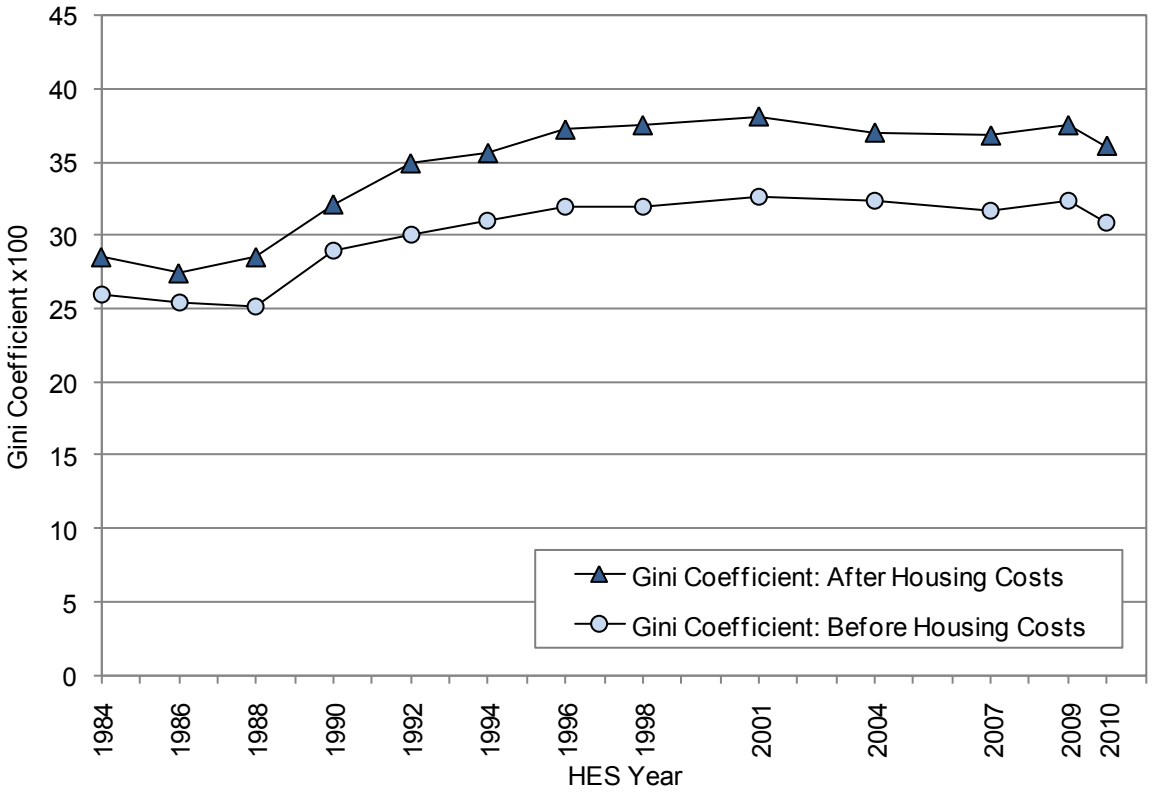
In New Zealand during 1984–2010 income inequality, as measured by the P80/P20 ratio and Gini coefficient, was higher after adjusting for housing costs than prior to this adjustment. The most rapid rises in income inequality occurred between the late 1980s and early 1990s. During the early–mid 2000s however, income inequality declined, a change Perry attributes largely to the Working for Families package. Additional falls in income inequality were seen in 2010, with Perry attributing this to a fall in higher incomes, coupled with small gains for lower income households [252].

Figure 150. Income Inequality in New Zealand as Assessed by the P80/P20 Ratio for the 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

Figure 151. Income Inequality in New Zealand as Assessed by the Gini Coefficient for the 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

CHILD POVERTY AND LIVING STANDARDS

Introduction

High rates of child poverty are a cause for concern, as low family income has been associated with a range of negative outcomes including low birth weight, infant mortality, poorer mental health and cognitive development, and hospital admissions from a variety of causes [255]. Further, the Christchurch Health and Development Study suggests that exposure to low family income during childhood and early adolescence may increase the risk of leaving school without qualifications, economic inactivity, early parenthood and contact with the justice system. While adjusting for potentially mediating factors (e.g. parental education, maternal age, and sole parent status) reduces the magnitude of these associations somewhat, they do not disappear completely, suggesting that the pathways linking low family income to long term outcomes are complex, and in part may be mediated by other socioeconomic variables [256]. Yet while there is much debate about the precise pathways involved, there is a general consensus that the relationship between poverty and adverse outcomes is non-linear, with the effects increasing most rapidly across the range from partial to severe deprivation [257].

In New Zealand, the Ministry of Social Development has periodically reviewed the socioeconomic wellbeing of families with children using information from two data sources:

1. The New Zealand Household Economic Survey, which can be used to assess the proportion of families with children who live below the income poverty line [258].
2. The New Zealand Living Standards Survey, which uses the Economic Living Standards Index (NZELSI) to assess the proportion of families with children who live in severe or significant hardship [259]

The following section uses information from these two data sources to assess the proportion of New Zealand children living in poverty, or exposed to severe or significant hardship in recent years.

Children Living in Households Below the Poverty Line

Data Source and Methods

Definition

1. *Proportion of children with equivalised disposable household income < 50% or <60% current median*
2. *Proportion of children with equivalised disposable household income < 50% or <60% 1998 or 2007 median (adjusted for movements in consumer prices)*

Data Source

Statistics New Zealand Household Economic Survey (NZHES n=2,800–3,500 households per survey) via Perry 2011 [252].Note: Child Poverty measures are reported on by the Ministry of Social Development using NZHES data [252] which was available 2-yearly from 1982–1998, and 3-yearly thereafter. Since 2007, income data have become available annually through the new HES Incomes Survey. The full NZHES (including expenditure data) however remains 3-yearly. For more detail on methodology used see Perry 2011 [252].

Interpretation

Relative poverty measures set a poverty benchmark that rises and falls with changes in national median incomes (i.e. poverty is defined in relation to the incomes of others in the same year). Constant-value (CV) poverty measures select a median at a set point in time (e.g. 1998 or 2007) and then adjust forward and back in time for changes in consumer prices (i.e. they seek to maintain a constant buying power for the poverty benchmark over time). In his 2011 update, Perry [252] notes that in real terms, the median income in 1998 was similar to 1982 and thus there is a good case for using 1998 as the reference year for CV poverty calculations back to 1982, as well as forward from 1998. By 2007 however, the median was 16% higher than in 1998 and by 2009, 26%. Thus the reference year was changed to 2007.While reporting CV poverty figures back to 1982 using 2007 as the reference tells us what proportion were 'poor' back then, relative to 2007, this approach is not useful for assessing the extent of hardship 'back then' relative to the standards of the day. Thus in the analyses which follow, 2007 CV figures are provided from 2007 onwards, with earlier years using 1998 as the reference year. The first two figures however, report 1998 and 2007 CV figures for the entire period, in order to demonstrate the impact the change of reference year has on the poverty rates produced.

Note: Most income poverty measures use equivalised disposable household income (i.e. after tax household income adjusted for family size and composition). Both measures can be calculated before or after taking housing costs into account. For more detail on the methodology used see Perry 2011 [252].

Child Poverty Trends Using Different Poverty Measures

Before Housing Costs

Relative Poverty (Compared to Contemporary Median): In New Zealand, relative child poverty rose rapidly during 1990–1992, a rise which Perry [253] attributes to rising unemployment and the 1991 Benefit Cuts (which reduced incomes for beneficiaries to a greater extent than the median fell during this period). During 1992–1998, relative child poverty rates then declined, a trend which Perry attributes to falling unemployment, occurring in a context where incomes for those around the poverty line rose more quickly than the median. After 1998 however, as economic conditions improved, median incomes again rose, while incomes for many low-income households with children did not, resulting in a rise in relative child poverty up until 2004. From 2004 to 2007 relative poverty rates again declined, a decline which Perry attributes to the roll out of the Working for Families package. Before housing cost, relative child poverty rates in 2010 were similar to what they were in the 1980s [252] (**Figure 152**).

Fixed Line Poverty (Compared to 1998 and 2007 Median): In New Zealand during the early 1990s, fixed line child poverty measures increased markedly, for similar reasons to those outlined above. During 1994–1998 however, child poverty rates declined, a trend which Perry attributes to improving economic conditions and falling unemployment. During 1998–2004, child poverty rates continued to fall (CV 2007 median only). Rates fell more rapidly (both CV 1998 and 2007 median) during 2004–2007, a change which Perry attributes to the Working for Families package [253](**Figure 152**).

After Housing Costs

Relative Poverty (Compared to Contemporary Median): In New Zealand during 1982–2010, while trends in relative child poverty after adjustment for housing costs (AHC), were broadly similar to before housing cost (BHC) measures, one key difference was evident: that AHC child poverty rates in 2010 remained higher than in the 1980s, while BHC measures were closer to 1980s levels. In addition, during 2007–2010 using the after housing costs measure, child poverty increased from 22% to 26%. Perry [252] attributes these differences to the fact that housing costs in 2010 accounted for a higher proportion of household expenditure for low-income households, than they did in the 1980s (in 1988 16% of households in the bottom income quintile spent >30% of their income on housing; in 2007 this figure was 33%). Perry notes however, that the income-related rental policies introduced in 2000, along with later changes to Accommodation Supplements, helped reduce housing expenditure for some low income households, and that these changes contributed to reductions in AHC child poverty during 2001–2007. There were no further policy changes during 2007–2010 however, with maximum rates of assistance remaining fixed, as housing costs continued to increase. As a result, net housing expenditure rose, especially for low income households and this resulted in increases in AHC child poverty rates during 2007–2010[252] (**Figure 153**).

Fixed Line Poverty (Compared to 1998 and 2007 Median): In New Zealand during 1984–2008, trends in fixed line child poverty after adjustment for housing costs (AHC), were broadly similar to before housing cost (BHC) measures, with the fixed line (AHC) poverty rate in 2007 being around the same as it was in the 1980s (in contrast to the relative AHC poverty rate, which was much higher than in the 1980s) (**Figure 153**).

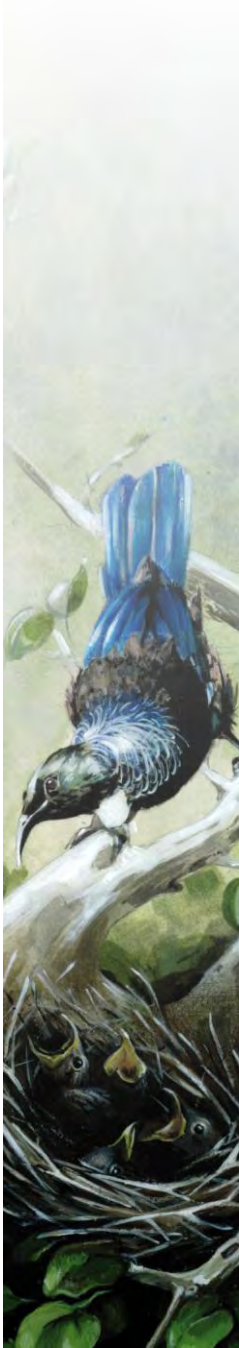
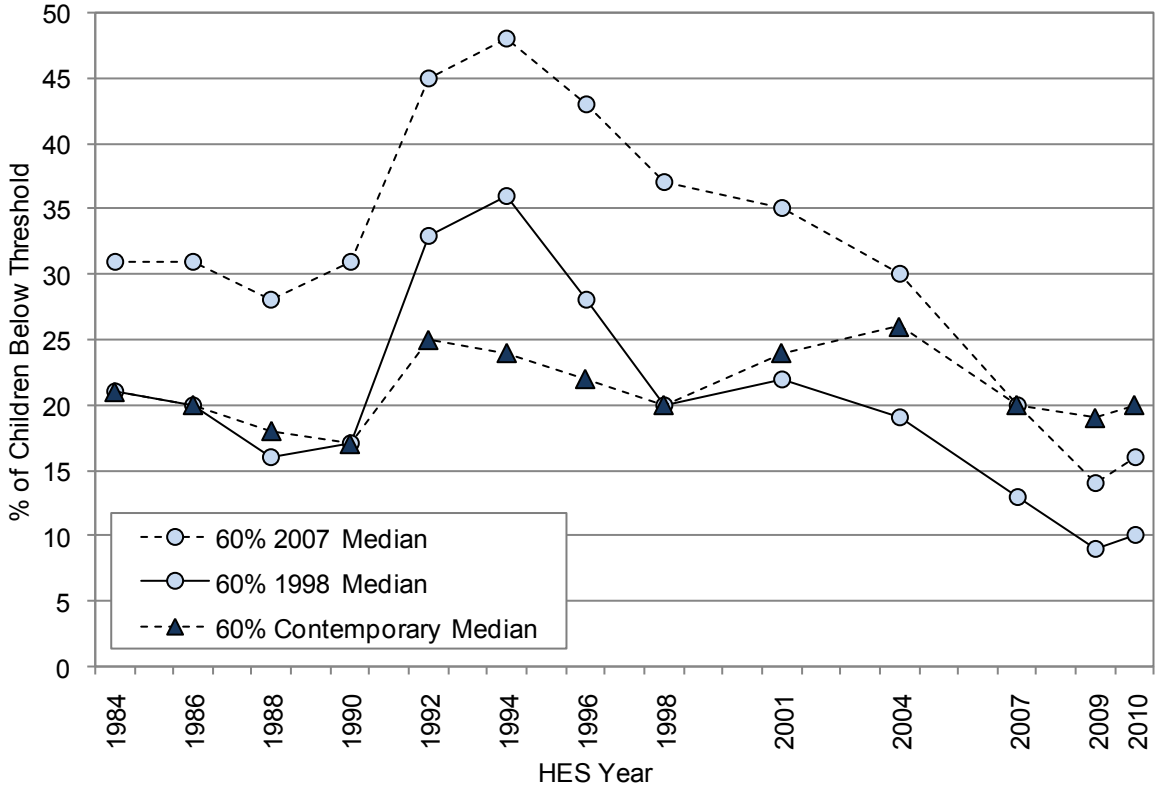
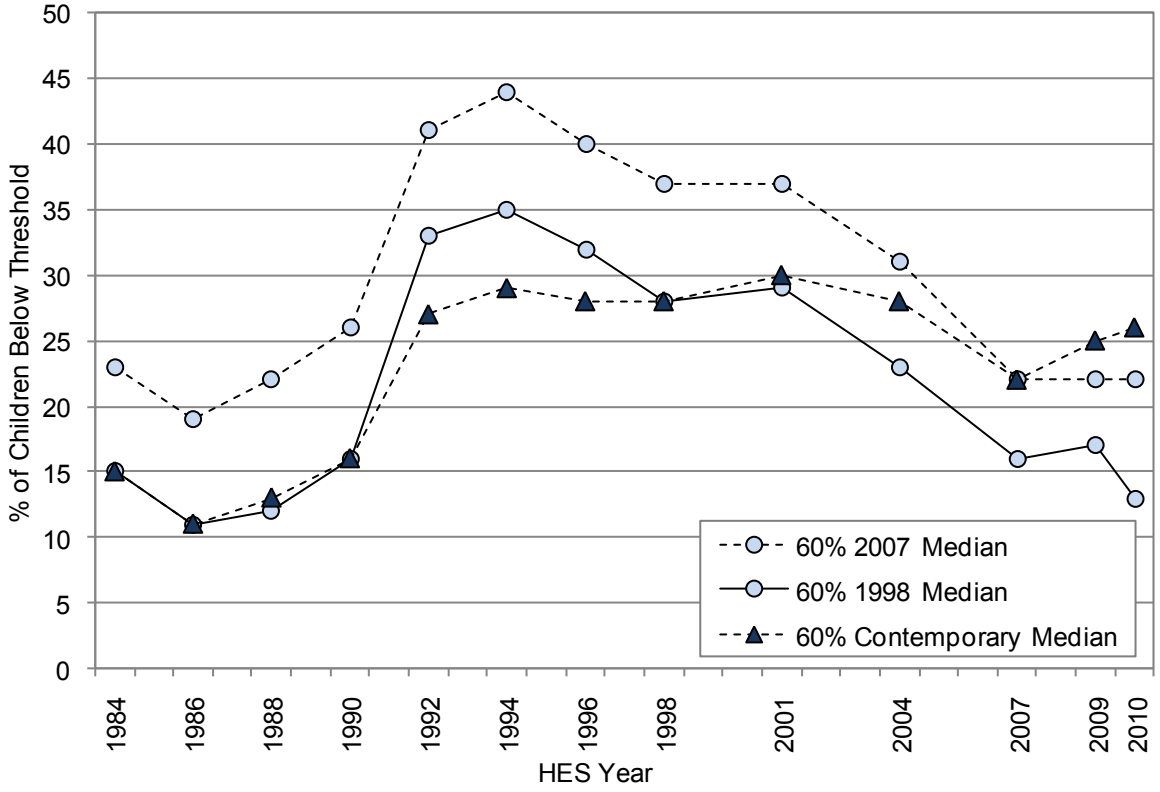


Figure 152. Proportion of Dependent Children Aged 0–17 Years Living Below the Income Poverty Threshold Before Housing Costs, New Zealand 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

Figure 153. Proportion of Dependent Children Aged 0–17 Years Living Below the Income Poverty Threshold After Housing Costs, New Zealand 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

Child Poverty Trends: <60% of 1998 / 2007 Median, After Housing Costs

Child Poverty by Children's Age

In New Zealand during 1984–2010, poverty rates for younger children (0–6 years and 7–11 years) were generally higher than for older children (12–17 years) (**Figure 154**).

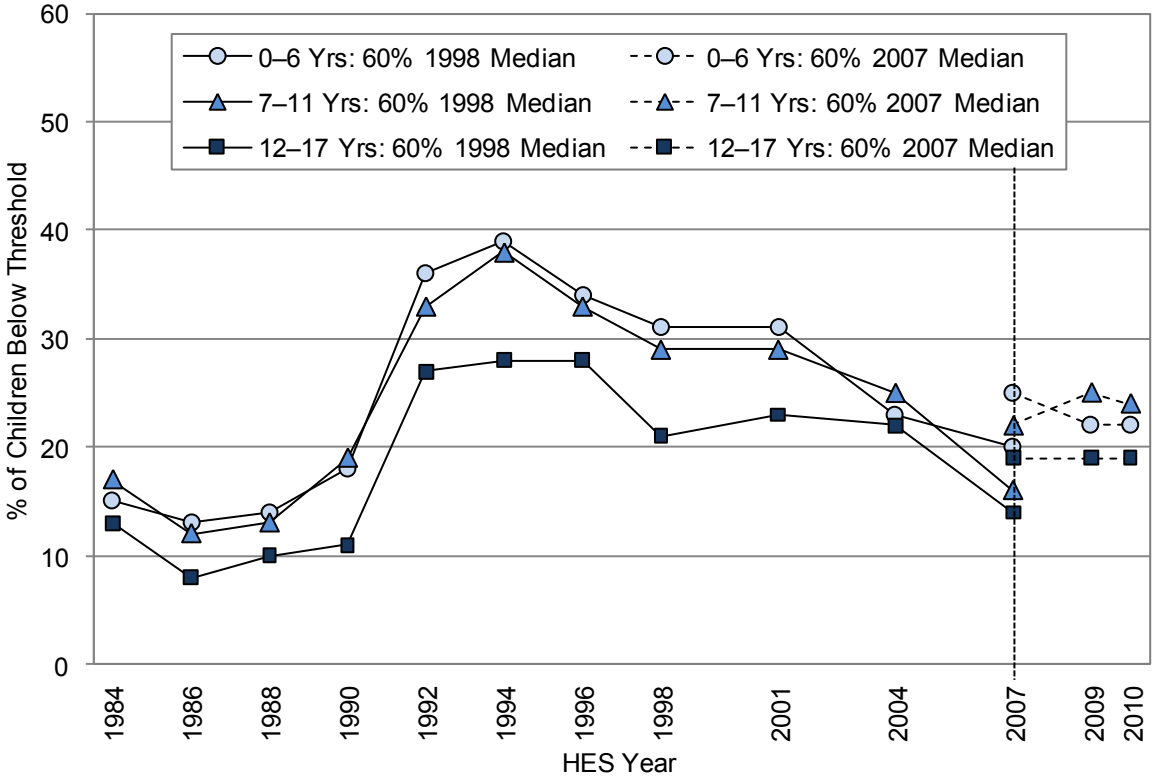
Child Poverty by Number of Children in Household

In New Zealand during 1984–2010, child poverty rates for households with 3 or more children were consistently higher than for households with 1–2 children (**Figure 155**). (Comment: Perry notes that in 2010, children from these larger households made up 48% of all poor children [252]).

Child Poverty Trends by Household Type

In New Zealand, child poverty rates for children in both sole-parent and two-parent households increased rapidly between 1988 and 1992. In absolute terms however, poverty rose most rapidly for children in sole-parent households, with rates reaching a peak of 77% in 1996 (two-parent: rates peaked at 29% in 1994). While rates for both household types declined between 2001 and 2007, during 2007 child poverty rates for those in sole-parent households remained higher than their 1980s levels, while rates for two-parent households were similar (**Figure 156**). (Comment: Perry notes that one in three sole parent families live in wider households with other adults, and that children living in these "other" households have significantly lower poverty rates than those living in sole parent households, because of the greater household resources available to them [252]).

Figure 154. Proportion of Dependent Children Living Below the 60% Income Poverty Threshold (1998 and 2007 Median, After Housing Costs) by Age, New Zealand 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

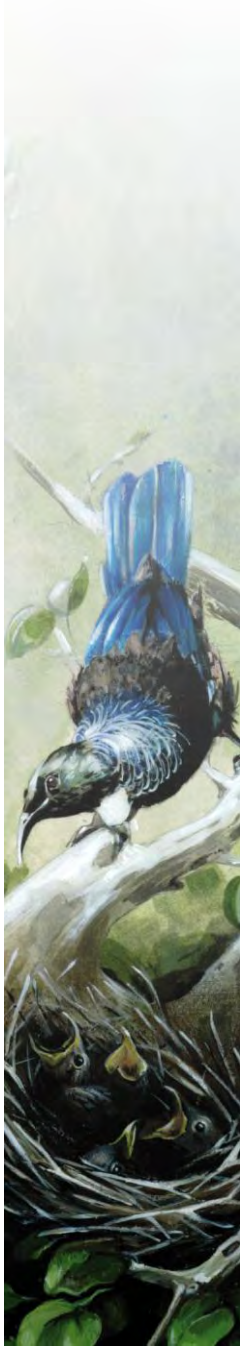
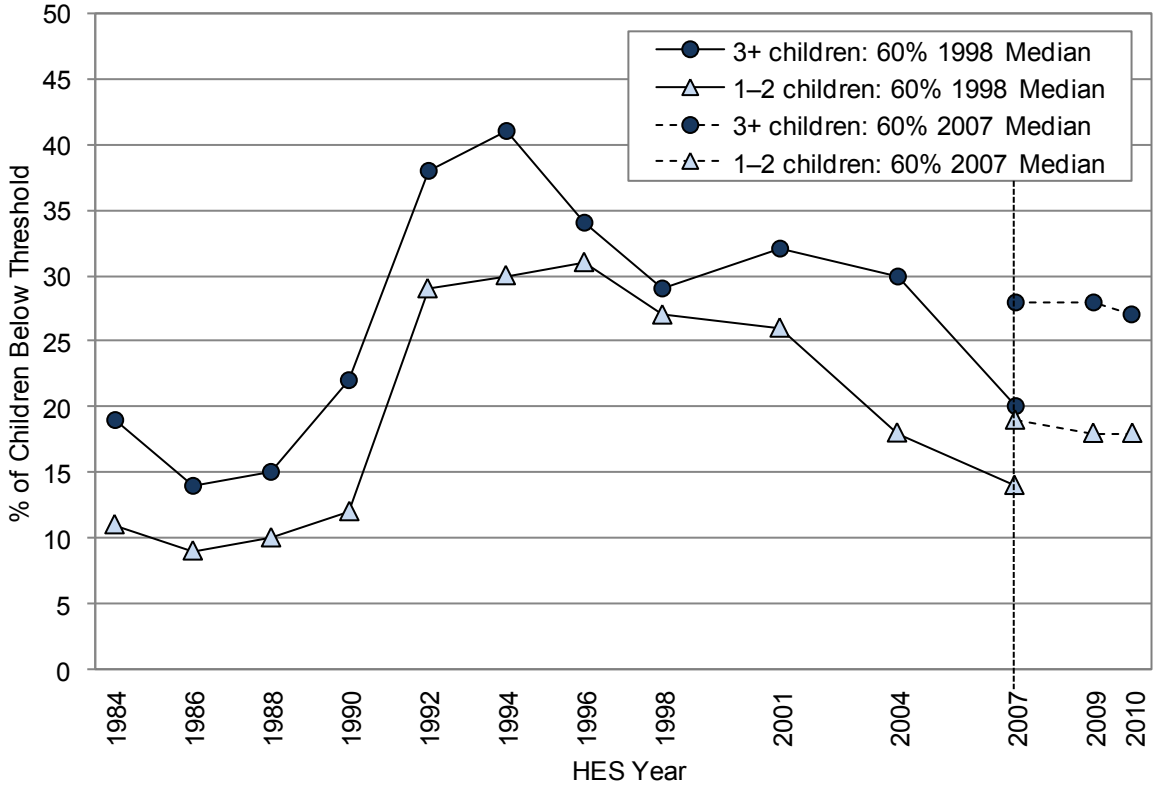
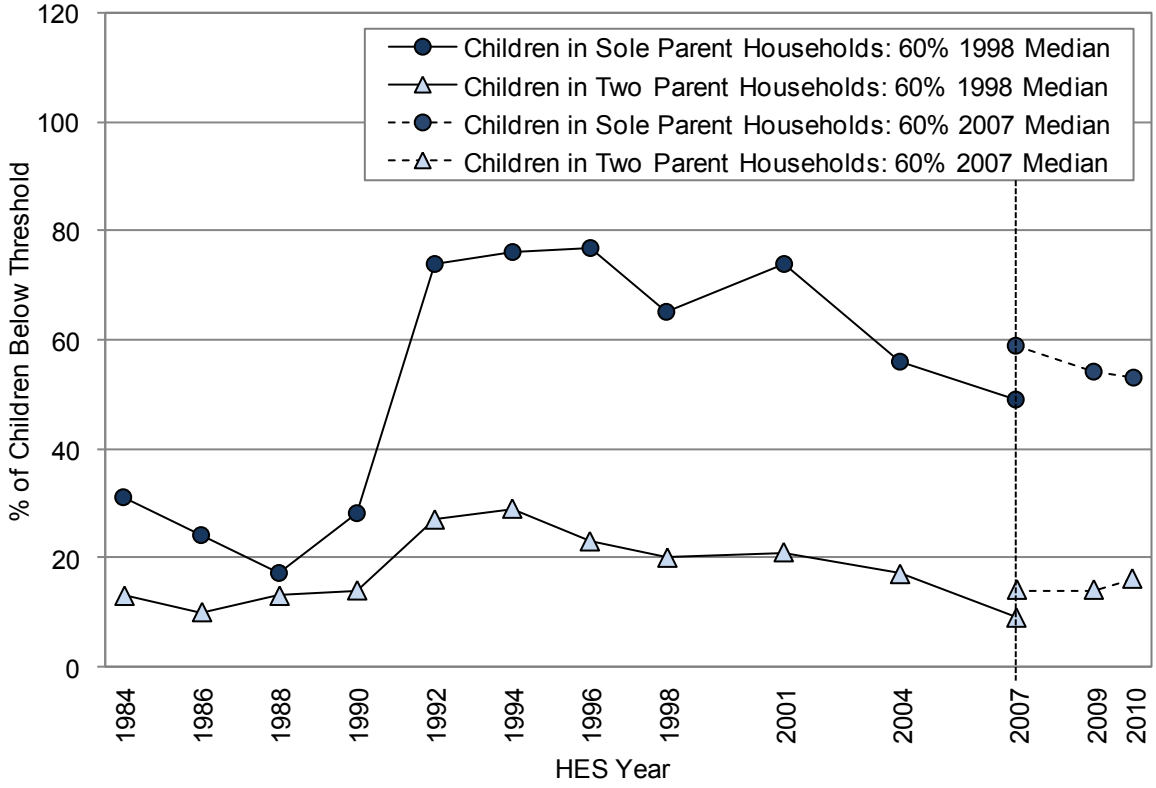


Figure 155. Proportion of Dependent Children Aged 0–17 Years Living Below the 60% Income Poverty Threshold (1998 and 2007 Median, After Housing Costs) by Number of Children in Household, New Zealand 1984–2010 HES Years



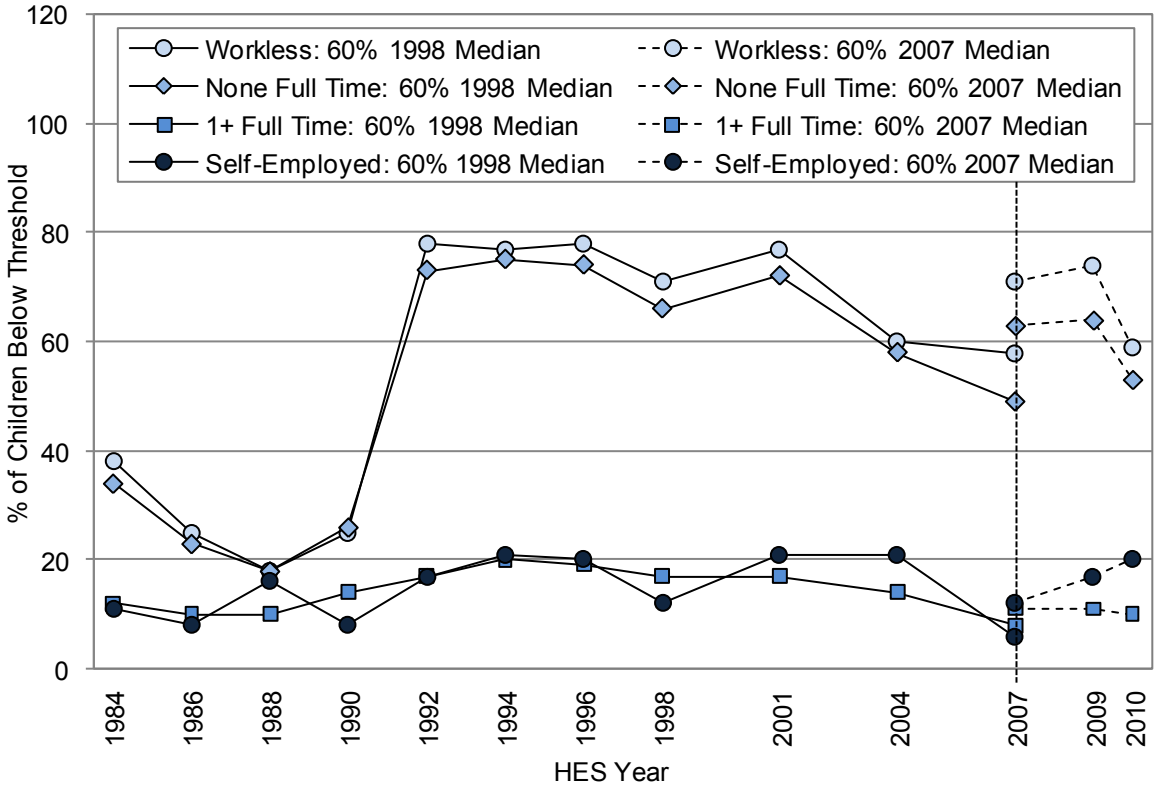
Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010

Figure 156. Proportion of Dependent Children Aged 0–17 Years Living Below the 60% Income Poverty Threshold (1998 and 2007 Median, After Housing Costs) by Household Type, New Zealand 1984–2010 HES Years



Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

Figure 157. Proportion of Dependent Children Aged 0–17 Years Living Below the 60% Income Poverty Threshold (1998 and 2007 Median, After Housing Costs) by Work Status of Adults in the Household, New Zealand 1984–2010 HES Years



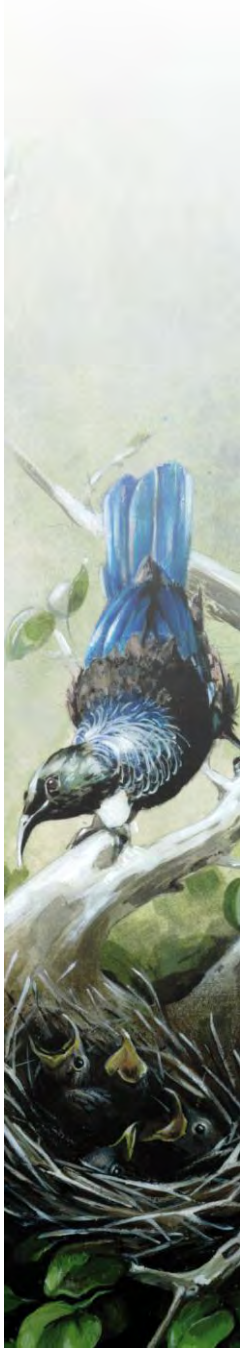
Source: Perry 2011 [252], derived from Statistics New Zealand, Household Economic Survey (HES) 1984–2010.

Child Poverty Trends by Work Status of Adults in Household

In New Zealand, child poverty rates for children in workless households, or where no adults worked full time, increased rapidly during 1988–1992. Poverty rates for children in these households remained elevated during the 1990s (range 66%–78%), before declining during 2001–2007. Even at their nadir in 2007, poverty rates for children in these households remained much higher than 1980s levels. In contrast, increases in child poverty for households where an adult worked full time, or was self-employed, were much less marked, with rates in 2007–2009 being similar to those in the 1980s (**Figure 157**). (Comment: Perry notes that during the 1980s, children in workless households were ≈2x as likely to be in poor households; during 1992–2004 this had risen to ≈ 3–4x higher, and by 2007–2009 it was ≈ 6–7x higher[253]).

Summary: Child Poverty

In New Zealand during 1988–1992, child poverty rates increased markedly, as a result of rising unemployment and the 1991 Benefit cuts. During 1994–1998 however, rates declined, as economic conditions improved and unemployment fell. During 1998–2004, child poverty trends varied, depending on the measure used, but between 2004 and 2007 they again declined, following the roll out of the Working for Families package. For the majority of this period, child poverty rates were higher for younger children (0–11 vs. 12–17 years), larger households (3 or more children vs. 1–2 children), sole parent households and households where the adults were either workless, or where none worked full time.



Families with Reduced Living Standards

The Ministry of Social Development has undertaken three national Living Standards Surveys, in 2000, 2004 and 2008. The 2008 Survey collected information from 5000 households on their material circumstances, including ownership and quality of household durables, their ability to keep the house warm, pay the bills, have broken down appliances repaired, and pursue hobbies and other interests [258]. The following section briefly reviews the living standards of children aged 0–17 years, using the 2008 Living Standards Survey's composite index of deprivation.

Data Source and Methods

Definition

Proportion of Children Aged 0–17 Years with Deprivation Scores of Four or More

Data Source

The Ministry of Social Development's 2008 Living Standards Survey [258].

In the 2008 Living Standards Survey, respondents provided information about themselves and others in their Economic Family Unit (EFU). A respondent's EFU comprised the respondent and partner (if any), together with their dependent children in the household (if any). This was a narrower concept than the census family unit which includes other family members such as adult children and parents of adult children.

In the survey, total response ethnicity was used, meaning that categories were not mutually exclusive, as one person could be in two or more categories depending on their response. When the analysis was repeated using prioritised ethnicity however, the change in classification had minimal impact on the results.

Deprivation Index Used in 2008 Living Standards Survey

In the 2008 Living Standards Survey, a 14 item material deprivation index was used to compare the relative positions of different population groups. Each item in the index assessed an 'enforced lack', with items being divided into two categories: ownership / participation, where an item was wanted but not possessed because of cost; and economising items, which focused on cutting back or going without in order to pay for other basic needs. The deprivation score for each respondent was the sum of all enforced lacks, with a cut off of 4+ being used as a measure of material hardship, as it represented the 15% of the population experiencing the most hardship (and was thus seen as being equivalent to the MSD's income poverty measures).

14 Items *(Enforced Lacks)* Included in 2008 Living Standards Survey Deprivation Index

Ownership/Participation

- A Good Bed
- Ability to Keep Main Rooms Adequately Warm
- Suitable Clothes for Important or Special Occasions
- Home Contents Insurance
- Presents for Family and Friends on Special Occasions

Economising 'A Lot' (To Keep Down Costs to Help Pay for Other Basics)

- Continued Wearing Worn Out Clothing
- Continued Wearing Worn Out Shoes
- Went Without or Cut Back On Fresh Fruit and Vegetables
- Bought Cheaper or Less Meat than Wanted
- Postponed Visits to the Doctor
- Did Not Pick Up a Prescription
- Put Up With Feeling Cold to Save on Heating Costs
- Went Without or Cut Back On Visits to Family or Friends
- Did Not go to a Funeral (Tangi) You Wanted to

Proportion of Children with High Deprivation Scores

In the 2008 Living Standards Survey, 51% of Pacific children, 39% of Māori children, 23% of "Other" children and 15% of European children aged 0–17 years scored four or more on the composite deprivation index, which measured a range of "enforced lacks", as outlined in the Methods box above. In addition, 59% of children whose family's income source was a benefit had scores of four or more (**Figure 158**). When broken down by individual item, those children who scored four or more on the composite deprivation index had much higher exposures to household economising behaviours such as having to wear worn out shoes or clothing, sharing a bed or bedroom, cutting back on fresh fruit and vegetables and postponing doctors visits because of cost (**Table 163**).

Table 163. Restrictions Experienced by Children, by the Deprivation Score of their Family, NZ Living Standards Survey 2008

	All	0	1	2–3	4–5	6+
Distribution of children across the DEP scores	**100**	**41**	**18**	**18**	**10**	**12**
Average number of children per family		2.2	2.3	2.5	2.7	2.7
Enforced lacks of children's items						
Friends to birthday party	6	-	-	5	9	31
Waterproof coat	8	-	2	8	11	39
Separate bed	5	-	-	3	13	20
Separate bedrooms for children of opposite sex (10+ yr)	8	2	3	6	14	24
All school uniform items required by the school	5	-	-	2	9	19
Economising 'a lot' on children's items to keep down costs to afford other basics						
Children continued to wear worn out shoes/clothes	8	-	-	5	15	39
Postponed child's visit to doctor	2	-	-	-	5	13
Did not pick up prescription for children	1	-	-	-	3	7
Unable to pay for school trip	3	-	-	-	6	17
Went without music, dance, kapa haka, art etc	9	2	4	8	18	37
Involvement in sport had to be limited	8	-	4	6	17	32
Multiple deprivation						
4+ of the 11 children's items above	6	-	-	2	11	35
5+ of the 11 children's items above	4	-	-	-	7	29
6+ of the 11 children's items above	3	-	-	-	2	24
Children's serious health problems reported by respondent						
Serious health problems for child in the last year	28	22	25	31	35	43
Enforced lacks reported by respondent in child's family						
Keep main rooms warm	9	-	3	8	18	37
Meal with meat/chicken/fish at least each second day	3	-	-	-	6	18
Cut back/did without fresh fruit and vegetables	14	-	-	15	32	63
Postponed visit to doctor	14	-	4	18	38	65
One weeks holiday away from home in last year	33	14	28	42	52	73
Home computer	8	3	6	8	13	25
Internet access	9	-	7	9	18	28
Housing and local community conditions						
Physical condition of house (poor/very poor)	7	-	3	7	15	28
Major difficulty to keep house warm in winter	22	9	13	27	38	58
Dampness or mould (major problem)	17	5	13	18	37	49
Crime or vandalism in the area (major problem)	11	6	6	11	13	31

Source: NZ 2008 Living Standards Survey [258]

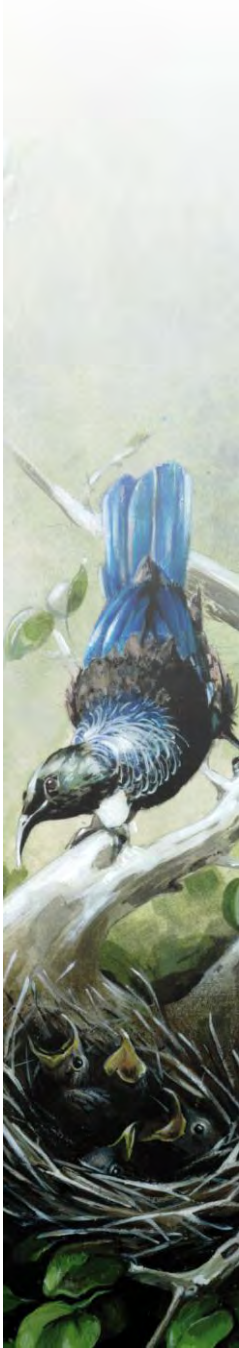
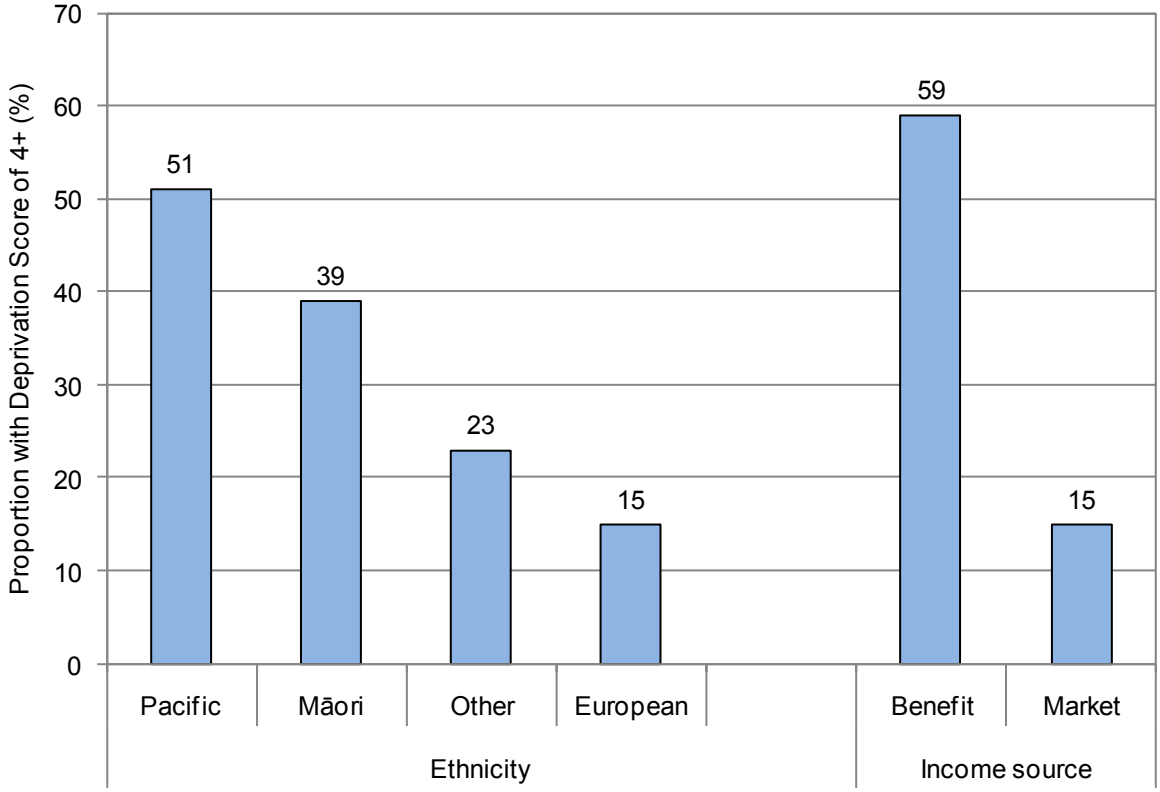


Figure 158. Proportion of Children Aged 0–17 Years with Deprivation Scores of Four or More by Ethnicity and Family Income Source, NZ Living Standards Survey 2008



Source: NZ 2008 Living Standards Survey [258]. Ethnicity is Total Response.

Summary

In the 2008 Living Standards Survey, 51% of Pacific children, 39% of Māori children, 23% of "Other" children and 15% of European children aged 0–17 years scored four or more on the composite deprivation index, which measured a range of "enforced lacks". In addition, 59% of children whose family's income source was a benefit had scores of four or more. When broken down by individual item, those children who scored four or more on the composite deprivation index had much higher exposures to household economising behaviours such as having to wear worn out shoes or clothing, sharing a bed or bedroom, cutting back on fresh fruit and vegetables and postponing doctors' visits because of cost.

UNEMPLOYMENT RATES

Introduction

In the quarter ending December 2009, seasonally adjusted unemployment rates rose to 7.1%, their eighth consecutive quarterly rise. Since then unemployment rates have remained in the mid-to-high 6% range, with rates in the most recent (September 2011) quarter being 6.6% [260]. Throughout this period, unemployment rates have been higher for Māori and Pacific people, young people (particularly those 15–19 years) and those without formal qualifications [145]. Such increases are of concern for New Zealand children and young people for two reasons:

Firstly, research suggests that children in families where their parents are unemployed have higher rates of psychosomatic symptoms, chronic illnesses and low wellbeing, and that while the magnitude of these associations is reduced once other potentially mediating factors are taken into account (e.g. parents' former occupation, sole parent status, and migrant status), the associations do not disappear completely [261]. Further, research suggests that these negative effects may be mediated via the impact unemployment has on parents' mental health, with the mental distress associated with decreased social status, disruption of roles, loss of self-esteem and increased financial strain, all impacting negatively on parents' emotional state [261]. This in turn may lead to non-supportive marital interactions, compromised parenting, and children's internalising (e.g. withdrawal, anxiety, depression) and externalising (e.g. aggressive or delinquent behaviour, substance abuse) behaviour [262].

Secondly, for young people the research suggests that unemployment leads to a range of negative psychological outcomes including depression, anxiety and low self-esteem, which are in turn associated with adverse outcomes such as heavy tobacco, alcohol and drug use, and higher mortality from suicide and accidents [263]. While social support may reduce the psychological distress associated with unemployment, the type of support provided is important (e.g. while positive support from family and friends decreases psychological distress amongst unemployed youth, parental advice may at times increase distress, as it may be perceived as pressure to find a job [263]). On a more positive note, research also suggests that this psychological distress decreases once young people find permanent employment, or return to further education [263].

The following section uses information from Statistics New Zealand's Quarterly Household Labour Force Surveys, to review unemployment rates during the past two decades.

Data Source and Methods

Definition

Unemployment Rate: The number of unemployed people expressed as a percentage of the labour force.

Data Source

Statistics New Zealand, Household Labour Force Survey (n≈15,000 households). Quarterly Since March 1986 and available on Statistics New Zealand's website www.stats.govt.nz

Notes on Interpretation

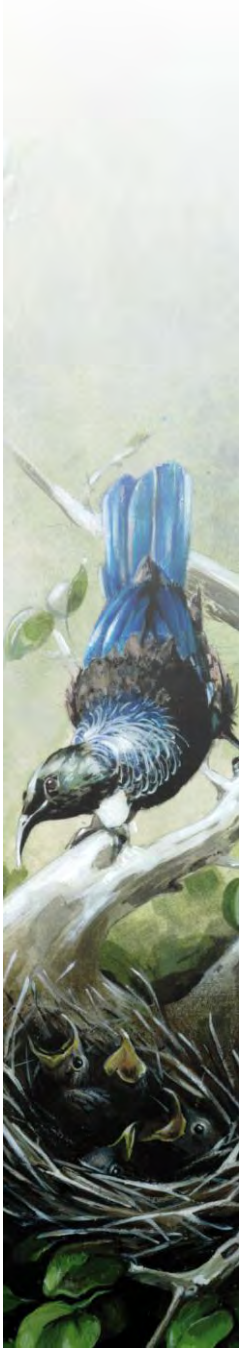
Unemployed refers to all people in the working-age population who during the reference week were without a paid job, were available for work and [264]:

(a) had actively sought work in the past four weeks ending with the reference week, or

(b) had a new job to start within four weeks.

Note 1: A person whose only job search method in the previous four weeks has been to look at job advertisements in the newspapers is not considered to be actively seeking work.

Note 2: Seasonal adjustment makes data for adjacent quarters more comparable by smoothing out the effects of any regular seasonal events. This ensures the underlying movements in time series are more visible. Each quarter, the seasonal adjustment process is applied to the latest and all previous quarters. This means that seasonally adjusted estimates for previously published quarters may change slightly [247].

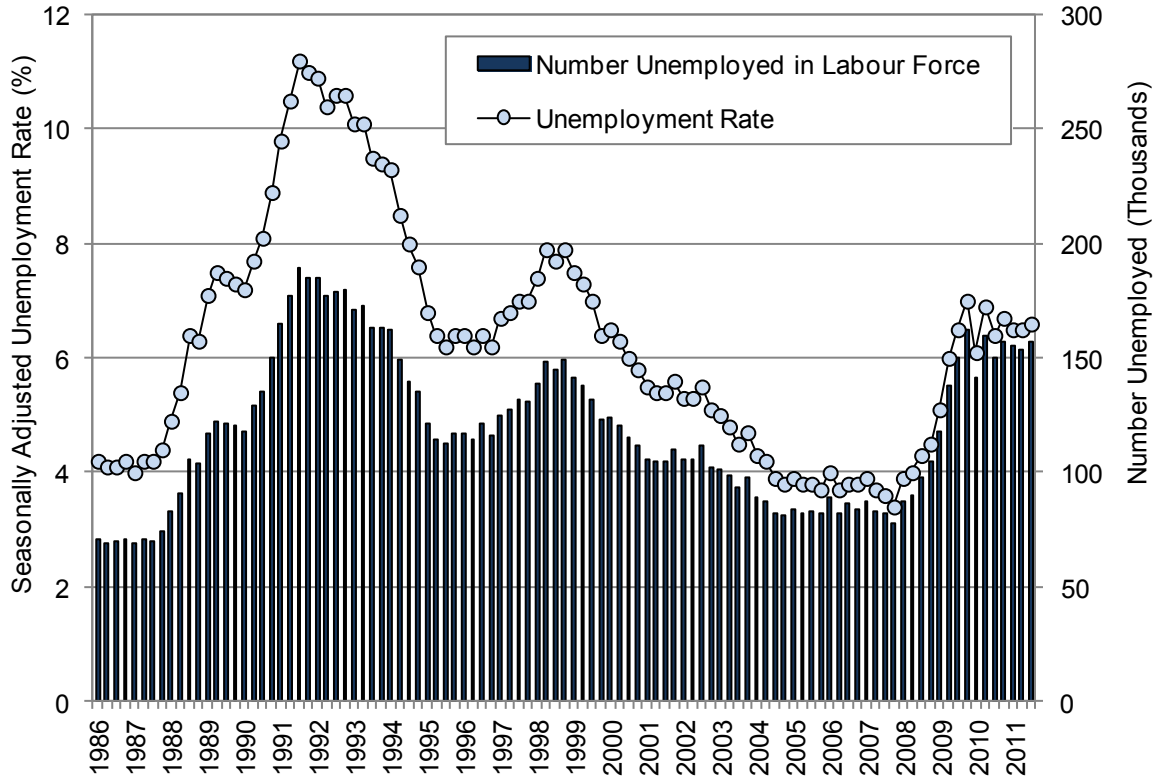


New Zealand Distribution and Trends

Seasonally Adjusted Unemployment Rates

In the quarter ending September 2011, the seasonally adjusted unemployment rate rose to 6.6%, while seasonally adjusted unemployment numbers increased from 154,000 to 157,000 (**Figure 159**). The number of people employed also increased (by 5,000) to reach 2,218,000 [260].

Figure 159. Seasonally Adjusted Unemployment Rates, New Zealand Quarter 1 (March) 1986 to Quarter 3 (September) 2011



Source: Statistics New Zealand, Household Labour Force Survey. Note: Rates have been seasonally adjusted.

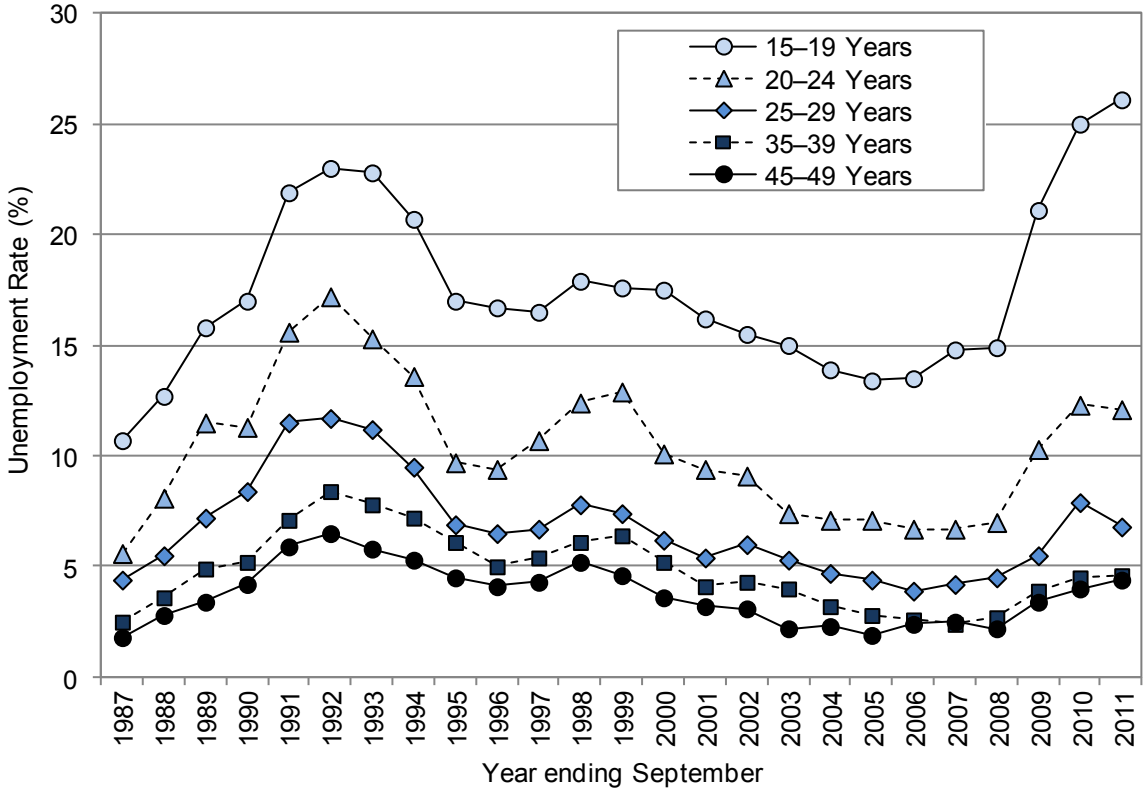
Unemployment Rates by Age

In New Zealand during September 1987–2011, unemployment rates were consistently higher for younger people (15–19 years > 20–24 years > 25–29 years > 35–39 years and 45–49 years). During the year ending September 2011, annual unemployment rates were 26.1% for those aged 15–19 years and to 12.1% for those aged 20–24 years (**Figure 160**).

Unemployment Rates by Age and Gender

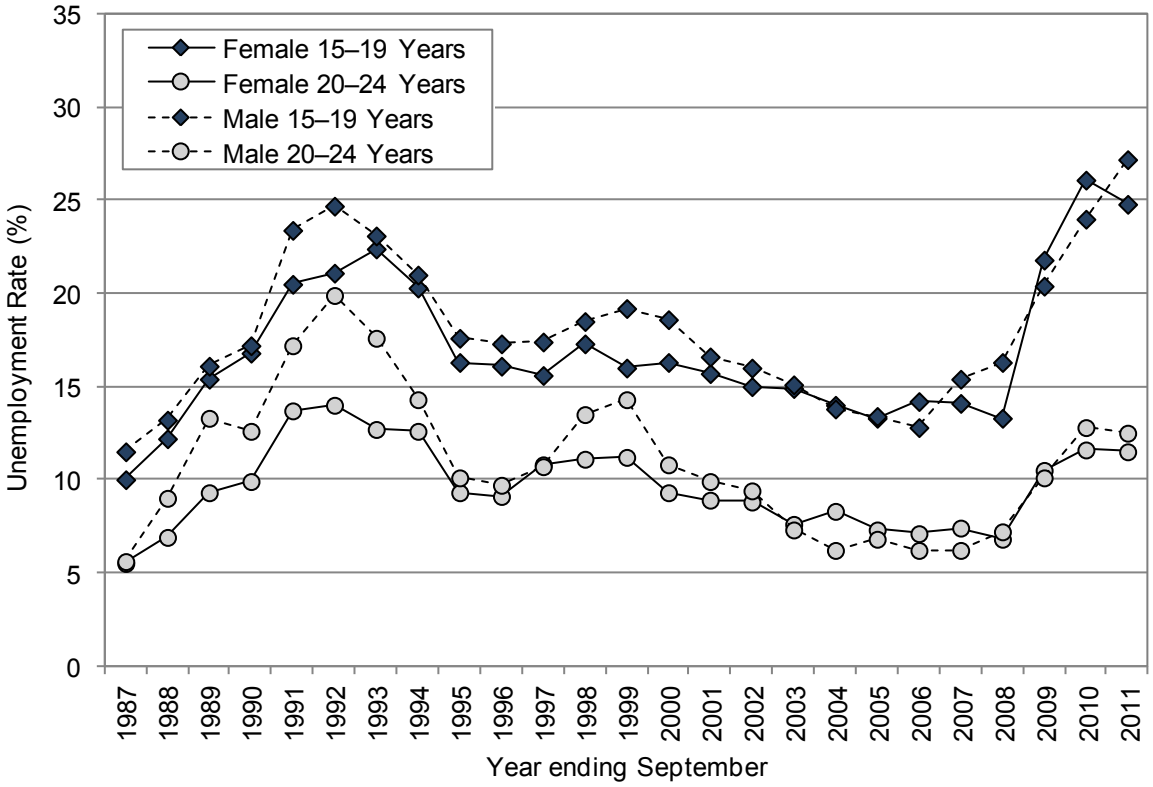
In New Zealand during September 1987–2011, there were no consistent gender differences in annual unemployment rates for young people aged 15–24 years. During the year ending September 2011, unemployment rates for those aged 15–19 years were 24.8% for females and 27.2% for males, while for those aged 20–24 years, rates were 11.5% for females and 12.5% for males (**Figure 161**).

Figure 160. Annual Unemployment Rates by Age (Selected Age Groups), New Zealand September 1987–2011



Source: Statistics New Zealand Household Labour Force Survey

Figure 161. Annual Unemployment Rates by Age and Gender in New Zealand Young People Aged 15–24 Years, September 1987–2011



Source: Statistics New Zealand Household Labour Force Survey

Unemployment Rates by Ethnicity

In New Zealand during 2007(Q4)–2011(Q3) unemployment rates were consistently higher for Māori and Pacific >Asian/Indian > European people. Unemployment rates increased for all ethnic groups during 2008 and 2009, but became more static during 2010–2011(Q3) for Māori, Pacific and European people. However, rates for Asian/Indian people exhibited a general downward trend between 2010(Q2) and 2011(Q2). Thus by 2011(Q3), unemployment rates were 13.2% for Māori, 14.4% for Pacific, 7.9% for Asian/Indian and 4.9% for European people (**Figure 162**).

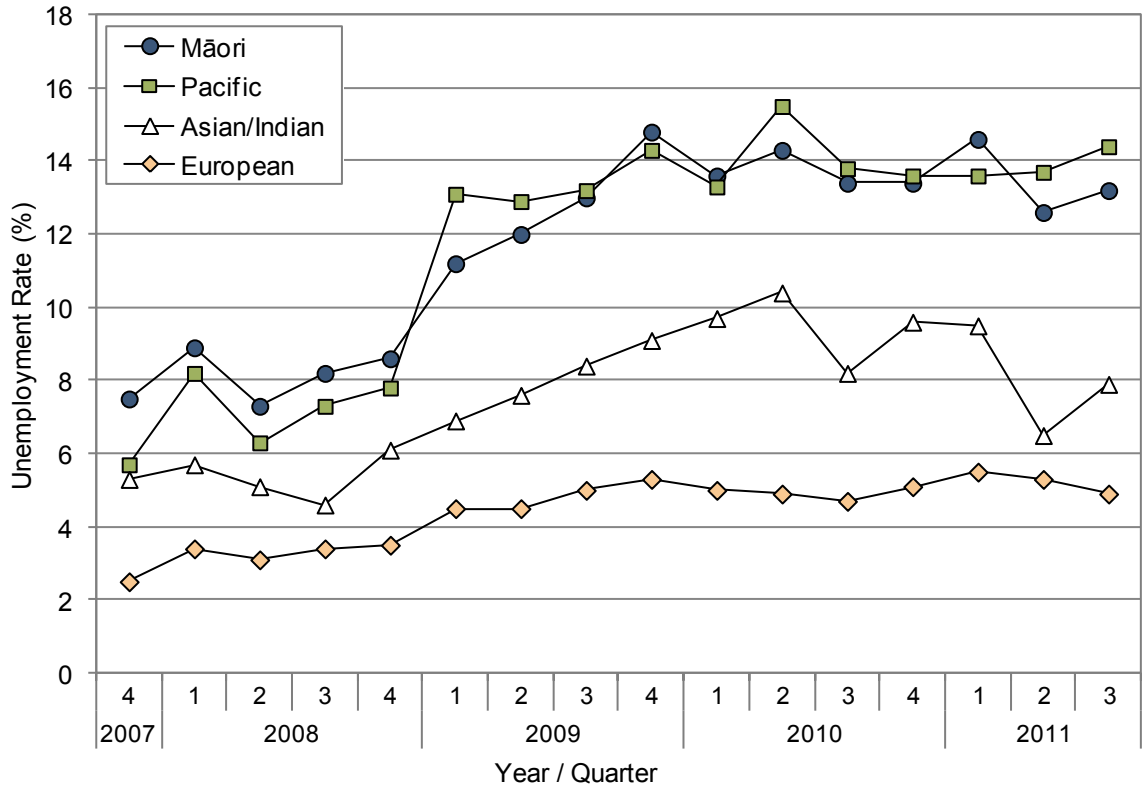
Unemployment Rates by Qualification

In New Zealand during the years ending September 1987–2011, unemployment rates were higher for those with no qualifications > school qualifications, or post school but no school qualifications > both post school and school qualifications. In the year ending September 2011, unemployment rates were 10.4% for those with no qualifications, 8.6% for those with a school qualification, 8.0% for those post school, but with no school qualifications and 4.2% for those both post school and with school qualifications (**Figure 163**).

Duration of Unemployment

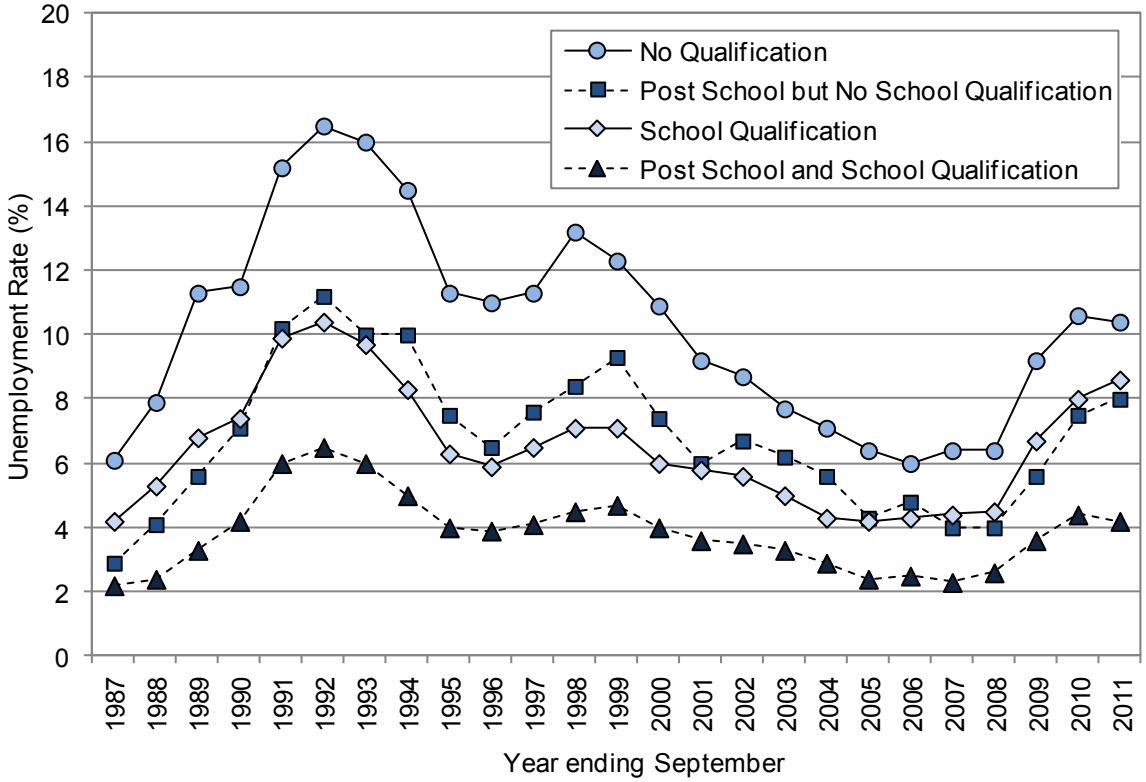
In New Zealand during the years ending September 1987–2011, duration of unemployment varied markedly, and in a manner consistent with prevailing unemployment rates. Thus the highest proportion of people unemployed for 53+ weeks occurred during the early / mid 1990s, when unemployment rates were at their peak, while the highest proportion unemployed for only 1–4 weeks occurred in the mid–late 2000s, when unemployment rates were at their lowest (**Figure 164**).

Figure 162. Quarterly Unemployment Rates by Total Response Ethnicity, New Zealand Quarter 4 (December) 2007 to Quarter 3 (September) 2011



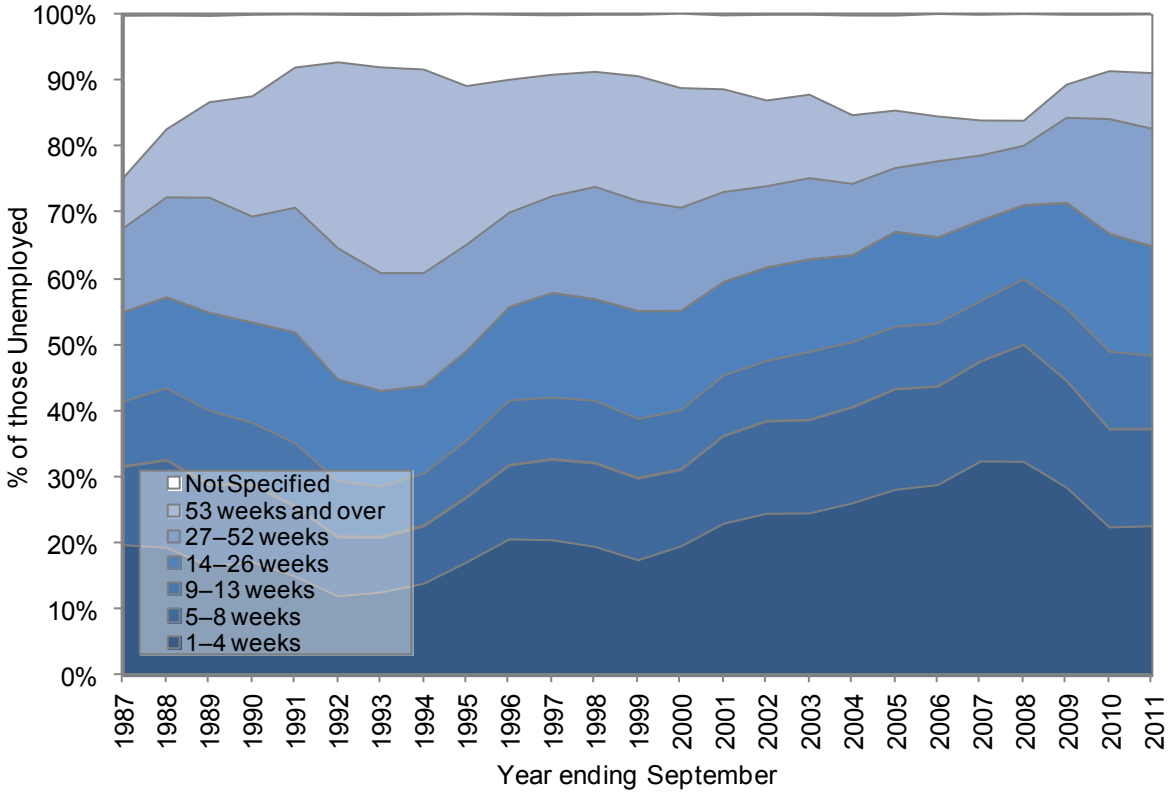
Source: Statistics New Zealand Household Labour Force Survey. Note: Ethnicity is Total Response.

Figure 163. Annual Unemployment Rates by Qualification, New Zealand September 1987−2011



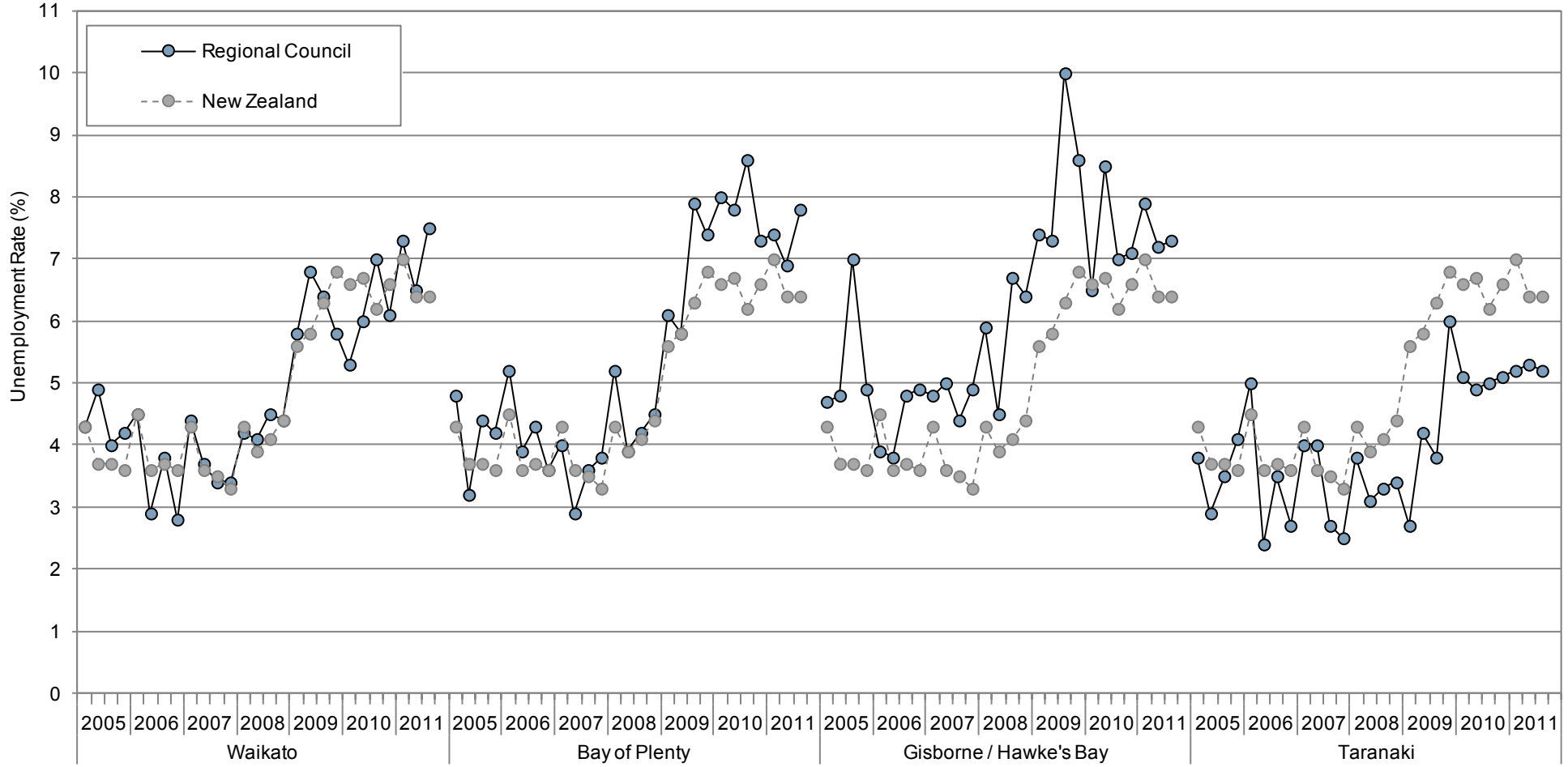
Source: Statistics New Zealand Household Labour Force Survey

Figure 164. Proportion of those Unemployed by Duration of Unemployment, New Zealand September 1987−September 2011



Source: Statistics New Zealand Household Labour Force Survey

Figure 165. Quarterly Unemployment Rates by Regional Council, Waikato, Bay of Plenty, Gisborne / Hawke's Bay and Taranaki Regions vs. New Zealand Quarter 1 (March) 2005 to Quarter 3 (September) 2011



Source: Statistics New Zealand Household Labour Force Survey

Regional Trends

Regional Unemployment Rates: Quarterly

In the Waikato, Bay of Plenty, Gisborne / Hawke's Bay and Taranaki regional council catchments during 2005(Q1)–2011(Q3) unemployment trends were similar to those occurring nationally. While rates were similar to the New Zealand rate in the Waikato, rates in Gisborne / Hawke's Bay were higher for the majority of 2005(Q1)–2011(Q3). In the Bay of Plenty rates were similar to the New Zealand rate during 2005-2008, but higher during 2009–2011(Q3), while in Taranaki rates were lower than the New Zealand rate during 2008–2011(Q3) (**Figure 165**).

Summary

In the quarter ending September 2011, the seasonally adjusted unemployment rate rose to 6.6%, while seasonally adjusted unemployment numbers increased from 154,000 to 157,000. During September 1987–2011, unemployment rates were higher for younger people (15–19 years > 20–24 years > 25–29 years > 35–39 years and 45–49 years) and those with no qualifications > school qualifications, or post school but no school qualifications > both post school and school qualifications, although there were no consistent gender differences for young people 15–24 years. During 2007(Q4)–2011(Q3) unemployment rates were higher for Māori and Pacific >Asian/Indian > European people. Unemployment rates increased for all ethnic groups during 2008 and 2009, but became more static during 2010–2011(Q3) for Māori, Pacific and European people. Rates for Asian/Indian people declined between 2010(Q2) and 2011(Q2).

In the Waikato, Bay of Plenty, Gisborne / Hawke's Bay and Taranaki regional council catchments during 2005(Q1)–2011(Q3) unemployment trends were similar to those occurring nationally. While rates were similar to the New Zealand rate in the Waikato, rates in Gisborne / Hawke's Bay were higher for the majority of 2005(Q1)–2011(Q3). In the Bay of Plenty rates were similar to the New Zealand rate during 2005-2008, but higher during 2009–2011(Q3), while in Taranaki rates were lower than the New Zealand rate during 2008–2011(Q3).

CHILDREN RELIANT ON BENEFIT RECIPIENTS

Introduction

In New Zealand, children who are reliant on benefit recipients are a particularly vulnerable group. During 2009, 75% of all households (including those with and without children) relying on income-tested benefits as their main source of income were living below the poverty line (housing adjusted equivalent disposable income <60% of 2007 median) [265].This proportion has increased over the past two decades, rising from 39% of benefit dependent households in 1990, to a peak of 76% in 1994, and then remaining in the low–mid 70s ever since [265], with these trends being attributed to three main factors: cuts in the level in income support during 1991, growth in unemployment (which peaked at 11% in 1991) and escalating housing costs, particularly for those in rental accommodation [266].

The vulnerability of benefit dependent children was further highlighted by the 2000 Living Standards Survey, which noted that even once the level of family income was taken into account, families whose main source of income was Government benefits were more likely to be living in severe or significant hardship and as a consequence, more likely to buy cheaper cuts of meat, go without fruit and vegetables, put up with feeling cold to save on heating costs, make do without enough bedrooms, have children share a bed, postpone a child's visit to the doctor or dentist, go without a computer or internet access and limit their child's involvement in school trips, sports and extracurricular activities [266]. The 2004 Living Standards Survey suggested that the picture may have worsened between 2000 and 2004, with the proportion of benefit dependent families living in severe or significant hardship increasing from 39% in 2000 to 58% in 2004 [259].

The following section reviews the number of children aged 0–18 years who were dependent on benefit recipients during April 2000–2011, using information from the Ministry of Social Development's SWIFTT database. While the number of children reliant on benefit recipients does not correlate precisely with the number living below the poverty line (in 2004 they comprised 60% of those in poverty [267]), in the context of New Zealand's recent rises in unemployment rates, they nevertheless reflect a particularly vulnerable group, who may have higher health needs, and as a consequence, may make a significant contribution to future health service demand.

Data Source and Methods

Definition

Children Reliant on a Benefit or a Benefit Recipient by Benefit Type

Data Source

Numerator: Number of Children Aged 0–18 years who were reliant on a Benefit or Benefit Recipient as recorded in the Ministry of Social Development's SWIFTT[2] database

Denominator: Statistics NZ Estimated Resident Population

Notes on Interpretation

Data were provided by the Ministry of Social Development (MSD) from their SWIFTT database which records information on recipients of financial assistance through Work and Income for 2000–2011. All figures, unless stated otherwise, refer to the number of children who were dependent on a benefit or benefit recipient as at the end of April and provide no information on those receiving assistance at other times of the year.

Note: New Zealand level trend data are for children 0–18 years, whereas Service Centre Data may also include a very small number (n=5 in 2010) who are aged 19+ years.

To be eligible for a benefit, clients must have insufficient income from all sources to support themselves and any dependents and meet the eligibility criteria for benefits. These are:

Domestic Purposes Benefit–Sole Parent (DPB-SP) and Emergency Maintenance Allowance: This benefit provides income support for sole parents living with their dependent children under 18 years, who meet an income test and are New Zealand citizens or permanent residents. To be eligible, a parent must be 18 years or older OR have been legally married or in a civil union. A 16 or 17 year old sole parent who has never been married may be eligible to receive an Emergency Maintenance Allowance. This emergency benefit can also be paid to sole parents aged 18 and over who do not meet specific criteria for DPB-SP or other benefits.

[2]SWIFTT is the income support database developed by the New Zealand Income Support Service to calculate, provide and record income support payments and related client history [268]

Unemployment Benefits: These benefits are available to people who are available for and actively seeking full time work. Clients must be aged 18+ years or 16–17 years and living with a spouse or partner and dependent children. Those receiving unemployment benefits are subject to a full time work test, as are their spouses or partners if they have no dependent children, or if their youngest dependent child is aged 14+ years. Applicants must have continuously lived in New Zealand for two years or more. An Unemployment Benefit-Hardship is available to those who do not meet these criteria but who are not successfully able to support themselves through paid employment or by other means.

Sickness Benefit: To be eligible for a Sickness Benefit people need to be 18 years of age, or 16–17 years of age and either 27+ weeks pregnant or living with a partner and children they support. They must have had to stop working or reduce their hours because of sickness, injury, pregnancy or disability OR, if unemployed or working part time, find it hard to look for or do full time work for the same reasons. To qualify, a person's (and their partner's) income must be below a certain level and they must have a medical certificate, the first of which can last for only up to 4 weeks. For pregnant women, payments may continue for up to 13 weeks after the birth of their child. At least two years' residence is required, though a benefit may be granted in cases of hardship.

Invalid's Benefit: To be eligible for an Invalid's Benefit, people need to be 16+ years of age and unable to work 15+ hours a week because of a sickness, injury or disability which is expected to last at least two years OR their life expectancy is less than two years and they are unable to regularly work 15+ hours a week OR they are blind with a specified level of visual impairment. A doctor's certificate is required and an applicant must be a New Zealand citizen or permanent resident and have lived in New Zealand for 10 years or more.

Other Benefits: In this section, Other Benefits includes DPB Women Alone and Caring for Sick or Infirm, NZ Superannuation, Veterans and Transitional Retirement Benefit, Emergency Benefits and Widows Benefit, Independent Youth Benefit, Unemployment Benefit Training and Unemployment Benefit Training Hardship, Unemployment Benefit Student Hardship. As Orphans and Unsupported Child Benefits are not means tested, they have not been included in the analysis.

Indicator Category Ideal B–C

New Zealand Distribution and Trends

Total Number of Children Reliant on a Benefit or Benefit Recipient

In New Zealand, the number of children aged 0–18 years who were reliant on a benefit, or benefit recipient, fell from 272,638 in April 2000, to 201,083 in April 2008, before increasing again to 234,572 in April 2011. A large proportion of this variation was due to changes in the number of children relying on unemployment benefit recipients, with numbers in this category falling from 49,499 in April 2000, to 5,289 in April 2008, before increasing to a peak of 16,380 in April 2010. Similarly the number of children reliant on DPB recipients fell from 188,216 in April 2000, to 158,173 in April 2008, before increasing again to 180,845 in April 2011 (**Table 164**).

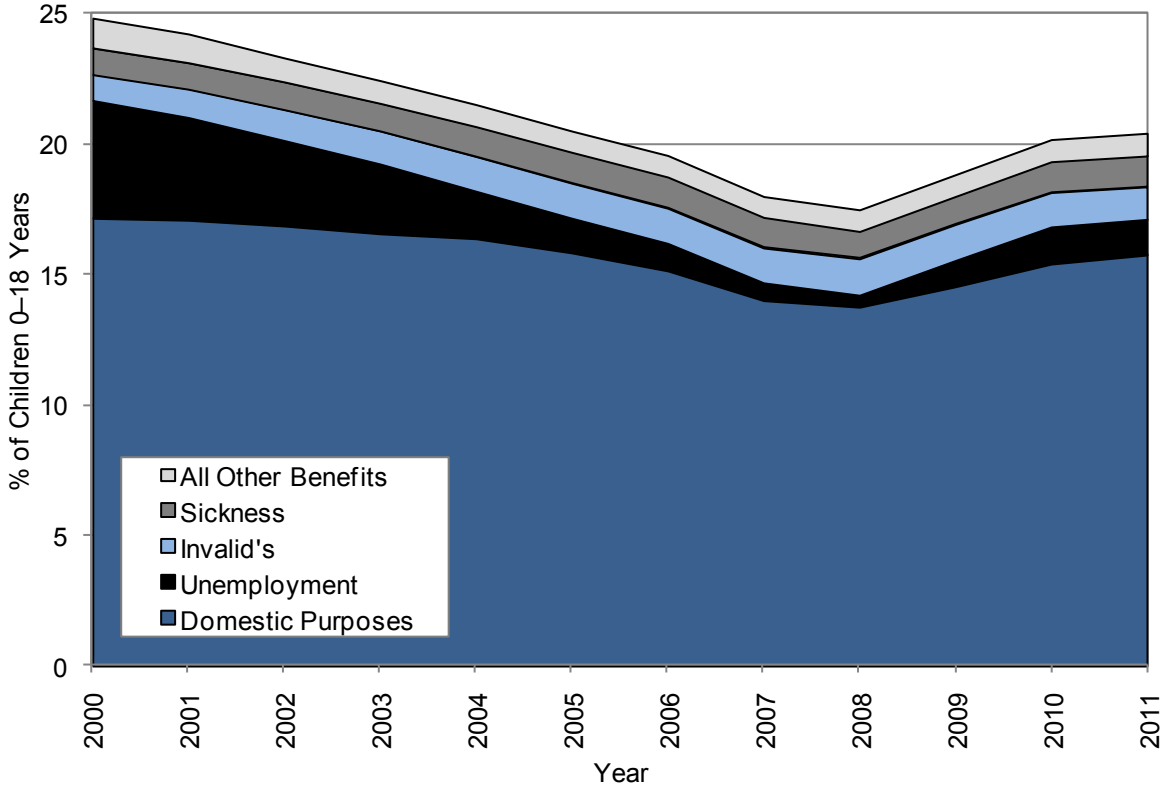
Proportion of All New Zealand Children Reliant on a Benefit Recipient

In New Zealand, the proportion of children aged 0–18 years who were reliant on a benefit, or benefit recipient, fell from 24.9% in April 2000 to 17.5% in April 2008, before increasing again to 20.4% in April 2011. A large proportion of the initial decline was due to a fall in the number of children reliant on unemployment benefit recipients (from 4.5% of children in 2000 to 0.5% in April 2008, before increasing to 1.4% in April 2011). While the proportion of children reliant on DPB recipients also fell (17.2% of children in April 2000, to 13.8% in April 2008, before increasing to 15.8% in April 2011 (**Figure 166**)), the rate of decline was much slower than for unemployment benefits, meaning that in relative terms, the proportion of benefit dependent children reliant on DPB recipients actually increased, from 69.0% of all benefit dependent children in April 2000, to 77.1% in April 2011(**Table 164**).

Age Distribution

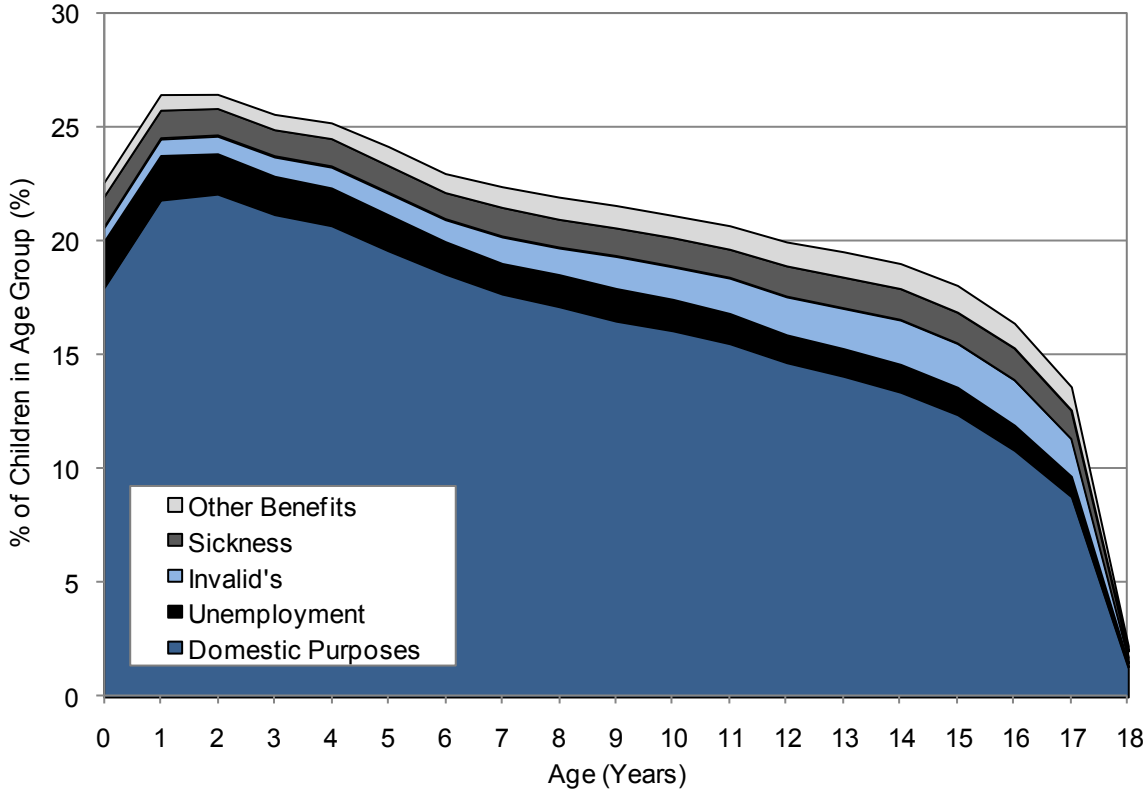
During April 2011, the proportion of children reliant on a benefit, or benefit recipient, was highest for those 0–4 years of age. Rates then tapered off gradually during middle-late childhood and early adolescence, and then very steeply after 17 years of age (**Figure 167**).

Figure 166. Proportion of All Children Aged 0–18 Years who were Reliant on a Benefit or Benefit Recipient by Benefit Type, New Zealand April 2000–2011



Source: Numerator: Ministry of Social Development; Denominator: Statistics NZ Estimated Resident Population. Note: For Composition of Other Benefits, see Methods Section; Orphans and Unsupported Child Benefits excluded.

Figure 167. Proportion of New Zealand Children Aged 0–18 Years who were Reliant on a Benefit or Benefit Recipient by Age and Benefit Type, as at the end of April 2011



Source: Numerator: Ministry of Social Development; Denominator: Statistics NZ Estimated Resident Population. Note: For Composition of Other Benefits, see Methods Section; Orphans and Unsupported Child Benefits excluded.

Table 164. Number of Children Aged 0–18 Years who were Reliant on a Benefit or Benefit Recipient by Benefit Type, New Zealand April 2000–2011

Year	Domestic Purposes		Unemployment		Invalid's		Sickness		All Other Benefits		Total
	Number	%	Number	%	Number	%	Number	%	Number	%	Number
New Zealand											
2000	188,216	69.0	49,499	18.2	11,120	4.1	11,295	4.1	12,508	4.6	272,638
2001	187,791	70.5	43,245	16.2	12,122	4.5	11,253	4.2	12,117	4.5	266,528
2002	187,207	72.3	36,342	14.0	13,219	5.1	11,983	4.6	10,209	3.9	258,960
2003	186,184	73.8	30,067	11.9	14,225	5.6	12,119	4.8	9,798	3.9	252,393
2004	185,610	76.0	20,663	8.5	15,053	6.2	13,182	5.4	9,572	3.9	244,080
2005	180,035	77.2	15,134	6.5	15,214	6.5	13,636	5.8	9,261	4.0	233,280
2006	172,995	77.4	12,069	5.4	15,332	6.9	13,797	6.2	9,430	4.2	223,623
2007	160,634	77.8	7,819	3.8	15,247	7.4	13,515	6.5	9,172	4.4	206,387
2008	158,173	78.7	5,289	2.6	15,962	7.9	12,128	6.0	9,531	4.7	201,083
2009	167,142	77.2	11,581	5.3	15,800	7.3	12,482	5.8	9,573	4.4	216,578
2010	177,226	76.3	16,380	7.1	15,116	6.5	13,752	5.9	9,757	4.2	232,231
2011	180,845	77.1	15,711	6.7	14,273	6.1	13,748	5.9	9,995	4.3	234,572

Source: Ministry of Social Development. Note: % refers to % of children relying on benefit recipients, rather than % of all children; Other Benefits includes DPB Women Alone and Caring for Sick or Infirm, NZ Superannuation, Veterans and Transitional Retirement Benefit, Emergency Benefits and Widows Benefit, Independent Youth Benefit, Unemployment Benefit Training and Unemployment Benefit Training Hardship, Unemployment Benefit Student Hardship (Orphans and Unsupported Child Benefits excluded).

Table 165. Number of Children Aged 0–18 Years who were Reliant on a Benefit or Benefit Recipient by Benefit Type for Service Centres in the Midland Region DHB Catchments, April 2007– 2011 (Table 1 of 2)

Year	DPB		Unemployment		Sickness		Invalid's		Other Benefits		Total
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Bay of Plenty (Greerton, Kawerau, Mount Maunganui, Opotiki, Tauranga, Te Puke, and Whakatane Service Centres)											
2007	8,981	80.8	315	2.8	648	5.8	740	6.7	432	3.9	11,116
2008	8,701	82.5	172	1.6	583	5.5	722	6.8	368	3.5	10,546
2009	9,498	81.4	464	4.0	643	5.5	677	5.8	391	3.3	11,673
2010	10,018	80.8	515	4.2	734	5.9	667	5.4	462	3.7	12,396
2011	10,394	81.6	447	3.5	765	6.0	583	4.6	545	4.3	12,734

Source: Ministry of Social Development. Note: % refers to % of children relying on benefit recipients, rather than % of all children; Other Benefits includes DPB Women Alone and Caring for Sick or Infirm, NZ Superannuation, Veterans and Transitional Retirement Benefit, Emergency Benefits and Widows Benefit, Independent Youth Benefit, Unemployment Benefit Training and Unemployment Benefit Training Hardship, and Unemployment Benefit Student Hardship (Orphans and Unsupported Child Benefits excluded).

Table 166. Number of Children Aged 0–18 Years Who Were Reliant on a Benefit or Benefit Recipient by Benefit Type for Service Centres in the Midland Region DHB Catchments, April 2007– 2011 (Table 2 of 2)

Year	DPB		Unemployment		Sickness		Invalid's		Other Benefits		Total
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total	
Lakes (Rotorua, Taupo and Turangi (until 2010) Service Centres)											
2007	6,091	82.8	335	4.6	281	3.8	356	4.8	295	4.0	7,358
2008	6,206	84.8	133	1.8	325	4.4	376	5.1	281	3.8	7,321
2009	6,593	84.5	207	2.7	350	4.5	378	4.8	273	3.5	7,801
2010	7,076	84.9	342	4.1	325	3.9	353	4.2	236	2.8	8,332
2011	7,337	83.6	437	5.0	359	4.1	340	3.9	302	3.4	8,775
Taranaki (Hawera, New Plymouth, Stratford, and Waitara Service Centres)											
2007	3,931	80.6	198	4.1	232	4.8	401	8.2	114	2.3	4,876
2008	3,746	82.3	88	1.9	172	3.8	420	9.2	127	2.8	4,553
2009	3,855	80.6	181	3.8	175	3.7	424	8.9	147	3.1	4,782
2010	4,276	81.6	232	4.4	196	3.7	399	7.6	138	2.6	5,241
2011	4,340	81.1	274	5.1	206	3.9	397	7.4	133	2.5	5,350
Tairawhiti (Gisborne, Kaiti and Ruatoria Service Centres)											
2007	3,394	78.8	241	5.6	178	4.1	342	7.9	151	3.5	4,306
2008	3,323	80.2	125	3.0	209	5.0	324	7.8	162	3.9	4,143
2009	3,325	79.0	152	3.6	227	5.4	316	7.5	190	4.5	4,210
2010	3,475	77.2	268	6.0	215	4.8	312	6.9	232	5.2	4,502
2011	3,596	78.7	246	5.4	231	5.1	299	6.5	200	4.4	4,572
Waikato (Cambridge, Dinsdale, Five Cross Roads, Glenview, Hamilton, Hamilton East, Hamilton City Super, Hamilton Employment Zone, Huntly, Matamata, Morrinsville, Ngaruawahia, Paeroa, Taumarunui, Te Awamutu, Te Kuiti, Thames, Tokoroa, and Waihi Service Centres)											
2007	15,875	79.3	742	3.7	987	4.9	1,685	8.4	727	3.6	20,016
2008	16,044	79.4	539	2.7	945	4.7	1,812	9.0	869	4.3	20,209
2009	16,852	78.4	1,023	4.8	968	4.5	1,774	8.3	878	4.1	21,495
2010	18,425	78.3	1,464	6.2	1,133	4.8	1,659	7.1	836	3.6	23,517
2011	19,054	80.2	1,242	5.2	1,044	4.4	1,550	6.5	878	3.7	23,768

Source: Ministry of Social Development. Note: % refers to % of children relying on benefit recipients, rather than % of all children; Other Benefits includes DPB Women Alone and Caring for Sick or Infirm, NZ Superannuation, Veterans and Transitional Retirement Benefit, Emergency Benefits and Widows Benefit, Independent Youth Benefit, Unemployment Benefit Training and Unemployment Benefit Training Hardship, and Unemployment Benefit Student Hardship (Orphans and Unsupported Child Benefits excluded).

Midland Region Distribution and Trends

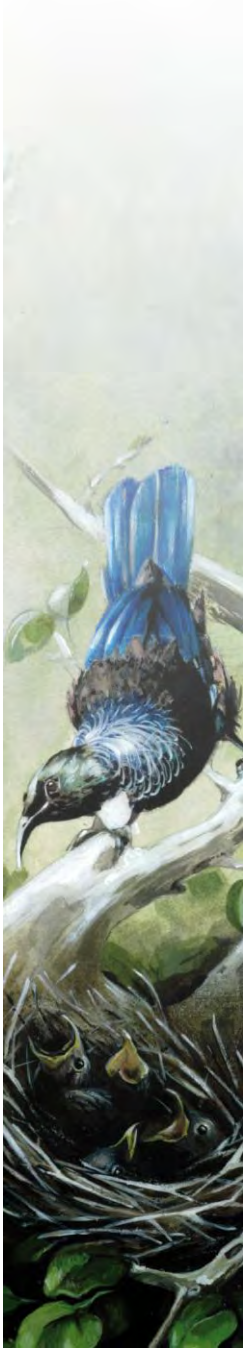
Total Number of Children Reliant on a Benefit or Benefit Recipient

At the end of April 2011, there were 55,199 children aged 0–18 years who were reliant on a benefit or benefit recipient and who received their benefits from Service Centres in the Waikato (n=23,768), Bay of Plenty (n=12,734), Lakes (n=8,775), Taranaki (5,350) and Tairawhiti (4,572) DHB catchments. While the majority of these children were reliant on DPB recipients, increases in the number reliant on unemployment benefit recipients were evident between April 2008 and April 2011 (**Table 166**).

Summary

In New Zealand, the proportion of children aged 0–18 years who were reliant on a benefit, or benefit recipient, fell from 24.9% in April 2000 to 17.5% in April 2008, before increasing again to 20.4% in April 2011. A large proportion of the initial decline was due to a fall in the number of children reliant on unemployment benefit recipients (from 4.5% of children in 2000 to 0.5% in April 2008, before increasing to 1.4% in April 2011). The proportion of children reliant on DPB recipients also fell, from 17.2% of children in April 2000, to 13.8% in April 2008, before increasing to 15.8% in April 2011.

At the end of April 2011, there were 55,199 children aged 0–18 years who were reliant on a benefit or benefit recipient and who received their benefits from Service Centres in the Waikato (n=23,768), Bay of Plenty (n=12,734), Lakes (n=8,775), Taranaki (5,350) and Tairawhiti (4,572) DHB catchments. While the majority of these children were reliant on DPB recipients, increases in the number reliant on unemployment benefit recipients were evident between April 2008 and April 2011.



THE CHILDREN'S SOCIAL HEALTH MONITOR: CHILD HEALTH AND WELLBEING INDICATORS

HOSPITAL ADMISSIONS AND MORTALITY WITH A SOCIAL GRADIENT IN CHILDREN

In New Zealand, there are currently large disparities in child health status, with Māori and Pacific children and those living in more deprived areas experiencing a disproportionate burden of morbidity and mortality [22]. These disparities were present even in the mid 2000s, when New Zealand experienced some of its lowest unemployment rates in recent decades. The macroeconomic environment began to change in 2008 however, with the country officially entering a recession at the end of June 2008, after two consecutive quarters of negative growth. While New Zealand technically left the recession at the end of June 2009 (when quarterly growth reached +0.1% [244]), progress since then has been variable, with unemployment rates, and the number of children reliant on benefit recipients remaining higher than in the mid-2000s.

The impact these changes might have on socially sensitive health outcomes remains unclear however, as international evidence suggests that the effects may vary, not only with the magnitude and duration of any economic downturn, but also as a result of the Government's social policy responses, and the extent to which New Zealand can maintain an effective social safety net (e.g. in housing, health, education, income support) for those most affected. Further, the adaptations families make to their economic circumstances (e.g. cutting back on heating and doctor's visits vs. reductions in cigarettes and takeaways), are also important, with the net impact of such positive / negative adaptations on health outcomes for children being difficult to predict (for a more detailed review of these issues see Craig et al's 2009 report [269]).

As predicting the impact of the economic downturn on child wellbeing is difficult, it would instead seem prudent to monitor a basket of key child health outcomes over time, in order to ensure that any impacts on child health and wellbeing can be identified early, so that proactive and co-ordinated responses can be put in place, should the need arise. The following section thus uses data from the National Minimum Dataset and the National Mortality collection to review hospital admissions for, and mortality from, the basket of socially sensitive conditions outlined in the Methods section below.

Data Source and Methods

Definition

1. Hospital Admissions for Medical Conditions with a Social Gradient in Children Aged 0–14 Years
2. Injury Admissions with a Social Gradient in Children Aged 0–14 Years
3. Mortality with a Social Gradient in Children Aged 0–14 Years

Data Source

For details of the methodology used to derive these indicators see **Appendix 9.**

Numerator:

Hospital Admissions for Medical Conditions with a Social Gradient: Acute and Arranged (Arranged= within 7 days of referral) Hospital Admissions (Waiting List, ACC cases and neonates <29 days excluded) in children aged 0–14 years with the following ICD-10-AM primary diagnoses: A00–A09, R11, K529 (Gastroenteritis); A15–A19 (Tuberculosis); A33, A34, A35, A36, A37, A80, B05, B06, B16, B26, B18.0, B18.1, P35.0 or M01.4 (Vaccine Preventable Diseases); A39 (Meningococcal Disease); B34 (Viral Infection of Unspecified Site); E40–E64 or D50–D53 (Nutritional Deficiencies / Anaemias); J00–J03 orJ06 (Acute Upper Respiratory Infections); J04 (Croup/Laryngitis/Tracheitis/Epiglottitis); J12, J10.0 or J11.0 (Viral Pneumonia); J13–J16 or J18 (Bacterial / Non-Viral Pneumonia); J21 (Acute Bronchiolitis); J45–J46 (Asthma); J47 (Bronchiectasis); G00–G01 (Bacterial Meningitis); A87, G02 or G03 (Viral / Other / NOS Meningitis); G40 or G41 (Epilepsy/ Status Epilepticus); H65, H66 or H67 (Otitis Media); I00–I09 (Rheumatic Fever/Heart Disease); K40 (Inguinal Hernia); L00–L08, H00.0, H01.0, J34.0 or L98.0 (Skin Infections); L20–L30 (Dermatitis and Eczema); M86 (Osteomyelitis); N10, N12, N13.6, N30.0, N30.9 or N39.0 (Urinary Tract Infection); R56.0 (Febrile Convulsions).

Injury Admissions with a Social Gradient: Hospital admissions (emergency department cases, neonates <29 days excluded) in children 0–14 years, with a primary diagnosis of injury (ICD-10-AM S00–T79) and an ICD-10-AM primary external cause code in the following range: V01–V09 (Transport: Pedestrian); V10–V19 (Transport: Cyclist); V40–V79 (Transport: Vehicle Occupant); W00–W19 (Falls); W20–W49 (Mechanical Forces: Inanimate); W50–W64 (Mechanical Forces: Animate); W85–X19 (Electricity / Fire / Burns); X40–X49 (Accidental Poisoning); In order to ensure comparability over time, all injury cases with an Emergency Department Specialty Code (M05–M08) on discharge were excluded.

Mortality with a Social Gradient: All deaths in children 0–14 years, (neonates <29 days excluded) with a main underlying cause of death in the ICD-10-AM medical and injury categories outlined above. In addition post-neonatal Sudden Unexpected Deaths in Infancy (SUDI) were included, if the child was aged between 29 days and 1 year and their main underlying cause of death was SUDI (ICD-10-AM R95, R96, R98, R99, W75).

Denominator: NZ Statistics NZ Estimated Resident Population

Indicator Category Proxy B–C

Notes on Interpretation (for further detail see **Appendix 9**)

Note 1: Hospital admissions in neonates (<29 days) were excluded from both indicators, as these admissions are more likely to reflect issues arising prior to / at the time of birth, (e.g. preterm infants may register multiple admissions as they transition from intensive care (NICU), through special care nurseries (SCBU) to the postnatal ward), and respiratory infections / other medical conditions arising in these contexts are likely to differ in their aetiology from those arising in the community.

Note 2: For medical conditions, only acute and arranged admissions have been included, as Waiting List admissions tend to reflect service capacity, rather than actual health need (e.g. inclusion of these admissions would result in a large number of children with otitis media with effusion (OME) and chronic tonsillitis being included (for grommets and tonsillectomies), whose demographic profile is very different from children attending hospital acutely for similar diseases). For injury admissions however, filtering by admission type could not occur, as a number of DHBs admitted injury cases under (now discontinued) ACC admission codes, making it difficult to distinguish between acute and waiting list admissions in this context. As with other injury data in these reports however, all injury cases with an Emergency Department Specialty Code (M05–M08) on discharge were excluded (see **Appendix 3** for rationale).

Note 3: Hospital admissions were considered to have a social gradient if rates for those in the most deprived (NZDep Decile 9–10) areas were ≥1.8 times higher than for those in the least deprived (NZDep Decile 1–2) areas, or where rates for Māori, Pacific or Asian/Indian children were ≥1.8 times higher than for European children. In addition, a small number of conditions were included where rates were ≥1.5 times higher, they demonstrated a consistent social gradient, and the association was biologically plausible.

Note 4: When considering the magnitude of social gradients between medical and injury admissions, it must be remembered that these differences are not strictly comparable, as for technical reasons emergency department cases have been removed from injury admissions (and social differences in attendance at the Emergency Department vs. primary care for minor medical conditions may have accounted for some (but not all) of the social gradients in medical admission seen). No such differential filtering occurred for mortality data however, and thus the magnitude of the social differences seen is more readily comparable.

Note 5: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or *non-significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

Note 6: SUDI rates are traditionally calculated per 1,000 live births. For this analysis rates for those aged 0–14 years have been calculated, so that the relative contribution SUDI makes to mortality in this age group (as compared to other causes of death) is more readily appreciated. As a result, the SUDI rates in this section are not readily comparable to traditional SUDI mortality rates for those <1 year reported elsewhere.

Note 7: The rates presented here may differ from those reported previously due to a change in the codes used to identify gastroenteritis. Prior to 2008, a large proportion of gastroenteritis cases were coded to A09 (diarrhoea and gastroenteritis of presumed infectious origin). From 2008 however, the Ministry of Health (as the result of a move from ICD-10-AM Version 3 to 6) began to map the majority of these cases to K529 (non-infective gastroenteritis and colitis unspecified). As the original CSHM hospital admissions indicator was developed using 2003–2007 data, because K529 only accounted for a minority of cases at that point (n ≈50-60 cases per year), and because the majority of gastroenteritis cases in the paediatric population are presumed to be of infectious origin, the K529 code was not initially included in the CSHM coding algorithms. The coding change however resulted in a large reduction in the number A09 coded cases and a large increase in the number of K529 coded cases after 2008. Thus, in order to preserve time series continuity (even though the clinical appropriateness of such a coding change remains debatable) the current year's analysis includes both the A09 and K529 gastroenteritis codes (with this coding change being extended back to 2000). As a result, the results presented here may differ from those presented previously, with the greatest impact being seen after 2008.

New Zealand Distribution and Trends

New Zealand Distribution by Cause

Hospital Admissions: In New Zealand during 2006–2010, gastroenteritis, bronchiolitis, and asthma made the largest individual contributions to hospitalisations for medical conditions with a social gradient, although infectious and respiratory diseases collectively were responsible for the majority of admissions. Similarly falls, followed by inanimate mechanical forces were the leading causes of injury admissions with a social gradient, although transport injuries as a group also made a significant contribution (**Table 167**).

Table 167. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years (excluding Neonates) by Primary Diagnosis, New Zealand 2006–2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Gastroenteritis	26,610	5,322.0	5.96	14.9
Acute Bronchiolitis	26,228	5,245.6	5.88	14.7
Asthma	24,030	4,806.0	5.38	13.5
Acute Upper Respiratory Infections Excl Croup	18,890	3,778.0	4.23	10.6
Viral Infection of Unspecified Site	17,635	3,527.0	3.95	9.9
Skin Infections	15,198	3,039.6	3.40	8.5
Bacterial/Non-Viral Pneumonia	14,900	2,980.0	3.34	8.4
Urinary Tract Infection	6,647	1,329.4	1.49	3.7
Croup / Laryngitis / Tracheitis / Epiglottitis	5,752	1,150.4	1.29	3.2
Epilepsy / Status Epilepticus	3,982	796.4	0.89	2.2
Febrile Convulsions	3,555	711.0	0.80	2.0
Otitis Media	3,483	696.6	0.78	2.0
Dermatitis and Eczema	3,136	627.2	0.70	1.8
Viral Pneumonia	1,925	385.0	0.43	1.1
Inguinal Hernia	1,427	285.4	0.32	0.8
Osteomyelitis	1,169	233.8	0.26	0.7
Rheumatic Fever/Heart Disease	914	182.8	0.20	0.5
Viral/Other/NOS Meningitis	722	144.4	0.16	0.4
Bronchiectasis	702	140.4	0.16	0.4
Meningococcal Disease	449	89.8	0.10	0.3
Vaccine Preventable Diseases	410	82.0	0.09	0.2
Nutritional Deficiencies / Anaemias	299	59.8	0.07	0.2
Bacterial Meningitis	221	44.2	0.05	0.1
Tuberculosis	59	11.8	0.01	<0.1
New Zealand Total	178,343	35,668.6	40.0	100.0
Injury Admissions				
Falls	24,511	4,902.2	5.49	49.1
Mechanical Forces: Inanimate	12,712	2,542.4	2.85	25.5
Transport: Cyclist	2,926	585.2	0.66	5.9
Mechanical Forces: Animate	2,807	561.4	0.63	5.6
Accidental Poisoning	2,632	526.4	0.59	5.3
Electricity / Fire / Burns	1,959	391.8	0.44	3.9
Transport: Vehicle Occupant	1,179	235.8	0.26	2.4
Transport: Pedestrian	974	194.8	0.22	2.0
Drowning / Submersion	175	35.0	0.04	0.4
New Zealand Total	49,875	9,975.0	11.2	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injury Admissions: Emergency Department cases removed.

Mortality: In New Zealand during 2004–2008, SUDI made the single largest contribution to mortality with a social gradient in children aged 0–14 years. This occurred despite the fact that, by definition, all of these deaths occurred during the first year of life. Vehicle occupant related deaths made the largest contribution to injury related deaths, followed by pedestrian injuries and drowning, while bacterial/non-viral pneumonia was the leading cause of mortality from medical conditions (**Table 168**).

Table 168. Mortality from Conditions with a Social Gradient in Children Aged 0–14 Years (excluding Neonates) by Cause, New Zealand 2004–2008

Diagnosis	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000	% of Total
Medical Conditions				
Bacterial/Non-Viral Pneumonia	49	9.8	1.10	32.5
Epilepsy / Status Epilepticus	19	3.8	0.43	12.6
Meningococcal Disease	18	3.6	0.41	11.9
Viral Pneumonia	14	2.8	0.32	9.3
Bacterial Meningitis	12	2.4	0.27	7.9
Asthma	9	1.8	0.20	6.0
Gastroenteritis	7	1.4	0.16	4.6
Acute Bronchiolitis	5	1.0	0.11	3.3
Acute Upper Respiratory Infections Excl Croup	3	0.6	0.07	2.0
Viral/Other/NOS Meningitis	3	0.6	0.07	2.0
Other Causes	12	2.4	0.27	7.9
Total Medical Conditions	151	30.2	3.40	100.0
Injuries				
Transport: Vehicle Occupant	87	17.4	1.96	36.0
Transport: Pedestrian	46	9.2	1.04	19.0
Drowning / Submersion	44	8.8	0.99	18.2
Electricity / Fire / Burns	21	4.2	0.47	8.7
Transport: Cyclist	12	2.4	0.27	5.0
Mechanical Forces: Inanimate	12	2.4	0.27	5.0
Falls	11	2.2	0.25	4.5
Accidental Poisoning	7	1.4	0.16	2.9
Other Causes	<3	s	s	s
Total Injuries	242	48.4	5.45	100.0
Post Neonatal SUDI				
SUDI (Infant)	266	53.2	5.99	100.0
New Zealand	659	131.8	14.8	100.0

Source: Numerator: National Mortality Collection (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: SUDI death numerators are for infants aged 29–364 days only; s: suppressed due to small numbers.

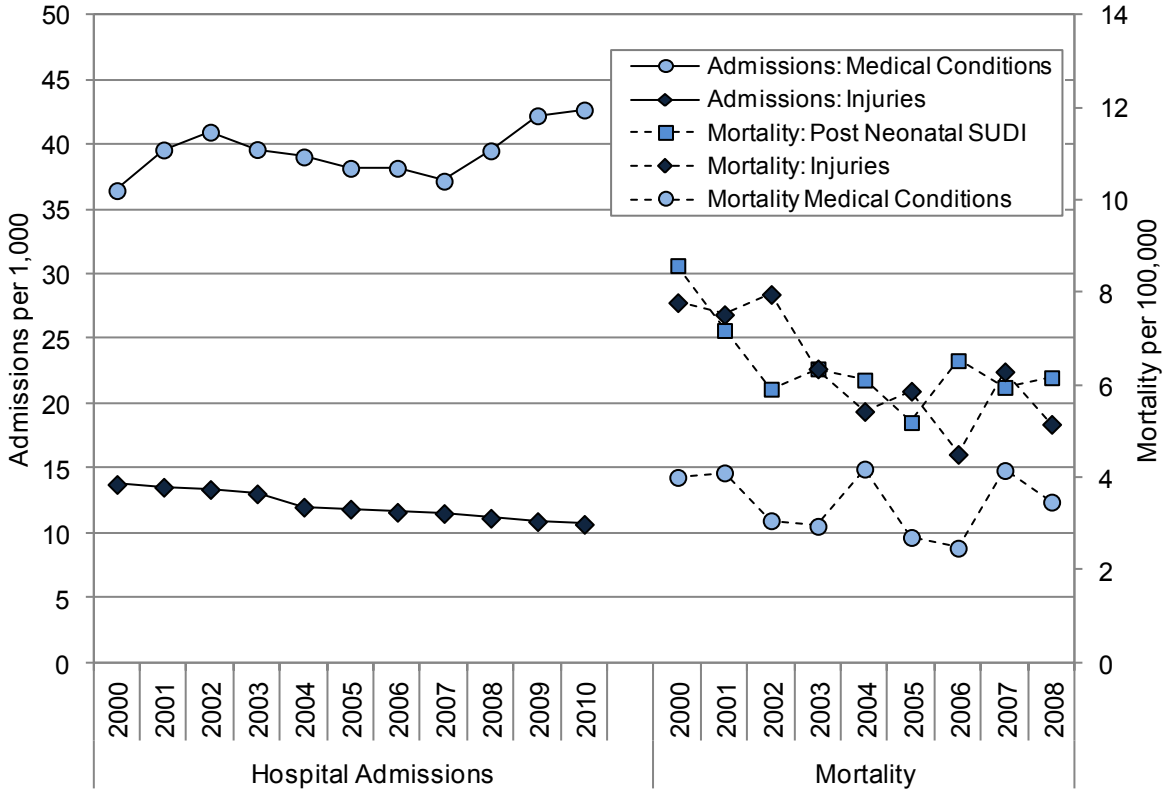
New Zealand Trends

Hospital Admissions: In New Zealand, medical admissions with a social gradient increased during the early 2000s, reached peak in 2002 and then declined, with an upswing in rates again being evident during 2007–2009. In contrast, injury admissions with a social gradient declined throughout 2000–2010 (**Figure 168**).

Mortality: In New Zealand, injury mortality with a social gradient decreased between 2000 and 2004, but fluctuated thereafter. Similarly, post-neonatal SUDI decreased between

2000 and 2002 and thereafter remained relatively static, while mortality from medical conditions with a social gradient fluctuated throughout 2000–2008 (**Figure 168**).

Figure 168. Hospital Admissions (2000–2010) and Mortality (2000–2008) from Conditions with a Social Gradient in New Zealand Children Aged 0–14 Years (excluding Neonates)



Source: Numerator Admissions: National Minimum Dataset (Neonates removed); Numerator Mortality: National Mortality Collection (Neonates Removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions Admissions: Acute and Arranged Admissions only; Injury Admissions: Emergency Department Cases removed.

New Zealand Trends by Ethnicity

Hospital Admissions for Medical Conditions: In New Zealand during 2000–2010, hospitalisations for medical conditions with a social gradient were consistently higher for Pacific > Māori > European and Asian/Indian children. For Pacific children, admissions increased during the early 2000s, reached a peak in 2003 and then declined. An upswing in rates was again evident during 2007–2009, with rates then declining during 2010. For Māori children, rates were static during the mid 2000s, but then increased between 2007 and 2009, while for Asian/Indian and European children rates were static during the mid-2000s but increased after 2007 (**Figure 169**).

Hospital Admissions for Injuries: In New Zealand during 2000–2010, injury admissions with a social gradient were also higher for Pacific and Māori > European >Asian/Indian children. Admission rates for European and Māori children declined during 2000–2010, while rates for Pacific and Asian/Indian children were more static, with ethnic differences being greater in 2010 than they were in 2000. While in absolute terms, the magnitude the ethnic differences seen appeared to be less marked than for medical conditions, for technical reasons, comparisons between these categories is not strictly possible (see Note 4 in Methods section) (**Figure 169**).

Mortality: In New Zealand during 2000–2008, SUDI mortality was consistently higher for Māori > Pacific > European and Asian/Indian infants, while mortality from medical conditions with a social gradient was generally higher for Māori and Pacific > European and Asian/Indian children. Mortality from injuries with a social gradient was also consistently higher for Māori than for European and Asian/Indian children while rates for Pacific children were more variable (**Figure 170**)

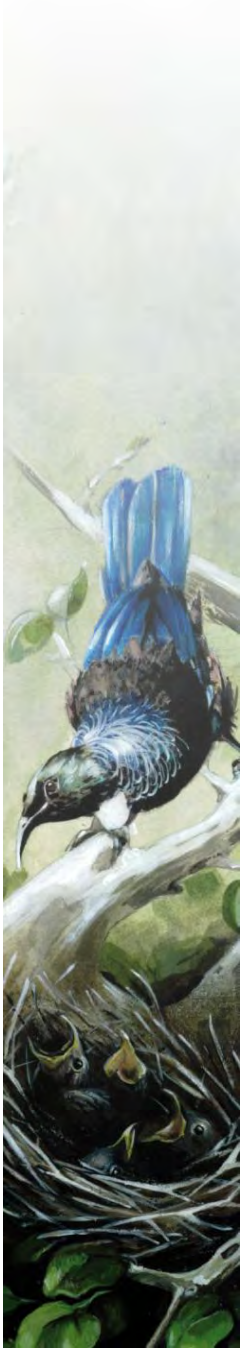
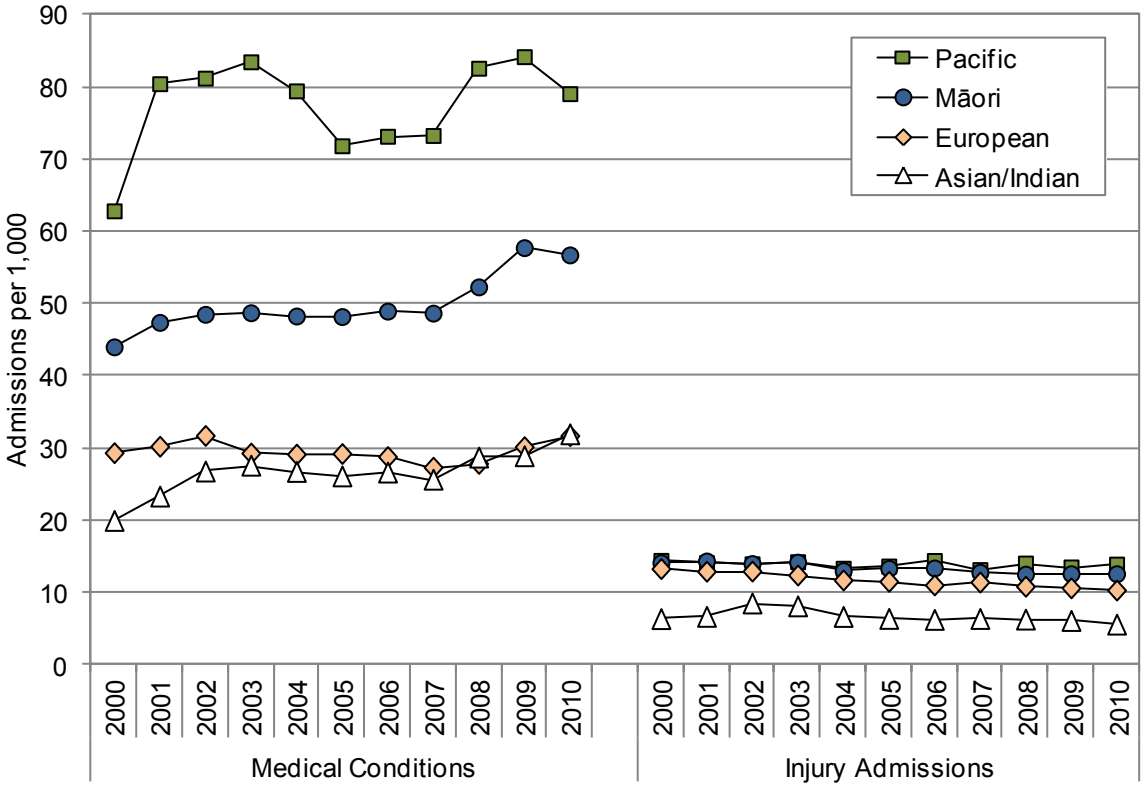
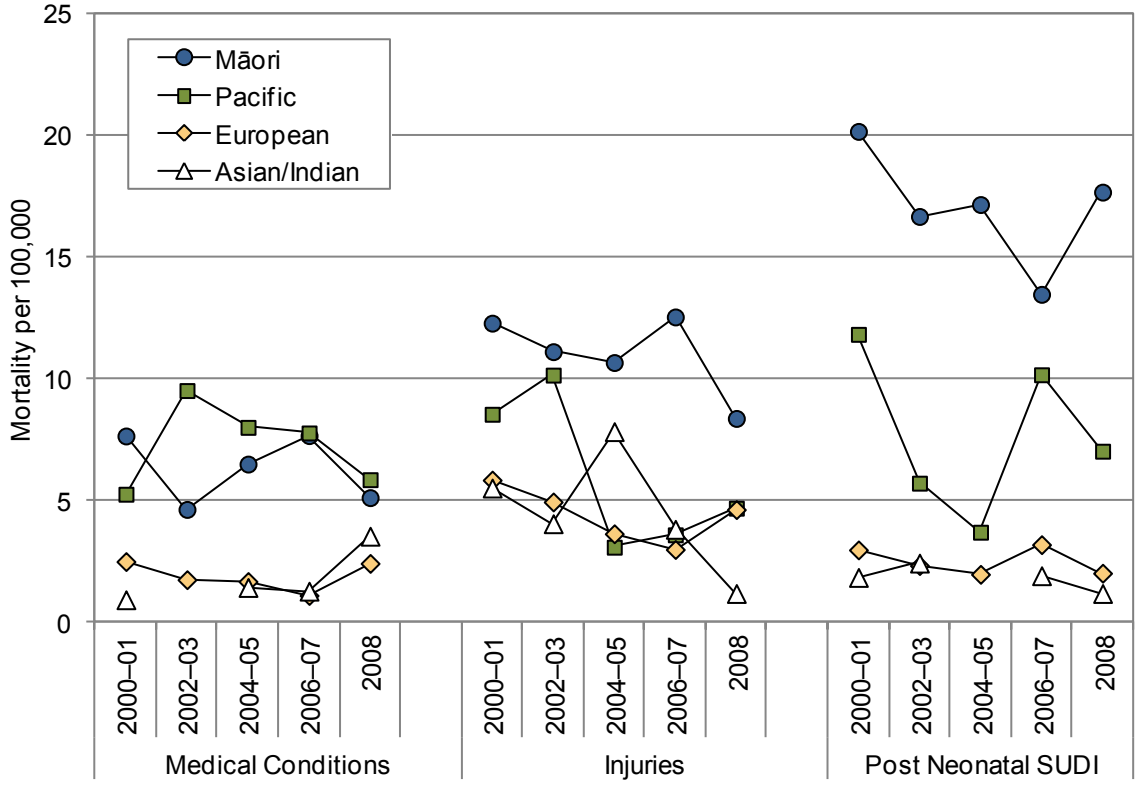


Figure 169. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injury Admissions: Emergency Department Cases removed. Ethnicity is Level 1 Prioritised.

Figure 170. Mortality from Conditions with a Social Gradient in Children Aged 0–14 Years (excluding Neonates) by Ethnicity, New Zealand 2000–2008



Source: Numerator: National Mortality Collection (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: SUDI deaths are for infants aged 29–364 days only. Ethnicity is Level 1 Prioritised.

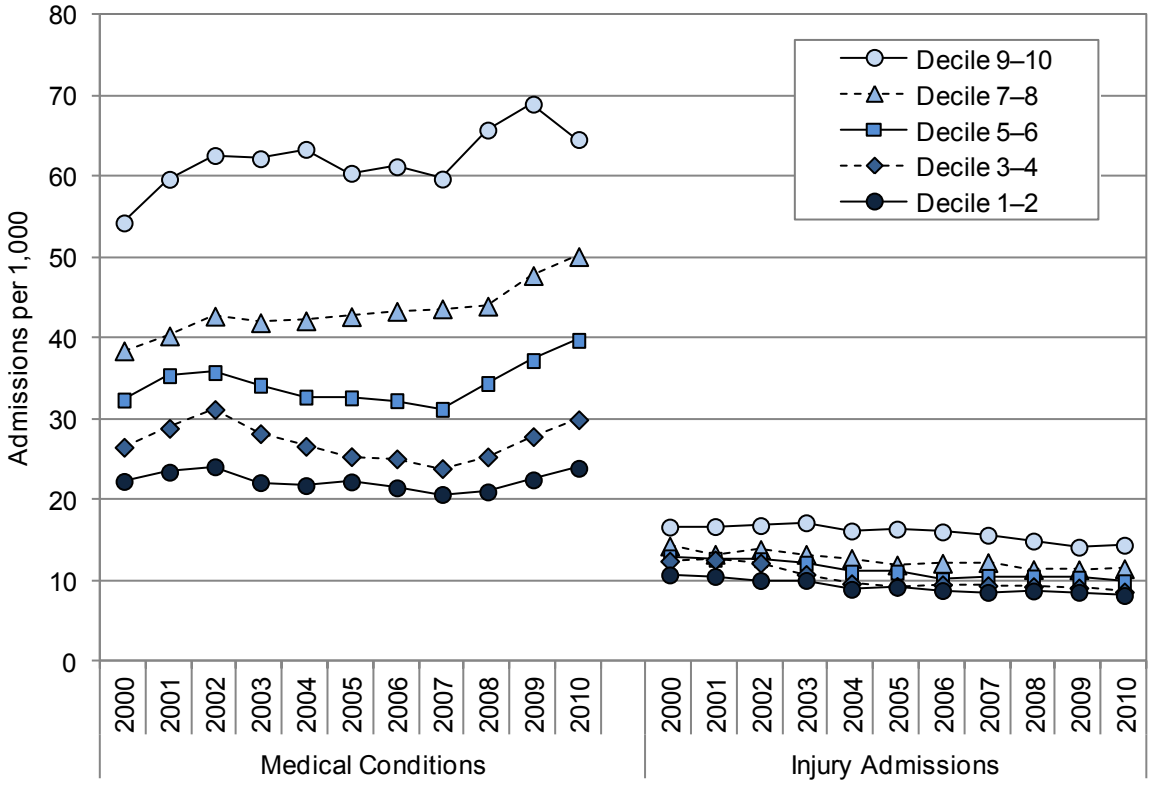
New Zealand Trends by NZDep Decile

Hospital Admissions for Medical Conditions: In New Zealand during 2000–2010, hospital admissions for medical conditions with a social gradient were consistently higher for those living in Decile 9–10 > Decile 7–8 > Decile 5–6 > Decile 3–4 > Decile 1–2 areas. While admissions for those in Decile 1–7 areas increased during 2008–2010, admissions for those in Decile 9–10 areas declined after 2009.

Hospital Admissions for Injuries: In New Zealand during 2000–2010, injury admissions with a social gradient were also consistently higher for those living in Decile 9–10 > Decile 7–8 > Decile 5–6 > Decile 3–4 > Decile 1–2 areas, although rates gradually declined for all socioeconomic groups during this period. While in absolute terms the socioeconomic differences seen were less marked than for medical conditions, for technical reasons comparisons between these admission categories is not strictly possible (see Note 4 in Methods section) (**Figure 171**).

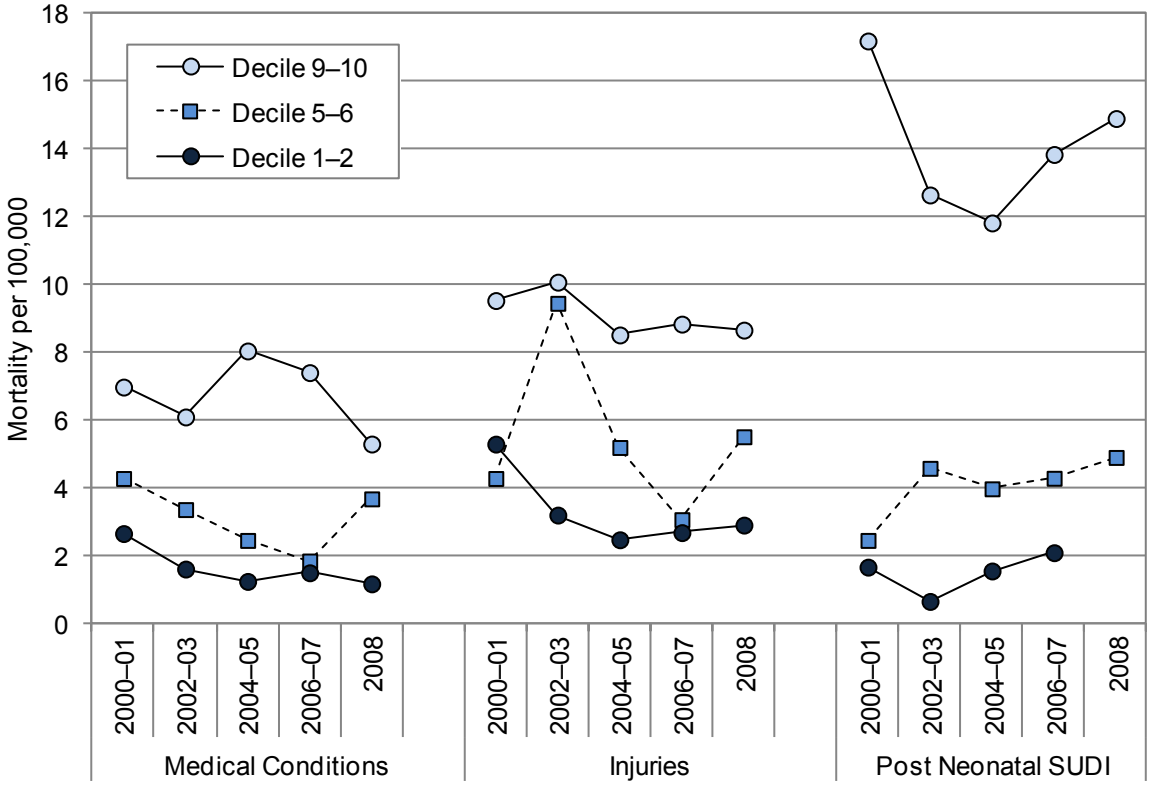
Mortality: In New Zealand during 2000–2008, medical conditions and injuries with a social gradient, and post neonatal SUDI were all consistently higher for those in the most deprived (Decile 9–10) areas than for those in the least deprived (Decile 1–2) areas, with the greatest absolute differences being evident for post neonatal SUDI (**Figure 172**).

Figure 171. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by NZ Deprivation Index Decile, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injury Admissions: Emergency Department Cases removed.

Figure 172. Mortality from Conditions with a Social Gradient in Children Aged 0−14 Years (excluding Neonates) by NZ Deprivation Index Decile, New Zealand 2000−2008



Source: Numerator: National Mortality Collection (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: SUDI deaths are for infants aged 29–364 days only.

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

Hospital Admission for Medical Conditions: In New Zealand during 2006–2010, hospital admissions for medical conditions with a social gradient were *significantly* higher for Pacific > Māori > European and Asian/Indian children, males and those in average-to-more deprived (NZDep decile 3–10) areas (**Table 169**).

Hospital Admission for Injuries: Similarly during 2006–2010, hospital admissions for injury admissions with a social gradient were *significantly* higher for Pacific > Māori > European >Asian/Indian children, males and those in average-to-more deprived (NZDep decile 4–10) areas. While the magnitude of these social differences appeared smaller for injury admissions, it must be remembered that that for technical reasons (See Note 4 in Methods Section) these categories are not strictly comparable (**Table 169**).

Mortality: In New Zealand during 2004–2008, mortality from medical conditions with a social gradient was *significantly* higher for Pacific and Māori > European and Asian/Indian children and those in more deprived (Decile 7–10) areas. Similarly mortality from injuries with a social gradient was *significantly* higher for Māori > Asian, Pacific and European children, males and those in more deprived (Deciles 3–4 and 7–10) areas (**Table 170**). Differences in SUDI mortality are considered in the Infant Mortality section.

Table 169. Risk Factors for Hospital Admissions with a Social Gradient in Children Aged 0–14 Years, New Zealand 2006–2010

Medical Conditions							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	22.2	1.00		Decile 1–2	21.9	1.00	
Decile 2	21.6	0.97	0.95–1.00	Decile 3–4	26.4	1.21	1.18–1.23
Decile 3	25.1	1.13	1.10–1.16	Decile 5–6	34.9	1.60	1.57–1.63
Decile 4	27.5	1.24	1.21–1.28	Decile 7–8	45.7	2.09	2.05–2.12
Decile 5	32.6	1.47	1.43–1.51	Decile 9–10	64.0	2.92	2.88–2.97
Decile 6	36.9	1.66	1.62–1.71	Ethnicity			
Decile 7	41.3	1.86	1.82–1.91	Asian/Indian	28.4	0.98	0.96–1.00
Decile 8	49.5	2.23	2.18–2.29	European	29.1	1.00	
Decile 9	59.4	2.68	2.62–2.74	Māori	52.8	1.82	1.80–1.84
Decile 10	67.9	3.06	3.00–3.13	Pacific	78.4	2.70	2.67–2.73
Gender							
Female	36.0	1.00		Male	43.8	1.22	1.21–1.23
Injuries							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	8.7	1.00		Decile 1–2	8.5	1.00	
Decile 2	8.3	0.94	0.90–0.99	Decile 3–4	9.1	1.07	1.04–1.11
Decile 3	8.9	1.01	0.97–1.06	Decile 5–6	10.2	1.20	1.16–1.24
Decile 4	9.4	1.07	1.02–1.12	Decile 7–8	11.7	1.37	1.33–1.41
Decile 5	10.2	1.17	1.12–1.22	Decile 9–10	15.0	1.76	1.71–1.81
Decile 6	10.2	1.17	1.12–1.22	Ethnicity			
Decile 7	11.1	1.27	1.22–1.33	Asian/Indian	6.0	0.56	0.54–0.58
Decile 8	12.2	1.39	1.34–1.45	European	10.7	1.00	
Decile 9	14.9	1.70	1.64–1.77	Māori	12.7	1.18	1.15–1.20
Decile 10	15.1	1.72	1.66–1.79	Pacific	13.7	1.28	1.24–1.31
Gender							
Female	8.9	1.00		Male	13.3	1.49	1.47–1.52

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injury Admissions: Emergency Department Cases removed; Rates are per 1,000; Rate Ratios are unadjusted; Ethnicity is Level 1 Prioritised.

Table 170. Risk Factors for Mortality with a Social Gradient in Children Aged 0–14 Years, New Zealand 2004–2008

Medical Conditions							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				Prioritised Ethnicity			
Decile 1–2	1.32	1.00		Asian/Indian	1.83	1.15	0.52–2.57
Decile 3–4	1.57	1.20	0.54–2.67	European	1.59	1.00	
Decile 5–6	2.44	1.85	0.89–3.87	Māori	6.69	4.22	2.86–6.21
Decile 7–8	3.30	2.51	1.26–5.00	Pacific	7.47	4.71	2.95–7.53
Decile 9–10	7.23	5.49	2.92–10.34	Gender			
				Female	2.86	1.00	
				Male	3.91	1.37	0.99–1.89
Injuries							
Variable	Rate	RR	95% CI	Variable	Rate	RR	95% CI
NZ Deprivation Index Decile				Prioritised Ethnicity			
Decile 1–2	2.63	1.00		Asian/Indian	4.70	1.32	0.79–2.19
Decile 3–4	4.85	1.84	1.09–3.10	European	3.57	1.00	
Decile 5–6	4.40	1.67	0.98–2.84	Māori	10.96	3.07	2.33–4.04
Decile 7–8	5.28	2.00	1.21–3.32	Pacific	3.61	1.01	0.59–1.75
Decile 9–10	8.66	3.29	2.06–5.24	Gender			
				Female	4.34	1.00	
				Male	6.51	1.50	1.16–1.94
SUDI: See Infant Mortality Section							

Source: Numerator: National Mortality Collection; Denominator Statistics NZ Estimated Resident Population. Note: Rates are per 100,000; Rate Ratios are unadjusted; Ethnicity is Level 1 Prioritised.

Midland Region Distribution and Trends

Table 171. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years, Midland DHBs vs. New Zealand 2006–2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Medical Conditions					
Waikato	11,531	2,306	29.4	0.74	0.72–0.75
Lakes	6,222	1,244	52.0	1.30	1.27–1.33
Bay of Plenty	11,252	2,250	50.6	1.27	1.24–1.29
Tairawhiti	3,252	650	56.2	1.41	1.36–1.45
Taranaki	3,368	674	30.1	0.75	0.73–0.78
New Zealand	178,343	35,669	40.0	1.00	
Injury Admissions					
Waikato	3,774	755	9.61	0.86	0.83–0.89
Lakes	1,372	274	11.5	1.03	0.97–1.08
Bay of Plenty	2,894	579	13.0	1.16	1.12–1.21
Tairawhiti	939	188	16.2	1.45	1.36–1.55
Taranaki	1,024	205	9.16	0.82	0.77–0.87
New Zealand	49,875	9,975	11.2	1.00	

Source: Numerator National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and arranged only; Injury Admissions: Emergency Department Cases removed.

Table 172. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Primary Diagnosis, Waikato 2006–2010

Primary Diagnosis	Waikato			
	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Acute Bronchiolitis	2,185	437.0	5.56	18.9
Gastroenteritis	1,726	345.2	4.40	15.0
Acute Upper Respiratory Infections Excl Croup	1,381	276.2	3.52	12.0
Asthma	1,299	259.8	3.31	11.3
Skin Infections	1,018	203.6	2.59	8.8
Viral Infection of Unspecified Site	801	160.2	2.04	6.9
Bacterial/Non-Viral Pneumonia	733	146.6	1.87	6.4
Urinary Tract Infection	417	83.4	1.06	3.6
Otitis Media	368	73.6	0.94	3.2
Croup / Laryngitis / Tracheitis / Epiglottitis	303	60.6	0.77	2.6
Epilepsy / Status Epilepticus	298	59.6	0.76	2.6
Febrile Convulsions	212	42.4	0.54	1.8
Dermatitis and Eczema	157	31.4	0.40	1.4
Inguinal Hernia	138	27.6	0.35	1.2
Viral Pneumonia	116	23.2	0.30	1.0
Osteomyelitis	87	17.4	0.22	0.8
Rheumatic Fever/Heart Disease	71	14.2	0.18	0.6
Viral/Other/NOS Meningitis	55	11.0	0.14	0.5
Bronchiectasis	50	10.0	0.13	0.4
Meningococcal Disease	32	6.4	0.08	0.3
Vaccine Preventable Diseases	30	6.0	0.08	0.3
Nutritional Deficiencies / Anaemias	29	5.8	0.07	0.3
Bacterial Meningitis	25	5.0	0.06	0.2
Waikato Total	11,531	2,306.2	29.4	100.0
Injury Admissions				
Falls	1,840	368.0	4.69	48.8
Mechanical Forces: Inanimate	926	185.2	2.36	24.5
Transport: Cyclist	286	57.2	0.73	7.6
Mechanical Forces: Animate	211	42.2	0.54	5.6
Electricity / Fire / Burns	166	33.2	0.42	4.4
Transport: Vehicle Occupant	114	22.8	0.29	3.0
Accidental Poisoning	114	22.8	0.29	3.0
Transport: Pedestrian	104	20.8	0.26	2.8
Drowning / Submersion	13	2.6	0.03	0.3
Waikato Total	3,774	754.8	9.61	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injuries: Emergency Department Cases removed.

Table 173. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Primary Diagnosis, Bay of Plenty 2006–2010

Primary Diagnosis	Bay of Plenty			
	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Gastroenteritis	1,753	350.6	7.88	15.6
Acute Bronchiolitis	1,745	349.0	7.85	15.5
Asthma	1,503	300.6	6.76	13.4
Acute Upper Respiratory Infections Excl Croup	1,498	299.6	6.74	13.3
Viral Infection of Unspecified Site	979	195.8	4.40	8.7
Skin Infections	886	177.2	3.99	7.9
Bacterial/Non-Viral Pneumonia	786	157.2	3.54	7.0
Otitis Media	353	70.6	1.59	3.1
Croup / Laryngitis / Tracheitis / Epiglottitis	329	65.8	1.48	2.9
Urinary Tract Infection	316	63.2	1.42	2.8
Dermatitis and Eczema	265	53.0	1.19	2.4
Epilepsy / Status Epilepticus	230	46.0	1.03	2.0
Inguinal Hernia	103	20.6	0.46	0.9
Osteomyelitis	98	19.6	0.44	0.9
Febrile Convulsions	98	19.6	0.44	0.9
Rheumatic Fever/Heart Disease	84	16.8	0.38	0.7
Viral Pneumonia	74	14.8	0.33	0.7
Vaccine Preventable Diseases	35	7.0	0.16	0.3
Viral/Other/NOS Meningitis	33	6.6	0.15	0.3
Bronchiectasis	26	5.2	0.12	0.2
Meningococcal Disease	24	4.8	0.11	0.2
Nutritional Deficiencies / Anaemias	19	3.8	0.09	0.2
Bacterial Meningitis	13	2.6	0.06	0.1
Tuberculosis	<3	s	s	s
Bay of Plenty Total	11,252	2,250.4	50.6	100.0
Injury Admissions				
Falls	1,461	292.2	6.57	50.5
Mechanical Forces: Inanimate	529	105.8	2.38	18.3
Transport: Cyclist	217	43.4	0.98	7.5
Accidental Poisoning	199	39.8	0.90	6.9
Mechanical Forces: Animate	183	36.6	0.82	6.3
Transport: Vehicle Occupant	111	22.2	0.50	3.8
Electricity / Fire / Burns	111	22.2	0.50	3.8
Transport: Pedestrian	62	12.4	0.28	2.1
Drowning / Submersion	21	4.2	0.09	0.7
Bay of Plenty Total	2,894	578.8	13.0	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injuries: Emergency Department Cases removed; s: suppressed due to small numbers.

Table 174. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Primary Diagnosis, Lakes DHB 2006–2010

Primary Diagnosis	Lakes DHB			
	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Acute Bronchiolitis	1,024	204.8	8.56	16.5
Asthma	896	179.2	7.49	14.4
Gastroenteritis	732	146.4	6.12	11.8
Acute Upper Respiratory Infections Excl Croup	723	144.6	6.04	11.6
Viral Infection of Unspecified Site	565	113.0	4.72	9.1
Skin Infections	515	103.0	4.30	8.3
Bacterial/Non-Viral Pneumonia	503	100.6	4.20	8.1
Urinary Tract Infection	213	42.6	1.78	3.4
Epilepsy / Status Epilepticus	177	35.4	1.48	2.8
Croup / Laryngitis / Tracheitis / Epiglottitis	164	32.8	1.37	2.6
Otitis Media	144	28.8	1.20	2.3
Dermatitis and Eczema	119	23.8	0.99	1.9
Viral Pneumonia	97	19.4	0.81	1.6
Febrile Convulsions	94	18.8	0.79	1.5
Bronchiectasis	60	12.0	0.50	1.0
Inguinal Hernia	58	11.6	0.48	0.9
Osteomyelitis	36	7.2	0.30	0.6
Rheumatic Fever/Heart Disease	31	6.2	0.26	0.5
Viral/Other/NOS Meningitis	25	5.0	0.21	0.4
Vaccine Preventable Diseases	21	4.2	0.18	0.3
Meningococcal Disease	13	2.6	0.11	0.2
Bacterial Meningitis	7	1.4	0.06	0.1
Nutritional Deficiencies / Anaemias	4	0.8	0.03	0.1
Tuberculosis	<3	s	s	s
Lakes DHB Total	6,222	1,244.4	52.0	100.0
Injury Admissions				
Falls	696	139.2	5.82	50.7
Mechanical Forces: Inanimate	272	54.4	2.27	19.8
Transport: Cyclist	110	22.0	0.92	8.0
Accidental Poisoning	82	16.4	0.69	6.0
Mechanical Forces: Animate	76	15.2	0.64	5.5
Electricity / Fire / Burns	65	13.0	0.54	4.7
Transport: Vehicle Occupant	33	6.6	0.28	2.4
Transport: Pedestrian	31	6.2	0.26	2.3
Drowning / Submersion	7	1.4	0.06	0.5
Lakes DHB Total	1,372	274.4	11.5	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injuries: Emergency Department Cases removed; s: suppressed due to small numbers.

Table 175. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Primary Diagnosis, Tairawhiti 2006–2010

Primary Diagnosis	Tairawhiti			
	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Acute Bronchiolitis	527	105.4	9.10	16.2
Acute Upper Respiratory Infections Excl Croup	452	90.4	7.81	13.9
Gastroenteritis	422	84.4	7.29	13.0
Asthma	400	80.0	6.91	12.3
Skin Infections	299	59.8	5.16	9.2
Bacterial/Non-Viral Pneumonia	294	58.8	5.08	9.0
Viral Infection of Unspecified Site	290	58.0	5.01	8.9
Croup / Laryngitis / Tracheitis / Epiglottitis	145	29.0	2.50	4.5
Dermatitis and Eczema	88	17.6	1.52	2.7
Otitis Media	72	14.4	1.24	2.2
Urinary Tract Infection	66	13.2	1.14	2.0
Febrile Convulsions	39	7.8	0.67	1.2
Epilepsy / Status Epilepticus	38	7.6	0.66	1.2
Inguinal Hernia	31	6.2	0.54	1.0
Osteomyelitis	22	4.4	0.38	0.7
Rheumatic Fever/Heart Disease	18	3.6	0.31	0.6
Meningococcal Disease	13	2.6	0.22	0.4
Viral/Other/NOS Meningitis	9	1.8	0.16	0.3
Vaccine Preventable Diseases	8	1.6	0.14	0.2
Nutritional Deficiencies / Anaemias	6	1.2	0.10	0.2
Bacterial Meningitis	5	1.0	0.09	0.2
Bronchiectasis	4	0.8	0.07	0.1
Viral Pneumonia	3	0.6	0.05	0.1
Tuberculosis	<3	s	s	s
Tairawhiti Total	3,252	650.4	56.2	100.0
Injury Admissions				
Falls	458	91.6	7.91	48.8
Mechanical Forces: Inanimate	207	41.4	3.58	22.0
Transport: Cyclist	76	15.2	1.31	8.1
Mechanical Forces: Animate	71	14.2	1.23	7.6
Accidental Poisoning	38	7.6	0.66	4.0
Electricity / Fire / Burns	33	6.6	0.57	3.5
Transport: Pedestrian	27	5.4	0.47	2.9
Transport: Vehicle Occupant	27	5.4	0.47	2.9
Drowning / Submersion	<3	s	s	s
Tairawhiti Total	939	187.8	16.2	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injuries: Emergency Department Cases removed; s: suppressed due to small numbers.

Table 176. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0−14 Years by Primary Diagnosis, Taranaki 2006–2010

Primary Diagnosis	Taranaki			
	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	% of Total
Medical Conditions				
Asthma	583	116.6	5.21	17.3
Gastroenteritis	504	100.8	4.51	15.0
Acute Bronchiolitis	470	94.0	4.20	14.0
Bacterial/Non-Viral Pneumonia	313	62.6	2.80	9.3
Acute Upper Respiratory Infections Excl Croup	296	59.2	2.65	8.8
Viral Infection of Unspecified Site	260	52.0	2.32	7.7
Skin Infections	242	48.4	2.16	7.2
Croup / Laryngitis / Tracheitis / Epiglottitis	144	28.8	1.29	4.3
Epilepsy / Status Epilepticus	117	23.4	1.05	3.5
Urinary Tract Infection	115	23.0	1.03	3.4
Dermatitis and Eczema	99	19.8	0.89	2.9
Otitis Media	57	11.4	0.51	1.7
Febrile Convulsions	51	10.2	0.46	1.5
Inguinal Hernia	32	6.4	0.29	1.0
Osteomyelitis	20	4.0	0.18	0.6
Viral Pneumonia	18	3.6	0.16	0.5
Meningococcal Disease	11	2.2	0.10	0.3
Rheumatic Fever/Heart Disease	9	1.8	0.08	0.3
Bronchiectasis	9	1.8	0.08	0.3
Viral/Other/NOS Meningitis	7	1.4	0.06	0.2
Bacterial Meningitis	4	0.8	0.04	0.1
Nutritional Deficiencies / Anaemias	4	0.8	0.04	0.1
Vaccine Preventable Diseases	3	0.6	0.03	0.1
Taranaki Total	3,368	673.6	30.1	100.0
Injury Admissions				
Falls	536	107.2	4.79	52.3
Mechanical Forces: Inanimate	202	40.4	1.81	19.7
Transport: Cyclist	69	13.8	0.62	6.7
Mechanical Forces: Animate	59	11.8	0.53	5.8
Electricity / Fire / Burns	58	11.6	0.52	5.7
Accidental Poisoning	53	10.6	0.47	5.2
Transport: Vehicle Occupant	26	5.2	0.23	2.5
Transport: Pedestrian	16	3.2	0.14	1.6
Drowning / Submersion	5	1.0	0.04	0.5
Taranaki Total	1,024	204.8	9.16	100.0

Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and Arranged Admissions only; Injuries: Emergency Department Cases removed.

Midland DHBs vs. New Zealand

Hospital Admissions: In the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for medical conditions and injuries with a social gradient were *significantly* higher than the New Zealand rate, while admissions in the Waikato and Taranaki were *significantly* lower. In Lakes, while admissions for medical conditions with a social gradient were *significantly* higher than the New Zealand rate, admissions for injuries were similar (**Table 171**).

Midland Region Distribution by Cause

Hospital Admissions: In the Midland Region during 2006–2010, asthma, bronchiolitis, gastroenteritis and acute upper respiratory infections made the largest individual contributions to hospitalisations for medical conditions with a social gradient, with infectious and respiratory diseases collectively being responsible for the majority of medical admissions. Falls, followed by inanimate mechanical forces were the leading causes of injuries with a social gradient in all five DHBs, although transport injuries as a group also made a significant contribution (**Table 172** to **Table 176**).

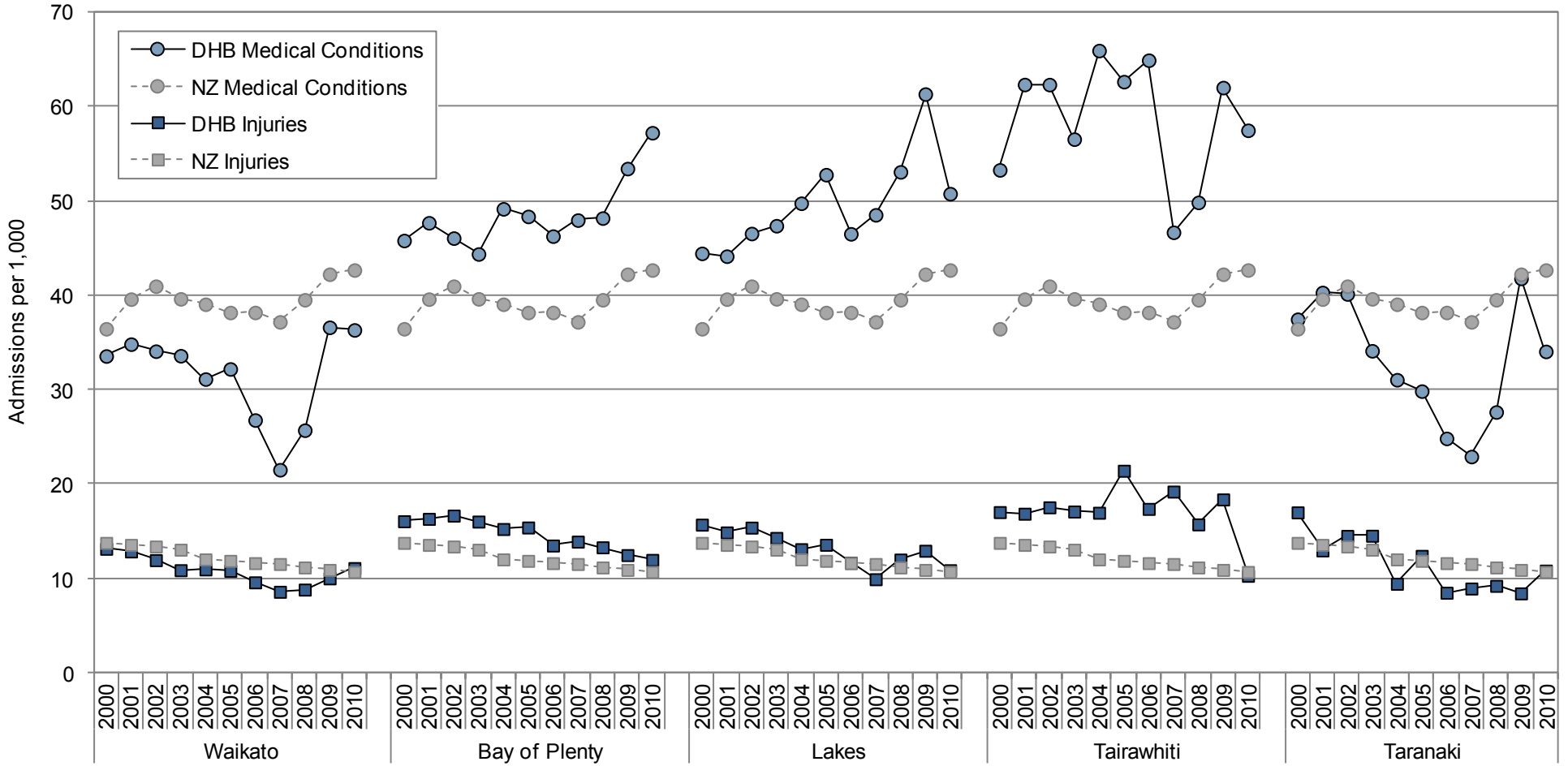
Mortality: During 2004–2008, a small number of children each year died from medical conditions or injuries with a social gradient, or from SUDI, in each of the Midland Region's DHBs (**Table 177**).

Table 177. Mortality from Conditions with a Social Gradient in Children Aged 0–14 Years (excluding Neonates) by Cause, Midland DHBs 2004–2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000
Waikato			
Medical Conditions	16	3.2	4.06
Injuries	26	5.2	6.60
SUDI (Infant)	30	6.0	7.61
Waikato Total	72	14.4	18.3
Lakes DHB			
Medical Conditions	<3	s	s
Injuries	8	1.6	6.58
SUDI (Infant)	13	2.6	10.7
Lakes DHB Total	23	4.6	18.9
Bay of Plenty			
Medical Conditions	11	2.2	4.96
Injuries	22	4.4	9.92
SUDI (Infant)	13	2.6	5.86
Bay of Plenty Total	46	9.2	20.7
Tairawhiti			
Medical Conditions	<3	s	s
Injuries	6	1.2	10.1
SUDI (Infant)	7	1.4	11.8
Tairawhiti Total	15	3.0	25.3
Taranaki			
Medical Conditions	7	1.4	6.06
Injuries	3	0.6	2.60
SUDI (Infant)	8	1.6	6.92
Taranaki Total	18	3.6	15.6

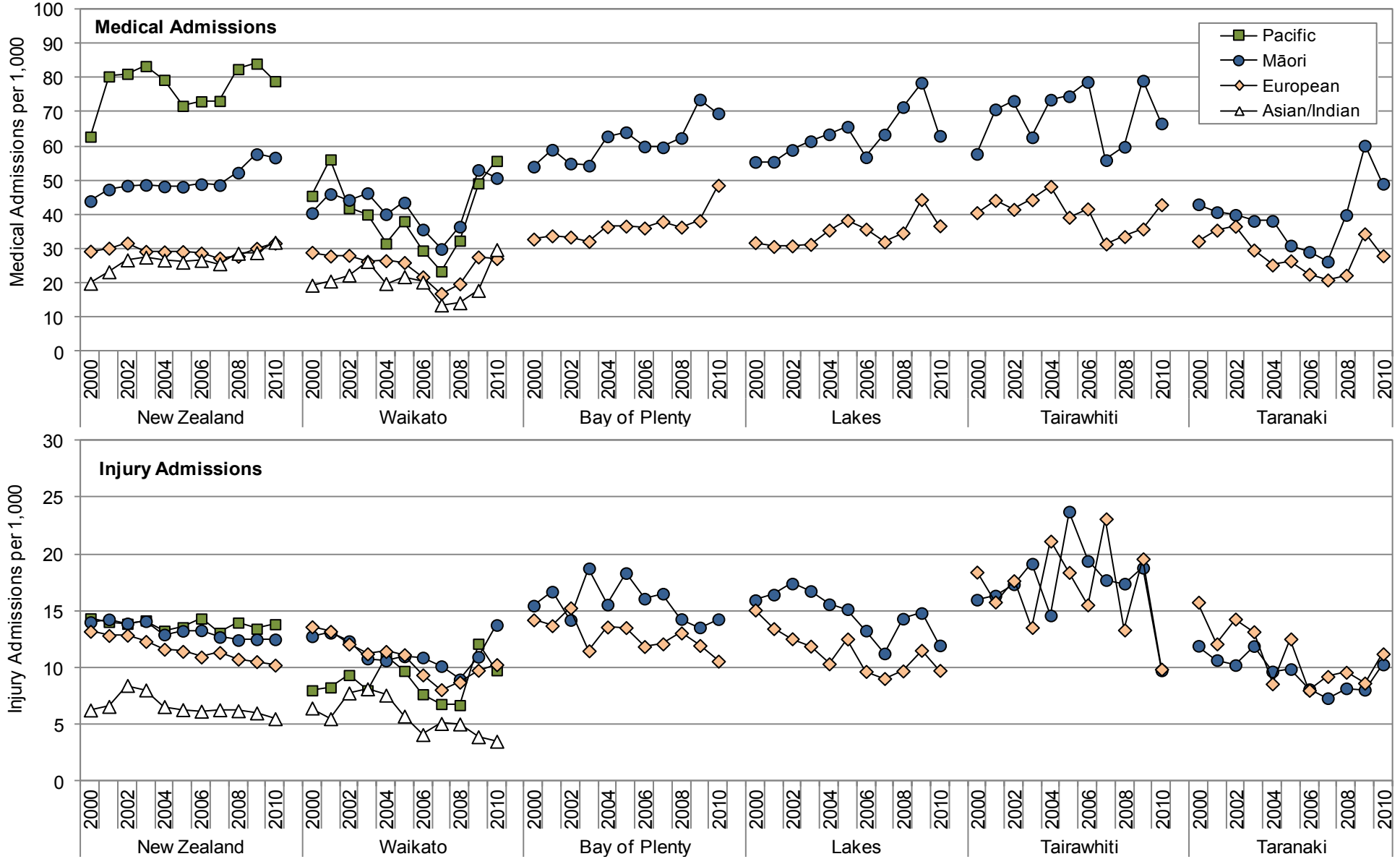
Source: Numerator: National Mortality Collection; Denominator Statistics NZ Estimated Resident Population.
Note: s: suppressed due to small numbers.

Figure 173. Hospital Admissions for Conditions with a Social Gradient in Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Conditions: Acute and arranged only; Injury Admissions: Emergency Department Cases removed.

Figure 174. Hospital Admissions for Medical Conditions and Injuries with a Social Gradient in Children Aged 0–14 Years by Ethnicity, Midland DHBs vs. New Zealand 2000–2010



Source: Numerator: National Minimum Dataset (Neonates removed); Denominator: Statistics NZ Estimated Resident Population. Note: Medical Admissions: Acute and arranged admissions only; Injury Admissions: Emergency Department Cases removed; Ethnicity is Level 1 Prioritised

Midland Region Trends
In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for medical conditions with a social gradient increased, while in the Waikato and Taranaki, admissions declined during the mid-2000s, reached a nadir and then increased again. Rates in Tairawhiti fluctuated from year to year. In contrast, injury admissions with a social gradient exhibited a general downward trend in all five DHBs (**Figure 173**).

Midland Region Trends by Ethnicity
Hospital Admissions for Medical Conditions: In the Waikato during 2000–2010, hospital admissions for medical conditions with a social gradient were generally higher for Pacific and Māori > European and Asian/Indian children, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European children (**Figure 174**).

Hospital Admissions for Injuries: In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for injuries with a social gradient were generally higher Māori than for European children. In the Waikato, Tairawhiti and Taranaki ethnic differences were less evident, although rates were lower for Waikato Asian/Indian children than for other ethnic groups (**Figure 174**).

Summary

In New Zealand during 2006–2010, gastroenteritis, bronchiolitis, and asthma made the largest individual contributions to hospitalisations for medical conditions with a social gradient, although infectious and respiratory diseases collectively were responsible for the majority of admissions. Falls, followed by inanimate mechanical forces were the leading causes of injury admissions with a social gradient, although transport injuries as a group also made a significant contribution. Similarly, during 2004–2008 SUDI made the single largest contribution to mortality with a social gradient. Vehicle occupant related deaths, followed by pedestrian injuries and drowning, made the largest contribution to injury related deaths, while bacterial/non-viral pneumonia was the leading cause of mortality from medical conditions.

Medical admissions with a social gradient increased during the early 2000s, reached peak in 2002 and then declined, with an upswing in rates being evident during 2007–2009. In contrast, injury admissions with a social gradient declined throughout 2000–2010. During this period, hospitalisations for medical conditions with a social gradient were higher for Pacific > Māori > European and Asian/Indian children. For Pacific children, admissions increased during the early 2000s, reached a peak in 2003 and then declined. An upswing in rates was again evident during 2007–2009, with rates then declining during 2010. For Māori children, rates were static during the mid 2000s, but then increased during 2007–2009, while for Asian/Indian and European children rates were static during the mid-2000s but increased after 2007. Injury admissions with a social gradient were also higher for Pacific and Māori > European >Asian/Indian children. Admission rates for European and Māori children declined during 2000–2010, while rates for Pacific and Asian/Indian children were more static, with ethnic differences being greater in 2010 than they were in 2000.

In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for medical conditions with a social gradient increased, while in the Waikato and Taranaki, admissions declined during the mid-2000s, reached a nadir and then increased again. Rates in Tairawhiti fluctuated from year to year. In contrast, injury admissions with a social gradient exhibited a general downward trend in all five DHB. In the Waikato, hospital admissions for medical conditions were generally higher for Pacific and Māori > European and Asian/Indian children, while in the Bay of Plenty, Lakes, Tairawhiti and Taranaki admissions were higher for Māori than for European children. In the Bay of Plenty and Lakes during 2000–2010, hospital admissions for injuries were generally higher Māori than for European children. In the Waikato, Tairawhiti and Taranaki ethnic differences were less evident, although rates were lower for Waikato Asian/Indian children than for other ethnic groups.

INJURIES ARISING FROM THE ASSAULT, NEGLECT OR MALTREATMENT OF CHILDREN

Introduction

Longitudinal studies suggest that 4–10% of New Zealand children experience physical abuse and 11–20% experience sexual abuse during childhood and that the long term consequences for these children are significant [270]. During the 1990s, New Zealand ranked 3rd highest amongst rich nations for its child maltreatment death rates [271], with 49 children <15 years dying as a result of maltreatment between 1996 and 2000. This situation does not appear to have improved over time, with mortality rates almost doubling during the late 1980s and changing very little since then [272]. Mortality represents the tip of the iceberg however, with the number of notifications to Child Youth and Family (CYF) for possible abuse or neglect increasing each year. In the 2009/2010 year, CYF received around 125,000 notifications, with just over half of such notifications each year typically requiring further action [273].This is of concern, as in addition to the physical effects, research has shown that survivors of childhood abuse often suffer long term psychological sequelae including depression, post-traumatic stress disorder, substance abuse, suicide / suicide attempts and high risk sexual behaviour [274].

The following section explores hospital admissions and mortality from injuries arising from the assault, neglect or maltreatment of children aged 0–14 years using information from the National Minimum Dataset and the National Mortality Collection.

Data Source and Methods

Definition

1. Hospitalisations for Injuries Arising From the Assault / Neglect / Maltreatment of Children Aged 0–14 Years

2. Deaths from Injuries Arising from the Assault / Neglect / Maltreatment of Children Aged 0–14 Years

Data Source

1. Hospital Admissions

Numerator: National Minimum Dataset: Hospital admissions of children (0–14 years) with a primary diagnosis of injury (ICD-10-AM S00–T79) and an external cause code of intentional injury (ICD-10-AM X85–Y09) in any of the first 10 External Cause codes. As outlined in **Appendix 3**, in order to ensure comparability over time, all cases with an Emergency Department Specialty Code (M05–M08) on discharge were excluded.

Denominator: NZ Statistics NZ Estimated Resident Population.

2. Mortality

Numerator: National Mortality Collection: Deaths in children (0–14 years) with a clinical code (cause of death) of Intentional Injury (ICD-10-AM X85–Y09).

Denominator: NZ Statistics NZ Estimated Resident Population.

Interpretation

The limitations of the National Minimum Dataset are discussed at length in **Appendix 3**.The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

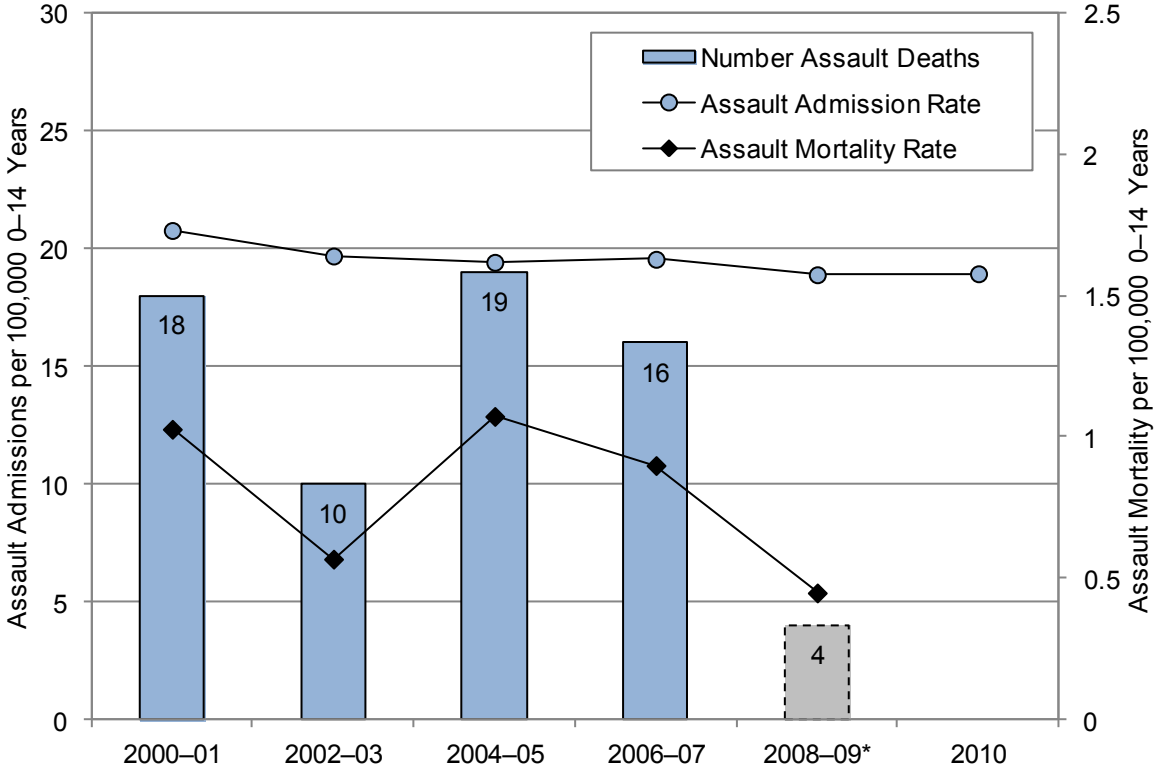
Indicator Category Admissions Proxy C; Mortality Ideal B

New Zealand Distribution and Trends

New Zealand Trends

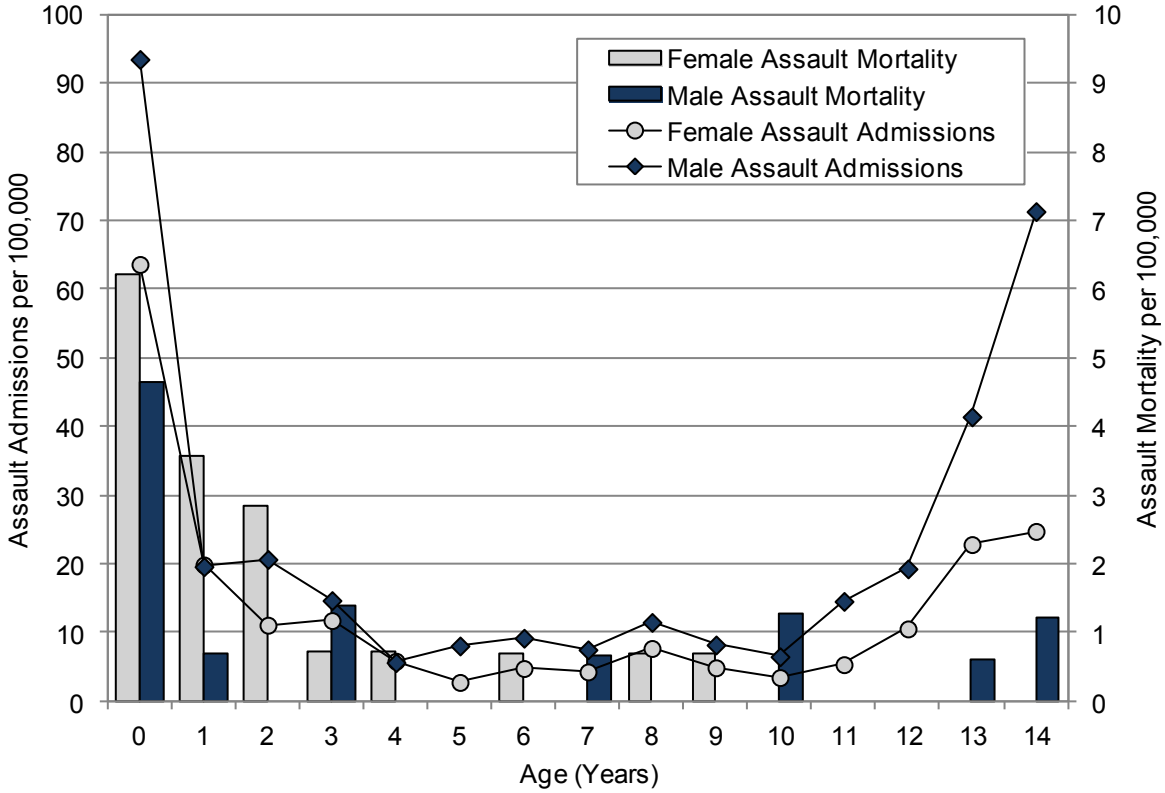
In New Zealand during 2000–2010, hospital admissions for injuries arising from the assault, neglect or maltreatment of children declined very gradually, while mortality during 2000–2008 fluctuated from year to year. On average during 2000–2008, 7.4 children per year died as a result of injuries arising from assault, neglect or maltreatment (**Figure 175**).

Figure 175. Hospital Admissions (2000–2010) and Deaths (2000–2008) due to Injuries Arising from the Assault, Neglect or Maltreatment of New Zealand Children 0–14 Years



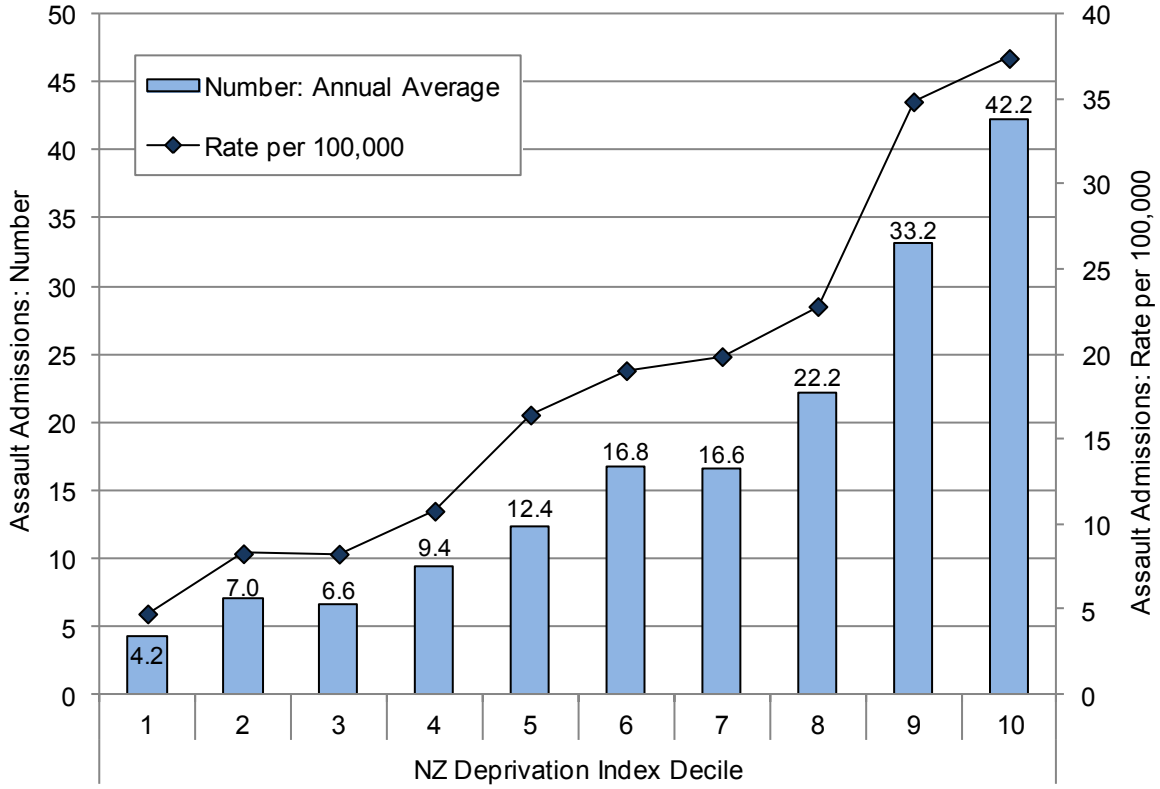
Source: Numerator Admissions: National Minimum Dataset; Numerator Mortality: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. *Note: Numbers are per 2-year period with the exception of 2008 which is for a single year only.

Figure 176. Hospital Admissions (2006–2010) and Deaths (2004–2008) due to Injuries Arising from the Assault, Neglect or Maltreatment of New Zealand Children 0–14 Years by Age and Gender



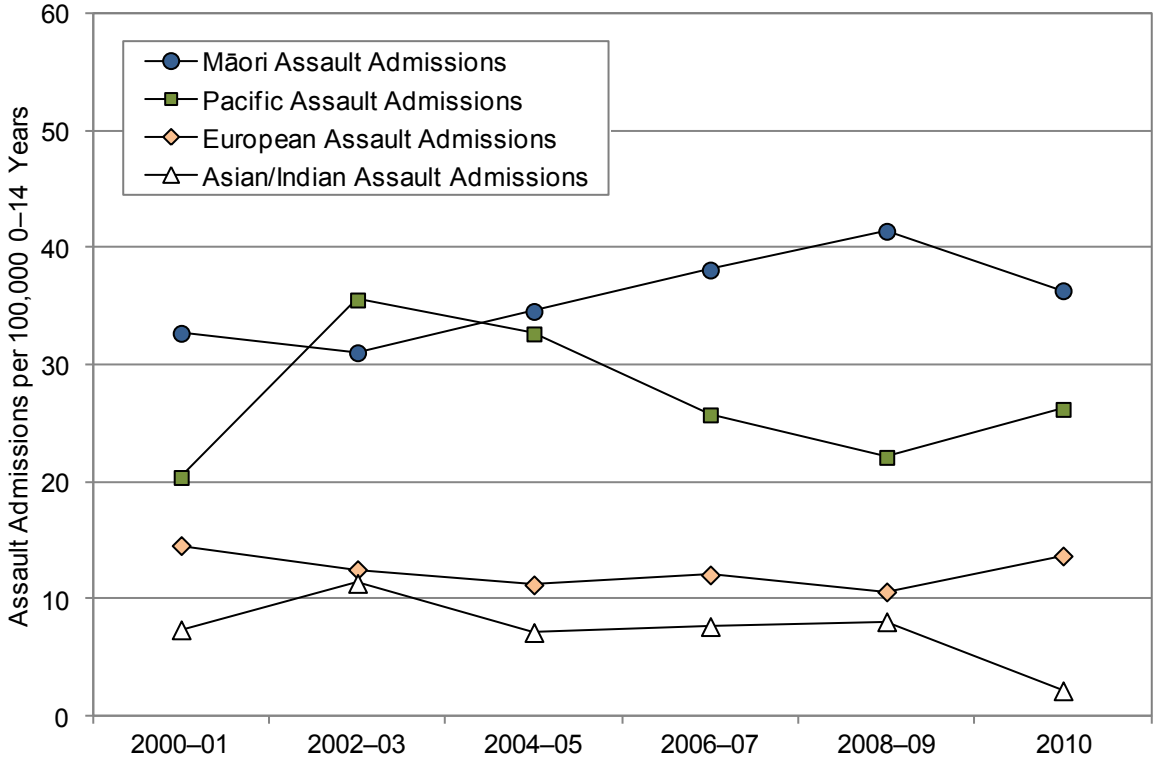
Source: Numerator Admissions: National Minimum Dataset; Numerator Mortality: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 177. Hospital Admissions for Injuries Arising from the Assault, Neglect or Maltreatment of Children Aged 0–14 Years by NZ Deprivation Index Decile, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 178. Hospital Admissions for Injuries Arising from the Assault, Neglect or Maltreatment of Children Aged 0–14 Years by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Table 178. Hospital Admissions for Injuries Arising from the Assault, Neglect or Maltreatment of Children Aged 0–14 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Number: Total 2006–2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
NZ Deprivation Index Decile					
Decile 1	21	4.2	4.8	1.00	
Decile 2	35	7.0	8.3	1.74	1.02–3.00
Decile 3	33	6.6	8.3	1.74	1.01–3.01
Decile 4	47	9.4	10.8	2.27	1.36–3.80
Decile 5	62	12.4	16.4	3.46	2.11–5.68
Decile 6	84	16.8	19.0	4.01	2.49–6.47
Decile 7	83	16.6	19.9	4.18	2.59–6.75
Decile 8	111	22.2	22.8	4.80	3.01–7.66
Decile 9	166	33.2	34.9	7.34	4.66–11.55
Decile 10	211	42.2	37.4	7.87	5.03–12.33
NZ Deprivation Index Quintile					
Decile 1–2	56	11.2	6.5	1.00	
Decile 3–4	80	16.0	9.6	1.48	1.05–2.08
Decile 5–6	146	29.2	17.8	2.75	2.02–3.75
Decile 7–8	194	38.8	21.5	3.31	2.46–4.46
Decile 9–10	377	75.4	36.2	5.59	4.22–7.41
Gender					
Female	302	60.4	13.9	1.00	
Male	554	110.8	24.3	1.75	1.52–2.01
Prioritised Ethnicity					
Asian/Indian	28	5.6	6.6	0.56	0.38–0.82
European	293	58.6	11.8	1.00	
Māori	420	84.0	39.1	3.32	2.86–3.85
Pacific	104	20.8	24.4	2.07	1.65–2.59

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.
Note: Rate is per 100,000 per year; Rate Ratios are unadjusted; Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Age and Gender

In New Zealand during 2006–2010, hospital admissions for injuries arising from the assault, neglect or maltreatment of children exhibited a U-shaped distribution with age, with rates being higher for infants <1 year and those > 11 years of age. In contrast, mortality was highest for infants < 1 year. While the gender balance for admissions was relatively even during infancy and early childhood, admissions for males became more predominant as adolescence approached (**Figure 176**).

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for injuries arising from the assault, neglect or maltreatment of children were significantly higher for males, Māori > Pacific > European >Asian/Indian children, and those living in average-to-more deprived (NZDep decile 2–10) areas (**Table 178**).

Similarly, during 2000–2010 hospital admissions for injuries arising from the assault, neglect or maltreatment of children were consistently higher for Māori and Pacific > European >Asian/Indian children, with rates also being higher for Māori than for Pacific children from 2004–05 onwards (**Figure 178**).

Nature of the Injury Sustained

During 2006–2010, the most common specific injury types sustained as the result of the assault, neglect or maltreatment of children aged 0–4 years were subdural haemorrhages and superficial head injuries, followed by fractures of the skull and face, and fractures of the femur. For children aged 5–12 years, head, upper limb and abdominal / spinal / pelvic injuries predominated, with superficial head injuries, fractures of the skull and facial bones and concussions being amongst the most common specific injury types documented (**Table 179**).

Table 179. Nature of Injury Arising from Assault, Neglect or Maltreatment in Hospitalised Children Aged 0–12 Years by Age Group, New Zealand 2006–2010

Nature of Injury	Total Number 2006–2010	Annual Average	% of Injuries in Age Group
Children 0–4 Years			
Traumatic Subdural Haemorrhage (S065)	116	23.2	29.4
Superficial Head Injury (S00)	62	12.4	15.7
Fracture Skull or Facial Bones (S02)	17	3.4	4.3
Other Head Injuries (Remainder S00–S09)	44	8.8	11.1
Injuries to Abdomen, Spine and Pelvis (S30–S39)	28	5.6	7.1
Injuries to Thorax (Including Rib Fractures) (S20–S29)	11	2.2	2.8
Injuries to Upper Limb (S40–S69)	27	5.4	6.8
Fracture of Femur (S72)	16	3.2	4.1
Other Injuries to Lower Limb (S70–S99)	19	3.8	4.8
Maltreatment (T74)	36	7.2	9.1
Other Injuries	19	3.8	4.8
Total	395	79.0	100.0
Children 5–12 Years			
Superficial Head Injury (S00)	30	6.0	15.5
Fracture Skull or Facial Bones (S02)	18	3.6	9.3
Concussion (S060)	16	3.2	8.2
Other Head Injuries (Remainder S00–S09)	35	7.0	18.0
Injuries to Abdomen, Spine and Pelvis (S30–S39)	23	4.6	11.9
Injuries to Thorax (Including Rib Fractures) (S20–S29)	3	0.6	1.5
Injuries to Upper Limb (S40–S69)	29	5.8	14.9
Injuries to Lower Limb (S70–S99)	11	2.2	5.7
Maltreatment (T74)	11	2.2	5.7
Other Injuries	18	3.6	9.3
Total	194	38.8	100.0

Source: National Minimum Dataset

Midland Region Distribution and Trends

Midland DHBs vs. New Zealand

In Lakes, the Bay of Plenty and Tairawhiti during 2006–2010, hospital admissions for injuries arising from the assault, neglect or maltreatment of children were *significantly* higher than the New Zealand rate. In the Waikato, rates were *significantly* lower than the New Zealand rate, while in Taranaki rates were similar (**Table 180**).

Midland Region Trends
In the Midland Region during 2000–2010, large year to year variations made trends in hospital admissions for injuries arising from the assault, neglect or maltreatment of children in individual DHBs difficult to interpret (**Figure 179**).

Midland Region Mortality
In the Midland Region during 2000–2008, four Waikato, three Bay of Plenty and three Taranaki children died as the result of injuries arising from assault, neglect or maltreatment.

Table 180. Hospital Admissions for Injuries Arising from the Assault, Neglect, or Maltreatment of Children Aged 0−14 Years, Midland DHBs vs. New Zealand 2006−2010

DHB	Total No. Admissions 2006–2010	No. Admissions Annual Average	Rate per 100,000	Rate Ratio	95% CI
Injuries Arising from the Assault, Neglect or Maltreatment of Children 0–14 Years					
Waikato	45	9.0	11.5	0.60	0.44–0.81
Lakes	39	7.8	32.6	1.70	1.23–2.34
Bay of Plenty	76	15.2	34.2	1.78	1.41–2.25
Tairawhiti	21	4.2	36.3	1.89	1.23–2.92
Taranaki	20	4.0	17.9	0.93	0.60–1.45
New Zealand	856	171.2	19.2	1.00	

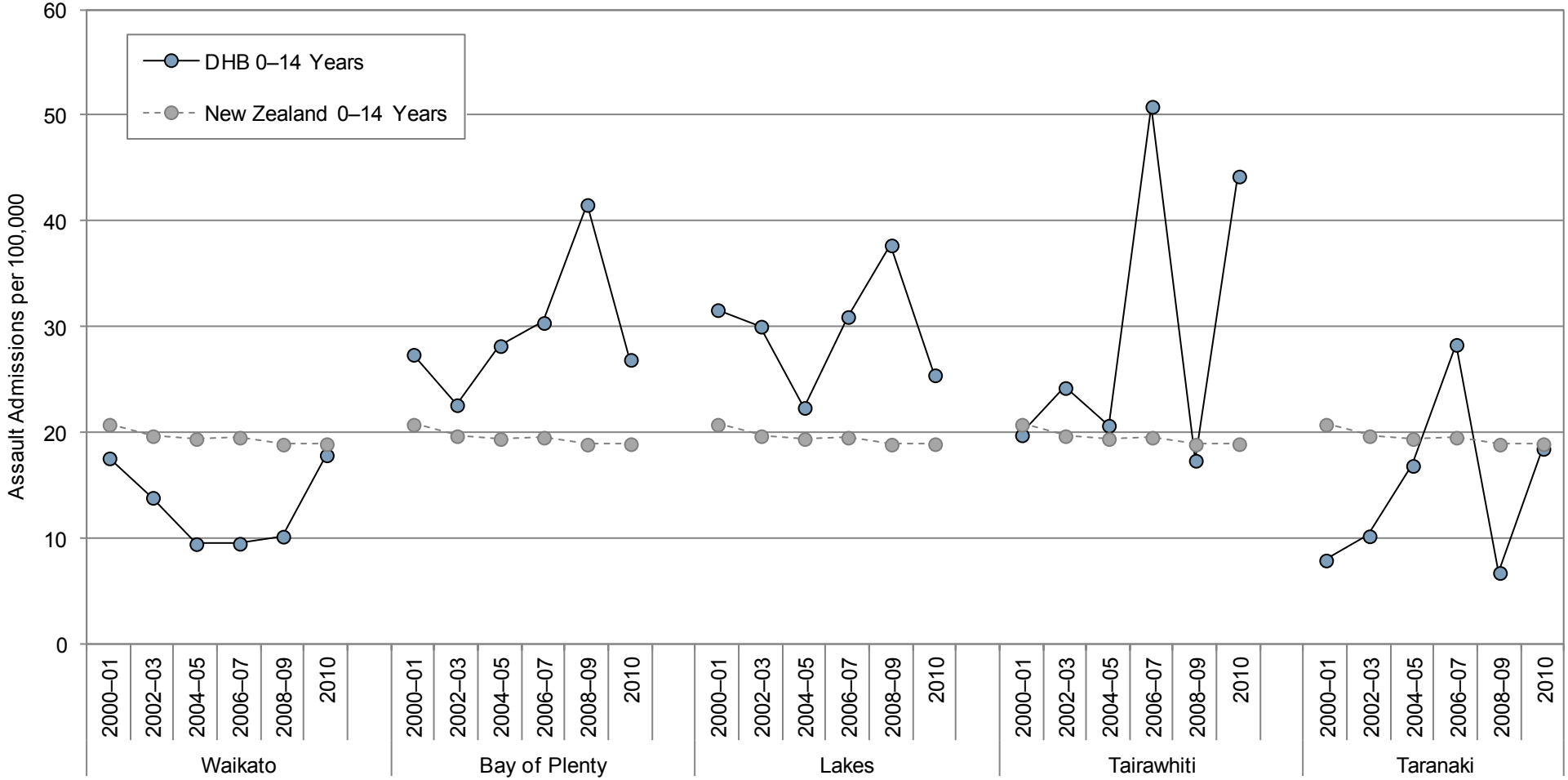
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Summary

In New Zealand during 2006–2010, hospital admissions for injuries sustained as the result of the assault, neglect or maltreatment of children exhibited a U-shaped distribution with age, with rates being highest for infants < 1 year, and those > 11 years of age. In contrast, mortality was highest for infants < 1 year. While the gender balance for admissions was relatively even during infancy and early childhood, hospital admissions for males became more predominant as adolescence approached. In addition, admissions were also *significantly* higher for males, Māori > Pacific > European >Asian/Indian children, and those in average-to-more deprived (NZDep decile 2–10) areas.

In the Midland Region during 2000–2010, large year to year variations made trends in hospital admissions for injuries arising from the assault, neglect or maltreatment of children in individual DHBs difficult to interpret. During 2006–2010 however, admissions were *significantly* higher than the New Zealand rate in Lakes, the Bay of Plenty and Tairawhiti. In the Waikato, rates were *significantly* lower than the New Zealand rate, while in Taranaki rates were similar. During 2000–2008, four Waikato, three Bay of Plenty and three Taranaki children died as the result of injuries arising from assault, neglect or maltreatment.

Figure 179. Hospital Admissions for Injuries Arising from the Assault, Neglect or Maltreatment of Children Aged 0–14 Years, Midland DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

APPENDICES AND REFERENCES

APPENDIX 1: SEARCH METHODS FOR POLICY DOCUMENTS AND EVIDENCE-BASED REVIEWS

One of the features of this reporting series is the inclusion of sections which briefly review local policy documents (e.g. Ministry of Health Strategies and Toolkits) and international evidence-based reviews that are relevant to the prevention and or management of child and youth health issues. The approaches taken in these sections borrow heavily from the principles of the Evidence-Based Medicine (EBM) movement, which has emerged in recent years as a means of providing busy clinicians with up to date overviews of the evidence in particular areas [275,276]. Such overviews generally rely on reviewers collating all of the available evidence (published and unpublished trials, observational studies etc.), evaluating it in a rigorous manner, and then publishing the resulting synthesis of the evidence in a format which allows clinicians to evaluate quickly the effectiveness of the intervention(s) reviewed. While the evidence base for population level interventions is much less developed than that for individual patient therapies (as such interventions often have longer follow up times, more diffuse outcomes, and less readily identifiable "control" groups [277]), there is nevertheless a reasonable body of evidence emerging about the effectiveness of specific population level interventions.

The brief overviews presented in this report therefore aim to provide busy DHB staff with a logical starting point from which to consider the types of interventions available to address particular child and youth health issues. In preparing these overviews the methodology used was not exhaustive but rather involved searching a number of EBM journals and databases (e.g. the Cochrane Library) as well as Ovid MEDLINE and PubMed for systematic reviews of population level interventions in child and youth health (see Text Box below).

Methodology Used in Preparing Policy/Evidence-Based Review Sections

New Zealand (Health) Policy Documents

Each review section aims to provide an overview of Ministry of Health (or where appropriate, other Government Agency) policy documents and strategies relevant to the area. The Ministry of Health's website (http://www.moh.govt.nz/moh.nsf) was searched for key documents. All identified documents were then scanned and the most relevant summarised, focussing on those which provided strategic guidance to DHBs on the prevention/population level management of the issues in question.

Evidence-Based and Other Reviews

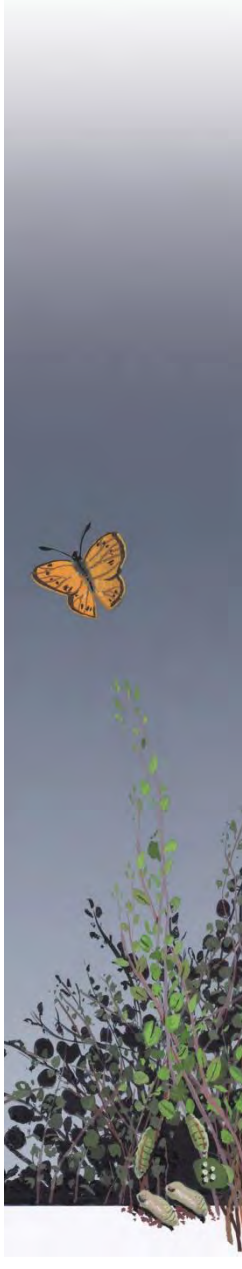
The five databases listed below were searched for reviews considering the effectiveness of population level interventions to prevent and/or manage each of the issues in question. While this list is not exhaustive, the databases were selected on the basis of the calibre of the institutions publishing the reviews. In addition, the search strategy concentrated on publications which attempted to synthesise all of the available evidence, thereby providing as broad as possible coverage of the relevant literature. In general, only literature from 2000 onwards was searched, although earlier publications were included if there was a paucity of more recent information. While individual trials and protocols were not specifically sought, if there was no other relevant information available, an attempt was made to locate individual research reports or recommendations. While they are not totally comprehensive, it is nevertheless hoped that these brief overviews will provide a useful starting point for DHBs wishing to explore strategies to address particular child and youth health issues.

Evidence Based Medicine Reviews This database allows seven EBM resources to be searched at once including The Database of Reviews of Effects (DARE), Health Technology Assessments (HTA) and the NHS Economic Evaluation Database (NHSEED) all produced by National Health Services' Centre for Reviews and Dissemination at the University of York, U.K., The Cochrane Database of Systematic Reviews, and the ACP Journal Club.

National Guideline Clearinghouse http://www.guideline.gov/ This is a searchable database of evidence-based clinical practice guidelines maintained by the Agency for Healthcare Research and Quality in the United States.

Centre for Reviews and Dissemination (CRD): This is a Department of the University of York and is part of the National Centre for Health Research (NCHR) (http://www.york.ac.uk/inst/crd/). While CRD produces the database of Review Effects (DARE), captured in the Evidence-Based Medicine Review Database, searching the CRD site identifies other reviews not captured by DARE. This database is available through most local library services.

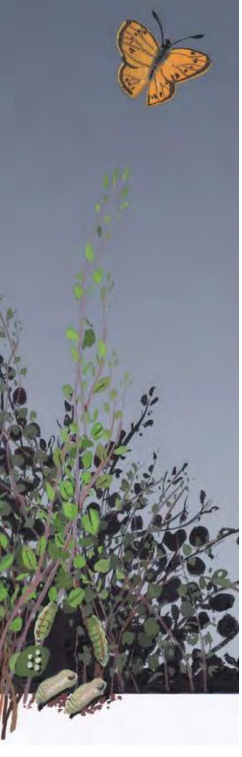
National Institute for Health and Clinical Excellence (NICE): This is an independent organisation based in the United Kingdom which provides national guidance on the promotion of good health and the prevention and treatment of ill health. (http://www.nice.org.uk/)



Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations: This guide was developed by the non-federal Task Force on Community Preventive Services whose members are appointed by the Director of the Centre for Disease Control and Prevention (CDC) . The Community Guide summarises what is known about the effectiveness, economic efficiency, and feasibility of interventions to promote community health and prevent disease.
(http://www.thecommunityguide.org/about/)

While undertaking this task it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed. In addition, in many cases, the research provided reasonably strong guidance about what did not work (e.g. current evidence suggests additional social support is ineffective in preventing preterm birth in high-risk women), but little advice on effective interventions.

Thus in many cases these brief overviews serve to highlight the current paucity of evidence on population level interventions to address child and youth health needs (although the absence of systematic/other reviews does not rule out the existence of individual studies in particular areas). In this context, while the search strategy utilised did not primarily aim to identify individual studies, or reviews of individual patient therapies, in cases where such studies were identified, and where no other systematic reviews were available, they were included under the heading of *Other Relevant Publications*. In such cases the reader needs to be aware that these studies were identified in a non-systematic manner and that their findings should therefore not be given the same weight as systematic reviews (e.g. Cochrane reviews) where all of the available evidence has been rigorously evaluated. The evidence-based review tables also include some topical New Zealand research publications.



APPENDIX 2: STATISTICAL SIGNIFICANCE TESTING AND ITS USE IN THIS REPORT

Understanding Statistical Significance Testing

Inferential statistics are used when a researcher wishes to use a sample to draw conclusions about the population as a whole (e.g. weighing a class of 10 year old boys, in order to estimate the average weight of all 10 year old boys in New Zealand). Any measurements based on a sample however, even if drawn at random, will always differ from that of the population as a whole, simply because of chance. Similarly, when a researcher wishes to determine whether the risk of a particular condition (e.g. lung cancer) is truly different between two groups (smokers and non-smokers), they must also consider the possibility that the differences observed arose from chance variations in the populations sampled.

Over time, statisticians have developed a range of measures to quantify the uncertainty associated with random sampling error (i.e. to quantify the level of confidence we can have that the average weight of boys in our sample reflects the true weight of all 10 year old boys, or that the rates of lung cancer in smokers are really different to those in non-smokers). Of these measures, two of the most frequently used are:

P values: The p value from a statistical test tells us the probability that we would have seen a difference at least as large as the one observed, if there were no real differences between the groups studied (e.g. if statistical testing of the difference in lung cancer rates between smokers and non-smokers resulted in a p value of 0.01, this tells us that the probability of such a difference occurring if the two groups were identical is 0.01 or 1%. Traditionally, results are considered to be statistically significant (i.e. unlikely to be due to chance) if the probability is <0.05 (i.e. less than 5%) [278].

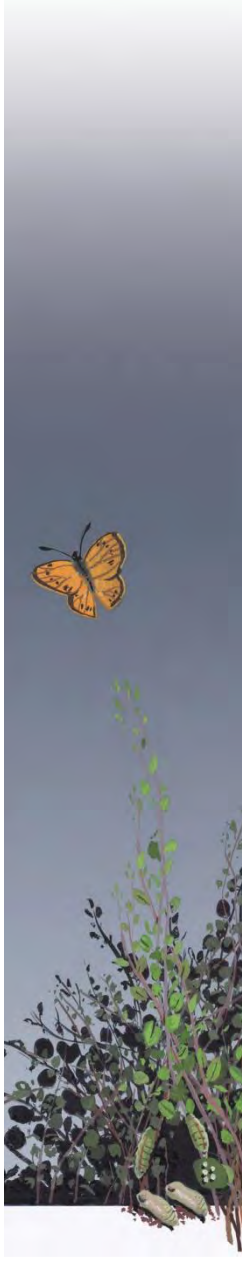
Confidence Intervals: A 95% Confidence Interval suggests that if you were to repeat the sampling process 100 times, 95 times out of 100 the confidence interval would include the true value. In general terms, if the 95% confidence intervals of two samples overlap, there is no significant difference between them (i.e. the p value would be ≥0.05), whereas if they do not overlap, they can be assumed to be statistically different at the 95% confidence level (i.e. the p value would be <0.05) [278].

The Use of Statistical Significance Testing in this Report

In the preparation of this report a large range of data sources were used. For the purposes of statistical significance testing however, these data sources can be considered as belonging of one of two groups: Population Surveys and Routine Administrative Datasets. The relevance of statistical testing to each of these data sources is described separately below:

Population Surveys: A number of indicators in this report utilise data derived from national surveys (e.g.2006/07 New Zealand Health Survey), where information from a sample has been used to make inferences about the population as a whole. In this context statistical significance testing is appropriate, and where such information is available in published reports, it has been incorporated into the text accompanying each graph or table (i.e. the words significant, or not significant in italics are used to imply that a test of statistical significance has been applied to the data and that the significance of the associations are as indicated). In a small number of cases however information on statistical significance was not available in published reports, and in such cases any associations described do not imply statistical significance.

Numbers and Rates Derived from Routine Administrative Data: A large number of the indicators in this report are based on data derived from New Zealand's administrative datasets (e.g. National Minimum Dataset, National Mortality Collection), which capture

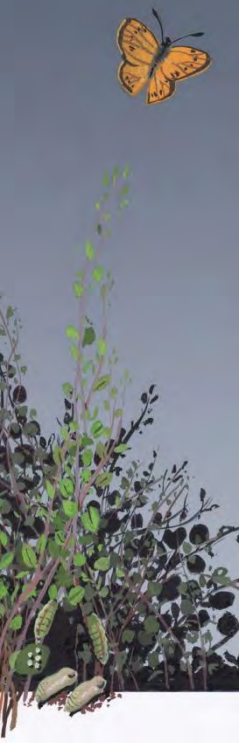


information on all of the events occurring in a particular category. Such datasets can thus be viewed as providing information on the entire population, rather than a sample and as a consequence, 95% confidence intervals are not required to quantify the precision of the estimate (e.g. the number of leukaemia deaths in 2003–2007, although small is not an estimate, but rather reflects the total number of deaths during this period). As a consequence, 95% confidence intervals have not been provided for any of the descriptive data (numbers, proportions, rates) presented in this report, on the basis that the numbers presented are derived from the total population under study.

Rate Ratios Derived from Routine Administrative Data: In considering whether statistical significance testing is ever required when using total population data Rothman [279] notes that if one wishes only to consider descriptive information (e.g. rates) relating to the population in question (e.g. New Zealand), then statistical significance testing is probably not required (as per the argument above). If however, one wishes to use total population data to explore biological phenomena more generally, then the same population can also be considered to be a sample of a larger super-population, for which statistical significance testing may be required (e.g. the fact that SIDS in New Zealand is 10 times higher in the most deprived NZDep areas might be used to make inferences about the impact of the socioeconomic environment on SIDS mortality more generally (i.e. outside of New Zealand, or the 5 year period concerned)). Similarly, in the local context the strength of observed associations is likely to vary with the time period under study (e.g. in updating 5-year asthma admission data from 2004–2008 to 2005–2009, rate ratios for Pacific children are likely to change due to random fluctuations in annual rates, even though the data utilised includes all admissions recorded for that particular 5-year period). Thus in this report, whenever measures of association (i.e. rate ratios) are presented, 95% confidence intervals have been provided on the assumption that the reader may wish to use such measures to infer wider relationships between the variables under study [279].

The Signalling of Statistical Significance in this Report

In order to assist the reader to identify whether tests of statistical significance have been applied in a particular section, the significance of the associations presented has been signalled in the text with the words *significant*, or *not significant* in italics. Where the words *significant* or *non-significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.



APPENDIX 3: THE NATIONAL MINIMUM DATASET

Mode of Data Collection

The National Minimum Dataset (NMDS) is New Zealand's national hospital discharge data collection and is maintained by the Ministry of Health. The information contained in the dataset has been submitted by public hospitals in a pre-agreed electronic format since 1993. Private hospital discharges for publicly funded events (e.g. births, geriatric care) have been submitted since 1997. The original NMDS was implemented in 1993, with public hospital information back loaded to 1988 [280]. Information contained in the NMDS includes principal and additional diagnoses, procedures, external causes of injury, length of stay and sub-specialty code and demographic information such as age, ethnicity and usual area of residence.

Dataset Quality and Changes in Coding Over Time

There are a number of key issues which must be taken into account when interpreting information from the NMDS. Many of these issues arise as a result of regional differences in the way in which data are coded and uploaded to the NMDS. These include:

1. Inconsistencies in the way in which different providers upload day cases to the NMDS, and how this has changed over time.
2. The changeover from the ICD-9 to ICD-10 coding system, and irregularities in the way in which diagnoses and procedures are allocated ICD codes.
3. Changes in the way in which ethnicity information has been collected over time and across regions (**Appendix 6**).

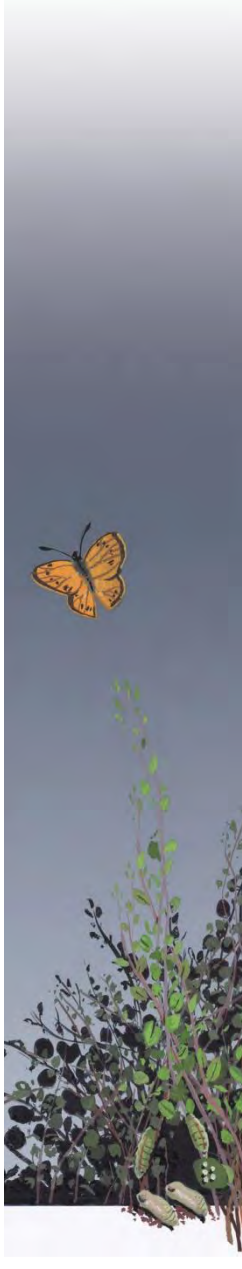
The following sections discuss the first two of these issues, while the third is discussed in Appendix 6, which reviews the way in which ethnicity information is collected and coded within the health sector.

1. Inconsistencies in the Uploading of Day-Cases to the NMDS

One of the key issues with time series analysis using hospital discharge data is the variability with which different providers upload day cases to the NMDS. Day cases are defined as cases that are admitted and discharged on the same day, with the "three hour rule" (treatment time >3 hours) traditionally being utilised to define an admission event. In contrast patients who spend at least one (mid)night in hospital are classified as inpatients irrespective of their length of stay [281].

In the past, there have been significant regional variations in the way in which different providers have uploaded their day cases to the NMDS, leading to problems with both time series analysis and regional comparisons. These inconsistencies have included:

1. During the mid 1990's, a number of providers began to include A&E events as day cases if the total time in the Emergency Department (including waiting time) exceeded 3 hours, rather than uploading only those whose actual treatment time exceeded 3 hours [281]. New Zealand Health Information Service provided feedback which rectified this anomaly and since January 1995 the correct procedure has been used (these additional cases were coded using medical and surgical sub-specialty codes and are thus difficult to filter out using traditional Emergency sub-specialty filters).
2. Over time, a number of providers have become more efficient at recording the time of first treatment within the Emergency Department (rather than time of attendance) and thus during the late 1990s and early 2000s have become more efficient in identifying emergency department cases which meet the 3-hour treatment rule and are thus eligible to be uploaded to the NMDS. This has resulted in a large number of additional cases being uploaded to the NMDS, particularly in the upper North Island.



3. In addition, some providers admit cases to their short stay observation units while other providers do not, leading to regional variations in the appearance of day cases in the NMDS [100].

Previous Attempts to Address Inconsistent Uploading at the Analytical Stage

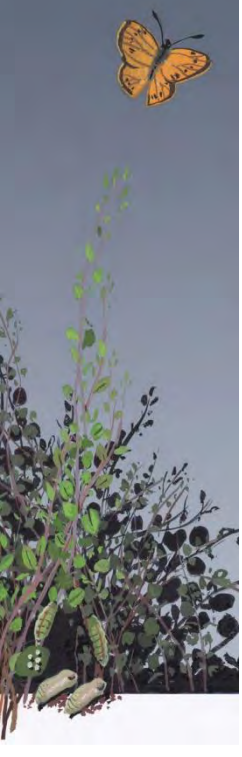
When producing their annual Hospital Throughput reports, the Ministry of Health has adopted the following filter to ensure regional and time series comparability with respect to day patient admissions [100]. In its analyses it excludes all cases where:

1. the admission and discharge date are the same (length of stay = 0)
2. and the patient was discharged alive
3. and the health specialty code on discharge is that of Emergency Medicine (M05, M06, M07, and M08).

While this coding filter succeeds in ensuring a degree of comparability between regions and across time (although it fails to correct the anomalies occurring during the mid 1990s when A&E cases were uploaded using medical sub-specialty codes), the exclusion of emergency day cases from time series analysis has a number of limitations including:

1. Exclusion of only those with a length of stay of 0 days means that those emergency cases who begin their treatment late at night and are discharged in the early hours of the following morning (up ¼ of emergency cases have a length of stay of 1 day in some DHBs) are included as genuine hospital admissions, whereas those who begin their treatment early in the morning and are discharged late in the afternoon or the evening of the same day are excluded.
2. With a move towards the development of specialist paediatric emergency departments in larger urban centres (e.g. Auckland), there remains the possibility that some larger DHBs are now seeing and treating a number of acute medical patients within the emergency setting, while in regional centres similar patients continue to be assessed on the paediatric medical ward / assessment unit and thus receive a paediatric medical specialty code. The exclusion of all emergency presentations from time series and sub-regional analysis may thus differentially exclude a large portion of the workload occurring in large urban centres where access to specialist advice and treatment is available within the Emergency Department setting.

The potential impact of inconsistent uploading of day cases to the NMDS is likely to be greatest for those conditions most commonly treated in the emergency department setting. Analysis of 2001–2003 hospital admission data suggests that >1/3 of NMDS emergency department discharges for those 0–24 years were due to injury, with another 1/3 were due to ambulatory sensitive conditions (e.g. asthma, gastroenteritis, respiratory infections). In contrast, only 2% of those presenting with bacterial meningitis and 4% of those with septic arthritis were discharged with an emergency sub-specialty code.



Further sub-analysis of these two admission categories however demonstrated that inclusion / exclusion of emergency department admissions had quite different effects depending on the category of admission under study (injury vs. ambulatory sensitive admissions) and whether the region had access to a specialist Paediatric Emergency Department. In this analysis the Wider Auckland Region, (comprising 1/3 of the NZ population and whose residents have access to specialist Paediatric Emergency Departments) was compared to the rest of NZ. For ambulatory sensitive admissions, exclusion of emergency department cases resulted in Auckland's admission rates being consistently lower than in the rest of New Zealand. It was only when emergency cases were included in this analysis that Auckland's admission rates began to approximate those of the rest of NZ. In contrast for injuries, inclusion of emergency department cases resulted in hospital admissions in the Auckland Region consistently exceeding the rest of New Zealand. It was only when emergency cases were excluded from the analysis that Auckland's injury admission rates began to approximate those of the rest of NZ. (These findings occurred despite Auckland having a similar proportion of children living in the most deprived NZDep small areas as the rest of NZ).

Loosely interpreted, the findings of this analysis suggest that the workload of large specialist paediatric emergency departments must not be discounted when examining trends in ambulatory sensitive or other medical admissions, as it is only when emergency cases are included in the analysis that the admission rates of the Wider Auckland Region (with its access to Specialist Paediatric Emergency care) begin to approximate the rest of NZ. In contrast, it is possible that specialist paediatric emergency departments have much less of an influence on admission thresholds for injury, with these being handled in a similar manner by different emergency departments across the country. Thus for injury data, the greater tendency for some emergency departments to upload their cases to the NMDS must be taken into account in any analysis.

Implications for Interpreting Time Series Analyses in these Reports

Throughout this report, analysis of time series and other information has been undertaken using unfiltered hospital admission data, with the exception of the injury and poisoning sections. Here emergency department discharges have been filtered out of the dataset, in an attempt to address some of the inconsistencies discussed above. Despite such an approach, there remains the potential for the inconsistent uploading of day cases to significantly influence the time series analyses presented in this report. In particular, such practices may lead to an over estimate of the number of medical admissions commonly treated in the emergency department setting (e.g. asthma, skin infections, respiratory tract infections), while at the same time the filtering out of injury/poisoning emergency cases may lead to undercounting for a number of more minor types of injury. Nevertheless, the filtering process utilised in this report are thought to provide the best balance when considering hospital admissions amongst those 0–24 years. Despite this, the reader must bear in mind that a potential for significant residual bias remains, when interpreting the time series analyses presented in this report.

2. Data Quality and Coding Changes over Time (ICD-9 and ICD-10)

Change Over from ICD-9 to ICD-10 Coding

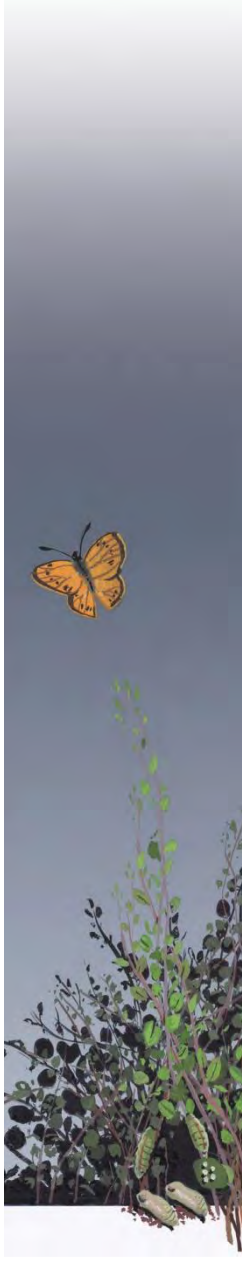
From 1988 until June 1999, clinical information in the NMDS was coded using versions of the ICD-9 classification system (ICD-9 CM until June 1995, then ICD-9-CM-A until June 1999). From July 1999 onwards, the ICD-10-AM classification system has been used, although for time series analysis, back and forward mapping between the two classification systems is possible fusing pre-defined algorithms [280].

The introduction of ICD-10-AM represents the most significant change in the International Classification of Diseases (ICD) in over 50 years and uses an alphanumeric coding system for diseases in which the first character of the code is always a letter followed by several numbers. This has allowed for the expansion of the number of codes to provide for recently recognised conditions and to provide greater specificity about common diseases (there are about 8,000 categories in ICD-10-AM as compared to 5,000 in ICD-9). While for most conditions there is a reasonable 1:1 correspondence between ICD-9 and ICD-10 codes, for some this may lead to some irregularities in time series analysis [282]. Where possible such irregularities will be highlighted in the text, although care should still be taken when interpreting time series analysis across the 1999–2000 period as some conditions may not be directly comparable between the two coding systems.

Accuracy of ICD Coding

In recent years the Ministry of Health has undertaken a number of reviews of the quality of ICD coding in the NMDS. In the latest audit 2,708 events were audited over 10 sites during a 3 month period during 2001/2002. Overall the audit found that 22% of events required a change in coding, although this also included changes at the fourth and fifth character level. The average ICD code change was 16%, with changes to the principal diagnosis being 11%, to additional diagnoses being 23% and to procedure coding being 11%. There were 1625 external causes of injury codes, of which 15% were re-coded differently [283]. These findings were similar to an audit undertaken a year previously.

While the potential for such coding errors must be taken into consideration when interpreting the findings of this report, it may be that the 16% error rate is an overestimate, as in the majority of the analyses undertaken in this report, only the principal diagnosis



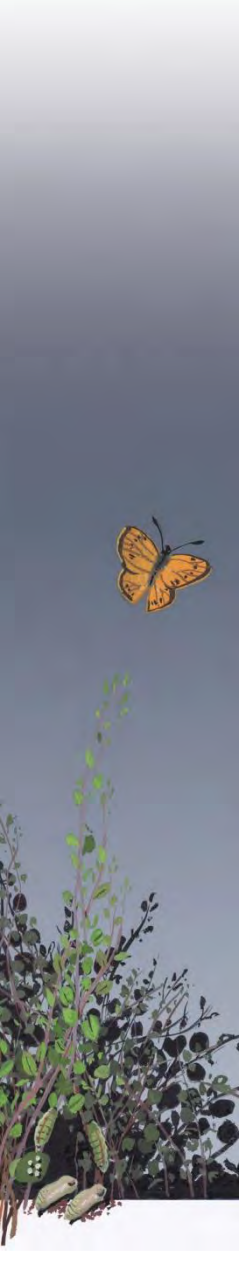
(with an error rate of 11%) is used to describe the reason for admission. In addition, for most admissions the diagnostic category (e.g. lower respiratory tract infections) is assigned using information at the 3 digit level (with the 16% error rate also including issues with coding at the 4th or 5th digit level).

3. Ethnicity Information in the NMDS

The reader is referred to **Appendix 6** for a discussion of this issue.

Conclusion

In general the inconsistencies outlined above tend to make time series and (regional) comparative analyses based on the NMDS less reliable than those based on Mortality or Birth Registration data (where legislation dictates inclusion criteria and the type of information collected). While hospital discharge data still remains a valuable and reasonably reliable proxy for measuring the health outcomes of children and young people in this country, the reader is cautioned to take into consideration the biases discussed above, when interpreting the findings outlined in this report.



APPENDIX 4: THE BIRTH REGISTRATION DATASET

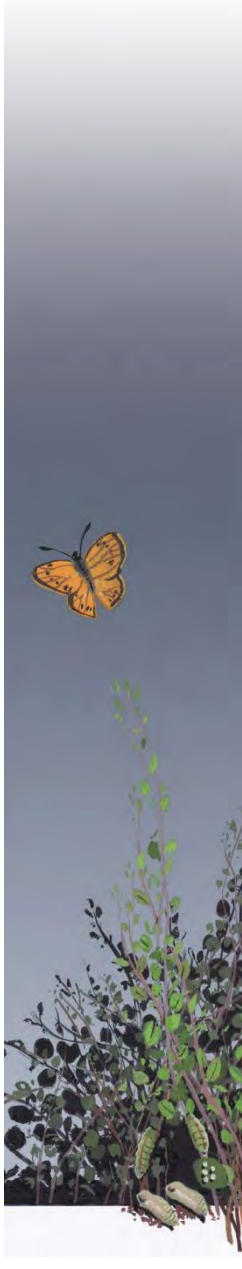
Mode of Data Collection

Since 1995 all NZ hospitals / delivering midwives have been required to notify the Department of Internal Affairs (within 5 working day of delivery), of the birth of a live / stillborn baby 20+ weeks gestation or weighting >400g. Prior to 1995, only stillborn babies reaching 28+ weeks of gestation required birth notification. Information on the hospital's notification form includes maternal age, ethnicity, multiple birth status, and baby's sex, birth weight and gestational age. In addition parents must complete a Birth Registration Form within 2 years of delivery, duplicating the above information, with the exception of birth weight and gestational age, which are supplied only on hospital notification forms. Once both forms are received by Internal Affairs, the information is merged into a single entry. This 2-stage process it is thought to capture 99.9% of births occurring in New Zealand and cross checking at the receipting stage allows for the verification of birth detail [284].

Issues to Take into Account When Interpreting Information Derived from the Birth Registration Dataset

Because of the 2-stage birth registration process, the majority of variables contained within the birth registration dataset are >98% complete, and cross checking at the receipting stage (with the exception of birth weight and gestational age) allows for the verification of birth details. In addition, the way in which ethnicity is collected in this dataset confers a number of advantages, with maternal ethnicity being derived from the information supplied by parents on their baby's birth registration form. This has the advantage of avoiding some of the ambiguities associated with hospital and mortality data, which at times have been reported by third parties. Changes in the way ethnicity was defined in 1995 however make information collected prior to this date incomparable with that collected afterwards. For births prior to 1995, maternal ethnicity was defined by ancestry, with those having half or more Māori or Pacific blood meeting ethnic group criteria, resulting in three ethnic groups, Māori, Pacific and non-Māori non-Pacific. For births after 1995 maternal ethnicity was self-identified, with an expanded number of ethnic categories being available and parents being asked to tick as many options as required to show which ethnic group(s) they belonged to. For those reporting multiple ethnic affiliations a priority rating system was introduced, as discussed Appendix 6 of this report.

Because this dataset captures 99.9% of births occurring in NZ, is >98% complete for most variables, collects self-reported ethnicity in a standard manner and is collated and coded by a single agency, information derived from this dataset is likely to be of higher quality than that derived from many of NZ's other data sources. Limitations however include the relatively restricted number of variables contained within the dataset (e.g. it lacks information on maternal smoking, BMI or obstetric interventions) and the lack of cross checking for birth weight and gestational age (which is supplied only on the hospital notification form). The change in ethnicity definition during 1995 also prohibits time series analysis by ethnicity over the medium to long term. Finally, since the last report, the Ministry of Health has stopped providing stillbirth data in the Birth Registration Dataset, and thus all analyses based on this set are restricted to live births only. Each of these factors must thus be taken into account when interpreting information in this report that has been derived from the Birth Registration Dataset.



APPENDIX 5: NATIONAL MORTALITY COLLECTION

Mode of Data Collection

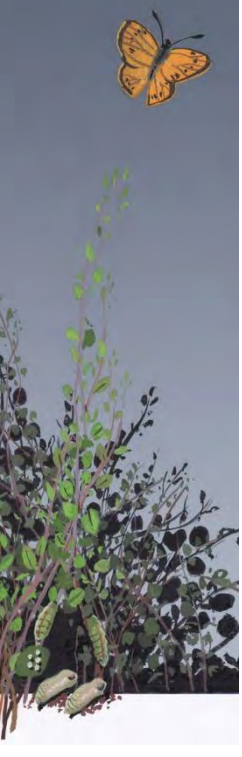
The National Mortality Collection is a dataset managed by the Ministry of Health, which contains information on the underlying cause(s) of death, as well as basic demographic data, for all deaths registered in New Zealand since 1988. Fetal and infant data are a subset of the Mortality Collection, with cases in this subset having additional information on factors such as birth weight and gestational age [285].

Each month Births, Deaths and Marriages send the Ministry of Health electronic death registration information, Medical Certificates of Cause of Death, and Coroners' reports. Additional information on the cause of death is obtained from the National Minimum Dataset (NMDS), private hospital discharge returns, the NZ Cancer Registry (NZCR), the Department of Courts, the Police, New Zealand Transport Agency (NZTA), Water Safety NZ, the Institute of Environmental Science and Research (ESR), media searching and from writing letters to certifying doctors, coroners and medical records officers in public hospitals. Using information from these data sources, an underlying cause of death (ICD-10-AM) is assigned by Ministry of Health staff using the World Health Organisation's rules and guidelines for mortality coding [285].

Data Quality Issues Relating to the National Mortality Collection

Unlike the NMDS, where information on the principal diagnosis is coded at the hospital level and then forwarded electronically to the Ministry of Health, in the National Mortality Collection each of the approximately 28,000 deaths occurring in New Zealand each year is coded manually by Ministry of Health staff. For most deaths the Medical Certificate of Cause of Death provides the information required, although coders also have access to the information contained in the NMDS, NZ Cancer Registry, NZTA, Police, Water Safety NZ and ESR [286]. As a consequence, while coding is still reliant on the accuracy of the death certificate and other supporting information, there remains the capacity for a uniform approach to the coding which is not possible for hospital admission data.

While there are few published accounts of the quality of coding information contained in the National Mortality Collection, the dataset lacks some of the inconsistencies associated with the NMDS as the process of death registration is mandated by law and there are few ambiguities as to the inclusion of cases over time. As a consequence, time series analyses derived from this dataset are likely to be more reliable than that provided by the NMDS. One issue that may affect the quality of information derived from this dataset however is the collection of ethnicity data, which is discussed in more detail in **Appendix 6** of this report.



APPENDIX 6: MEASUREMENT OF ETHNICITY

The majority of rates calculated in this report rely on the division of numerators (e.g. hospital admissions, mortality data) by Statistics NZ Estimated Resident Population denominators. Calculation of accurate ethnic specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and the denominator, and that a single child will be identified similarly in each dataset. In New Zealand this has not always been the case, and in addition the manner of collecting information on ethnicity has varied significantly over time. Since 1996 however, there has been a move to ensure that ethnicity information is collected in a similar manner across all administrative datasets in New Zealand (Census, Hospital Admission, Mortality, Births). The following section briefly reviews how information on ethnicity has been collected in national data collections since the early 1980s and the implications of this for the information contained in this report.

1981 Census and Health Sector Definitions

Earlier definitions of ethnicity in official statistics relied on the concept of fractions of descent, with the 1981 census asking people to decide whether they were fully of one ethnic origin (e.g. Full Pacific, Full Māori) or if of more than one origin, what fraction of that ethnic group they identified with (e.g. 7/8 Pacific + 1/8 Māori). When prioritisation was required, those with >50% of Pacific or Māori blood were deemed to meet the ethnic group criteria of the time [287]. A similar approach was used to recording ethnicity in health sector statistics, with birth and death registration forms asking the degree of Pacific or Māori blood of the parents of a newborn baby / the deceased individual. For hospital admissions, ancestry based definitions were also used during the early 1980s, with admission officers often assuming ethnicity, or leaving the question blank [288].

1986 Census and Health Sector Definitions

Following a review expressing concern at the relevance of basing ethnicity on fractions of descent, a recommendation was made to move towards self-identified cultural affiliation. Thus the 1986 Census asked the question "What is your ethnic origin?" and people were asked to tick the box(s) that applied to them. Birth and death registration forms however, continued to use the "fractions of blood" question until 1995, making comparable numerator and denominator data difficult to obtain [287]. For hospital admissions, the move from an ancestry based to a self-identified definition of ethnicity began in the mid-80s, although non-standard forms were used and typically allowed a single ethnicity only [288].

1991 Census and Health Sector Definitions

A review suggested that the 1986 ethnicity question was unclear as to whether it was measuring ancestry or cultural affiliation, so the 1991 Census asked two questions:

1. Which ethnic group do you belong to? (tick the box or boxes which apply to you)
2. Have you any NZ Māori ancestry? (if yes, what iwi do you belong to?)

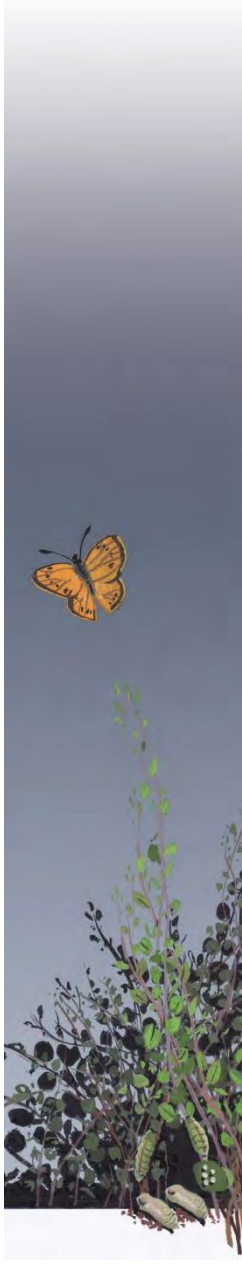
As indicated above however, birth and death registrations continued with ancestry based definitions of ethnicity during this period, while a number of hospitals were beginning to use self-identified definitions in a non standard manner [288].

1996 Census and Health Sector Definitions

While the concepts and definitions remained the same as for the 1991 census, the ethnicity question in the 1996 Census differed in that:

- The NZ Māori category was moved to the top of the ethnic categories
- The 1996 question made it more explicit that people could tick more than 1 box.
- There was a new "Other European" category with 6 sub groups

As a result of these changes, there was a large increase in the number of multiple responses, as well as an increase in the Māori ethnic group in the 1996 Census [287].



Within the health sector however, there were much larger changes in the way in which ethnicity information was collected. From late 1995, birth and death registration forms incorporated a new ethnicity question identical to that in the 1996 Census, allowing for an expansion of the number of ethnic groups counted (previously only Māori and Pacific) and resulting in a large increase in the proportion of Pacific and Māori births and deaths. From July 1996 onwards, all hospitals were also required to inquire about ethnicity in a standardised way, with a question that was compatible with the 1996 Census and that allowed multiple ethnic affiliations [288]. A random audit of hospital admission forms conducted by Statistics NZ in 1999 however, indicated that the standard ethnicity question had not yet been implemented by many hospitals. In addition, an assessment of hospital admissions by ethnicity over time showed no large increases in the proportions of Māori and Pacific admissions after the 1996 "change over", as had occurred for birth and death statistics, potentially suggesting that the change to a standard form allowing for multiple ethnic affiliations in fact did not occur. Similarities in the number of people reporting a "sole" ethnic group pre and post 1996 also suggest that the way in which information on multiple ethnic affiliations was collected did not change either. Thus while the quality of information available since 1996 has been much better than that previously, there remains some concern that hospitals continue to undercount multiple ethnic identifications and as a result, may continue to undercount Pacific and Māori peoples [288].

2001 Census and Health Sector Definitions

The 2001 Census reverted back to the wording used in the 1991 Census after a review showed that this question provided a better measure of ethnicity based on the current statistical standard [287]. The health sector also continued to use self-identified definitions of ethnicity during this period, with the *Ethnicity Data Protocols for the Health and Disability Sector* providing guidelines which ensured that the information collected across the sector was consistent with the wording of the 2001 Census (i.e. *Which ethnic groups do you belong to (Mark the space or spaces that apply to you)?*)

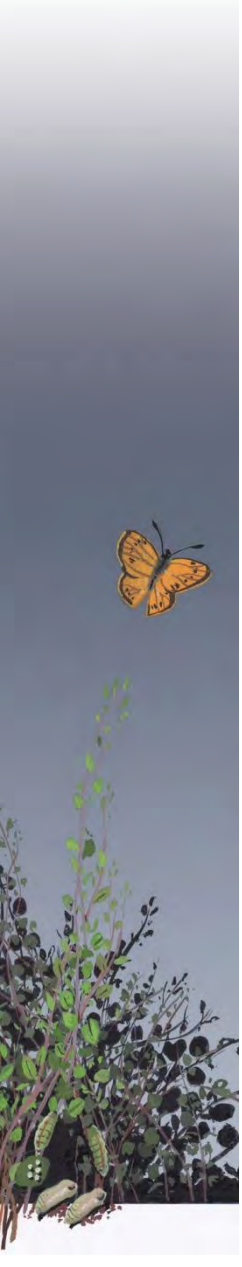
2006 Census and Health Sector Definitions

In 2004, the Ministry of Health released the *Ethnicity Data Protocols for the Health and Disability Sector[289]*, with these protocols being seen as a significant step forward in terms of standardising the collection and reporting of ethnicity data in the health sector [290]. The protocols stipulated that the standard ethnicity question for the health sector was the 2001 Census ethnicity question, with respondents being required to identify their own ethnicity, and with data collectors being unable to assign this on respondent's behalf, or to transfer this information from another form. The protocols also stipulated that ethnicity data needed to be recorded to a minimum specificity of Level 2 (see below) with systems needing to be able to store, at minimum, three ethnicities, and to utilise standardised prioritisation algorithms, if more than three ethnic groups were reported. In terms of outputs, either: sole / combination, total response, or prioritised ethnicity needed to be reported, with the methods used being clearly described in any report [289].

The following year, Statistics New Zealand's Review of the Measurement of Ethnicity (RME), culminated in the release of the *Statistical Standard for Ethnicity 2005*[291], which recommended that:

1. The 2006 Census ethnicity question use identical wording to the 2001 Census.
2. Within the "Other" ethnic group, that a new category be created, or those identifying as "New Zealander" or "Kiwi". In previous years these responses had been assigned to the European ethnic group.
3. All collections of official statistics measuring ethnicity have the capacity to record and report six ethnicity responses per individual, or at a minimum, three responses when six could not be implemented immediately.
4. The practice of prioritising ethnicity to one ethnic group should be discontinued.

At the 2006 Census however, a total of 429,429 individuals (11.1% of the NZ population) identified themselves as a New Zealander, with further analysis suggesting that 90% of the increase in those identifying as New Zealanders in 2006, had arisen from those identifying



as New Zealand European at the 2001 Census [292]. In 2009 Statistics NZ amended the Standard to reflect these issues [293] with the current recommendation being that future Censuses retain the current ethnicity question (i.e. that New Zealander tick boxes not be introduced) but that alongside the current standard outputs, where New Zealander responses are assigned to the Other ethnicity category, that an alternate classification be introduced, which combines the European and New Zealander ethnic groups into a single European and Other Ethnicity category for use in time series analysis (with those identifying as both European and New Zealanders being counted only once in this combined ethnic group [293].

The Current Recording of Ethnicity in New Zealand's National Datasets

In New Zealand's national health collections (e.g. National Minimum Dataset and Mortality Collection, NZ Cancer Registry),up to 3 ethnic groups per person are stored electronically for each event, with data being coded to Level 2 of Statistics New Zealand's 4 Level Hierarchical Ethnicity Classification System [280]. In this Classification System increasing detail is provided at each level. For example [289]:

- Level 1 (least detailed level) e.g. code 1 is European
- Level 2 e.g. code 12 is Other European
- Level 3 e.g. code 121 is British and Irish
- Level 4 (most detailed level) e.g. code 12111 is Celtic

Māori however, are identified similarly at each level (e.g. Level 1: code 2 is Māori...vs Level 4: code 21111 is Māori).

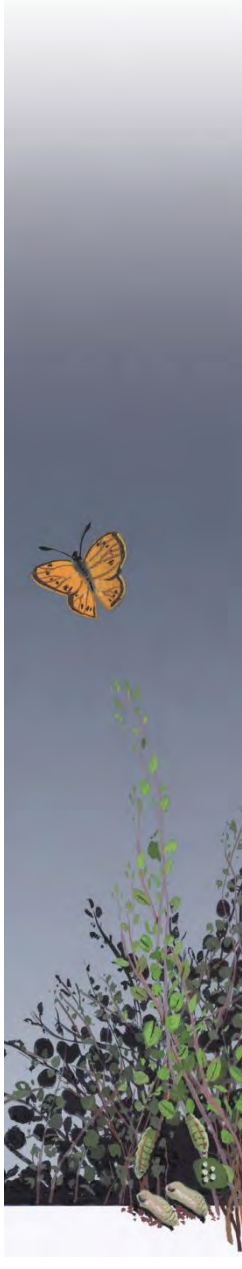
For those reporting multiple ethnic affiliations, information may also be prioritised according to Statistics New Zealand's protocols, with Māori ethnicity taking precedence over Pacific >Asian/Indian > Other > European ethnic groups [289]. This ensures that each individual is counted only once and that the sum of the ethnic group sub-populations equals the total NZ population [288]. The implications of prioritisation for Pacific groups however are that the outcomes of those identifying as both Māori and Pacific are only recorded under the Māori ethnic group.

For those reporting more than 3 ethnic affiliations, the ethnic groups recorded are again prioritised (at Level 2), with Māori ethnicity taking precedence over Pacific >Asian/Indian > Other > European ethnic groups (for further details on the prioritisation algorithms used see [289].In reality however, less than 0.5% of responses in the National Health Index database have three ethnicities recorded, and thus it is likely that this prioritisation process has limited impact on ethnic specific analyses [289].

Undercounting of Māori and Pacific Peoples in National Collections

Despite significant improvements in the quality of ethnicity data in New Zealand's national health collections since 1996, care must still be taken when interpreting the ethnic specific rates presented in this report, as the potential still remains for Māori and Pacific children and young people to be undercounted in our national data collections. In a review that linked hospital admission data to other datasets with more reliable ethnicity information (e.g. death registrations and Housing NZ Corporation Tenant data), the authors of Hauora IV [294] found that on average, hospital admission data during 2000–2004 undercounted Māori children (0–14 years) by around 6%, and Māori young people by around 5–6%. For cancer registrations, the undercount was in the order of 1–2% for the same age groups. While the authors of Hauora IV developed a set of adjusters which could be used to minimise the bias such undercounting introduced when calculating population rates and rate ratios, these (or similar) adjusters were not utilised in this report for the following reasons:

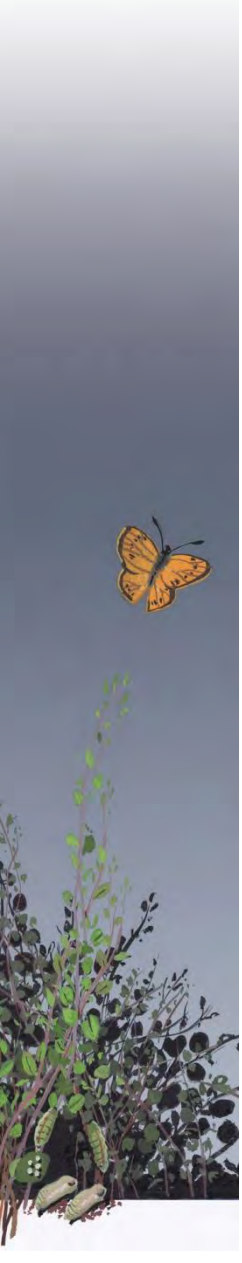
1. Previous research has shown that ethnicity misclassification can change over time, and thus adjusters developed for one period may not be applicable to other periods [295].
2. Research also suggests that ethnic misclassification may vary significantly by DHB [295], and thus that adjusters developed using national level data (as in Hauora IV) may not be applicable to DHB level analyses, with separate adjusters needing to be developed for each DHB.



Further, as the development of adjusters requires the linkage of the dataset under review with another dataset, for which more reliable ethnicity information is available, and as this process is resource intensive, and not without error (particularly if the methodology requires probabilistic linkage of de-identified data) the development of a customised set of period and age specific adjusters was seen as being beyond the scope of the current project. The reader is thus urged to bear in mind, that the data presented in this report may undercount Māori and Pacific children to a variable extent (depending on the dataset used) and that in the case of the hospital admission dataset for Māori, this undercount may be as high as 5–6%.

Ethnicity Classifications Utilised in this Report and Implications for Interpretation of Results

Because of inconsistencies in the manner in which ethnicity information was collected prior to 1996, all ethnic specific analysis presented in this report are for the 1996 year onwards. The information thus reflects self-identified concepts of ethnicity, with Statistics NZ's Level 1 Ethnicity Classification being used, which recognise 5 ethnic groups: European (including New Zealander), Māori, Pacific, Asian (including Indian) and Other (including Middle Eastern, Latin American and African). In order to ensure that each health event is only counted once, unless otherwise specified, prioritised ethnic group has been used.



APPENDIX 7: NZ DEPRIVATION INDEX

The NZ Deprivation Index (NZDep) is a small area index of deprivation, which has been used as a proxy for socioeconomic status in this report. The main concept underpinning small area indices of deprivation is that the socioeconomic environment in which a person lives can confer risks / benefits which may be independent of their own social position within a community [296]. They are thus aggregate measures, providing information about the wider socioeconomic environment in which a person lives, rather than about their individual socioeconomic status.

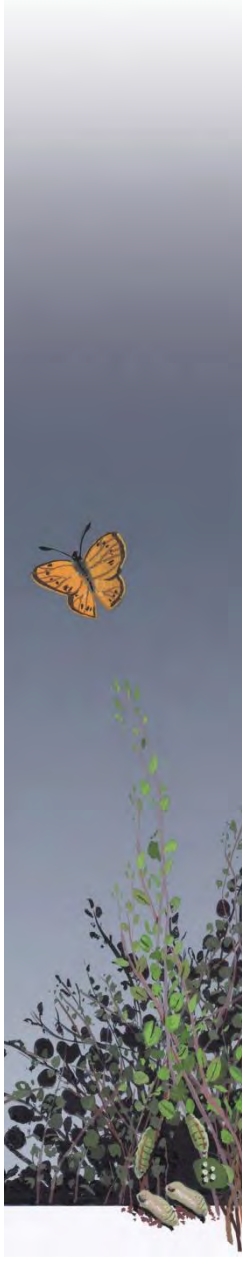
The NZDep was first created using information from the 1991 census, but has since been updated following each census. The NZDep2006 combines 9 variables from the 2006 census which reflect 8 dimensions of deprivation (**Table 110**). Each variable represents a standardised proportion of people living in an area who lack a defined material or social resource (e.g. access to a car, income below a particular threshold), with all 9 variables being combined to give a score representing the average degree of deprivation experienced by people in that area. While the NZDep provides deprivation scores at meshblock level (Statistics NZ areas containing approx 90 people), for the purposes of mapping to national datasets, these are aggregated to Census Area Unit level (≈1,000–2,000 people). Individual area scores are then ranked and placed on an ordinal scale from 1 to 10, with decile 1 reflecting the least deprived 10% of small areas and decile 10 reflecting the most deprived 10% of small areas [297].

Table 110. Variables used in the NZDep2006 Index of Deprivation [298]

No	Factor	Variable in Order of Decreasing Weight in the Index
1	Income	People aged 18–64 receiving means tested benefit
2	Employment	People aged 18–64 unemployed
3	Income	People living in households with income below an income threshold
4	Communication	People with no access to a telephone
5	Transport	People with no access to a car
6	Support	People aged <65 living in a single parent family
7	Qualifications	People aged 18–64 without any qualifications
8	Owned Home	People not living in own home
9	Living Space	People living in households below a bedroom occupancy threshold

The advantage of NZDep is its ability to assign measures of socioeconomic status to the elderly, the unemployed and to children (where income and occupational measures often don't apply), as well as to provide proxy measures of socioeconomic status for large datasets when other demographic information is lacking. Small area indices have limitations however, as not all individuals in a particular area are accurately represented by their area's aggregate score. While this may be less of a problem for very affluent or very deprived neighbourhoods, in average areas, aggregate measures may be much less predictive of individual socioeconomic status [296]. Despite these limitations, the NZDep has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

Note: As New Zealand's national datasets have traditionally continued to use the previous Census' domicile codes for 1–2 years after any new Census, all of the numerators (e.g. numbers of hospital admissions, deaths) and denominators in this report have been mapped to NZDep2001.



APPENDIX 8: AMBULATORY SENSITIVE HOSPITAL ADMISSIONS

The ASH analysis in this report was performed using two coding algorithms, the new Paediatric ASH Algorithm specifically developed by Anderson et al in conjunction with the New Zealand Child and Youth Epidemiology Service (NZCYES) (**Table 181**), and the old coding algorithm developed by Tobias and Jackson, which was used within the New Zealand health sector until 2008 (**Table 182**).

The development of the new Paediatric ASH Coding Algorithm involved four steps:

1. Identification of the most frequent causes of hospital admissions for children and young people in New Zealand using data from the National Minimal Dataset (NMDS).
2. Formation of a convening group to define avoidable morbidity for the purposes of the indicator and to identify key policy areas to be considered in the indicator.
3. Consultation with experts in the paediatric, public health and primary care fields to determine the influence of various policy areas on hospital admissions for the 42 conditions identified in step one. This was an iterative process with the initial feedback being re-circulated to the panel of experts for further consideration before hospitalisations were confirmed as either potentially avoidable or non potentially avoidable. Access to primary care was one of the policy areas considered, with the subset of conditions where the expert panel judged that hospitalisations could potentially be avoided by timely access to appropriate primary care being classified as ASH in the new coding algorithm.
4. Development of a final coding algorithm (**Table 181**) and consideration of appropriate filters.

The ASH classification finally developed is intended to be representative of hospitalisations that could potentially be prevented by access to primary care in the 0–14 year age group, but is not exhaustive. It is important to note that only conditions consulted on during the process described above were included in the ASH coding algorithm. For example while the majority of cases of epiglottitis can be prevented through vaccination against Hib, and therefore hospitalisations due to epiglottitis might be considered ambulatory sensitive, epiglottitis is rare and was not identified in step one of the process described above. Epiglottitis was therefore not consulted on and was not included in the ASH coding algorithm.

Injury and poisoning are also important causes of childhood morbidity and make up a large proportion of paediatric hospital admissions. However injury and poisoning were not consulted on during this process because of the greater tendency for some emergency departments to upload their cases to the NMDS than others, thus making it difficult to obtain consistent data across DHBs. Ideally injury will be incorporated into the ASH coding algorithm in the future if these data issues can be resolved.

The convening group also determined that a number of filters should be applied to this coding algorithm including:

1. Neonatal Admissions (0–28 days) are specifically excluded (as issues arising in the context of a birth are likely to require different care pathways than those arising in the community, with the exception of neonatal tetanus and congenital rubella, which can be prevented by timely access of women to immunisation in primary care).
2. Waiting List Admissions are specifically excluded, with the exception of Waiting List admissions for dental caries, as DHBs differ in the way these children are admitted around the country.

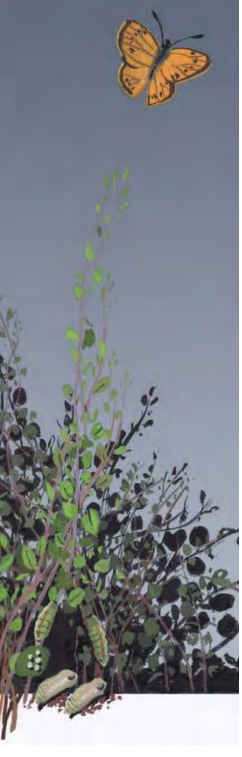


Table 181. New Paediatric ASH Codes Developed for the New Zealand Health Sector

Ambulatory Sensitive Conditions	ICD 10 coding
Asthma	J45, J46
Bronchiectasis	J47
Skin Infections	H000, H010, J340, L01–L04, L08, L980
Constipation	K590
Dental Caries	K02, K04, K05
Dermatitis and Eczema	L20–L30
Gastroenteritis	A02– A09, R11
Gastro–Oesophageal Reflux	K21
Nutritional Deficiency	D50–D53, E40–E46, E50–E56, E58–E61, E63, E64
Bacterial/Non-Viral Pneumonia	J13–J16, J18
Rheumatic Fever / Heart Disease	I00–I09
Otitis Media	H65–H67
Acute Upper Respiratory Tract Infection	J00–J03, J06
Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella ≥6 months: Pertussis, Diphtheria, Hepatitis B ≥16 months Measles, Mumps, Rubella	A35, A36, A37, A80, B16, B180, B181 A33, A34, P350, B05, B06, B26, M014,
ASH Urinary Tract Infection > 4 years	N10, N12, N300, N390, N309, N136
Filters: Codes Apply to Children 0–14 Years (excluding the neonatal period) Acute and Arranged Admissions Only (except Dental Conditions where Waiting List included)	

Note: Coding Algorithm developed by Pip Anderson, Elizabeth Craig, Gary Jackson and Martin Tobias in conjunction with the New Zealand Child and Youth Epidemiology Service

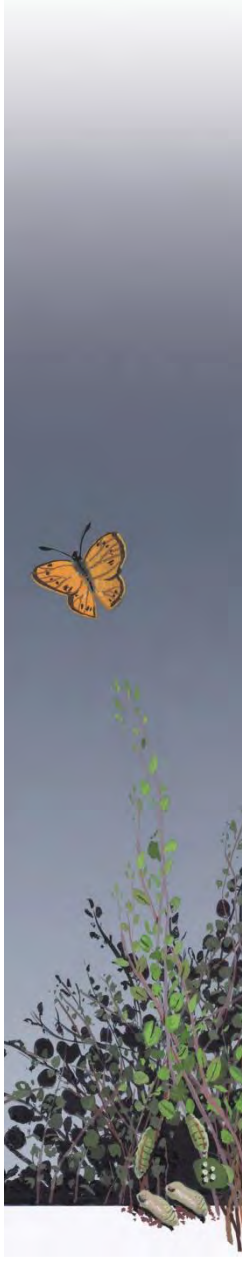
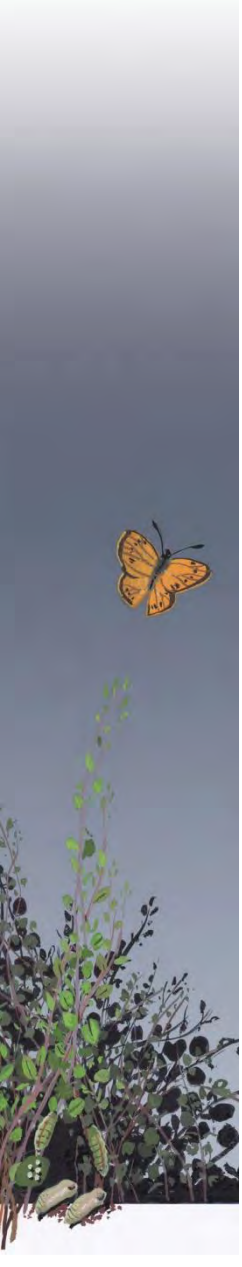


Table 182. Weightings Applied to Potentially Avoidable Hospital Admissions by Jackson and Tobias [101] and Subsequently Used by the New Zealand Ministry of Health [299]

Condition	Population Preventable	Ambulatory Sensitive	Injury Prevention
Tuberculosis	0.5	0.5	0
HIV / AIDS	1	0	0
Skin Cancers	0.5	0.5	0
Oral Cancers	1	0	0
Colorectal Cancer	0.7	0.3	0
Lung Cancer	1	0	0
Breast Cancer	0.3	0.7	0
Nutrition	1	0	0
Alcohol-Related Conditions	1	0	0
Ischemic Heart Disease	1	0	0
Gastroenteritis	0.2	0.8	0
Other Infections	0.2	0.8	0
Immunisation-Preventable	0	1	0
Hepatitis / Liver Cancer	0	1	0
Sexually Transmitted Disease	0	1	0
Cervical Cancer	0	1	0
Thyroid Disease	0	1	0
Diabetes	0.2	0.8	0
Dehydration	0	1	0
Epilepsy	0	1	0
ENT Infections	0	1	0
Rheumatic Fever / Heart Disease	0	1	0
Hypertensive Disease	0.3	0.7	0
Angina	0	1	0
Congestive Heart Failure	0	1	0
Stroke	0.5	0.5	0
Respiratory Infections	0	1	0
CORD	0.6	0.4	0
Asthma	0	1	0
Dental Conditions	0.4	0.6	0
Peptic Ulcer	0	1	0
Ruptured Appendix	0	1	0
Obstructed Hernia	0	1	0
Kidney / Urinary Infection	0	1	0
Cellulitis	0	1	0
Failure to Thrive	0	1	0
Gangrene	0	1	0
Road Traffic Injury	0	0	1
Poisoning	0	0	1
Swimming Pool	0	0	1
Recreation Injury	0	0	1
Sport Injury	0	0	1
Fire	0	0	1
Drowning	0	0	1
Suicide	0	0	1



APPENDIX 9: METHODS USED TO DEVELOP THE CHILDREN'S SOCIAL HEALTH MONITOR

Introduction

In response to deteriorating economic conditions in New Zealand and Australia in the late 2000s, a Working Group of health professionals from a range of organisations[3] with an interest in child health was formed in early 2009. Over the course of the year, this Working Group discussed the conceptualisation of an indicator set to monitor the impact of the recession on child wellbeing, the types of indicators which might be included, and the criteria by which individual indicators should be selected. As a result of these discussions, it was proposed that a Children's Social Health Monitor be developed, which comprised the following:

1. *A Basket of Indicators to Monitor Prevailing Economic Conditions:* Ideally, indicators would capture different facets of economic wellbeing (e.g. in a recession several quarters of negative growth (*GDP*) may precede upswings in Unemployment Rates, which in turn will influence the number of Children Reliant on Benefit Recipients.
2. *A Basket of Indicators to Monitor Children's Wellbeing:* Ideally indicators would respond relatively quickly (e.g. months–small number of years) to family's adaptations to deteriorating economic conditions (e.g. hospitalisations for poverty related conditions) and would provide an overview of family wellbeing from a variety of different perspectives.

Indicator Selection Criteria

In selecting these indicators, it was decided that only routinely collected data sources which were of good quality, and which provided complete population coverage would be used, in order to ensure the indicator set was methodologically robust and could be consistently monitored over time. In order to achieve this aim, the Working Group developed a set of selection criteria, against which candidate indicators were scored. These selection criteria included:

Conceptual Criteria

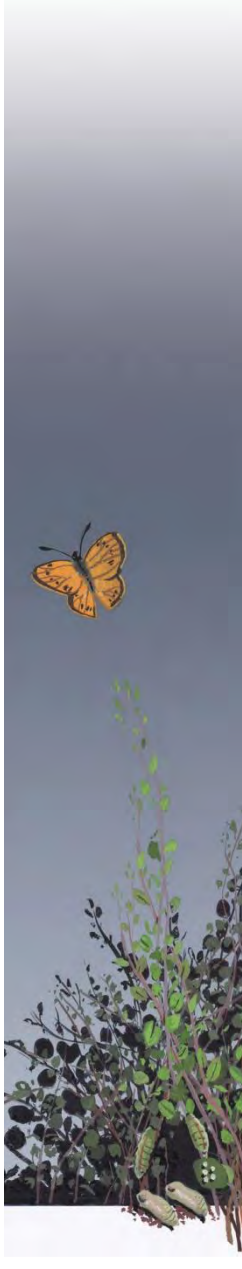
Criteria for Indicators to Monitor Prevailing Macroeconomic Conditions

1. Internationally recognised and reported measure of economic performance / wellbeing
2. Should impact on at least one facet of children's wellbeing (i.e. the pathway(s) via which it impacts on children's wellbeing should be relatively well understood, or an association between the indicator and wellbeing documented in the literature).
3. Likely to change in response to a recession (i.e. months–small number of years)

Criteria for Indicators to Monitor Children's Health and Wellbeing

1. The condition is likely to be influenced by family's physical adaptations to worsening economic conditions (e.g. saving on heating to pay for food, moving in with family to save on rent).
2. The condition is likely to be influenced by family's psychological adaptations to worsening economic conditions (e.g. increased family conflict in response to financial stress).

[3]The Paediatric Society of New Zealand, the Population Child Health Special Interest Group of the Royal Australasian College of Physicians, the New Zealand Child and Youth Epidemiology Service, TAHA (the Well Pacific Mother and Infant Service), the Māori SIDS Programme, the Kia Mataara Well Child Consortium, the New Zealand Council of Christian Social Services, and academics from the Universities of Auckland and Otago



3. The condition exhibits a socioeconomic gradient (e.g. rates are higher in more deprived areas)
4. The condition is likely to respond to changing economic conditions in the short to medium term (e.g. months to 1–2 years)

Data Quality Criteria

Data Quality Criteria (for either of the above indicator categories)

1. Needs to be routinely collected
2. Available at the national level i.e. complete coverage of target population
3. Updated at least annually (although quarterly preferable)
4. Availability of consistent time series data going back several years (i.e. standard and stable method of data collection)
5. Distribution can be broken down by e.g. ethnicity, socioeconomic status, region

Selection of the Baseline Indicator Set

In mid-2009 a long list of candidate indicators (selected by means of a scan of the available literature, email consultation with child health networks, and the suggestions of Working Group members) were then scored against each of these criteria by Working Group members and other health professionals (n=20). Those scoring the indicators were also asked to select a Top five Economic and Top five Health and Wellbeing Indicators for inclusion in the Children's Social Health Monitor. The resulting Top five Economic and Wellbeing indicators (as determined both by criteria scoring and priority ranking) were:

Economic Indicators:

Gross Domestic Product

Income Inequality

Child Poverty

Unemployment Rates

The Number of Children Reliant on Benefit Recipients

Child Health and Wellbeing Indicators:

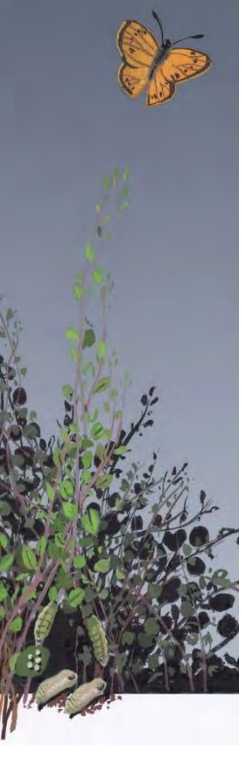
Hospital Admissions with a Social Gradient

Mortality with a Social Gradient

Infant Mortality

Hospital Admissions and Mortality from Non-Accidental Injury

Ambulatory Sensitive Hospital Admissions



Methodology for Developing the Hospital Admissions and Mortality with a Social Gradient Indicator

While all of the Top five Economic Indicators, and a number of the Child Health and Wellbeing indicators already had established methodologies, the hospital admissions and mortality with a social gradient indicator had to be developed specifically for the Children's Social Health Monitor. The methodology used to develop this indicator is outlined below:

Hospital Admissions

In considering which conditions should be included in the analysis of hospital admissions with a social gradient, the 40 most frequent causes of hospital admission in children aged 0–14 years (excluding neonates) were reviewed, and those exhibiting a social gradient (a rate ratio of ≥1.8 for NZDep Decile 9–10 vs. Decile 1–2; or for Māori, Pacific or Asian vs. European children) were selected. A small number of conditions with rate ratios in the 1.5–1.8 range were also included, if they demonstrated a consistent social gradient (i.e. rates increased in a stepwise manner with increasing NZDep deprivation) and the association

was biologically plausible (the plausibility of the association was debated by Working Group members).

Inclusion and Exclusion Criteria
Neonatal hospital admissions (<29 days) were excluded on the basis that these admissions are more likely to reflect issues arising prior to / at the time of birth (e.g. preterm infants may register multiple admissions as they transition from intensive care (NICU) → special care nurseries (SCBU) → the postnatal ward), and respiratory infections / other medical conditions arising in these contexts are likely to differ in their aetiology from those arising in the community.

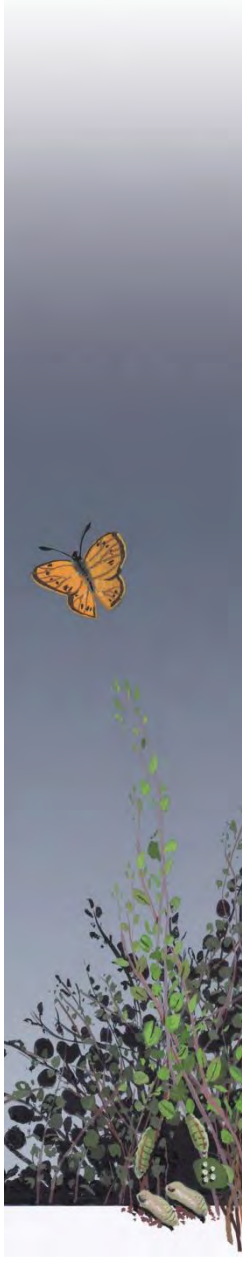
For medical conditions, only acute and arranged hospital admissions were included, as Waiting List admissions are likely to reflect service capacity, rather than the burden of health need (e.g. the inclusion of Waiting List admissions would result in a large number of children with otitis media and chronic tonsillitis (who were being admitted for grommets and tonsillectomies) being included, and the demographic profile of these children may be very different from children attending hospital acutely for the same conditions).

For injury admissions, filtering by admission type was not possible, as a number of DHBs admitted injury cases under (now discontinued) ACC admission codes, making it difficult to distinguish between acute and waiting list admissions in this context. As with other NZCYES reports, all injury cases with an Emergency Department Specialty Code (M05–M08) on discharge were excluded as a result of inconsistent uploading of Emergency Department cases across DHBs (see **Appendix 3** for further detail). This differential filtering however means that it is not possible to accurately compare the magnitude of the social gradients between the medical condition and injury categories, as they were derived using different methodologies (and social differences in Emergency Department vs. primary care attendances for minor medical conditions may have accounted for some of the social gradients seen). No such differential filtering occurred for mortality data however (see below), and thus the magnitude of the social differences seen in this context is more readily comparable.

Mortality
In the case of mortality, because in many instances, the number of deaths from a particular condition was insufficient to calculate reliable rate ratios by NZDep and ethnicity, the rate ratios derived from the analysis of hospital admission data were used to denote category membership. The most frequent causes of mortality in those 0–14 years (excluding neonates) were reviewed however, in order to ensure that no additional conditions making a large contribution to mortality had been missed by the analysis of hospital admission data. This identified two further conditions (which by analysis of mortality of data met rate ratio criteria); deaths from drowning and Sudden Unexpected Death in Infancy, which were then included in the coding algorithms (for both hospital admissions and mortality data). A number of deaths were also identified, which were attributed to issues arising in the perinatal period (e.g. extreme prematurity, congenital anomalies), but in order to preserve consistency with previous exclusion criteria (i.e. the exclusion of conditions arising in the perinatal period) these were not included in coding algorithms.

In Conclusion

While it is hoped that over time this indicator set will be expanded and further refined, it is intended that the NZ Child and Youth Epidemiology Service will monitor this core minimum indicator set on an annual basis, until the economic position of New Zealand children improves appreciably.



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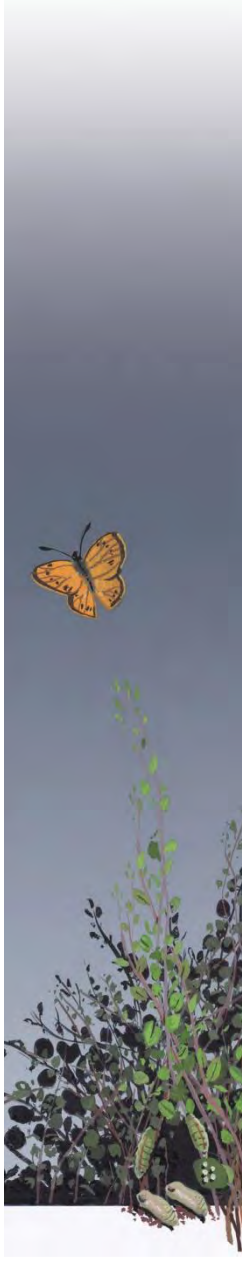

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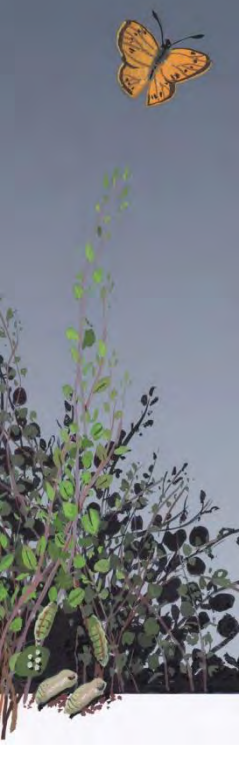

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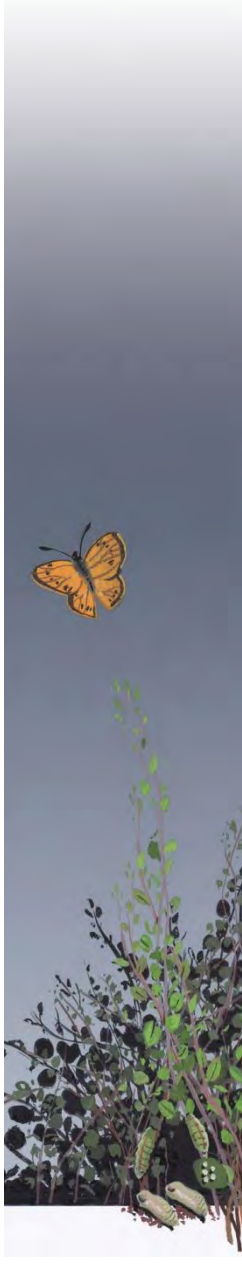

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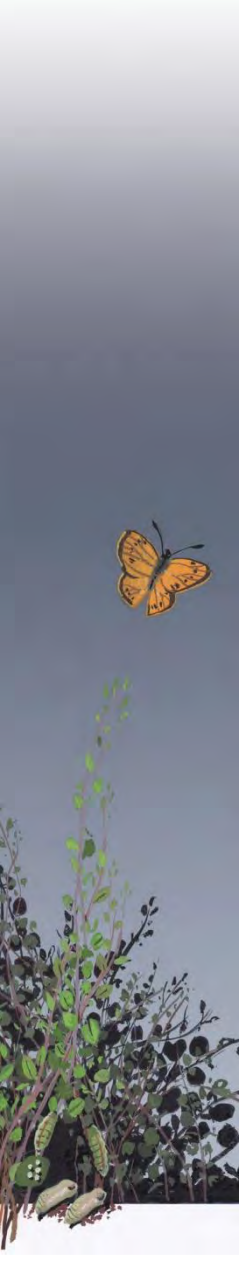

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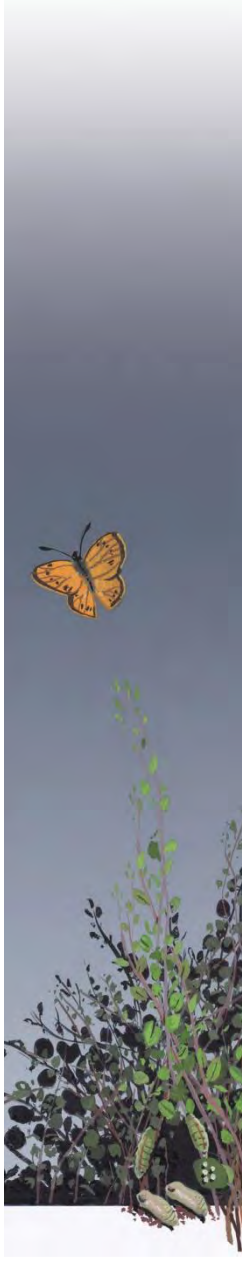

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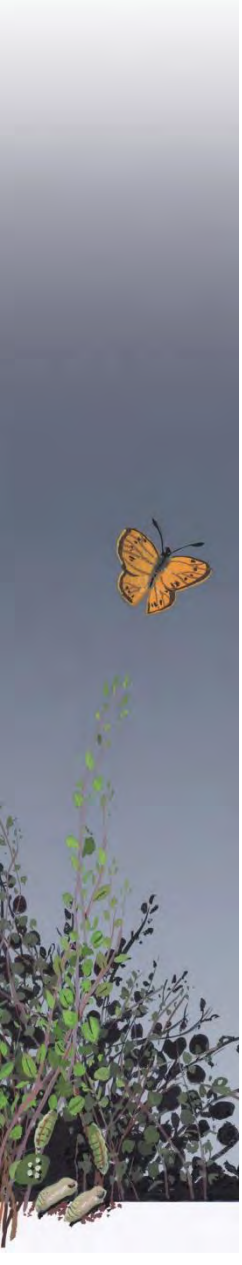

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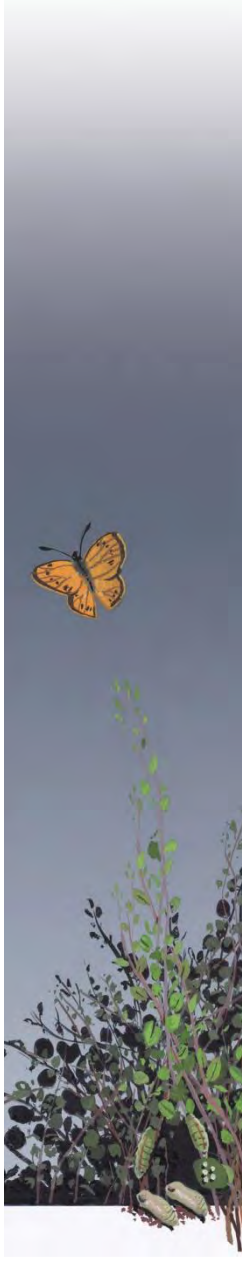

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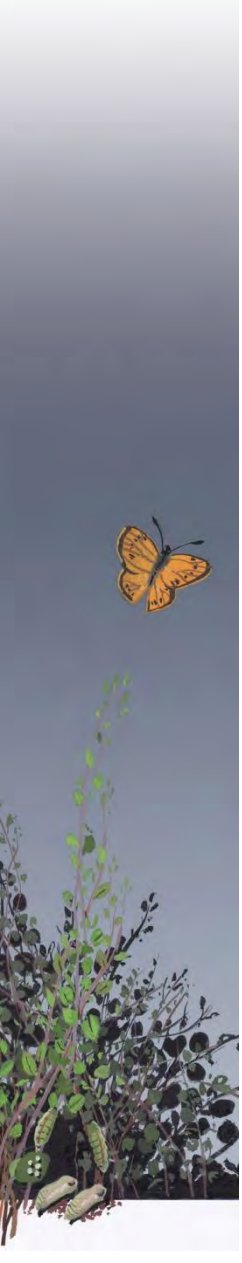

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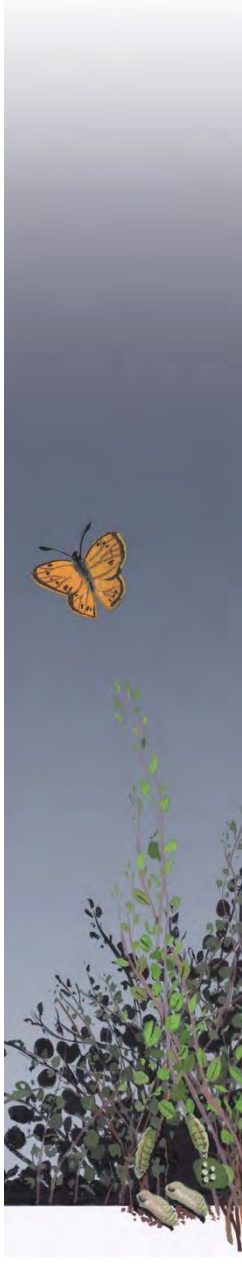

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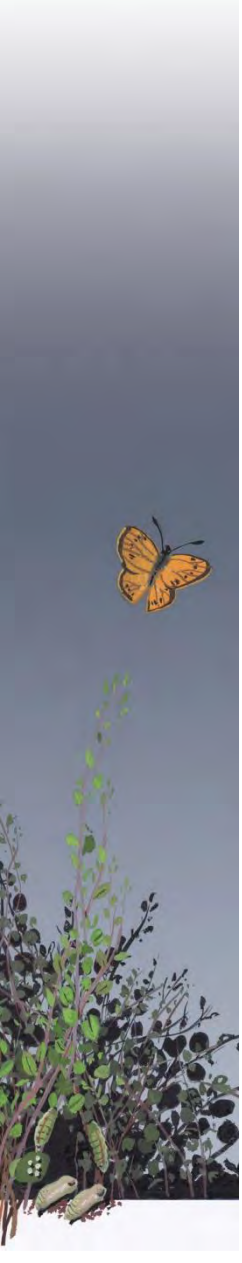

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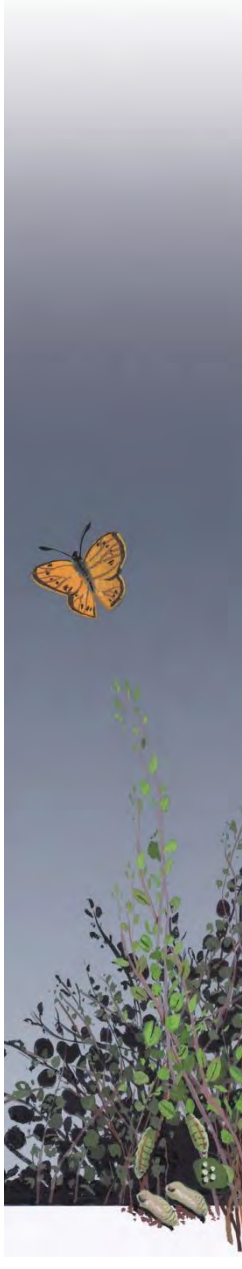

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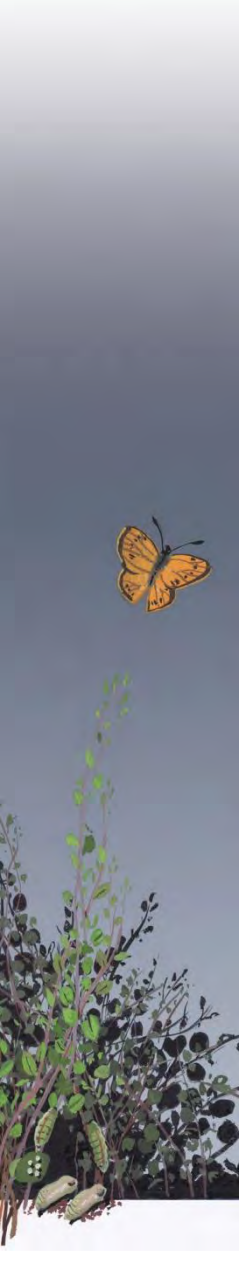

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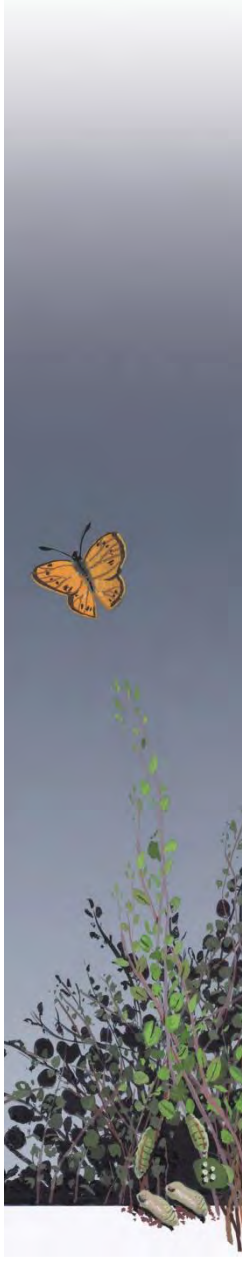
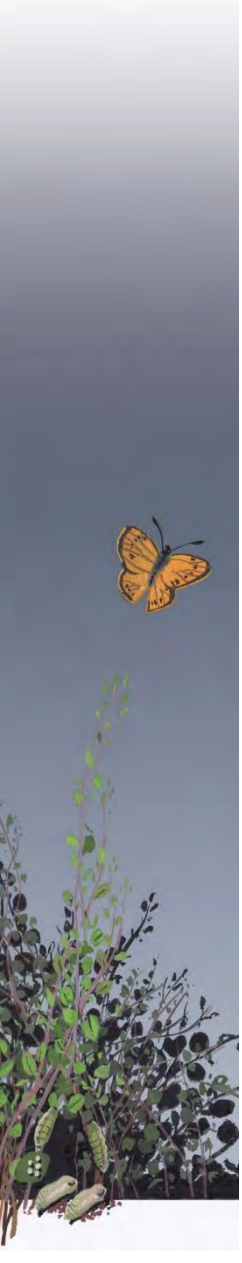
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