

## Supporting Information: Fluoridation of Drinking Water

### Dental Decay

Dental decay is an important public health issue. Dental decay affects 41% of children aged 2-11 years in their primary teeth, 39% of children aged 5-17 years in their permanent teeth and 77% of the 18-24 years age group<sup>1</sup>. It is a progressive disease that affects people of all ages.

The Taranaki DHB is committed to reducing health inequalities in the population it serves by focusing on the health of Maori and groups with poorer health status.<sup>2</sup> The Taranaki District Health Board (DHB) considers that dental decay is an important public health issue with poorer oral health outcomes reflecting differences in ethnicity and socioeconomic status.<sup>1</sup> In Taranaki in 2010, 55% of all five year old children were free of dental caries.<sup>3</sup> Sixty-two percent (62%) of “other” ethnic groups were caries free compared to only 33% of Maori children being caries free.<sup>3</sup>

### Fluoride

Fluoride is a naturally occurring element present in most water, soil, plants and many foods. In New Zealand, while fluoride is found naturally in water it is mostly at a level too low to protect against tooth decay.

Fluoride, at a certain concentration in drinking water has benefits for oral health. Fluoride works in three ways to improve oral health: making the teeth more resistant to decay by toughening (through mineralisation) the enamel tooth surface; reducing the growth of bacteria that cause dental decay and cavities; and assisting the repair of the early stages of tooth decay. Fluoride can help strengthen baby teeth before they come through the gums by building fluoride into their structure. The main effect of fluoride occurs when teeth erupt through the gums. If fluoride is present in saliva, teeth will continually be exposed to small levels of fluoride, which helps strengthen the tooth surface.

### Fluoridation

‘Fluoridation’ is the name given to adding fluoride to drinking water to achieve a level recommended by the New Zealand Ministry of Health of between 0.7 mg/L to 1.0 mg/L.<sup>Error! Bookmark not defined.</sup> This is considered the optimal concentration level that provides protection against tooth decay while minimising public health risk.

Fluoride, like many other common substances such as, water, iron, vitamins A and D or even oxygen, in excess quantities can be harmful. At the very low concentrations (0.7 ppm to 1 ppm) used in water fluoridation it is not toxic, even when used over a lifetime<sup>1</sup>

The maximum level of fluoride allowed in drinking water is 1.5 milligrams per Litre.<sup>4</sup> The amount added is monitored to make sure that the levels stay within that range.

## **Evidence Base**

A large body of scientific literature supports fluoridation as a safe means of reducing rates of tooth decay. Extensive studies of water fluoridation and human health have been undertaken in many countries over many years. The safety of water fluoridation to general health has been reviewed in New Zealand, and in overseas reviews. These reviews have consistently found no evidence of significant adverse health effects of water fluoridation. Mild dental fluorosis is seen in populations who do not drink fluoridated water.

In 1994 the New Zealand Public Health Commission published a report on water fluoridation in New Zealand, which, in part, dealt with the evidence of possible adverse effects. This report found that evidence for adverse health effects such as bone fracture and cancer was inconclusive, and recommended that more research be carried out. The Ministry of Health commissioned a further review of studies on the potential adverse effects of fluoridation, and this was published in 2000.<sup>6</sup> The report stated: "No persuasive evidence of harmful effects of optimal water fluoridation was revealed, and, generally, the evidence has strengthened that there are no serious health risks associated with the practice. That was particularly the case for bone fracture risk."

## **Cost Effectiveness**

Water fluoridation can benefit all people with natural teeth regardless of age, income or education status. It gives the greatest benefit to children and especially those most at risk of tooth decay. It is the most cost effective way for communities to receive fluoride. In New Zealand, water fluoridation has been estimated to prevent between 2.4–12.0 decayed, missing and filled teeth in the average person over a lifetime, or between 58,000 and 267,000 decayed, missing and filled teeth in New Zealand per year.<sup>9</sup>

Fluoridation is one of the most cost-effective ways to reduce dental decay in communities. The financial costs of treating dental disease are high, while the costs of water fluoridation are relatively low. A report produced for the Ministry of Health found that fluoridation for populations ranging from 1,000 to 300,000 was very economic.<sup>9</sup> At present in Taranaki, there are several towns with populations of 1000 or greater who do not receive fluoridated water. These include Oakura, Inglewood, Waverley, Patea, Eltham and Opunake. At present over 50% of New Zealand's population receives fluoridated drinking water.

## **Impact for Lower Socio Economic Groups and Maori**

As fluoridated water acts irrespectively of an individual's behaviour, ethnic or socio-economic status, Taranaki DHB considers that it is effective in addressing some of the inequalities that exist in oral health with the greatest potential to benefit among the most vulnerable population groups. Children from low socioeconomic status areas, Maori and Pacific peoples in particular, experience poorer oral health outcomes compared to other population groups. Older people also have increased oral health needs, are increasingly dentate (have their own teeth) and therefore more likely to benefit. In addition, preventing dental caries leads to the prevention of dental pain and the prevention of dental diseases and serious dental infections requiring Hospital treatment.

## Dental Fluorosis

Dental fluorosis is a condition of enamel formation and occurs when young children are exposed to excessive amounts of fluoride when their teeth are developing.<sup>12</sup> For this reason, most countries using water fluoridation have determined an optimal level of fluoridation for their water supply that maximises oral health benefits, while minimising fluorosis levels.

Dental fluorosis in New Zealand can appear as small white flecks or patches on the tooth surface. In 1989 a NZ study (de Liefde and Herbison) found that while it was present in some children, water fluoridation was not associated with unaesthetic front teeth. To reduce problems with fluorosis it is recommended that toothpaste be issued as a smear on the child's brush and that children don't eat toothpaste.<sup>13</sup> Moreover, it is not permitted to add fluoride to infant formula that is marketed in New Zealand due to concerns about infants having increased exposure if their drinking water is also fluoridated. The more severe form of fluorosis, characterised by pitting is very rare in New Zealand.

## Tooth Brushing

Water fluoridation is not a replacement for tooth brushing with a toothpaste containing fluoride, as brushing helps to remove bacteria (found in plaque) and keeps gums healthy. Teeth require regular, small amounts of fluoride such as in fluoridated water and fluoride toothpaste. The two work hand in hand to help prevent tooth decay. Fluoridation alone cannot entirely prevent tooth decay, meaning it is not an alternative to oral health care. Along with brushing teeth twice a day, eating healthy foods and timely check-ups with a dental provider, water fluoridation can have significant benefits to an individual's oral health.

## References

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<sup>1</sup> Ministry of Health. 2010. *Our Oral Health: Key finding of the 2009 New Zealand Oral Health Survey*. Wellington: Ministry of Health.

<sup>2</sup> Taranaki District Health Board. *Taranaki Together, A Healthy Community. District Strategic Plan, 2005-2015*.

<sup>3</sup> New Zealand School Dental Service, 2011.

<sup>4</sup> Ministry of Health. (2005). *Drinking water standards for New Zealand*. Wellington: Ministry of Health.

<sup>6</sup> Bates, M. (2000). *Fluoridation of water supplies – an evaluation of the recent epidemiological evidence*. Institute of Environmental Science and Research, Porirua.

<sup>9</sup> *The Cost-Effectiveness of Fluoridating Water Supplies in New Zealand. A report for the Ministry of Health (1999)*. Institute of Environmental Science and Research, Porirua.

<sup>12</sup> National Health and Medical Research Council of Australia (NHMRC). (2007). *A systematic review of the efficiency and safety of fluoridation*. Canberra: NHMRC

<sup>13</sup> NZ Dental Association. (2002). *Statement on Water Fluoridation*. Wellington. NZDA