Nau mai haere mai,

Welcome to the eighth issue of our NFIS e-newsletter 'On Tap'. Three referenda have been completed in Whakatane, Hamilton and Hastings with all three communities voting to maintain or reinstate community water fluoridation (CWF). We would like to think that our service and especially our ongoing six monthly reviews of the scientific literature contributed to people's understanding of the issues and their ability to separate information from misinformation. Certainly we experienced a huge spike in 'hits' on our website running up to the referendums with a peak on the week before the close of voting on 12 October.

Since the referenda there have been ongoing media releases with various health claims relating to CWF, we have addressed these through media releases where we can. Addressing misinformation can be time consuming and requires a degree of research, lots of reading and often some detective work to track the source of the claim (such as a report, article, presentation, study or website). Over the months of August, September and October several carefully researched and well written responses to various health claims came through our media monitoring written by staff at the chemistry department at the University of Waikato. These letters help to provide some clarity on many questions which may arise from reading various health claims in the media. We have reproduced several of the responses here to share with those outside the Waikato District. I hope you find them interesting and helpful.

HOW MANY GLASSES OF FLUORIDATED WATER CAN I DRINK?

This article looks at how many glasses of optimally fluoridated water need to be drunk for different population groups to get to risky levels of fluoride intakes.

Table 1 shows estimated adequate intakes (AI), upper levels of intake (UL), probably toxic doses (PTD) and certainly lethal doses (CLD) for fluoride. Table 2 illustrates a few different examples of the amount of water different aged people would need to drink to reach the AI, the UL, the PTD and the CLD for fluoride intakes.

Table 1. Estimated adequate intakes (AI), upper levels of intake (UL), probably toxic doses (PTD), and certainly lethal doses (CLD) for fluoride from all sources by age and gender

Sex / age	Estimated weight	Adequate intake (AI)	Upper level of intake (UL)	Probably toxic dose (PTD) (5mg/kg)	Certainly lethal dose (CLD) (32mg/kg)
Any / 0-6months	7 kg	0.1mg/day	0.7mg/day	35mg	224mg
Any / 7-12months	9 kg	0.5mg/day	0.9mg/day	45mg	288mg
Any / 1-3years	13 kg	0.7mg/day	1.3mg/day	65mg	416mg
Any / 5-6years	22 kg	1.0mg/day	2.2mg/day	110mg	704mg
Male / 15-18years	64 kg	3.0mg/day	10.0mg/day	320mg	2048mg
Female / 15-18years	57 kg	3.0mg/day	10.0mg/day	285mg	1824mg
Male / 19+ years	76 kg	4.0mg/day	10.0mg/day	380mg	2432mg
Female / 19+ years	61 kg	3.0mg/day	10.0mg/day	305mg	1952mg

(NHMRC and MoH, 2006; Whitford, 1987)

Table 2. Estimated number of glasses of water to reach the AL; UL; PTD and CLD level of intakes for fluoride

Sex / age	Estimated weight	Adequate intake (AI) (glasses a day)	Upper level of intake (UL) (glasses a day)	Probably toxic dose (PTD) (glasses)	Certainly lethal dose (CLD) (glasses)
Any / 0-6months	7kg[1]	0.4	2.8	140	896
Any / 7-12months	9kg	2	3.6	180	1152
Any / 1-3years	13kg	2.8	5.2	260	1664
Any / 5-6years	22kg	4	8.8	440	2816
Male / 15-18years	64kg	12	40	1280	8192
Female / 15-18years	57kg	12	40	1140	7296
Male / 19+ years	76kg	16	40	1520	9728
Female / 19+ years	61kg	12	40	1220	7808

Note: Water fluoridated at the optimal level recommended by the Ministry of Health (1.0mg/L= 0.001mg/ml) would provide approximately 0.25 mg fluoride in a standard 250ml glass of water.

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There are differences in the effects of fluoride from large amounts taken as a single dose (acute fluorosis, as the PTD and CLD refers to), compared with the effects of more moderately elevated daily amounts consumed over longer periods of time. The latter could result in dental fluorosis, which the UL is designed to protect against. Acute fluorosis is very rare in New Zealand and is most commonly related to accidental ingestion of dental products containing fluoride at very much higher concentrations than that used in community water fluoridation programmes, (e.g. community water fluoridation (CWF) is at 0.7 to 1.0ppm and toothpaste is at 1000 to 1500ppm). Credible documented chronic forms of fluorosis include skeletal and dental fluorosis (both of which are endemic in some parts of the world with naturally high levels of fluoride in drinking water or high exposures to other sources, such as burning of high fluoride coal). [2]

As can be seen in Table 2, adults (19 years and over) would need to drink at least 1220 glasses of water in an area with community water fluoridation to reach a toxic dose of fluoride (the PTD). Similarly, high numbers of glasses of water are needed to be drunk for teens and children to reach a toxic dose. For infants at zero to six month old approximately 140 glasses of water would be required to reach a toxic dose. Reaching these levels would be next to impossible for any age group, even on the occasional very hot day, as the body would process and excrete most of the associated water and fluoride before a toxic dose of fluoride could be accumulated. In healthy adults a toxic dose of water would be reached long before the toxic dose of fluoride. In children, the equivalent of approximately 24 glasses in one sitting has been fatal (Arieff, 1999).

Comparing this with the Nutrient Reference Values (NRVs) UL however; fewer glasses of water are required for younger children and infants to reach the UL for fluoride.[3] These age groups are therefore at a higher risk of reaching intake levels associated with an increased risk of developing moderate dental fluorosis. As noted earlier, dental fluorosis is only a risk for children and babies with developing teeth, and risk of dental fluorosis does not increase for older children or adults regardless of how much water they drink (though fluoride still helps prevent decay through enamel remineralisation). The risk for skeletal fluorosis increases as drinking water fluoride concentrations increase above 1.5mg/L.[4]

Cressey et al. (2010) (New Zealand's key research group on dietary fluoride intakes), estimated that infants at 6-12 months[5] living in areas with CWF and also using fluoride toothpaste were the only group of the New Zealand population at risk of exceeding the UL for fluoride, based on estimated fluoride intakes from fluoridated water, food and toothpaste (using information from diet histories/food frequency questionnaires)[6] . On the other hand, the estimated intakes for the adult population showed many people may not reach the AI, and therefore are not getting the full oral health benefits of fluoride. The intake levels used in the study were estimates and it is difficult to know how closely they reflect actual fluoride intakes of the population. The 2009 New Zealand Oral Health Survey found low levels of mild and very mild dental fluorosis both in areas with and without community water fluoridation, and severe dental fluorosis was close to non-existent. There were no significant differences found in the presentation of fluorosis between areas with and without CWF (MoH, 2010). These findings suggest that actual fluoride intakes from CWF in New Zealand are likely to be below levels associated with increased risk of adverse effects (MoH, 2010).

This link takes you to an FAQ on our website describing how adequate intakes (AIs), upper levels (ULs), probably toxic doses (PTD) and certainly lethal doses (CLD) were developed for fluoride.

References

Arieff, A.I. and Kronlund, B.A. (1999). Fatal child abuse by forced water intoxication. Pediatrics. 103(6 Pt 1), pp. 1292-5.

Cressey, P. et al. (2010). Estimated dietary fluoride intake for New Zealanders. Journal of Public Health Dentistry. doi: 10.1111/j.1752-7325.2010.00192.x

Department of Health and Human Services. (2003). Public Health Statement – Fluorides. Agency for Toxic Substances and Disease Registry: CDC.

Ministry of Health. (2010). Our oral health: Key findings from the 2009 New Zealand Oral Health Survey. Wellington: Ministry of Health.

NHMRC and Ministry of Health. (2006). The Nutrient Reference Values for Australia and New Zealand. Canberra: Department of Health and Ageing.

Whitford, G.M. (1987). Fluoride in Dental Products: Safety Considerations. Journal of Dental Research. 66(5), pp. 1056-1060.

World Health Organization. (2006). Fluoride in Drinking Water. London: WHO.

World Health Organization. (2010). Inadequate or excess fluoride: A major public health concern http://www.who.int/entity/ipcs/features/fluoride.pdf

NFIS

National Fluoridation Information Service

1. This is an average reference weight for babies 0-6 months old.
2. A number of factors play a part in the risk of skeletal fluorosis, such as climate, water consumption and nutritional status. It has therefore been difficult to estimate exactly what level of fluoride exposure causes skeletal fluorosis. The World Health Organization (WHO) International Programme on Chemical Safety (IPCS) has concluded that there is a 'clear excess risk of adverse skeletal effects at a total intake of 14mg per day', and 'there is suggestive evidence of increased risk at intakes above about 6mg a day' (WHO, 2006).
3. For 0-2 year olds the AI for liquids is 700ml per day (breastmilk and/or infant formula), and from 7 months to 1 year 800 ml per day (600ml fluids and 200ml complimentary foods). Fluid intake for newborns does not start at 700ml from birth. The UL for fluoridated water is at 900ml for 7-12 month olds. For 0-6 months the NRV UL is equivalent to 700ml of fluoridated water, the same volume as the AI for liquids (NHMRC and MoH, 2006),
4. 1.5 mg/l (WHO recommends that, in setting a standard, Member States should take into account drinking-water consumption).
5. 0-6 month olds were not included.
6. The Cressey et al., study was published in 2010, but fluoride intakes were estimated from data gathered for the 1997 National Nutritional Survey for 15 yr olds and over, and the 2002 National Children's Nutrition Survey for 5-14 year olds. Simulated typical diet food consumption information was also estimated from the 2003-2004 NZ Total Diet Surveys.

fluoride in the news

LETTERS TO THE EDITOR FROM THE CHEMISTRY DEPARTMENT AT THE UNIVERSITY OF WAIKATO

There has been a considerable amount of media related to community water fluoridation (CWF) over the last few months, particularly in the three areas that held referenda on CWF with the local government elections in mid-October. We note a considerable amount of this media coverage contains claims not supported by scientific evidence. NFIS' main role is to provide up-to-date, evidence-based information on CWF, but we have limited capacity to address all the misinformation in the media. From August through October we were helped in this task in Hamilton by well researched letters to the editor put together by members of the Waikato University Chemistry Department. Those of you outside Hamilton may not have seen these, so we have copied a selection of the letters below for your information.

BIOCHEMIST ASSURES ON FLUORIDATION

WAIKATO TIMES - 23 OCTOBER 2013

[Correspondent] wished to hear from biochemists at the University of Waikato. I have taught biochemistry there for more than 40 years. Fluoride is like other natural minerals taken with our food and drink, such as copper, iron, zinc, selenium, iodide – in low amounts, all are needed to be fully healthy, but too much is poisonous. Because fluoride is so rapidly excreted from the body, it is not possible to take in a poisonous amount by drinking too much water containing fluoride at just a few parts per million. Fluoride is not accumulated anywhere other than in the mineral of bones and teeth, which it strengthens. The amount that accumulates there depends on the concentration in the water consumed – 0.7 to 1 ppm is ideal. Cancer-causing agents work by giving rise to free radicals – fluoride does not do this.

I have seen a large amount of scientifically incorrect information being put forward as fact, presumably coming from the internet and from literature other than recognised scientific and medical journals. (Fluoride is not a recognised journal, for instance.) I have not seen any respectable evidence of harmfulness of 1 ppm fluoride, and I am open to evaluating any shown to me.

Hamilton

FLUOROSIS RISK IN PERSPECTIVE

WAIKATO TIMES - 28 SEPTEMBER 2013

[Correspondent] (September 25) describes the onset of chronic fluorosis at 20 mg/kg dry matter in the diet.

Let us assume an average 50 percent water content in food (water content varies from one food to another) and an average daily intake of 2.13 kg wet weight of food (that's the USDA figure for average Americans, so possibly a little high); at 50 percent water that is 1.06 kg dry weight food/day.

On this diet, an individual would have to ingest 21.3 mg of fluoride from their food daily in order to experience chronic fluorosis.

At the levels that fluoride is present in drinking water that has been fluoridated by the municipal authorities (0.7 – 1 ppm, that is a maximum of 1 mg/litre) this would require the individual to consume 21.3 litres of water a day before the advent of chronic fluorosis.

Cressey et al., (Journal of Public Health Dentistry 70 (2010) 327-336), in a study of New Zealanders, have estimated that the mean highest daily fluoride intake in any age group from both diet and municipally fluoridated water combined is 2.1 mg/day approximately 1/10th of the dose required to cause the advent of chronic fluorosis according to [correspondent].

Chemistry Department, University of Waikato

KNOW YOUR ANIONS OR SHOW YOUR IGNORANCE

HAMILTON PRESS - 18 SEPTEMBER 2013

In her letter (Hamilton Press, September 4) [correspondent] states that there are different types of fluoride, the most toxic being the type added to water. This is factually incorrect.

Fluoride derived from the addition of hydrofluorosilicic acid to drinking water is no different to fluoride from any other source. There is absolutely no difference between a molecule (or in this case a monoatomic anion) that is naturally occurring as compared with one that is specifically added from a man-made source.

[Correspondent] is correct in stating that hydrofluorosilicic acid typically contains small amounts of arsenic, but so does almost every fruit and vegetable grown in New Zealand due to our volcanic soils (including those that are "organically" produced). Does [correspondent] suggest parents stop allowing their children to eat fruits and vegetables as well? (Abridged)

Department of Chemistry, University of Waikato

FLUORIDE FACTS

WAIKATO TIMES - 2 SEPTEMBER 2013

In her letter (Waikato Times, August 29) [correspondent] makes several vague claims concerning fluoride in the diet. She includes the statement that "Prozac is 65-85 percent fluoride" which is factually incorrect (as well as being of no relevance to the debate about fluoridation of water). Prozac is a chemical compound, fluoxetine, of formula $C_{17}H_{18}F_3NO$, from which any chemistry student can calculate that it contains exactly 18.44 percent fluoride. Equally, I am sure that Edmonds would be very surprised to learn that their baking powder contains high levels of fluoride. The rest of her assertions can be assumed to be equally unreliable.

Hamilton

FLUORIDATION FACTS

WAIKATO TIMES - 31 AUGUST 2013

I write in response to [correspondent] letter on August 27 regarding water fluoridation.

Firstly, the correspondent is mistaken in believing that we drink hydrofluorosilicic acid (HFA); at low concentration (1 ppm) and neutral pH, as found in fluoridated water, HFA is completely decomposed to fluoride ions, hydrogen ions and colloidal silica ("silicon dioxide") or silicates (Environmental Science and Technology, 2006, vol. 40, 2572).

Secondly, the levels of contaminants in HFA are low. For example, arsenic in HFA is typically lower than 30 ppm (Environmental Science and Policy, 2013, vol.29, 81). To generate a 1 ppm solution of fluoride about 0.001g of HFA is required per litre of water; the resulting concentration of arsenic is less than 0.1 ppb, significantly lower than the WHO standard (10 ppb) and that naturally in Hamilton's drinking water (2.2 ppb).

Thirdly, there is a multitude of publications in peer-reviewed journals reporting the beneficial effects and no adverse health effects of fluoridation. I recommend the reviews by Harrison (Journal of Fluorine Chemistry, 2005, vol. 126, 1448) and Kumar and Moss (The Dental Clinics of North America, 2008, vol. 52, 387), which cite a lot of these, as good places to start.

Department of Chemistry, University of Waikato

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HAZARDOUS HERRING

HAMILTON PRESS - 14 AUGUST 2013

I am writing in response to a letter regarding hydrofluorosilicic acid suggesting that its material safety data sheet (MSDS) should be used as an indication of the nature of fluoridated water. Under the conditions in the water supply, ie: low concentration (about 1 ppm) and neutral pH (7), hydrofluorosilicic acid is completely decomposed to fluoride ions (fluorine atoms bearing a negative charge), hydrogen ions (hydrogen atoms bearing a positive charge) and colloidal silica ("silicon dioxide") or silicates. Hydrogen ions are responsible for acidity, and those from hydrofluorosilicic acid would acidify the water, but for this and other reasons the pH of the water is returned to around 7 in the final step of the water treatment process. Silicon dioxide and silicates are non-harmful, and indeed are used as anti-caking agents in a variety of food products. Thus, fluoridated water contains no actual hydrofluorosilicic acid and to use its MSDS as a guide to the nature of fluoridated water is entirely inappropriate.

Department of Chemistry, University of Waikato

INFORMATION RESEARCHED

WAIKATO TIMES - 9 AUGUST 2013

Your correspondent (August 6) attributes information about a double blind experiment on the effects of fluoridated water to Grimbergen, G W. A search of this author and also of the article title yielded no hits in the SciFinder database, indicating that this sole work by that author is not considered to be of acceptable scientific quality for inclusion in the database, very likely because it was published 39 years ago in the journal Fluoride. The journal is published by the International Society for Fluoride Research, which was founded by George L Waldbott, a key figure in the anti-fluoridation movement. Readers may draw their own conclusions from the foregoing.

The NRC review, mentioned by, [correspondent], details Grimbergen's work (p269) as claiming GI effects from water fluoridated at 1 mg/L.

It then goes on to critique the study for not estimating effects in the general population and failing to demonstrate that the relatively small number of cases documented were not hypersensitive. The review almost immediately goes on to point out that some areas in the US with natural fluoride levels at 4-8 mg/L had been documented with no reports of GI distress or discomfort.

University of Waikato Chemistry Department

FAST FLUORIDE FACTS

The latest Key Findings from the NFIS review of scientific papers relevant to community water fluoridation (CWF) in New Zealand published between January and June 2013. Over this six month 58 Papers were reviewed out of 342 identified papers from database searches. Key findings included:

An Australian study found that children who drank sugar sweetened drinks had greater risk of tooth decay. However if they had lived in a fluoridated area all their lives, this risk was reduced. (Armfield et al.)

A Lithuanian study found that children who brushed their teeth with fluoride toothpaste at least once a day on school days had more fluoride in their saliva. (Richards et al.)

A UK study found that there was a big difference in the amount of fluoride found in different brands of tea. From these results it found that tea could contribute up to three quarters of dietary reference intake (DRI) for fluoride. (Chan et al.)

An Australian study found that people born before CWF was introduced were more likely to have missing teeth than those born after CWF (even after allowing for differences in age). It also found that people who had spent most of their lives drinking fluoridated water had, on average, better teeth than those who had spent most of their lives drinking non-fluoridated water. (Slade et al.)

A study in Bauru, Brazil, found that fluoride levels in the public water supply were within the target range for CWF for an average of 69% of the year, over a seven year period. (Buzalaf et al.)

A similar study, looking at fluoride levels in 40 Brazilian cities over a seven year period, found that about half of all water samples collected had the desired amount of fluoride. Cities with lots of small water sources had the greatest difficulty in controlling the amount of fluoride in the water. (Moimaz et al.)

A study in Sweden, found that a group of teenagers who drank a glass of milk daily with 5ppm fluoride added to it, had less loss of enamel around the (fixed) braces on their teeth than a group who drank the same amount of milk without fluoride added. (Sköld-Larsson et al.)

A study of fluoride in drinking water in China recommended water fluoride levels of 0.5-1.0mg/ l to protect against tooth decay and avoid getting dental fluorosis. (Gao et al.)

A study in Northern Brazil suggested that fluoride works best at preventing tooth decay when the minerals calcium and phosphate are also in the water. (Macedo de Souza et al.)

An economic analysis of Quebec's water fluoridation programme found that CWF saved money even if it only reduced tooth decay by one percent. (Tchouaket et al.)

References

Armfield JM, Spencer J, Roberts-Thomson KF, Plastow K (2013). Water Fluoridation and the Association of Sugar-Sweetened Beverage Consumption and Dental Caries in Australian Children. American Journal of Public Health, 103(3), 494-500.

Richards A, Machiuskiene V, Nyvad B, Baelum V (2013). Saliva fluoride before and during 3 years of supervised use of fluoride toothpaste. Clinical Oral Investigation. E-publication.

Chan L, Mehra A, Saikat S, Lynch P (2013). Human exposure assessment of fluoride from tea (Camellia sinensis L): A UK based issue? Food Research International, 51, 564-570.

Slade GD, Sanders AE, Do L, Roberts-Thomson K, Spencer AJ (2013). Effects of Fluoridated Drinking Water on Dental Caries in Australian Adults. Journal of Dental Research, 92(4), 376-382.

Buzalaf MAR, Moraes CM, Olympio KPK, Pessan JP, Grizzo LT, Silva TL, Magalhães, de Oliverira RC, Groisman S, Ramires I (2013). Seven years of external control of fluoride levels in the public water supply in Bauru, São Paulo, Brazil. Journal of Applied Oral Science. E-publication.

Moimaz SAS, Saliba NA, Saliba O, Sumida DH, de Souza NP, Chilba FY, Garbin CAS (2013). Water fluoridation in 40 Brazilian cities: 7 year analysis. Journal of Applied Oral Science, 21(1), 13-19.

Sköld-Larsson K, Sollenius O, Karlsson L, Petersson LG, Twetman S (2013). Effects of fluoridated milk on enamel demineralisation adjacent to fixed orthodontic appliances. Acta Odontologica Scandinavia, 71, 464-468.

Gao H-J, Jin Y-Q, Wei J-L (2013). Health risk assessment of fluoride in drinking water from Anhui Province in China. Environmental Monitoring and Assessment, 185, 3687-3695.

Macedo de Souza CF, Lima Jr. JF, Adriano MSPF, Albatti de Carvalho F, Soares Forte FD, de Farias Oliveira R, Pessoa Silva A, Sampian FC (2013). Assessment of groundwater quality in a region of endemic fluorosis in the northeast of Brazil, Environmental Monitoring and Assessment, 185, 4735-4743.

Tchouaket E, Brousselle A, Fansi A, Dionne PA, Bertrant E, Fortin C (2013). The economic value of Quebec's water fluoridation program, Journal of Public Health. E-publication.

RESPONDING TO QUERIES

The information in this article was provided as a response to the question:

Does water fluoridation increase the risk of hip fractures?

The studies discussed here were identified through our scientific review process.

The reference most often cited in discussions about is the York Review (McDonagh et al., 2000). This systematic review of evidence relevant to community water fluoridation (CWF) was published in 2000 and was included in the NFIS Review of Scientific Reviews 2000-2010 (NFIS, 2011b). Although to an extent overtaken by recent research, it is useful to consider the studies reviewed in the York Review that were looking for an association between CWF and bone fractures (including hip):

- All but one of the papers relevant to bone fractures were of relatively low validity.
- A meta-analysis carried out on the findings of included papers indicated that associations between CWF and bone fractures were evenly distributed around the line of no effect (1.0).
- The authors noted that the results of the meta-analysis should be treated with caution due to differences in the methods used in the included studies (significant heterogeneity, $P<0.001$), and the relatively low validity of the studies included.
- Four studies indicated a significant positive risk (increased risk) and five studies indicated a significant negative risk (decreased risk) of bone fractures.
- The main finding of the York Review was that the quality of studies showing both an increased risk of bone fracture and a protective effect were of such a low validity that firm conclusions could not be drawn of an association between CWF and bone fracture from their review of the literature at that time (McDonagh et al. 2000).

As well as the York Review, NFIS' initial Review of Scientific Reviews Related to Water Fluoridation published between January 2000 and July 2010 (NFIS, 2011b) identified other reviews that included studies looking at the association between CWF and hip/bone fractures, the findings of these reviews included:

- Harrison (2005) and Parnell (2009) concluded that CWF had no effect on the likelihood of hip fractures and that there was insufficient evidence to assess the effects of CWF on other bone disorders (NFIS, 2011b, p.23, 64-66, 95-98).
- The Australian National Health and Medical Research Council (NHMRC) Systematic Review of the Efficacy and Safety of Fluoridation (2007) found "No evidence of increased risk of bone fracture resulting from CWF". (NFIS, 2011b, p. 23, 83-85).
- Demos (2001), concluded that fluoride concentrations up to 1mg/L had no adverse effect on fracture incidence, bone mineral density or bone strength (NFIS, 2011b, pp.24, 28, 58-60).
- The US National Research Council (NRC) (2006), conducted a review of the US Environmental Protection Agency's water standard for fluoride. This review has limited relevance to New Zealand because it did not include an examination of the benefits and adverse effects that might arise at the drinking-water fluoride levels of 0.7-1.0mg/L . The authors noted that the "best available" study included in the review, suggested an increased rate of hip fractures associated with fluoride drinking water concentrations higher than 1.5mg/L, (the maximum acceptable value (MAV) for drinking water supplies in New Zealand is 1.5 mg/L) (p. 30, 86-88).

Following the Review of Scientific Reviews 2000-2010, NFIS has reviewed all new scientific research relevant to CWF in New Zealand for the period December 2010 to the current date, and have identified a number of studies that have looked at the association between fluoride and hip fractures. These studies are of widely variable validity and firm conclusions cannot be drawn from them, findings include:

- Nasman et al. (2013) conducted a retrospective cohort study in Sweden, based on 473,277 individuals born between 01/01/1900 and 31/12/1919. Subjects were followed up between 1964 and 2006. The study found no evidence of an increased risk of hip fractures with exposures to drinking water fluoride concentrations ranging from 0.1mg/L to 2.7 mg/L. The large study population, individual follow up of water fluoride exposures and incidence of hip fractures over a 38 year period, means this study is of high validity.
- Ravula et al. (2012) found oxidative activity was higher and antioxidant activity lower with high fluoride exposure amongst post-menopausal women living in a high fluoride (2.07mg/L) village. The authors did not adjust for factors such as calcium intake (reported to be lower in the high fluoride village) and participants were voluntarily selected, limiting the validity of the conclusions that were made (NFIS, 2013, pp. 123-124). The study is of low validity, includes fluoride levels well above that used in CWF and does not directly relate to hip fracture.
- In their study of lower back, knee and leg pain, Namkaew and Wiwatanadate, (2012) found a positive association between lower back pain and living in an area with high drinking water fluoride concentrations. It appears the authors were investigating pain as a proxy for skeletal fluorosis, rather than bone fracture. The study does not directly relate to hip fracture. There could be numerous confounders for the cause of the back pain. No association with leg or knee pain was reported. The study is of low validity (NFIS, 2013, pp. 42-43).

What can be concluded from this? There are several things to consider when drawing conclusions from many studies. A recent article in Nature (2013) summarises key issues to look at when interpreting evidence, including:

- No measurement is exact, all measurements have some error. If the meas¬urement process were repeated, one might record a different result. But using many measurements means you can get an average and use the lowest and highest measurements as your lower and upper measurement range.
- Bigger is usually better for sample size – due to natural variation between subjects, the averages taken from a large number of observations are usually closer to the 'truth' or real measure and therefore more reliable and accurate than those taken from smaller samples.
- Association does not imply causation – there may be a variety of factors that affect the results of a study, not just the ones that were measured, so although there is an association found between two factors it does not mean one is a cause of the other.
- Extrapolating beyond the data is risky – a pattern found within a study does not necessarily predict what will happen in measurement ranges outside the range used in that study.
- Study relevance limits generalisations – although the findings of a study are valid in the conditions where the study took place, they may not be relevant to other resembling conditions, e.g. one area of the world may have different factors to consider in relation to a study than another area (e.g. climate), and this limits the extent to which findings can be generalised from one area to another.

Using the York Review as a baseline, which found no conclusive relationships between water fluoridation and hip fractures, and considering the points outlined above, the best new evidence we have found is the Nasman (2013) study. This was a reasonably robust study due to the large study sample used, the ability to follow-up the study sample over a considerable period of time and the adjustment for import-

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ant confounding factors. We cannot draw clear conclusions from any of the other studies due to the considerable limitations that were identified. An assessment of the current evidence leads to a conclusion that in the range from 0.7 to 1.0mg/L long-term fluoride exposure from CWF is unlikely to have any effects on the risk of hip fracture.

You can find the NFIS reviews referred to above on our website at www.nfis.org.nz.

References

McDonagh, M. et al. (2000). Systematic review of water fluoridation (York Report). BMJ. 321, pp. 855-859.

Nasman, P. et al. (2013). Estimated Drinking Water Fluoride Exposure and Risk of Hip Fracture: A Cohort Study. Journal of Dental Research. 92(11), pp 1029-1034.

National Fluoridation Information Service. (2013). Review of Scientific Papers Related to Water Fluoridation published between August and December 2012. Wellington: NFIS.

National Fluoridation Information Service. (2011a). Review of Scientific Papers Related to Water Fluoridation published between January and November 2010. Wellington: NFIS.

National Fluoridation Information Service. (2011b). Review of Scientific Reviews Related to Water Fluoridation Published between January 2000 and July 2010. Wellington: NFIS.

Sutherland, W. et al. (2013). Twenty tips for interpreting scientific claims. Nature. 503, pp. 335-337.

CONSORTIUM PARTNER

Introducing

DR STEPHEN PALMER

Dr Palmer is a specialist public health physician and a medical officer of health for the greater Wellington region.

He has worked at Regional Public Health for the past two decades focussing on environmental health.

His areas of responsibility include recreational water quality; hazardous substances; transport; waste management; risk analysis and risk communication; alcohol; smoke-free environments; community water fluoridation; and more recently psychoactive substances.

He has considerable experience working with local government at both the officer and political level, regularly providing expert evidence for council hearings and other decision-making processes.

One of Dr Palmer's key pieces of work for NFIS has been the development of the advisory on community water fluoridation (CWF) and osteosarcoma, looking at the number of osteosarcoma cases (from the NZ Cancer Registry) in areas with and without CWF. This advisory can be found on our website www.nfis.org.nz.

NFIS CONSORTIUM PARTNERS:

WHAT'S NEW @ NFIS.ORG.NZ

This quarter we have added a number of interesting things to our website.

On the NFIS documents page you will find:

- 2012-2013 Environmental Scan
- Review of Scientific Papers Relating to Water Fluoridation published between August and December 2012

On the CWF Activities page you will find:

- several new media statements and letters to the editor
- the New Zealand College of Public Health Physicians top 10 Priorities for Public Health
- the Cancer Society's statement on osteosarcoma
- ESR (the Institute for Environmental Science and Research), updated map of communities with CWF in New Zealand.

On the DHB resources page you will find:

- the Public Health Association's CWF fact sheet

nfis.org.nz

Waimarama

Kia ora e hoa ma,

Since the last issue of On Tap where we discussed the implications of the judicial review in South Taranaki, the judicial review was heard on 26 November with Judge Hanson reserving his decision until the new year.

On 4 November the Fluoride Action Network New Zealand issued a press release stating the group also plans to seek a judicial review against Kapiti Coast District Council. The reasons given for the judicial review in Kapiti are different to those given for taking action against the South Taranaki District Council. We expect that the ins and outs of these court proceedings will come through into the NFIS Environmental Scan for the 2013-2014 year.

The 2012-2013 scan was a huge amount of work but, I think you will agree, makes for very interesting reading. I would like to say a huge thank you to everyone who provided us with information about what and how events unfolded in your community. It has certainly been an intriguing year in the world of community water fluoridation. It takes a huge effort to contact people in all the relevant councils and district health boards and to collate the information from them and cross reference with council documents and the media. In hindsight people's memory of events differ somewhat so it is important to keep checking with everyone to ensure we have an accurate as possible picture of what happened and the correct order of events and decisions.

Our website update section provides you with links to the Environmental Scan and other documents we have been working on recently, including an external evaluation. If you are reading this electronically you can click on the links and be taken directly to the relevant documents/links. I do recommend you take a good look at all the information we have added to our CWF Activities Hub. There are links, documents and presentations that may help answer many of the questions people come to you with, or, that you yourself may have about CWF.

Please feel free to contact us if you have a specific question which you cannot find the answer to.

Mere Kirihmete,

Emmeline