

Water Fluoridation and effects on health

**Report completed by NCCP
January 2014**

Contents

1. Background
2. Known benefits of fluoridation
3. Debate about possible adverse effects
 - 3.1 Is there an association with fractures?
 - 3.2 Is there an association with cancer?
4. Conclusion

1. Background

Fluoride salts, generally referred to as fluorides, occur naturally in the water, rocks and soil. One of the more commonly used fluoride salts is sodium fluoride; principally used in preventing tooth decay. Water fluoridation and the use of appropriate fluorides is a major part of public health policy in Ireland in the prevention and management of tooth decay. The World Health Organization recommends a guideline maximum fluoride value of 1.5 mg/L (Fawell *et al*, 2006a). EU law defines a maximum permitted concentration of 1.5 ppm for public water supplies through its drinking water directive. The maximum permitted level for water fluoridation schemes in Ireland is between 0.6-0.8ppm approximately half of the EU permitted level). Currently, approximately 70% of the population in Ireland receives fluoridated public water supplies.

Approximately 400 million people around the world reside in areas with optimal fluoridated water, of note is that three EU member states (Ireland, UK and Spain) have national or regional water fluoridation policies. Other countries with fluoridation include the USA, Canada, Australia, New Zealand, Malaysia, South Africa, Singapore and Hong Kong and a small number of other countries. Other forms of fluoridation including salt fluoridation are practiced in South and Central American countries. For some European countries water fluoridation is impractical due to the number of separate water sources; many of these countries use salt fluoridation or milk fluoridation as an alternative.

2. Known benefits of water fluoridation

Evidence suggests that water fluoridation significantly benefits dental health. Fluoridation has been shown to be effective at reducing cavities in both children and adults (Parnell *et al*, 2009). Fluoride can prevent and even reverse tooth decay by inhibiting bacteria that produce acid in the mouth and by enhancing remineralisation, the process through which tooth enamel is “rebuilt” after it begins to decay (CDC, 1991). The Expert Body on Fluorides and Health in Ireland states *“that water fluoridation, at the optimal level, does not cause ill effects and continues to be safe and effective in protecting oral health of all age groups”*.

3. Debate about possible adverse effects.

No claim associating water fluoridation with negative health effects has been substantiated. A known side effect of fluoridation is slight whitening of the teeth, which in a small proportion of cases can result in a staining of the surface of the enamel. This cosmetic condition, known as mild or very mild enamel fluorosis is not regarded as a negative health effect.

It is the daily total fluoride intake over a prolonged period of time, only during the developmental phase of the teeth (0-3 years for front teeth) that causes fluorosis.

It is estimated that much of the dental fluorosis occurs from sources other than fluoridated water, such as inappropriate use of fluoride toothpaste (Ketley, O'Mullane and Holbrook, 2004) (Whelton et al 2004).

Fluoride can occur naturally in water in high concentrations, which can cause long-term adverse effects, including severe fluorosis, skeletal fluorosis and weakened bone (Fawell *et al*, 2006b). Skeletal fluorosis is a pathological condition, resulting from long term exposure to high levels of fluoride. Skeletal fluorosis, in some cases with severe crippling, has been reported in individuals residing in India, China and Africa, where the fluoride intake is exceptionally high e.g., high concentration of fluoride (naturally occurring) in drinking water, indoor burning of fluoride-rich coal resulting in a high indoor fluoride concentration (SCHER 2011).

There is no evidence of such effects occurring in populations drinking optimally fluoridated water.

3.1 Is there an association with fractures?

A large number of epidemiological studies have investigated the effect of fluoride intake on bone fractures. The amount of fluoride taken up by the bone is inversely related to age. During the first year of life, up to 90% of ingested fluoride is deposited in the skeleton, which gradually decreases to 50% in children older than 15 years of age. In 2000, the York report concluded that there was no association between fluoridated water and bone fractures based on an analysis of 29 bone fracture studies included in its systematic review (McDonagh *et al* 2002). A report by the Australian National Health and Medical Research Council, published in 2007 (AU-NHMRC

2007), concurred with these findings and found that fluoridation at levels of 0.6-1.1 ppm may actually lower risk of fracture.

More recently Nasman et al (2013) found no association between chronic fluoride exposure and the occurrence of hip fracture.

3.2 Is there an association with cancer?

A possible relationship between fluoridated water and cancer risk has been debated for years. The subcommittee on Health Effects of Ingested Fluoride of the National Research Council, part of the National Academy of Sciences, reviewed 50 human epidemiological studies and six animal studies and concluded that none of the data demonstrated an association between fluoridated drinking water and cancer (National Research Council, 1993). The CDC supported these findings. The CDC report concluded that studies to date have found “no credible evidence” of an association between fluoridated drinking water and an increased cancer risk (CDC, 1999). Another large scale review concluded that there is no clear association between water fluoridation and overall cancer incidence or mortality for ‘all cause’ cancer, and for bone cancer and osteosarcoma (McDonagh *et al*, 2000). Subsequent interview studies of patients with osteosarcoma and their parents produced conflicting results, with no clear evidence of a causal relationship between fluoride intake and risk of this tumour (Bassin et al, 2006). More recently, researchers measured fluoride concentration in samples of normal bone adjacent to the person’s tumour and found no difference in bone fluoride levels between people with osteosarcoma and people in the control group who had other malignant bone tumours (Kim et al, 2011). The EU Scientific Committee on Health and Environmental Risks (SCHER) published its ‘Opinion on critical review of any evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water’ – 16 May 2011. The report concluded that there are no known health implications from fluoridating water at levels used in the EU. SCHER agrees that epidemiological studies do not indicate a clear link between fluoride in drinking water, and osteosarcoma and cancer in general. There is no evidence from animal studies to support the link, thus fluoride cannot be classified as a carcinogen. In addition, the International Agency for Research on Cancer (IARC) have evaluated fluorides (inorganic, used in drinking-water) as “*not classifiable as to their carcinogenicity to humans*” (IARC Monographs, 1982).

A recently published ecological study (Levy & Leclerc, 2012) suggests that water fluoridation status in the U.S. has no influence on osteosarcoma incidence rates during childhood and adolescence. Furthermore, a study (Comber *et al*, 2011) comparing the incidence of osteosarcoma in Northern Ireland with that of the Republic of Ireland do not support the hypothesis that osteosarcoma incidence in the island of Ireland is significantly associated with public water fluoridation.

In fact the National Cancer Registry Ireland has stated that there is no good evidence to link fluoride levels in water, whether natural or added, to cancer risk, the NCRI has further stated that *'Some maps contained in an [All-Ireland Cancer Atlas](#) published recently by the N. Ireland Cancer Registry and the National Cancer Registry have been used erroneously by anti-fluoridation groups to suggest a link between water fluoridation and cancer. The atlas in which these maps were published ([and some previous reports](#)) has analysed the differences in cancer risk between the two countries. We do not consider that water fluoridation is a plausible explanation for the patterns shown'*. <http://www.ncri.ie/news/article/misinterpretation-all-ireland-cancer-atlas-1995-2007-regard-water-fluoridation-and>

4. Conclusion

In conclusion, all systematic reviews to date have found no association between fluoridation of drinking water at the recommended levels and risk of cancer or bone fracture. The effects of fluoride on health and related matters are kept under constant review. In addition, the Expert Body on Fluorides and Health in Ireland is of the opinion that water fluoridation significantly benefits dental health. Good oral health is an integral part of good general health.

The Expert Body's advice that water fluoridation, at the optimal level, does not cause any ill health effects and protects the oral health of the population is supported by major international scientifically validated reviews.

References

Australian National Health and Medical Research Council, (2007)

http://ec.europa.eu/health/scientific_committees/environmental_risks/docs/scher_o_139_note.pdf

Bassin EB, Wypij D, Davis RB, Mittleman MA. Age-specific fluoride exposure in drinking water and osteosarcoma (United States). *Cancer Causes Control*. 2006;17:421–428.

Centers for Disease Control and Prevention. Public Health Service report on fluoride benefits and risks. *JAMA* 1991; 266(8):1061–1067. [[PubMed Abstract](#)]

Centers for Disease Control and Prevention. Achievements in public health, 1900–1999: fluoridation of drinking water to prevent dental caries. *Morbidity and Mortality Weekly Report* 1999; 48(41):933–940.

Comber H, Deady S, Montgomery E, Gavin A. Drinking water fluoridation and osteosarcoma incidence on the island of Ireland. *Cancer Causes Control*. 2011;22:919–924.

Fawell J, Bailey K, Chilton J, Dahi E, Fewtrell L, Magara Y. *Fluoride in Drinking-water* [PDF]. World Health Organization; 2006a. [ISBN 92-4-156319-2](#). Guidelines and standards. p. 37–9.

Fawell J, Bailey K, Chilton J, Dahi E, Fewtrell L, Magara Y. *Fluoride in Drinking-water* [PDF]. World Health Organization; 2006b. [ISBN 92-4-156319-2](#). Human health effects. p. 29–36.

IARC Monographs, 27, 237-303, 1982.

Ketley, C.E., O’Mullane, D., Holbrook, W.P., Editors (2004) Project FLINT: Fluoride Intake from Toothpaste, Community Dentistry and Oral Epidemiology, Vol. 32, Supplement 1, Pages 1-76.

Kim, F.M., Hayes, C., et al, *Journal of Dental Research*. 2011 An Assessment of Bone Fluoride and Osteosarcoma Vol. 90, no. 10, 1171-1176.

Levy M, Leclerc BS. Fluoride in drinking water and osteosarcoma incidence rates in the continental United States among children and adolescents. *Cancer Epidemiol*. 2012;36:e83–88.

McDonagh MS, Whiting PF, Wilson PM, et al. Systematic review of water fluoridation. *BMJ*. 2000;321:855–859. (Full report available online at: www.york.ac.uk/inst/crd/CRD_Reports/crdreport18.pdf. Accessed May 7, 2013.).

McDonagh, M., Whiting, P., Bradley, M., et al. (2002) “No association between water fluoridation and bone fractures 3, 45-46.

[Näsman P](#), [Ekstrand J](#), [Granath F](#), [Ekbom A](#), [Fored CM](#). *Estimated drinking water fluoride exposure and risk of hip fracture: a cohort study*. *J Dent Res*. 2013 Nov;92(11):1029-34.

National Research Council, Subcommittee on Health Effects of Ingested Fluoride. Carcinogenicity of fluoride. *In: Health Effects of Ingested Fluoride*. Washington, DC: National Academy Press, 1993.

Parnell C, Whelton H, O'Mullane D. Water fluoridation. *Eur Arch Paediatr Dent*. 2009;10(3):141–8. [PMID 19772843](#).

SCHER, Opinion on critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water – 16 May 2011

Whelton H, Crowley E, O'Mullane D, Donaldson M, Kelleher V, Cronin M. *Dental caries and enamel fluorosis among the fluoridated and non-fluoridated populations in the Republic of Ireland in 2002*. *Community Dent Health*. 2004 Mar;21(1):37-44.

National Cancer Control Programme,
200 Parnell St, Dublin 1
Tel: 01 8287100

© NCCP January 2014