

Osteosarcoma and fluoride

This information has been compiled by the Department of Human Services' Public Health Branch in collaboration with The Cancer Council Victoria. Its purpose is to provide balanced evidence-based information in relation to recent claims about an association with fluoride in drinking water and the occurrence of osteosarcoma.

Osteosarcoma is a primary bone cancer that usually affects young adults. Primary bone cancer, or cancer that starts in the bone, is very rare. Less than one per cent of people with bone cancer have primary bone cancer. The causes of primary bone cancer are not known and epidemiological studies show no clear association between fluoride in drinking water and osteosarcoma.

In Australia, an average of nine to ten cases of osteosarcoma are diagnosed each year in children under the age of 15.¹ In Victoria, an average of two to three cases are diagnosed each year².

A comparison in the occurrence of osteosarcoma is best expressed as a rate. The table below shows some comparative rates.

Locality	Rate*	Locality	Rate
Melbourne**	2.5	Hong Kong	2.6
Rural and Regional Victoria	3.7	Denmark	1.8
Victoria***	2.9	Finland	3.2
Queensland ³	4.5	France	2.7
New South Wales ⁴	2.9	Italy	3.9
Australia ¹	2.2	Netherlands	2.9
International¹		Sweden	2.7
Canada	2.9	Switzerland	2.5
USA	3.3	UK England & Wales	2.6
Japan	2.3	UK Scotland	1.9

* The number of cases per year per million children under the age of 15.

** Fluoridated in 1977.

*** About three quarters of Victorians have water with either naturally occurring or added fluoride—most of these people live in Melbourne.

Research summary

- A review of worldwide studies by The International Agency for Research on Cancer (IARC) concluded there was no evidence of an increase in cancer rates associated with fluoride in drinking water.⁵
- The San Francisco Department of Public Health Occupational Health and Environmental Health Section states that within a search of relevant peer reviewed medical literature to September 2005, a total of seven (7) epidemiological studies were discovered, none of which showed a relationship between fluoride exposure and osteosarcoma (Moss et al. 1995, Gelberg et al. 1995, Freni and Gaylor 1992, Grandjean et al. 1992, McGuire et al. 1991, Mahoney et al. 1991, Hrudey et al. 1990).⁶
- Three small case control studies of osteosarcoma (McGuire et al 1995, Gelberg et al 1995, Moss et al 1995) have been reviewed by the Australian National Health and Medical Research Council in 1999. None of these studies found any evidence of fluoride increasing the risk of osteosarcoma.⁷
- The York Review (2000), a systematic review of 214 studies of varying quality, found no clear association between fluoridation of water and osteosarcoma.⁸
- A study by Hoover et al found no relationship between osteosarcoma and fluoridation. This study is important because of the large numbers involved (125,000 incident cancers, and 2.3 million cancer deaths).⁹
- In 2002 the British Medical Research Council agreed that overall, evidence does not suggest that artificially fluoridated water increases the risk of cancer.⁹
- A review of fluoride by the Scientific Panel on Dietetic Products, Nutrition and Allergies published by the European Food Safety Authority in 2005, found no increased risk of cancer from drinking fluoridated water.¹⁰

Harvard study

In April 2006, a paper by Elise Bassin et al, *Age-specific fluoride exposure in drinking water and osteosarcoma (United States)*¹¹ was published in the seventeenth issue of the journal *Cancer Causes Control*. Elise Bassin is from the Department of Oral Health Policy and Epidemiology, Harvard University School of Dental Medicine.

The paper presents partial findings of a 15-year study of fluoride and osteosarcoma by the Harvard School of Dental Medicine in collaboration with the National Institute of Environmental Health Sciences (NIEHS), National Cancer Institute (NCI) and National Institute of Dental and Craniofacial Research (NIDCR).

The 15-year study started in 1992 and examines osteosarcoma cases that existed between 1989 and 1992, and new cases diagnosed between 1993 and 2000, all identified from 11 hospitals throughout the United States.

Bassin et al explored age and gender-specific effects of fluoride levels in drinking water and the incidence of osteosarcoma, using the cases identified between 1989 and 1992 that were younger than 20 years old (103 cases) and comparing them to 215 matched controls.

Each of the cases was interviewed to determine residential history, use of mouth rinses and fluoride supplements, with the amount of fluoride in drinking water being the main exposure of interest. Drinking water included the public supply, bottled and well water.

The researchers then estimated the level of fluoride consumed at each age, based on an estimate of the concentration of fluoride in public drinking water supplies (data on fluoride concentrations was obtained from the CDC's 1985 and 1992 Fluoridation Census), estimates of bottled water levels and samples from well water.

Bassin et al concluded that their exploratory analysis found an association between osteosarcoma and fluoride in drinking water in males, but not in females. They also concluded that further studies are required to confirm or refute the findings, particularly using a biomarker such as fluoride levels in bone and considering genetic conditions (there are several genetic conditions for which an increased risk of osteosarcoma is well documented).¹²

Review of Bassin et al's paper

In a letter to the editor of the journal *Cancer Causes Control*,¹³ Chester Douglass, principal investigator of the Harvard study, advises readers to be cautious when interpreting the findings, noting the following reasons:

- The preliminary findings from the overall analysis of the cases identified between 1993 and 2000 (second set of cases) do not show an association between osteosarcoma and fluoride in drinking water.
 - The cases had been identified from the same hospitals within the same orthopaedic departments and the same pathology departments diagnosing osteosarcoma, and similar methods of fluoride exposure
- Bone specimens were also provided by many of the cases—preliminary analysis of bone specimens suggests fluoride level in the bone is not associated with osteosarcoma.

- The 1990 NIEHS National Toxicology Program study found an association with high levels of fluoride in drinking water and osteosarcoma in male rats. However, the findings of their second study did not find an association.

Some of the limitations noted by Bassin et al in their paper include:

- The estimates of fluoride in drinking water at each residence do not reflect the actual consumption of fluoride.
- The study did not obtain biologic markers for fluoride uptake in bone.
- The actual amount of fluoride in a fluoridated supply may vary (within guideline levels).
- Natural fluoride levels can vary over time (the researchers thought this unlikely for the time spent at each residence).
- There is a lack of data on other potential confounders.
- Fluoride may not be the causative agent—another factor in drinking water may be correlated with the presence of fluoride.
- Data to assess fluoride exposure from diet, industrial sources or other sources such as pesticides was not available—cases may have been exposed to other unknown factors such as contaminants or carcinogens in the bottled or well water, with the fluoride in these products or natural sources irrelevant, regardless of the concentration.

Further enquiries

**Water fluoridation information line
1800 651 723**

References

1. International Agency for Research on Cancer, *International Incidence of Childhood Cancer*. Volume 2. 1998.
2. Victorian Cancer Registry, 1984–2003.
3. Queensland Cancer Registry, 1984–2003.
4. International Agency for Research on Cancer, *International Incidence of Childhood Cancer*. Volume 1. 1988.
5. International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risks of Chemicals to Humans*, Volume 27. 1982.
6. San Francisco Department of Public Health, *Current Scientific Evidence: Water Fluoridation is not associated with osteosarcoma*. 2005, www.sfdph.org/phes/water/fluoride/Osteosarcoma_fluoride_fact_sheet.pdf
7. Ahokas, J., et al., *Review of water fluoridation and fluoride intake from discretionary fluoride supplements: review for NHMRC*. 1999. Available at <http://www.nhmrc.gov.au/advice/pdfcover/fluorcov.htm>, Royal Melbourne Institute of Technology and Monash University: Melbourne.
8. McDonagh M S, et al., *Systematic review of water fluoridation*. *BMJ*, 2000. 321.
9. Medical Research Council Working Group, *Water fluoridation and health*. 2002, Medical Research Council: United Kingdom.
10. European Food Safety Authority, *Opinion of the Scientific Panel on Dietetic products, Nutrition and Allergies on a request from the Commission related to the Tolerable Upper Intake Level of Fluoride*. *The EFSA Journal*, 2005. 192: p. 1–65.
11. Bassin, E.B., et al., *Age-specific fluoride exposure in drinking water and osteosarcoma (United States)*. *Cancer Causes Control*, 2006(17): p. 421–428.
12. Ries LAG, et al., *Cancer Incidence and Survival among Children and Adolescents: United States SEER Program 1975–1995, (Chapter VIII Malignant Bone Tumours)*. James G. Gurney, Andrine R. Swensen, Marc Bulterys <http://seer.cancer.gov/publications/childhood/bone.pdf>. 1999, National Cancer Institute, SEER Program, NIH Pub. No. 99–4649: Bethesda, MD.
13. Douglass, C.W. and K. Joshipura, *Caution needed in fluoride and osteosarcoma study*. *Cancer Causes Control*, 2006(17): p. 481–482.