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## Water Fluoridation and Cancer Risk

Many decades after fluoride was first added to drinking water in some parts of the United States, there is still controversy about its possible health effects. Many people have strong views either for or against water fluoridation. Their concerns are based on everything from legitimate scientific research, to freedom of choice issues, to government conspiracy theories.

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This is a review of the possible link between water fluoridation and cancer. Other possible health effects of fluoridation (positive or negative) are not addressed here. This is not a position statement of the American Cancer Society.

### What is fluoride?

Fluorides are compounds that combine the element fluorine with another substance, usually a metal. Examples of these compounds include sodium fluoride, stannous fluoride, and fluoride monofluorophosphate (MFP fluoride).

Some fluorides occur naturally in soil, air, or water, although the levels of fluoride can vary widely. Just about all water has some fluoride. Fluoride is also found in food sources from some plants and animals.

Once inside the body, fluorides are absorbed into the blood through the digestive tract. They travel through blood and tend to collect in areas high in calcium, such as the

bones and teeth.

## How are people exposed to fluoride?

The major sources of fluoride for most people are water and other beverages, food, and fluoride-containing dental products (toothpastes, mouth rinses, etc.). Because dental products are generally not swallowed (except, perhaps, by younger children), they are less likely to be of concern in terms of possible health issues.

### Fluoride in drinking water

Water fluoridation began in some parts of the United States in 1945, after scientists noted that people living in areas with higher water fluoride levels had fewer cavities. Starting in 1962, the United States Public Health Service (PHS) recommended that public water supplies contain fluoride to help prevent tooth decay.

Fluoride is now used in the public drinking water supplied to about 3 out of 4 Americans. The decision to add fluoride to drinking water is made at the state or local level. The types of fluoride added to different water systems include fluorosilicic acid, sodium fluorosilicate, and sodium fluoride.

Natural drinking water sources in the US also have some fluoride in them. Surface water sources (such as lakes and rivers) in the US have an average level of about 0.2 milligrams of fluoride per liter of water (mg/L), although levels can be much higher in some places than in others.

## How is fluoride in drinking water regulated?

Fluoride is not required in all drinking water sources in the United States, but the levels of fluoride in water are regulated by several government agencies.

### Public water systems

Starting in 1962, the United States Public Health Service (PHS) recommended that public water supplies contain between 0.7 and 1.2 mg/L of fluoride to help prevent tooth decay. This recommendation was updated in 2015 to a fluoride level of 0.7 mg/L. The change was made in part to account for the fact that people now get more fluoride from other sources (such as toothpaste) than in the past.

The US Environmental Protection Agency (EPA) has set a **drinking water standard**,

which is the maximum amount of fluoride allowable in public drinking water systems, of 4.0 mg/L. If someone is exposed to levels higher than this for a long time, it can cause a condition called **skeletal fluorosis**, in which fluoride builds up in the bones. This can eventually result in joint stiffness and pain, and can also lead to weak bones or fractures in older adults.

The EPA has also set a **secondary standard** of no more than 2.0 mg/L to help protect younger children from **dental fluorosis**. In this condition, fluoride collects in developing teeth, preventing tooth enamel from forming normally. This can cause permanent tooth staining or pitting. (This secondary standard is a guideline, as opposed to an enforceable regulation, but public water systems must tell their customers if the fluoride level goes above it.)

States can set maximum fluoride levels in drinking water that are lower than the national

fluoridation might affect the risk of osteosarcoma is based on the fact that fluoride tends to collect in parts of bones where they are growing. These areas, known as **growth plates**, are where osteosarcomas typically develop. The theory is that fluoride might somehow cause the cells in the growth plate to grow faster, which might make them more likely to eventually become cancerous.

### **What have studies found?**

Many population-based studies have looked at the potential link between water fluoride levels and cancer. Most of these have not found a strong link to cancer. Just about all of the studies have been retrospective (looking back in time). They have compared, for example, the rates of cancer in a community before and after water fluoridation, or compared cancer rates in communities with lower levels of fluoride in drinking water to those with higher levels (either naturally or due to fluoridation). Some factors are hard to control for in these types of studies (that is, the groups being compared may be different in ways other than just the drinking water), so the conclusions reached by any single study need to be looked at with caution.

And there are other issues that make this topic hard to study. For example, if fluoridation is a risk factor, is the type of fluoride used important? Also, is there a specific level of fluoride above which the risk is increased, or a certain amount of time or an age range during which a person would need to be exposed?

[Osteosarcoma](#)<sup>2</sup> is a rare cancer. Only about 500 osteosarcomas are diagnosed in

areas with low concentrations,” they also noted that the evidence was inadequate to draw conclusions one way or the other.

In 1991, the **US Public Health Service** issued a report on the benefits and risks of fluoride. When looking at a possible link with cancer, they first reviewed the results of studies in lab animals. They concluded that the few studies available “fail[ed] to establish an association between fluoride and cancer.” They also looked at population-based studies, including a large study conducted by the National Cancer Institute. They concluded: “Optimal fluoridation of drinking water does not pose a detectable cancer risk to humans as evidenced by extensive human epidemiological data available to date, including the new studies prepared for this report.”

The **National Research Council (NRC)**, part of the National Academies, issued a report titled “Health Effects of Ingested Fluoride” in 1993. Its conclusion was that “the available laboratory data are insufficient to demonstrate a carcinogenic effect of fluoride in animals.” They also concluded that “the weight of the evidence from the epidemiological [population-based] studies completed to date does not support the hypothesis of an association between fluoride exposure and increased cancer risk in humans.” The report recommended that additional well-designed studies be done to look at the possible link to cancers, especially osteosarcomas.

In the United Kingdom, the **National Health Service (NHS) Centre for Reviews and Dissemination**, University of York, published a systematic review of water fluoridation in the year 2000. After searching through the medical literature, they included 26 studies in their analysis, all of which were considered to be of “low” to “moderate” quality. They concluded, “Overall, no clear association between water fluoridation and incidence or mortality of bone cancers, thyroid cancer, or all cancers was found.” However, they also noted, “Given the level of interest surrounding the issue of public water fluoridation, it is surprising to find that little high quality research has been undertaken.”

The **National Research Council** issued an update of its 1993 review in 2006. While the review included some new data, the results of this report were essentially the same: “On the basis of the committee’s collective consideration of data from humans, genotoxicity assays, and studies of mechanisms of actions in cell systems, the evidence on the potential of fluoride to initiate or promote cancers, particularly of the bone, is tentative and mixed.”

The **European Scientific Committee on Health and Environmental Risks (SCHER)** reviewed the evidence on water fluoridation in 2010. It concluded that the evidence

In 2011, California's **Carcinogen Identification Committee (CIC)** reviewed the evidence and concluded that "fluoride and its salts has not been clearly shown to cause cancer."

The general consensus among the reviews done to date is that there is no strong evidence of a link between water fluoridation and cancer. However, several of the reviews noted that further studies are needed to help clarify the possible link.

### ***More recent research***

Several studies looking at a possible link between water fluoridation and cancer have been published in recent years.

A partial report of a study from the Harvard School of Public Health, published in 2006, found that exposure to higher levels of fluoride in drinking water was linked to a higher risk of osteosarcoma in boys but not in girls. The second part of the Harvard study, published in 2011, compared the fluoride levels in bones near tumors in people with osteosarcoma to the levels in people with other types of bone tumors. The researchers found no difference between the fluoride levels in the two groups.

Other studies published after the expert health organization reviews have compared the rates of osteosarcoma in areas with higher versus lower levels of fluoridation in Great Britain, Ireland, and the United States. These studies have not found an increased risk of osteosarcoma in areas of water fluoridation.

## **Can you reduce your fluoride exposure?**

Even without fluoridation, the natural levels of fluoride in water in some places can be higher than 4 mg/L. Community water systems in such areas are required to lower the fluoride level below the acceptable standard. But the levels in private water sources, such as wells, may still be higher.

For people concerned that they or their families may be exposed to too much fluoride, there are some steps you can take to reduce your exposure.

- **Know the level of fluoride in your drinking water.** If your drinking water comes from a public source, you can find out about the levels of fluoride in your drinking water by contacting your local community water system. People who get their drinking water from a private source such as a well can have the fluoride levels tested by a reputable laboratory. Each system is also required to provide its

customers with an annual report on water quality known as a *Consumer Confidence Report*. This report lists the levels of certain chemicals and other

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