

# In the Fight Against Tooth Decay: May the Fluoride Be With You!

Joanne Prasad, DDS, MPH  
Helen Hawkey  
Merrilynn Marsh, MA  
Megan Guy  
Dan Bain, PhD  
May 2021

## Rationale

Fluoridation of drinking water is an important public health measure in the fight against tooth decay, yet many community water systems remain unfluoridated. A summary of the underlying science can help inform decision making at the individual and municipal levels.

## Approach

The most current information and guidance on fluoridation are gathered and summarized in this document.

## Questions

We evaluated the scientific literature and conducted research into fluoridation of community water systems in Pennsylvania to answer the following questions:

- *Why is fluoride added to drinking water?*
- *How is fluoride added to drinking water?*
- *Is my drinking water fluoridated?*
- *What are other sources of fluoride?*

## Findings

### Why is fluoride added to drinking water?

Fluoride is a naturally occurring element that is found in both surface and groundwater. At an optimal level (0.7 parts per million, or ppm), studies have shown that fluoride in drinking water is an effective ally in the fight against tooth decay. Tooth decay occurs when acids in the mouth break down the mineral crystals of the tooth enamel. Enamel is the hard, outer layer of teeth which contains crystals of calcium and phosphate. The acids responsible for tooth decay are formed when bacteria in the dental plaque are exposed to sugars. If the breakdown of the enamel is severe enough, a hole, or cavity, is formed in the enamel. This hole creates access for bacteria to invade and destroy the much softer inner dentin layer of the tooth. If the disease is left to progress, the bacteria can reach the innermost pulp chamber and root canal(s) of the tooth. Drinking fluoridated water makes tooth enamel more resistant to tooth decay. Fluoridated water helps teeth resist cavities in several ways, depending on the stage of development of the tooth.

Fluoride is a natural element that exists in lakes, rivers, oceans, and groundwater



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## What is Community Water Fluoridation?

Community water fluoridation (CWF) is “the controlled addition of a fluoride compound to a public water supply to achieve a concentration optimal for dental [cavities] prevention.”

(US Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000)

<https://bit.ly/2JRYl0n>



Fluoridated water prevents **one** out of every **four** cavities in children and adults

During childhood, drinking fluoridated water while the teeth are forming creates enamel crystals that are stronger and more resistant to the acids produced by plaque bacteria. Fluoridation is also beneficial for adults. In fact, fluoridated water reduces the risk of tooth decay by enhancing remineralization and formation of fluorapatite crystals on the surface of the enamel in humans of all ages. Fluoride in drinking water also interferes with the ability of plaque bacteria to convert sugars to acids.

The tooth decay prevention benefits of fluoride were established in the first half of the 20th century. Dr. Frederick McKay, a dentist in Colorado Springs (where the naturally-occurring levels of fluoride in the water were high, up to 12.2ppm), observed that something in the drinking water led to development of teeth that were more resistant to tooth decay. Subsequent research established the link between drinking fluoridated water and a reduced incidence of tooth decay. Of note, Dr. Gerald J. Cox, former Director of Dental Research at the University of Pittsburgh School of Dental Medicine, was the first to suggest adding fluoride to drinking water in 1939, as a public health measure aimed at reducing the burden of tooth decay in children. In 1945, Grand Rapids, Michigan became the first city in the world to fluoridate its drinking water. The rate of tooth decay among Grand Rapids children born after fluoridation of the water supply dropped by more than 60 percent in 11 years. Community water fluoridation (CWF) was endorsed on a broad scale in 1951 by the U.S. Surgeon General, a step that would later be declared one of the 10 greatest public health achievements of the twentieth century.

Community water fluoridation continues to be the most effective, equitable, and low-cost public health intervention to reduce the risk and severity of tooth decay. Tooth decay is the most common chronic disease of children and adults. It is five times more common than asthma in children. Ninety percent of adults have had a cavity at some point in their lives. In Pennsylvania, approximately 41% of older adults have experienced severe tooth loss. Further, 1 in 4 U.S. children between the ages of 2 and 11 years live with untreated cavities, and many suffer from pain, infection, and/or tooth loss as a result.

## What is tooth decay?

Tooth decay (also known as dental decay or caries) is a disease of teeth caused by bacteria in dental plaque. When exposed to sugars in the oral cavity, these bacteria produce acids that can erode and destroy the tooth structure. With progressive disease, the bacteria can irritate or invade the pulp and root canals of the tooth, leading to pain and expensive treatment or tooth loss. Drinking fluoridated water makes teeth more resistant to tooth decay.

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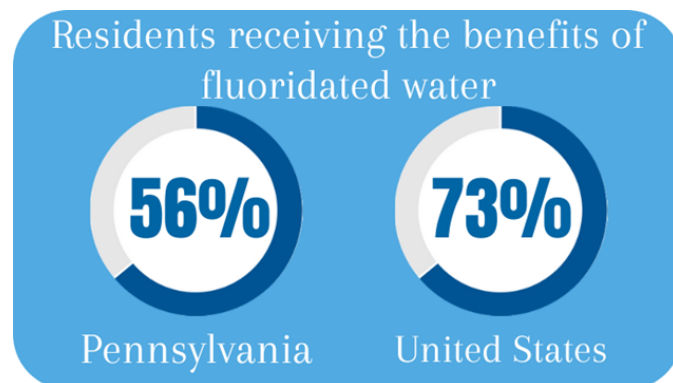
CWF is also an equitable public health measure that helps to minimize racial and socioeconomic disparities in oral health. In the US, Native American, Black, Hispanic, and lower socioeconomic status populations are more likely to experience tooth decay, to suffer from more severe decay, and are less likely to receive care. With daily access to fluoridated drinking water, everyone has an improved chance of being and staying free of tooth decay.

## How is fluoride added to drinking water?

Each community water system in PA is governed locally and makes its own decisions on whether or not to adjust the fluoride level of the water it provides to the community. One of the following approved fluoride additives may be utilized for CWF: sodium fluoride, sodium silicofluoride, or fluorosilicic acid. Each water system provider selects the additive that works best with its equipment and the treatment process it uses. Water can be fluoridated at various points during the treatment process, including in the final stage, at localized pump stations. Fluoride levels are carefully monitored to avoid exceeding levels optimal for dental health. In PA, water suppliers who adjust fluoride levels in their drinking water must obtain a permit from the PA Department of Environmental Protection.

## Is my drinking water fluoridated?

Currently, approximately 73% of the U.S. population served by community water systems receives fluoridated water. One goal of the government's Healthy People 2030 initiative has been to increase this percentage to over 77%. In the Commonwealth of Pennsylvania, approximately 56% of the population served by community water systems receives fluoridated water.

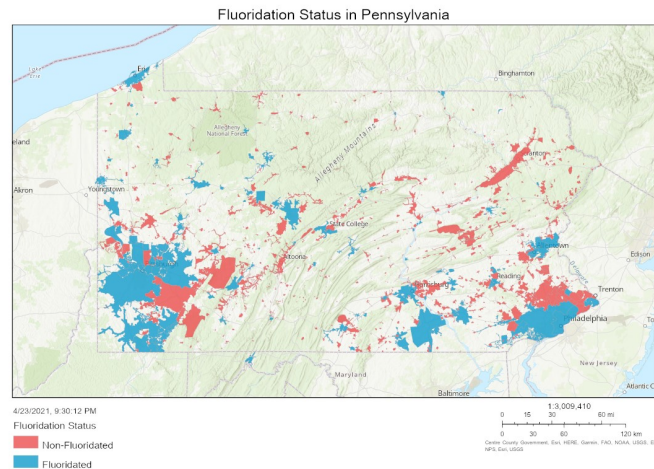


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## Resources for further learning:

- [ADA's Fluoridation Facts](#)
- [MouthHealthy.org](#)
- [Recent JADA Articles](#)
- [Fluoride FAQs](#)
- [Fluoridation videos](#)
- [Healthy People 2030](#)

The best way to know the fluoridation status of your drinking water is to call your water company directly and ask. Another way is to locate your water company's annual Consumer Confidence Report, aka Water Quality Report. The University of Pittsburgh in collaboration with the PA Coalition for Oral Health has also developed an interactive map to quickly find out which geographic areas in Pennsylvania have CWF and which areas do not (<http://bit.ly/FluorideWaterBriefing>). This interactive map is also a useful resource for dental providers and pediatricians who might want to obtain this information in caring for their patients.



If your drinking water does not come from a commercial water supply (e.g. your tap water comes from a well), the natural fluoride levels in your drinking water are likely to be below the level recommended for supporting dental health. Groundwater in Pennsylvania contains limited naturally occurring fluoride. Talk to your dentist or family doctor to find out what you can do to help minimize your risk of tooth decay.

100

Number of reputable international health and science organizations that recognize the public health benefit of fluoride

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## What are other sources of fluoride?

In addition to CWF, there are other common sources of fluoride that can help prevent tooth decay. Fluoride is found in many over-the-counter and prescribed oral hygiene products that are commonly used as part of an at-home oral health care regimen, such as toothpastes and mouthwashes. Topical fluorides, in the form of gels, foams, and varnishes, are also effective against tooth decay. They are also commonly used by dentists and pediatricians as part of preventive care visits. These topical agents contain a more concentrated amount of fluoride and are directly applied to the teeth in an office setting. Some school-based oral healthcare programs may also include topical application of a fluoride varnish, gel, or foam. It should be noted that these measures add to, but do not negate, the benefits of drinking fluoridated water in reducing tooth decay.

In addition to fluoride-based dental products, fluoride is also found in certain foods and beverages. Some food products and drinks may contain more fluoride than others, such as grapes, black tea, and carbonated drinks prepared with fluoride-containing water. Parents of young children should be mindful of the different sources of fluoride that their children might encounter. Children who ingest excessive amounts of fluoride from combined sources while the enamel of their teeth is still forming (between birth and 8 years of age) could develop white spots on their teeth that may or may not be noticeable, a condition known as “fluorosis”. Therefore, to minimize the ingestion of excess fluoride from toothpaste by young children, dentists recommend only using a smear of toothpaste for children under 3, and a small (pea size) amount of toothpaste for children 3 and older. Parental monitoring during brushing is also important. Dental fluorosis cannot develop after tooth formation is complete, thus an adult cannot “get” dental fluorosis by ingesting too much fluoride.

## Implications

- Tooth decay is a common, but preventable, disease that affects individuals of all ages
- Community water fluoridation is an important public health measure to combat tooth decay
- Almost half of community water systems in the Commonwealth of Pennsylvania do not currently fluoridate drinking water

***In the fight against tooth decay, may the Fluoride be with you!***

### Contact Us:

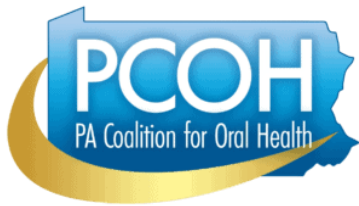


#### Email

[PittWater@pitt.edu](mailto:PittWater@pitt.edu)

#### Website

[www.water.pitt.edu](http://www.water.pitt.edu)



#### Email

[info@paoralhealth.org](mailto:info@paoralhealth.org)

#### Website

[www.paoralhealth.org](http://www.paoralhealth.org)

### Pitt Dental Medicine

#### Email

[jl92@pitt.edu](mailto:jl92@pitt.edu)

#### Website

[www.dental.pitt.edu](http://www.dental.pitt.edu)