

# Fluoride at High Levels 'Presumed' a Neurodevelopmental Hazard

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Decades after [fluoride](#) was first added to drinking water in some parts of the United States, controversy continues about the possible detrimental health effects of fluoridation.

Now, a [draft report](#) from the National Toxicology Program (NTP) concludes that fluoride is "presumed" to be a cognitive neurodevelopmental hazard to humans.

Their conclusion is based on a consistent pattern of findings from human studies across various populations that show an association between higher fluoride exposure and decreased IQ or other cognitive impairments in children, explained Kyla W. Taylor, PhD, a health scientist in NTP's Office of Health Assessment and Translation at the National Institute of Environmental Health Sciences.

However, the consistency is only seen with exposure to higher levels of fluoride (ie, >1.5 ppm in drinking water). Findings from studies that looked at lower exposures were inconsistent as to the effects on cognitive neurodevelopment. (For community water systems that add fluoride, the US Public Health Service recommends a level of 0.7 mg/L [ppm] fluoride in water systems for oral health prevention and the US Environmental Protection Agency has an enforceable limit of 4.0 mg/L fluoride for public water supplies.)

"Based on the high quality of studies that we looked at, there was a moderate level of evidence that high fluoride exposure is associated with decreased IQ and other cognitive effects in children," Taylor said.

But few high-quality studies were available for adult exposure. "There were only two high-quality cross-sectional studies and they did not provide consistent evidence that there is an association between cognitive impairment and exposure to fluoride," she said. "Seven low-quality cross-sectional studies did provide some evidence of cognitive impairment in adults, but due to the limited number of high-quality studies, there was an inadequate level of evidence."

Taylor presented the draft report on November 6 to a National Academies of Sciences, Engineering, and Medicine (NAS) committee, which conducted a public peer review of the NTP study. This month's meeting was focused on the NTP's methodology. A final critique of the report and the findings are expected sometime in 2020. In the meantime, committee members declined to comment on the findings.

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## Decades of Controversy

About 67% of the US population has fluoridated tap water, and fluoride is commonly found in dental products such as toothpaste and mouth rinses. Fluoride also occurs naturally in drinking water, and in foods and beverages.

Although studies have shown that [fluoride can prevent cavities](#), and water fluoridation has been supported by the World Health Organization and the Centers for Disease Control and Prevention (CDC), some groups remain concerned about the potential harmful effects of fluoride.

Taylor pointed out that previous studies have suggested there could be neurodevelopmental and cognitive health effects associated with exposure to excess fluoride. For example, a 2006 article by the National Research Council found an association between ingesting high levels of naturally occurring fluoride in drinking water and neurological effects in humans.

In 2016, the NTP conducted a systematic review of animal studies that looked at the potential effects of fluoride exposure on learning and memory. The results showed a low-to-moderate level of evidence that exposure appeared associated with learning and memory deficits.

In the past 2 years, several studies have suggested an association between fluoride ingestion and a negative neurological impact in children.

Earlier this year, an [article published](#) in *JAMA Pediatrics* showed that fluoride intake among pregnant women was associated with a reduction in their children's IQ at ages 3 to 5 years.

Some of the same researchers [published a study](#) in 2017 showing a similar trend among a cohort of children in Mexico. In that study, researchers followed the children from the time of their mother's pregnancy to early adolescence, uncovering an association between high fluoride levels in the mothers' urine and reduced scores on the children's cognitive tests.

In addition, last year a [study published](#) in *Environmental International* suggested a link between prenatal exposure to higher

levels of fluoride and increased incidence of [attention deficit hyperactivity disorder](#) (ADHD) in children.

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## Effect in Children

In the current NTP systematic review, Taylor and colleagues expanded their 2016 article to include human epidemiological studies, updated animal evidence, and selected mechanistic information to examine the evidence linking fluoride exposure with neurodevelopmental and cognitive effects.

The team identified 149 published human studies, 339 experimental animal studies, and 60 in vitro/mechanistic studies in a literature search. Of the human studies, 82 looked at the association between fluoride exposure and neurodevelopmental or cognitive effects. The other studies evaluated the possible effect of fluoride on thyroid function or other outcomes.

Taylor explained that they were able to rule out confounding as a concern in most studies. She also noted that individual measures of exposure were considered more accurate than group-level measures.

"Another key determinant was exposure characterization," she said. "Some studies measured individual and group exposures, areas with naturally high fluoride compared with those artificially fluoridated or nonfluoridated, and areas with high dental fluorosis versus those with low dental fluorosis."

In addition, some studies looked at drinking tap versus bottled water, as well as other water-based beverages, including black and green tea. Maternal urine fluoride levels were also assessed in some articles, and "that is considered to be a valid measurement," she explained.

Unlike the studies in adults, which were generally limited in number and quality, researchers found 13 high-quality studies of children, which were conducted in several different countries. All reported a statistically significant association with fluoride exposure and lower IQ, including the recent studies of Mexican and Canadian cohorts.

There were also 41 lower-quality studies in children that provided supporting evidence, Taylor noted.

The review also includes 35 new animal studies that had not been part of the 2016 article, but the authors conclude that the data from them are inadequate to inform conclusions about fluoride's effect on humans.

"While there is some evidence that fluoride may affect neurodevelopment in animals, the body of evidence is inadequate to contribute to the effects on IQ in humans," Taylor said.

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## Public Input

Taylor's presentation at the NAS committee meeting was followed by a question and answer session from the committee, primarily about the group's methodology, and then public comments were taken.

Seun Ajiboye, PhD, from the American Association of Dental Research, noted the risks and benefits of fluoridation need to be weighed, and emphasized the benefits of fluoride on dental health. She reminded the committee that water fluoridation was recognized by the CDC as one of the [top 10 public health achievements](#) of the 20th century.

Chris Neurath, from the Fluoride Action Network, pointed out that his group had nominated fluoride for the NTP review for several years and "although it has taken more than 4 years, we feel that they have certainly weighed the evidence to conclude that it is a presumed neurotoxin."

"However, we feel that the NTP monograph downgraded the evidence of [neurotoxicity](#) at each step of the assessment," he said.

Neurath added that if the authors had followed their own "prespecified methodology they would have concluded that fluoride is not just a presumed but it is a known neurotoxin at exposures below 1.5 ppm."

Another comment came from a man identified as Dr Scott Smith, who emphasized that "when we are dealing with public health, the public has a right to know about all studies."

As far as fluoride goes, he pointed out no one dose fits all situations. "Doctors would not prescribe antibiotics and not monitor our bodies' reactions to the medicine," he said. "You can repair a cavity, but you cannot repair a brain."

Scott also pointed out that there are many other ways of receiving fluoride. "It works topically, such as in toothpaste or a treatment," he said, but as for fluoridating water, "people may want a choice."

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## Rigorous Process

Approached by *Medscape Medical News* for an independent comment, Howard Hu, MD, ScD, who was a co-author of the

Mexican cohort study on fluoride exposure and IQ, noted that "this is not your ordinary systematic review."

"They were quite rigorous in applying the methodology that they developed and published on," said Hu, an affiliate professor in environmental and occupational health science at the University of Washington in Seattle. "I am fully supportive of this methodology in order to provide more transparent, rigorous, and unbiased support of the science, and the public health world should be grateful for this review."

Hu declined to comment on the NTP findings, as it is a draft version of the report, but noted that "depending on which way it may go, these finding will influence public policy, and it would be hard for folks on either side of the debate to see this as a biased or unprofessional review."

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