Higher prenatal fluoride exposure in public drinking water linked to lower fluid cognition scores in children

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KEY TAKEAWAYS:

- Children whose mothers were potentially exposed to higher fluoride levels in public drinking water during pregnancy tended to score lower on tests of problem-solving, memory, attention, and adapting to new information.
- The association was strongest when fluoride levels in neighborhood drinking water were close to or above the current U.S. recommended levels.

Who sponsored this study?

The Environmental influences on Child Health Outcomes (ECHO) Program, Office of the Director, National Institutes of Health supported this research.

Why was this study needed?

Fluoride is found naturally in some water sources and is also added to many public drinking water systems to help prevent cavities. Current United States guidance for fluoridated water is designed to support dental health and reduce the risk of tooth or bone problems, but more evidence is needed to fully understand the possible effects of fluoridated water on children's brain development. In a recent review, the National Toxicology Program found moderate evidence that children exposed to fluoride levels above 1.5 milligrams in each liter of drinking water may have lower IQ scores. The report also noted that there is limited research on lower fluoride levels, especially in U.S. populations.

ECHO researchers wanted to know whether fluoride levels in public drinking water during pregnancy were related to children's cognition, or thinking and learning skills, later in childhood.

What were the study results?

Children whose mothers were potentially exposed to higher fluoride levels in public drinking water during pregnancy tended to score lower on tests of fluid cognition. Fluid cognition includes skills such as problem-solving, memory, attention, and adapting to new information.

The association was strongest at fluoride levels near or above the current U.S. Public Health Service recommended level for fluoridated water. In one analysis, lower fluid cognition scores were seen after about 675 micrograms per liter, which is close to the current recommended level of 700 micrograms per liter. The current regulatory level set by EPA is higher at 4,000 micrograms per liter. Above 675 micrograms per liter, each 500 micrograms per liter increase in fluoride was associated with an average 3.36-point lower score on the standardized fluid cognition scale.

The results were clearer for fluid cognition than for crystallized cognition, which includes learned knowledge such as vocabulary. The study did not find the same consistent pattern between higher fluoride levels and lower crystallized cognition scores across all children.

Children younger than 7 had larger differences in cognition scores linked to higher prenatal fluoride exposure, though more research is needed to understand why.

What was the study's impact?

This study adds to a large body of work that looks at how early exposure to environmental contaminants may be associated the development of the thinking and learning processes that are important for children's developmental outcomes. Future research could focus on when children may be most sensitive to fluoride exposure and examine both potential developmental risks and dental health benefits to better understand relationships between fluoride exposure and child health. Because this was an observational study, the results show an association and do not prove that fluoride caused lower cognition scores.

Who was involved?

The study included 2,514 children from 17 ECHO Cohort Study Sites across 23 U.S. states. Children were born between 2006 and 2019 and completed cognition testing between ages 3 and 17.

What happened during the study?

Researchers estimated each child's prenatal fluoride exposure by linking public water fluoride data to the mother's residential address during pregnancy. They used monthly address information to estimate the average fluoride level in public drinking water during pregnancy. Children later completed NIH Toolbox cognition tests, which measured fluid cognition, crystallized cognition, and total cognition. Researchers then examined whether higher prenatal fluoride levels were related to differences in cognition scores, while accounting for factors such as child sex, birthing parent age and education, prenatal tobacco use, season of conception, and neighborhood characteristics.

The study focused on fluoride levels in public drinking water and did not measure total fluoride exposure from other sources such as toothpaste, tea, foods, supplements, bottled water, or private wells.

Footnote: Results reported here are for a single study. Other or future studies may provide new information or different results. You should not make changes to your health without first consulting your healthcare professional.

Where can I learn more?

Access the full journal article, titled "Prenatal exposure to fluoride in public water and child cognition in the US ECHO Cohort, 2006-2019," in *American Journal of Epidemiology*.

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