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# Impact of fluoride on neurological development in children

July 25, 2012 — For years health experts have been unable to agree on whether fluoride in the drinking water may be toxic to the developing human brain. Extremely high levels of fluoride are known to cause neurotoxicity in adults, and negative impacts on memory and learning have been reported in rodent studies, but little is known about the substance’s impact on [children’s neurodevelopment](#). In a meta-analysis, researchers from Harvard School of Public Health (HSPH) and China Medical University in Shenyang for the first time combined 27 studies and found strong indications that fluoride may adversely affect cognitive development in children. Based on the findings, the authors say that this risk should not be ignored, and that more research on fluoride’s impact on the developing brain is warranted.

The [study](#) was published online in *Environmental Health Perspectives* on July 20, 2012.

The researchers conducted a systematic review of studies, almost all of which are from China where risks from fluoride are well-established. Fluoride is a naturally occurring substance in groundwater, and exposures to the chemical are increased in some parts of China. Virtually no human studies in this field have been conducted in the U.S., said lead author [Anna Choi](#), research scientist in the [Department of Environmental Health](#) at HSPH.

Even though many of the studies on children in China differed in many ways or were incomplete, the authors consider the data compilation and joint analysis an important first step in evaluating the potential risk. “For the first time we have been able to do a comprehensive meta-analysis that has the potential for helping

us plan better studies. We want to make sure that cognitive development is considered as a possible target for fluoride toxicity,” Choi said.

Choi and senior author [Philippe Grandjean](#), adjunct professor of environmental health at HSPH, and their colleagues collated the epidemiological studies of children exposed to fluoride from drinking water. The China National Knowledge Infrastructure database also was included to locate studies published in Chinese journals. They then analyzed possible associations with IQ measures in more than 8,000 children of school age; all but one study suggested that high fluoride content in water may negatively affect cognitive development.

The average loss in IQ was reported as a standardized weighted mean difference of 0.45, which would be approximately equivalent to seven IQ points for commonly used IQ scores with a standard deviation of 15.\* Some studies suggested that even slightly increased fluoride exposure could be toxic to the brain. Thus, children in high-fluoride areas had significantly lower IQ scores than those who lived in low-fluoride areas. The children studied were up to 14 years of age, but the investigators speculate that any toxic effect on brain development may have happened earlier, and that the brain may not be fully capable of compensating for the toxicity.

“Fluoride seems to fit in with lead, mercury, and other poisons that cause chemical brain drain,” Grandjean says. “The effect of each toxicant may seem small, but the combined damage on a population scale can be serious, especially because the brain power of the next generation is crucial to all of us.”

*\* This sentence was updated on September 5, 2012.*

[Read a September 2012 statement by the authors.](#)

*\*\* [Learn more](#) about the IQ measurements by HSPH’s Anna L. Choi and Philippe Grandjean in response to a letter to the journal published in the March 2013 (Vol. 121, No. 3) *Environmental Health Perspectives*. – [Marge Dwyer](#)*