

US schoolchildren exposed to arsenic in well water have lower IQ scores

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A study by researchers at Columbia University reports that schoolchildren from three school districts in Maine exposed to arsenic in drinking water experienced declines in child intelligence. While earlier studies conducted by the researchers in South Asia, and Bangladesh in particular, showed that exposure to arsenic in drinking water is negatively associated with child intelligence, this is the first study to examine intelligence against individual water arsenic exposures in the U.S. Findings are reported online in the journal, *Environmental Health*.

The research team, led by Joseph Graziano, PhD, professor of Environmental Health Sciences at Columbia University's Mailman School of Public Health, assessed 272 children in grades 3-5, who were, on average, 10 years old, from three [school districts](#) in Maine where household wells are the predominant source for drinking water and cooking. The Augusta area in particular was studied because of earlier research indicating higher than normal exposures.

Using the Wechsler Intelligence Scale for Children (WISC-IV), the most often used assessment tool for measuring intelligence in children ages 6 to 16, the researchers found that arsenic in household water was associated with decreased scores on most WISC-IV indices. After adjusting for maternal IQ and education, characteristics of the home environment, school district, and number of siblings, the children who were exposed to greater than 5 parts arsenic per billion of household well water ($WAs \geq 5 \mu g/L$) showed reductions in Full Scale, Working Memory, Perceptual Reasoning and Verbal Comprehension scores,

losses of 5-6 points, considered a significant decline, that may translate to problems in school, according to Gail Wasserman, PhD, professor of Medical Psychology in the Department of Psychiatry at Columbia, and the study's first author.

Water samples were taken at the point of entry into the home via connection to the garden hose and at the consumption point, the kitchen sink. The researchers also considered drinking habits, length of residence in the home, well construction and use of filtering procedures.

On average, water arsenic (WAs) levels measured at the kitchen tap were 9.88 parts arsenic (9.88 μ g/L), with almost a third of samples exceeding 10 μ g/L, the maximum contaminant level guideline of the World Health Organization and U.S. Environmental Protection Agency. The highest level of WAs reported was 115.3 μ g/L.

"The strength of associations found in this study is comparable to the modest increases that have been found in blood lead, an established risk factor for diminished IQ," said Dr. Graziano.

Analogous to the earlier work in Bangladesh with similarly aged children, the researchers found negative associations between water arsenic and performance that persisted upon adjustment for similar socio-demographic data. However, in Bangladesh, IQ tests were slightly modified to increase cultural appropriateness, and not precisely the same test as administered in Maine. Also significant, in Bangladesh and other such countries, children's nutritional and health status, as well as their regularity of school attendance, differs from that of U.S. children. Most noteworthy, Dr. Graziano emphasizes that water arsenic concentrations in the previously studied settings ranged far higher than in these U.S. communities, but also included low levels.

"Our findings of adverse impact in a U.S. sample, particularly in

performance-related functioning, gives confidence to the generalizability of findings from our work in Bangladesh, where we also observed a steep drop in intelligence scores in the very low range of water arsenic concentrations," said Dr. Graziano, who is also professor of Pharmacology at Columbia's College of Physicians and Surgeons.

"Collectively, our work in Bangladesh and in Maine suggests that aspects of performance intelligence, particularly perceptual reasoning and working memory, are impacted by exposure to arsenic in [drinking water](#)."

"Even though purchasing a standard filter at the hardware store is inadequate for treating well water, the good news is that there are steps one can take to ameliorate the situation," noted Dr. Graziano. Although somewhat expensive, Dr. Graziano and other experts recommend installing a reverse osmosis system to alleviate the effects of water arsenic. A series of outreach programs are also underway to educate families in the region.

Provided by Columbia University's Mailman School of Public Health

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