

Arsenic in public water is linked to higher urinary arsenic totals among the US population

April 20 2023



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A new study by researchers at Columbia University Mailman School of Public Health shows that water arsenic levels are linked to higher urinary

arsenic among the U.S. population for users of both private wells and public water systems. The findings are published in the journal *Environmental Research*.

Long-term exposure to arsenic even at low and moderate levels can increase the risk of cancer and other types of chronic disease. While drinking water along with diet is a major source of arsenic for the [general population](#), the contribution of arsenic in drinking water to total arsenic exposure has been unclear in U.S. populations, especially at less than high levels in [public water supplies](#).

The researchers evaluated the association between arsenic in private wells and public water supplies using urinary arsenic biomarkers within U.S. populations. "To date, no nationwide study had evaluated the link between drinking water arsenic with arsenic biomarkers in urine to assess how drinking water contributes to arsenic exposure for both regulated community water systems (CWS) and unregulated private wells," said Maya Spaur, a Ph.D. candidate in environmental health sciences at Columbia Mailman School of Public Health.

The U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry includes arsenic as a potent carcinogen and toxicant associated with numerous adverse health outcomes, ranking it number one on their substance priority list. The U.S. Environmental Protection Agency (EPA) regulates arsenic in public drinking water supplies and sets the maximum contaminant level (MCL) allowable in [public water systems](#). However, differences in CWS arsenic concentrations persist across the U.S.

In 2006, the EPA reduced allowable maximum contaminant levels to 10 µg/L, from 50 µg/L. However, based solely on risk to health, the EPA set an MCL goal (MCLG) of 0 µg/L. In addition to community water systems, arsenic exposure from drinking water is also a major concern

for approximately 40 million U.S. residents reliant on private well water. However private wells are not subject to EPA's MCL or other federal regulations.

To conduct the study the researchers evaluated 11,088 participants from the 2003-2014 National Health and Nutrition Examination Survey (NHANES). For each participant, the researchers assigned private well and CWS arsenic levels according to county of residence using estimates previously derived by the U.S. Environmental Protection Agency and U.S. Geological Survey. Participants also completed an in-person interview, dietary recall, and physical examination.

The average recalibrated urinary dimethylarsinate (rDMA), the main metabolite of arsenic excreted in urine was 2.52 $\mu\text{g/L}$ among private well users and 2.64 $\mu\text{g/L}$ among CWS users. Urinary rDMA was highest among participants in the West and South, and among Mexican American, other Hispanic, and non-Hispanic other participants. Urinary rDMA levels were 25 percent and 20 percent higher comparing the highest to the lowest third of the population distribution of CWS and private well arsenic, respectively.

"We found that higher private well and public water arsenic levels were linked to higher urinary arsenic among NHANES participants," noted Spaur.

"We further observed very similar relationships between water arsenic and urinary arsenic for both regulated public water supplies and unregulated private wells, but did see differences by region with the strongest associations in the South and West, and among Mexican American participants. Our findings show that water arsenic, including in public water, is a major contributor to total arsenic as measured in urine. Additional efforts are needed to target regions and communities that continue to experience higher exposure."

"Evaluating the link between drinking water [arsenic](#) and [arsenic levels](#) within U.S. populations is critical for informing drinking water regulatory policies going forward and for identifying communities that need additional financial, technical, and regulatory assistance to reduce the exposure to their residents," said Anne E. Nigra, assistant professor of [environmental health sciences](#) at Columbia Mailman School of Public Health, and senior author.

More information: Maya Spaur et al, Cross-sectional associations between drinking water arsenic and urinary inorganic arsenic in the United States: NHANES 2003–2014, *Environmental Research* (2023). [DOI: 10.1016/j.envres.2023.115741](https://doi.org/10.1016/j.envres.2023.115741)

Provided by Columbia University's Mailman School of Public Health

Citation: Arsenic in public water is linked to higher urinary arsenic totals among the US population (2023, April 20) retrieved 24 April 2024 from <https://medicalxpress.com/news/2023-04-arsenic-linked-higher-urinary-totals.html>

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