

Arsenic contamination is common in Punjabi wells, study finds

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Students testing for arsenic in Pakistan's Punjabi wells. Credit: Junid Ali Khattak

While most Americans have access to safe, potable water, populations in

some regions of the world are not as fortunate. In fact, the majority of some 90 million people who live in the Punjab areas of Pakistan and India drink and cook with untreated well water that they collect themselves from privately-owned wells on their properties.

The main contaminant of the well [water](#) in this region of South Asia is arsenic—high levels of which can cause a range of illnesses, including cardio-vascular disease for adults and impaired cognitive function in children.

A new study uncovers how widespread the [arsenic contamination](#) problem is in Punjab wells, as well as a relatively easy way to solve it. In the study—which was published online in *Science of the Total Environment* in November—Columbia University earth scientists partnered with Southeast Asian research professors and students to test more than 30,000 [water wells](#) in nearly 400 Pakistani and Indian villages. These villages are located within the floodplain of the Indus River and its tributaries, which transport arsenic-laden sediment down from the Himalaya mountains.

In the Bengal basin in Bangladesh, well-water arsenic causes approximately 40,000 adult deaths per year—equivalent to about five percent of the country's overall mortality rate. Arsenic is likely causing premature, preventable deaths in Punjabi communities as well. But as India and Pakistan lack the financial resources and manpower to install centralized water supply systems in the foreseeable future, the only way to address the problem is regularly testing the village wells. "The villagers need to know where the safe wells are," explained Lex van Geen, a research professor at Columbia's Lamont-Doherty Earth Observatory and the study's lead author.

About 45 students from local Pakistani and Indian colleges—under the supervision of Ph.D. students from Quaid-i-Azam University and the

TERI School of Advanced Studies—visited 383 select villages and knocked on every residential door, requesting to test the homeowners' wells with their field kits.



Map of the Punjab area shown in white. Credit: [Ktims](#) at [English Wikipedia](#)

They found that nearly a quarter of all the tested wells contain more than 10 micrograms per liter of arsenic, the World Health Organization's (WHO's) threshold in safe drinking water. Fortunately though, the study found that 87 percent of households with a high-arsenic well live within 100 meters (or about 330 feet) of a private well that meets the WHO guideline for arsenic. Proximity to wells is important, as the villagers have to manually fill and carry buckets of water back to their homes, noted van Geen. "If it's 500 meters away instead of 50 meters," he said,

"that makes a big difference."

The students advised Punjab households with unsafe well water to switch to neighbors' wells that are considered safe based on the [test results](#). They also asked villagers with safe wells to allow their less fortunate neighbors to use them. "We can't force anyone, but as part of our campaign, we say, 'You have an unsafe well, you should really consider switching, especially for the health of your children,'" said van Geen. "We hope you can [get along] with your neighbor so you can use their well."

When the researchers returned to five of the Pakistani villages a year later, about two-thirds of the 150 surveyed households with high-[arsenic](#) wells claimed to have switched to a neighbor's safe well. (Funding constraints prevented them from returning to more of the Punjabi villages.) In a previous test involving some 12,000 villagers' wells across 60 Bangladesh villages, about 60 percent of households surveyed also made the switch to safe wells. The studies have found that households that don't switch, despite being notified of the risks, are likely to be less educated and poorer, and may have more urgent daily issues to attend to.

Van Geen and his team are hoping that the latest rounds of testing will encourage the Pakistani and Indian governments to conduct "blanket" testing of as many of the 9 million or more Punjabi wells as possible. The testing campaign closest in magnitude to this kind occurred between 2000 and 2005, when Bangladesh's national government tested nearly 5 million wells—an effort that convinced approximately 10 million local villagers to switch to safe wells. But most of these wells have since been replaced.

"Since water treatment or pipewater [supply] isn't going to happen anytime soon," said van Geen, "the only realistic solution is for villages to share the subset of safe wells. And the only way to do that, is to

actually test them all."

More information: Alexander van Geen et al. Field testing of over 30,000 wells for arsenic across 400 villages of the Punjab plains of Pakistan and India: Implications for prioritizing mitigation, *Science of The Total Environment* (2018). [DOI: 10.1016/j.scitotenv.2018.11.201](https://doi.org/10.1016/j.scitotenv.2018.11.201)

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