Study identifies better, cheaper ways to stem arsenic poisoning in Bangladesh

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A well installation in Bangladesh. Credit: Rajib Mozumder

In what has been called "the largest mass poisoning of a population in history," some 40 million people in Bangladesh are drinking water that contains unsafe levels of arsenic. The naturally occurring element seeps into groundwater reached by shallow wells, and from there it has a huge impact on the health and lives of Bangladeshis; chronic exposure to arsenic is estimated to be responsible for six percent of deaths in the country. It causes cardiovascular disease, cancer, infant mortality, and motor and intellectual problems in children.

Bangladesh's government is taking measures to address the problem, and plans to invest $200 million toward cleaning up water supplies. A new

study, published last week in *Environmental Science and Technology*, could help to inform how that money would be best spent. The analysis compares four methods of dealing with the arsenic contamination, and pinpoints strategies to deliver cleaner water to the greatest number of people at the lowest cost.

The study was inspired by a regional pipe water system recently built by the Bangladeshi government, said Lex van Geen, a research professor at Columbia University's Lamont-Doherty Earth Observatory and a coauthor on the new study. "We saw that the pipe system cost several hundred thousand dollars, and that it was only helping a tiny part of the population."

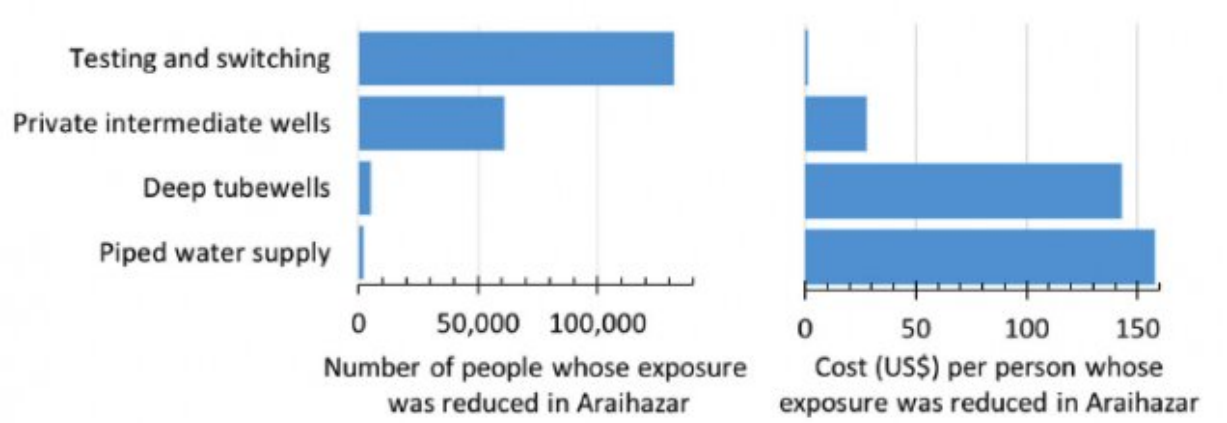
By comparing the costs and impacts of the different mitigation strategies, the study concludes that the government's strategies of constructing pipe systems and drilling deeper wells are the most expensive yet least effective options. Instead, the researchers recommend several strategies that could help more people at a much lower cost.

Four Strategies

The study, led by Nadia Jamil at Montclair State University, pulls from van Geen's decades-long research in Bangladesh. Van Geen's work has shown that simply testing well water and providing information about the risks of arsenic poisoning can get 60 percent of people, on average, to switch to lower-arsenic water sources. His team's most recent survey of 48,790 wells in Araihazar province is estimated to have helped 132,000 inhabitants find a cleaner source of water, at a cost of just $1 per person.

Because arsenic contamination is more common in shallow wells, another strategy the government uses is to drill medium-depth wells, with households responsible for paying for 10 percent of the well's cost.

This option is a bit more expensive—costing $28 per person whose exposure is reduced—and often results in the wells getting installed on private land instead of being a public resource, so they end up helping fewer people.



The study finds that the Bangladesh government's preferred strategies of drilling deep tubewells and constructing piped water supply systems are the least cost-effective ways to deal with arsenic contamination. Credit: Jamil et al.

"The real shocker was that both of the government approaches were closer to $150 per person," says van Geen. These included drilling deep tubewells—a process that requires special equipment—and constructing piped water supply systems. The researchers calculated that these strategies cost $143 and $158 per person, respectively. But, says van Geen, "it could be closer to $10 if they did it better."

Wider Implications

Although the study focused on one district, called Araihazar Upazila, the

authors think the results have significant implications for arsenic mitigation all over Bangladesh.

"It strengthens the importance of widespread testing programs, which would work as a basis for other mitigation options," said Jamil. "Testing is the cheapest of all mitigation methods." She added that study also underlines the potential of intermediate wells, which are quite low in cost, but have been "overlooked for a long period of time for unknown reasons."

Due to the high cost of piped water systems, the study recommends that this approach should be used only as a last resort in areas where not even deep wells can provide low arsenic water.

However, van Geen says his conversations with government officials have indicated that they will likely continue investing in deep tubewells and piped water systems, despite the fact that cheaper and more impactful strategies exist.

There may be ways to increase the effectiveness of deep wells. The authors mention that by siting the wells in a more strategic way and ensuring they are truly public, just 916 wells could bring 132,000 inhabitants with an unsafe well to within 100-meters of a safe source of water. The researchers are currently exploring strategies to help make these deep well deployments more tactical.

"The government is spending the money on deep wells anyway," he says, "so why not do it better?"

More information: Nadia B Jamil et al. Effectiveness of Different Approaches to Arsenic Mitigation over 18 Years in Araihazar, Bangladesh: Implications for National Policy, *Environmental Science & Technology* (2019). DOI: 10.1021/acs.est.9b01375