

Deadly effect of arsenic in drinking water measured in massive study

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More than 20 percent of deaths in a study of 12,000 Bangladeshis were attributable to arsenic exposure from contaminated drinking water, new research reports.

The large 10-year study is the first to prospectively measure the relationship between individual exposure to [arsenic](#) and its associated [mortality risk](#), the authors said. The data, collected by an international team from Chicago, New York, and Bangladesh, will be published early online Saturday in *The Lancet*.

Since the widespread installation of hand-pumped wells to tap groundwater sources in the 1970's, as many as 77 million people - about half the population of Bangladesh - have been accidentally exposed to dangerous levels of arsenic. The World Health Organization calls the exposure "the largest mass poisoning of a population in history."

The Health Effects of Arsenic Longitudinal Study (HEALS) was led by Habibul Ahsan, MD, MMedSc, Director of the Center for Cancer Epidemiology and Prevention at the University of Chicago Medical Center. Arsenic levels from well [drinking-water](#) and repeated biennial urine samples of 12,000 subjects were associated with deaths in that population over the last decade.

For the 25 percent of people exposed to the highest levels of arsenic, mortality risk increased by nearly 70 percent, the study determined. People exposed to moderate levels of the poisonous chemical also

exhibited increased deaths from chronic disease, relative to those whose exposure was within WHO recommendations of 10 parts per million.

"The results of this study have important public health implications for arsenic in drinking water," the authors write. The exposure levels studied are "similar to other populations that have low-level arsenic exposure."

Arsenic is known to be a potent carcinogen and toxic to organs such as the liver, skin, kidney and the cardiovascular system. But previous studies assessing the effects of long-term drinking-water exposure to arsenic have lacked resolution, relying upon retrospective analysis and estimations of exposure on a group, rather than individual, level.

The HEALS project sought to improve upon this body of research with a prospective study, actively monitoring exposure levels in a large set of individual Bangladeshis. Nearly 12,000 subjects were recruited and tested for baseline arsenic levels in drinking water and urine between 2000 and 2002, then underwent follow-up tests approximately every 2 years thereafter.

"We set up this study to measure health effects based on individual level data so that other factors or biases that may affect our study findings were much less likely," Ahsan said. "This allowed us to examine disease quite reasonably in a more accurate way."

The collection of so many samples was no simple task. More than 100 staff members traveled to remote Bangladesh villages by foot, car, or boat to collect samples from subjects and measure arsenic levels in the water from local wells. Millions of such wells were installed by global health organizations in the 1970's to provide a supposedly cleaner source of water than that available from dirty rivers and streams.

"In Bangladesh, waterborne illnesses have gone down in the last 2 to 3

decades," Ahsan said. "Unfortunately, there is now this new problem affecting them."

While a quarter of the study's population was within the WHO-determined safe range of 10 µg/L, the upper quartile was exposed to 27 times that amount on average. Those individuals were found to be 68 percent more likely to die from a chronic disease over the time period studied, compared to individuals with exposure less than 10 µg/L, after controlling for other factors such as sex, age, body mass, blood pressure and smoking.

Subjects with moderate arsenic exposure were at a smaller yet still elevated risk of mortality. When the entire population exposed to arsenic levels above the WHO guideline was combined, 21.4 percent of all deaths and 23.5 percent of deaths from chronic disease could be attributed to arsenic exposure, the authors wrote.

An ongoing expansion of the HEALS project to 20,000 subjects hopes to clarify the deleterious effects of the lower doses, which are similar to the levels found in the groundwater of some regions in the United States, Argentina, Mexico and other countries.

"With a larger population, we can make much more definitive conclusions on whether this low dose exposure between 10 to 150 micrograms that some US populations have been exposed to are indeed deleterious, increasing cancer or even deaths," Ahsan said.

The study found no reduction in mortality risk for subjects with high baseline arsenic levels that were subsequently lowered in follow-up measurements. That suggests that the effects of chronic exposure to high levels of arsenic are not reduced even when the individual is given access to cleaner drinking water - at least not during the time surveyed by the study.

"This says that further exposure to arsenic for those individuals already exposed needs to be reduced immediately if possible," Ahsan said.

"Unfortunately in a developing country such as Bangladesh, the real solution of replacing the source of drinking water from contaminated to safe water sources for 50 million people is quite a task. What is needed is for the government and international community to deal with that challenge."

More information: The paper, "Arsenic exposure from drinking water, and all-cause and chronic-disease mortalities in Bangladesh (HEALS): a prospective cohort study," will be published online Saturday by The Lancet.

Provided by University of Chicago Medical Center

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