

# Trace arsenic linked to motor-skill decline in American Indian elders

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Credit: University of Colorado at Boulder

Long-term exposure to low levels of inorganic arsenic, or the "poison of kings," through drinking water is linked with deteriorating motor skills and neurological processing speed of American Indian elders, according to new research by Clint Carroll, an assistant professor in ethnic studies at the University of Colorado Boulder, and a nationwide team of scientists.

This research builds on an existing body of findings, and is the first of its kind looking at both the impact of arsenic on this specific underserved

and under-represented segment of the population and the effects on neuropsychological health, which, Carroll asserts, have large-scale cultural implications.

"When you think about who are the sources of traditional knowledge or of ancestral knowledge, elders are the subset of the population who contain a lot of this generational knowledge and language," Carroll, who is also a citizen of the Cherokee nation, said. "And so, that knowledge is often conveyed through the language, and so when you've got impacts on neuropsychological health from this long-term, low-level exposure to arsenic, it raises concerns, at least in my mind, about the transmission of that knowledge to future generations."

"What is implicated is the cultural element of things—cultural transmission, knowledge transmission."

Arsenic is a naturally occurring mineral that can exist in food, water, soil and air in either an organic or inorganic form. Inorganic arsenic, when compared to its organic counterpart, is much more toxic and was once a common poison, as it gives off no smell or taste and can exist in the body with little to no side effect for years.

Inorganic arsenic is created in a variety of ways, such as through volcanic eruptions, the erosion of arsenic-containing rocks, runoff from mining (including gold mining), and the use of arsenic-containing pesticides—all of which disproportionately taint the drinking water of the western United States.

While the U.S. Environmental Protection Agency limits the amount of [arsenic](#) allowed in drinking water from the tap, the mineral can still leach into ground water from naturally occurring and man-made sources, significantly affecting those (such as rural American Indian communities in the western United States) who rely on well water for their [drinking](#)

[water](#).

To study the effect of this exposure, the authors analyzed data collected via the [Strong Heart Study](#) and the [Strong Heart Stroke Study](#). For more than 20 years, these two studies gathered data on thousands of American Indians in three regions: the American Southwest (or, an area near Phoenix), the Central Plains (or, the southwestern area of Oklahoma), and the Northern Plains (or, western and central North and South Dakota).

The Strong Heart Study data, which served as the baseline information, was collected in three different chunks (1989-91, 1993-94 and 1998-99) and included objective measurements regarding participants' health. Of these metrics, which included everything from familial history to BMI measurements, [inorganic arsenic](#) levels in the body were measured from the urine samples.

This information was then statistically combined with additional data collected between 2009 and 2013 (the Strong Heart Stroke Study), examining the surviving Strong Heart Study participants' vascular and structural brain disease risk factors. These data included, among other tests, a neuropsychological test that measured cognitive functioning, mental processing speed, verbal fluency and memory and fine [motor skills](#) (such as the tapping of a finger).

Altogether, the new study found one statistically significant conclusion: low level [inorganic arsenic exposure](#) in American Indian populations, over long periods of time, correlates with decreasing fine motor functioning and processing speed in elders.

These results, while dramatic, may not be quite the cause of alarm that they appear. Rather than immediate action, Carroll hopes they instead spark a conversation.

"The message is not to not drink the water or to go and buy bottled water," Carroll said. Instead, he hopes to raise awareness of risks "that are disproportionately shouldered by communities in rural areas—especially in the West—and, so, looking into ways that water can be made safer for these communities."

**More information:** Clint R. Carroll et al. Low-level inorganic arsenic exposure and neuropsychological functioning in American Indian elders, *Environmental Research* (2017). [DOI: 10.1016/j.envres.2017.03.018](https://doi.org/10.1016/j.envres.2017.03.018)

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