Arsenic not linked to diseases in Yellowknife area, study finds

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The Giant Mine remediation site with Yellowknife in the distance. Ollie Williams/Cabin Radio

Arsenic levels among Yellowknife-area residents are not tied to certain health conditions, according to the latest findings of a long-term study.

Researchers shared the results along with other new findings from the Health Effects Monitoring Program at a community meeting in Yellowknife on Monday evening.

"I feel like I'm coming back to talk to friends," said Laurie Chan, a professor at the University of Ottawa and principal investigator of the study, which has been under way for five years.

The project monitors levels of arsenic and other contaminants of concern, such as lead and cadmium, in residents of Yellowknife, Dettah and Ndılǫ. It was launched in 2017 in response to concerns about the potential health effects of arsenic and remediation work at Giant Mine.

Operating from the 1940s to 2004, the abandoned mine sits on 237,000 tonnes of highly toxic arsenic trioxide, a byproduct of the process used to extract gold. A federally led project began work to clean up the site in 2021.

One of the project's requirements was to conduct a long-term monitoring study to ensure that the remediation work would not increase residents' exposure to contaminants.

Before the clean-up began, researchers worked to establish baseline levels of exposure and possible health effects in residents of Yellowknife, Dettah and Ndılǫ.

In the winter of 2017 and the spring and summer of 2018, they collected urine, toenail and saliva samples from 2,037 people – 1,531 adults and 506 children and youth. The researchers also had participants fill out a lifestyle and food frequency questionnaire and asked for permission to access their medical records from the past five years.

In 2019, the team shared the first of their findings. In most cases, they found levels of contaminants measured in residents' urine and toenails to be comparable to those measured in people elsewhere in Canada.

"It was very good news," Chan said during his presentation on Monday, recapping the earlier findings. The concern was that contaminant levels would be heightened among residents of the Yellowknife region.

Chan then went on to summarize new results, which have yet to be published in a peer-reviewed journal. The findings came from analyses of medical records, saliva samples, potential "biomarkers of effect" (which may provide insight on the impact of chemical exposure) and an in-depth look at arsenic in toenail samples.

Monday's presentation focused on findings related to Yellowknife residents, Chan said. Community meetings would be held in Dettah and with North Slave Métis Alliance members later in the week, he said.

Medical records

Long-term arsenic exposure has been linked to variety of health conditions, such as skin cancer, heart disease and diabetes.

To understand whether residents' arsenic levels were related to health outcomes, the researchers looked through participants' medical files from the past five years for diseases that could potentially be tied to arsenic, such as those that affect the kidneys, heart and skin, as well as various forms of cancer.

Although Yellowknife's population has a higher rate of melanoma and other skin cancers compared to the NWT and national average, arsenic levels in urine and toenails were not predictors of these diseases, the team reported.

Hundreds of seacans containing highly contaminated material at Giant Mine. Ollie Williams/Cabin Radio

It’s not clear why skin cancer rates are heightened in Yellowknife, Chan said, but it’s possible that other factors, such as spending a lot of time outdoors and long hours of sunlight in the summer, play a role.

One limitation of the study, Chan said, is that technology currently doesn’t allow scientists to assess arsenic exposure from years past. Urine samples only provide a sense of arsenic exposure from the previous few days, and toenail clippings offer a glimpse of exposure on the scale of months, but there’s nothing scientists can measure to figure out a person’s level of arsenic exposure from 30 years ago, even though it could have impacted

their health.

“We cannot trace back,” he said. “What we can do is look forward.”

Although there wasn’t a link between arsenic and health outcomes at this phase in the study, he said ongoing research might provide more insight.

“Let’s wait until more results come in in future years. We’ll keep monitoring,” he said.

Toenails

Arsenic can end up in toenails in two ways, according to Chan. It can be ingested, processed by the body and eventually deposited in hair and nails, or it can settle on nails from external sources, such as dust and soil.

To better understand how people were exposed to arsenic, the researchers analyzed different forms of arsenic in 1,872 toenail clippings.

Children had higher levels of arsenic in their toenails than adults, the team reported, and arsenic levels were higher during the spring and summer compared with the winter.

Arsenic in toenails was also dominated by inorganic forms, suggesting that the contaminant wasn’t processed by the body but likely came from external sources.

Chan suspects that children’s arsenic levels are higher in the spring and summer because they are more likely to

be barefoot, playing outside and crawling on the ground.

Uncertainty remains, but Chan suggested washing children's feet more carefully, leaving their shoes outside the house or vacuuming more often during summer months.

Biomarkers of effect

Next, Chan and his colleagues looked for potential biomarkers of effect – something that can be measured in the body and that can signal the health impacts of chemical exposure.

They looked at two candidate molecules in urine samples from children: kidney injury molecule-1 (KIM-1), a protein produced when kidneys are damaged, and club cell secretory protein (CC16), a protective protein produced in the lungs.

Increased levels of CC16 and KIM-1 were both related to higher levels of arsenic in urine, the researchers reported. Whereas CC16 was also tied to higher levels of lead and manganese, KIM-1 was specific to arsenic.

These findings suggest that KIM-1 shows promise for detecting the effects of arsenic exposure on kidney function in children, the researchers reported. (Chan said the team didn't assess the biomarker in adults because many factors can affect kidney function in this group.)

"This is something that we can continue to look at," Chan said. Currently, doctors don't routinely test levels of KIM-1 to gauge arsenic-related effects, in part because researchers have yet to develop a cut-off for an acceptable level of the protein.

As the research progresses, however, the team plans to explore whether measuring KIM-1 could be used to assess the impact of arsenic on kidney function among children.

Genetics

Finally, the researchers used saliva samples to assess how a person's genes might affect their ability to process arsenic.

An enzyme called arsenite methyltransferase (AS3MT) is involved in metabolizing arsenic. People with higher levels of the enzyme are better at getting rid of the contaminant.

About 18 percent of participants from Yellowknife and 34 percent of participants from the Yellowknives Dene First Nation have a gene profile that leads to lower levels of AS3MT, the researchers reported. Results from North Slave Métis participants were not reported because the sample size was too small, according to the researchers.

People with this gene profile may be more susceptible to arsenic, Chan said, although a person's individual risk depends on a lot of other factors.

Accounting for genetic differences might help the researchers evaluate potential links between arsenic exposure and health outcomes in future phases of the study, Chan said. Going forward, he and his colleagues plan to pay more attention to people who may be genetically susceptible to arsenic. They also intend to collect genetic information from new study participants.

Five years into the study, the team is now preparing to collect follow-up samples from children. In April and May, all of the children who participated in the first round of data collection will be invited back, Chan said. Because the team expects to lose some participants, they will also be inviting new people to join the study. In 2028, both adults and children will be sampled again.

Addressing parents of children who participated in the study's first phase, Chan said: "Please come back."

"The more we have kids coming back, the better the results will be," he said.

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