HEALTH NEWS

COVID-19 is in our sewage. Duluth medical school researchers say that could be useful

How detection of the virus in wastewater could be an early warning system for Minnesota communities.

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Greg Wicks, a Western Lakes Superior Sanitary District laboratory technician, takes a wastewater sample that will be studied by researchers at the University of Minnesota Medical School-Duluth campus. The research is testing wastewater throughout Minnesota for traces of COVID-19. (Submitted photo)

Evidence of COVID-19 can be found in an infected person’s feces, so researchers at the University of Minnesota Medical School’s Duluth campus are testing samples of sewage collected at wastewater treatment around the state.

Medical school assistant professors Glenn Simmons Jr. and Richard Melvin are testing samples of wastewater submitted by Minnesota treatment plants — including the Western Lake Superior Sanitary District in Duluth, which treats sewage for more than 125,000 residents — to better understand where COVID-19 is and, eventually, how many people in a certain population have it.

"It’s after several months of doing this and then confirming the data that we have with the data from the Department of Health and other officials, where we may be able to start developing a formula that can help us make sense of it and then help redirect medical resources and public services," Simmons said.

It’s a method undertaken by other researchers, too.

David Hirschberg, founder and catalyst of Rain Incubator, a biotech nonprofit in Tacoma, Washington, has been testing wastewater there for traces of COVID-19 for about two months.

He said it’s important for other researchers across the country to do similar studies.

"By doing this kind of standoff monitoring, I think we could constantly be ready ... to be able to inform vaccine manufacturers or hospitals on how many beds do you need, things like that," Hirschberg said.

"Because this is an indicator that, hey, this is in your environment."

The idea

When news of COVID-19 emerged, Simmons dove into the literature about the virus. He found a few articles about the SARS virus outbreak of 2003, which, like COVID-19, was also caused by a coronavirus. The literature said the virus was present in patients’ stools.

Then he came across a paper from the Netherlands that showed positive viral particles of COVID-19 were found in the country’s wastewater.
"So now you have this connection between what we see with the coronavirus for SARS, and now you’re seeing something that would basically indicate that a similar thing would be happening with the COVID-19 virus,” Simmons said. "And then from there, we basically just started asking the question: Can we pull that off in Duluth?"

After working things out with the University of Minnesota and making sure the researchers weren’t competing for personal protective equipment or testing kit materials with other areas of the university that needed them, the answer was yes.

WLSSD and the Minnesota Environmental Science and Economic Review Board, which represents more than 50 wastewater utilities across Minnesota, were quick to sign on and provide regular samples to the UMD lab.

"We’re always happy to participate in a well-designed sample and to the extent ... that we can contribute to the knowledge in regard to this virus, we are very happy to do so,” Marianne Bohren, executive director of WLSSD, said.

Joe Mayasiach, WLSSD’s director of environmental services, said WLSSD often collaborates on studies with universities and government agencies, including on several that have won national Environmental Protection Agency awards.

The studies typically focus on the environment, toxicology and designs of wastewater treatment technologies. This is the first time WLSSD has taken part in a study like this.

"It’s one of the reasons you go into science: to generate data and provide information for the good of mankind, if you want to say it that way,” Mayasiach said. "But especially now that this is such an acute issue. To be able to step in and help out with something that really does look like it has utility and usefulness, it really is gratifying and rewarding."

How it works

Wastewater treatment plants regularly test wastewater, called influent.

WLSSD’s daily tests typically look for the influent’s total suspended solids, the biochemical oxygen demand and other properties.

Now, workers are taking a little bit extra on their daily sample runs and sending it to the lab at UMD.

"What we’re providing the UMD medical school is a split of our 24-hour total influent composite, so it’s a sample of what is coming into the plant collectively, and we’re giving them 250 milliliters a day sampled twice a week," Bohren said.

At the UMD lab, Simmons and Melvin test the samples for a very tiny amount of genetic material specific to the virus using polymerase chain reaction, or PCR, testing.

Right now, Simmons can detect whether COVID-19 is in the water — a positive or negative result.

The next step, Simmons said, is being able to determine how much of the virus is in a sample. And from that, it might be possible to estimate how many cases are in the community served by the wastewater treatment plant.

A potential forecast

Studying wastewater has worked in monitoring for other diseases.

In 2015, a sewage surveillance system in Israel detected a polio outbreak early on, allowing officials to contain the outbreak and quickly deploy a polio vaccine.

Detecting more virus in an area's wastewater could give health care officials a heads-up infections are rising, even before many people seek testing or medical attention.

"It would potentially be what we’d call a leading indicator as opposed to a lagging indicator because most people don’t actually go get tested until they start seeing symptoms,” Simmons said.

Additionally, data is showing people shed the virus in feces before they have symptoms and for up to a month after that, Simmons said.

"That’s another reason why whatever we do has to be done for a long enough period so that we capture both that initial peak and then the tail-off in a given population that may be full of individuals who have already recovered," Simmons said.

Simmons said "the big, audacious goal that we have" is to gather enough data over time to make formulas and algorithms that could, based on the amount of viral particles in the wastewater and the number of confirmed COVID-19 cases the population served by the treatment plant, determine just how many people have COVID-19 in that area.

While some testing labs such as Blobot, a startup associated with the Massachusetts Institute of Technology, said it can quantify an estimate of infected individuals based on wastewater testing, Hirschberg said he’s not sure that’s possible.

But Hirschberg said it would be possible to gauge whether overall cases are increasing or decreasing, especially if data is collected over a long period of time, based on the amount of virus found in the sample.

Hirschberg likened wastewater testing to a smoke alarm or a dashboard warning light.

"If those are positive weeks before patients start showing up in the hospital, that’s a much better indicator ... when people are coming into the emergency room having trouble breathing, it’s too late,” Hirschberg said.
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