

Kansas hopes sewage will provide advance warning of future COVID-19 surges

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Want to know if the novel coronavirus is in your town? The answer might be in the sewers.

Researchers at the University of Kansas are teaming up with the Kansas Department of Health and Environment to track the coronavirus pandemic by measuring virus particles in wastewater.

The technique, called wastewater surveillance, may provide an early warning system to give Kansas communities advance notice of future COVID-19 surges. Wastewater surveillance also helps fill in gaps in COVID-19 clinical testing, which can be limited, costly, and plagued by slow turnaround times.

“The amount of positive cases that are reported understate the actual extent of infection within a city or county population,” said Tom Stiles, the director of the KDHE Bureau of Water.

HOW WASTEWATER SURVEILLANCE WORKS

People who are infected with COVID-19 release the virus from their bodies, mainly in droplets produced by breathing, coughing, and sneezing. This viral release is how the coronavirus spreads. That’s why maintaining a social distance from others and wearing a face mask is so important.

Some virus particles also come out through an infected person’s stool.

Everything that gets flushed down the toilet eventually ends up in a wastewater treatment facility. The virus is too broken down to be infectious by then, but traces of its genetic material still remain in the sewer water.

By testing for the presence of coronavirus genes in wastewater, researchers can get an idea of how widespread COVID-19 infections are in a community.

Early studies suggest that wastewater surveillance is a promising technique for tracking COVID-19 infections, often revealing that actual coronavirus cases [may be higher](#) than reported counts. Scientists around the world are [now advocating](#) for widespread wastewater monitoring to track the pandemic.

“In early April, a [study came out](#) by MIT that showed wastewater tracking in Boston, and Tom Stiles with KDHE sent me that paper and asked if that was something we could try,” said Dr. Belinda Sturm, a professor in the Department of Civil, Environmental and Architectural Engineering at KU. Sturm is now leading the wastewater surveillance efforts.

Tracking COVID-19 through wastewater provides a more complete picture than typical testing methods. Not everybody who is infected with COVID-19 will show symptoms or get a nasal swab test. However, everybody poops.

“Most people don’t have any symptoms. They don’t know they have it, but they do,” Stiles said. “The wastewater just accumulates all of that.”

The virus also tends to show up in wastewater about [a week](#) before people begin to develop symptoms. The advance notice can help local health officials prepare resources for the coming spike in cases, while reminding community members to take appropriate precautions like hand-washing, social distancing, and wearing a face mask.

The virus particles measured in the wastewater are not infectious, and the coronavirus is not being spread through the sewers.

“The water system is safe,” Sturm said. “We’re measuring non-infective viruses.”

WASTEWATER TESTING IN KANSAS

Sturm’s research team at KU has been working since April to develop a protocol for wastewater COVID-19 testing. So far, they have begun preliminary testing in 18 communities across Kansas, including some in western Kansas.

The science is still developing nationally, Sturm said. It is not yet possible to accurately calculate the exact number of people infected with coronavirus, but the measurements are still valuable.

Detecting coronavirus genes in wastewater is providing critical insights on where the virus is present (and absent) across Kansas.

In Hiawatha, Brown County, zero COVID-19 cases had been reported as of late April. However, Sturm’s wastewater measurements from the same time period revealed that the [coronavirus was actually present](#) in the community.

City officials said in a statement that they were hopeful that “the precautions we have all been taking as a community have been helping to deter the spread of COVID-19,” and encouraged residents to continue taking precautions against the virus’s spread.

It also allows individual cities to monitor changes in coronavirus numbers over time more thoroughly than they can with nasal swab testing data.

The City of Lawrence also is working with Sturm’s team to test its wastewater on a weekly basis.

“This study will help us make informed decisions moving forward, including related to staffing, bandwidth and surge capacity,” said Sonia Jordan, Director of Informatics for Lawrence-Douglas County Public Health in a statement.

DEVELOPING AN “EARLY WARNING SYSTEM”

Stiles says that KDHE plans to use wastewater surveillance to warn Kansas communities about potential surges in coronavirus cases before people start to develop symptoms and require hospitalization.

“I think the hope is that this isn’t necessary, that we get COVID under control. But in that case, we want to continue monitoring to see if it’s spiking again,” said Sturm.

One priority is deploying the technique in more populated areas, like Johnson and Sedgwick Counties, ahead of COVID-19 surges predicted in the fall and winter.

“We want to use it this winter...to act as an early warning system for that second wave that everyone anticipates is probably going to come with the advent of flu season,” Stiles said. “The idea is to get ahead of it this time, so that the health resources can be ready.”

First, the methods need to be streamlined to be more cost-effective.

“It’s costly, so it’s not something that can go all over yet,” Stiles said. “And that’s one that KU is looking at, trying to perfect some techniques that are less expensive, and with quicker turnaround so we get the results much faster, with a reasonable amount of assurance that it’s accurate.”

To refine the measurement procedures, Sturm is working with a team of wastewater scientists who are collaborating remotely from all over the world using online tools such as Slack.

“It’s just nice that we’re talking to each other,” Sturm said. “When one person does something and it doesn’t work, then everybody doesn’t have to do that same thing.”

“People are just really interested to contribute to the pandemic response,” said Dr. Kyle Bibby, a professor at the University of Notre Dame who is also involved in COVID-19 wastewater surveillance and recently authored [a study](#) describing the cooperative effort. “It just leads to...a globally collaborative response for papers and helping people all over the world.”

Their research is also paving the way for more widespread use of wastewater testing as a way to track pathogens besides the novel coronavirus, such as antibiotic-resistant bacteria.

“Wastewater is a potentially valuable source of information,” Bibby said. “There’s a hope to leverage this to understand other diseases.”