Wastewater Surveillance Has Become a Critical Covid Tracking Tool, but Funding Is Inconsistent

Samples collected from sewage water suggest viral activity is higher than the number of reported cases suggests.

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To look at recent data posted on Clemson University's COVID-19 dashboard, one might assume that viral activity is low on the Upstate South Carolina college campus.

The dashboard, which relies on positive COVID tests reported by local laboratories and on-campus medical offices, identified 34 positive cases among students during the third week of August and 20 cases the week before.

These numbers pale in comparison to those from eight months ago, when the omicron variant first surged in the U.S. and Clemson averaged hundreds of positive COVID tests every day.

For those who rely on these kinds of dashboards to assess the risk of contracting COVID, the recent data doesn't paint the most accurate picture, said David Freedman, who chairs the university's Department of Environmental Engineering and Earth Sciences. With the proliferation of at-home COVID tests, only a small fraction of positive results are reported to public agencies. Many people with mild infections don't test at all.

He said that better data can be found in samples collected from sewage water and that those have shown this summer's viral activity is much higher than the number of reported cases suggests.

"In our area, the numbers are actually higher than at any time except for the [first] omicron surge," said Freedman, who runs the department's COVID wastewater surveillance program. "And yet the case reports are often zero."

Even though wastewater surveillance is proving to be the most accurate and economical way to gauge COVID activity in communities across the country, Freedman and others say funding for this type of tracking hasn't been consistent. And data collection is sometimes paused while wastewater researchers look for new ways to pay for the surveillance.

“For the wastewater data to be actionable, you have to observe it,” said Mariana Matus, CEO and co-founder of Biobot Analytics, which has a $10 million contract with the federal Centers for Disease Control and Prevention to run wastewater surveillance at more than 300 sites across the U.S. “The more that you observe, the easier it is to catch early changes and take action.”

Wastewater research isn’t new. The method was used in the 1940s to track polio outbreaks. Besides COVID, the technique is being used to track the spread of monkeypox.

It involves collecting a wastewater sample, often at a treatment plant, concentrating it, and processing it so scientists can run an analysis — similar to a PCR nasal swab — able to detect genetic evidence of the COVID virus, other infectious diseases, and even the presence of opioids.

Historically, wastewater samples have been collected to gauge community trends, such as the rise and fall of COVID cases. More recently, though, research published by Freedman and others in the journal Lancet Planetary Health found that wastewater surveillance can be used to estimate the number of infected people in an area.

For much of the pandemic, COVID numbers reported on a daily or weekly basis by state and local health departments moved in tandem with data collected by wastewater surveillance programs. Typically, when cases reported by the health departments increased so did the amount of COVID detected in wastewater samples.

COVID-related hospitalization data is also useful in measuring community spread and gauging the severity of variants, but it is considered a lagging indicator, meaning the data tends to peak weeks after COVID is already running rampant through a community, said Michael Sweat, director of the Center for Global Health at the Medical University of South Carolina, whose work focuses on COVID forecasting.

By contrast, because people excrete the COVID virus in feces before they show symptoms of illness, community-level infections can show up in wastewater sludge before case counts or hospitalizations start to rise.

Many scientists now consider wastewater surveillance a more precise way to track COVID activity in real time. Without wastewater surveillance, “we just don’t have a very accurate read of things,” Sweat said.

And researchers say data collection is not expensive. According to Freedman, the program at Clemson costs $700 a week. Erin Lipp, who runs the wastewater surveillance lab at the University of Georgia in Athens, said covid testing costs about $900 a week.

According to a U.S. Government Accountability Office report published in April, countries could save millions or billions of dollars by using wastewater surveillance, but the potential cost savings remain unclear. A general lack of cost-benefit analyses makes determining how and when to use it difficult, the report said.

Yet some labs say the lack of a consistent and centralized source of funding raises questions about how — or if — communities can continue to carry out this work.

“When we started this, it was basically extra bits of money I could find,” said Lipp. Her lab has used CDC grant money over the past year to pay for surveillance, but the portion of funding dedicated to that testing is set to expire at the end of August. Donations will sustain the lab through September.

“I’m very hopeful we can find some way to keep it going,” said Lipp. She is concerned that her lab, for the first time during the pandemic, is seeing a disconnect between the COVID spikes in wastewater and the spikes in clinical cases. “What we’re seeing is a huge undercount,” she said.

Wastewater surveillance sites often go “offline” for periods and then resume work later, said Colleen Naughton, an assistant professor of civil and environmental engineering at the University of California-Merced. She developed an online dashboard called CovidPoops19 that tracks wastewater surveillance efforts across the world.

Surveillance work can be intermittent, she explained, because funding comes from such a variety of sources, including governments, universities, and the private sector.

At the Plum Island Wastewater Treatment Plant in Charleston, South Carolina, wastewater surveillance was suspended for more than two months this year. The project was reinstated this summer when the state Department of Health and Environmental Control assumed control from the University of South Carolina.

“The academics that I know who have been doing this up to this point, we’re all facing similar levels of funding problems,” said Freedman, of Clemson University.

For much of the pandemic, Clemson paid for its wastewater surveillance. The program faced a funding shortfall earlier this year, but Freedman said his lab was never forced to suspend its surveillance. Before the money for his lab work ran out in May, Freedman turned to Biobot Analytics, which, in addition to the work it does for the CDC, analyzes wastewater samples for about 50 independent projects.

Biobot’s wastewater surveillance network is funded through venture capital investment, Matus said.

Regardless of the funding hurdles, wastewater surveillance is moving forward. Nationally, more wastewater research is being conducted now than ever before.

Although some researchers have had to look for alternative sources of funding this year, CDC spokesperson Jasmine Reed said that more than 1,000 CDC-funded surveillance sites are now operational across the U.S. The agency expects 200 more to start collecting data within the next few months.

That’s good news for researchers who want more data. But many will face a whole other hurdle in fighting the American public’s COVID burnout, said Freedman.

“People don’t want to hear about it anymore,” he said. “But if you look at the national statistics, we’re averaging around 400 deaths per day. We can pretend it’s not happening, but the wastewater and the deaths are telling us a different story.”

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