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Virus Clues Found in Wastewater

More health officials are turning to the sewers to monitor Covid-19 transmission and spot early signs of outbreaks as cases and hospitalizations remain far below peaks but rise again.

By Brianna Abbott

Residents learned Covid-19 cases might be ticking upward in parts of Davis, Calif., this month thanks to an increasingly popular data stream: wastewater surveillance.

More health officials are turning to the sewers to monitor coronavirus transmission and spot early signs of outbreaks as Covid-19 cases and hospitalizations remain far below peaks but rise again. The Centers for Disease Control and Prevention is allocating some \$33 million to 31 public-health laboratories to start wastewater testing in the coming months.

In Davis, health officials and researchers found multiple Covid-19-positive wastewater samples in parts of the city of roughly 68,000. Separate patient samples suggested the

Delta variant was in their midst. Local officials sent out an alert and hung more than 3,000 blue signs on doorknobs in three neighborhoods, encouraging people to get tested for the virus.

“Wastewater monitoring becomes a lot more useful both as testing rates go down and vaccination rates differ in different places,” said Heather Bischel, an assistant professor in the Department of Civil and Environmental Engineering at the University of California, Davis and lead of the city’s sewage-testing project.

As the U.S. has dropped most pandemic restrictions, people might not get tested for Covid-19 if they feel the threat has passed, some public health experts said. Wastewater testing can provide a snapshot of the relative level of virus in a community and the direction in which it is trending, regardless of whether people seek Covid-19 tests, adding a layer of information for health authorities.

U.S. laboratories processed about 599,000 Covid-19 tests a day in the week ended July 15, according to CDC data. That was up nearly 16% from the previous week but far below the peak of more than 2 million daily tests processed during the fall and winter. Just under 6% of those tests are coming back positive, up from a positivity rate of around 2% in June.

Many health officials said wastewater surveillance is also useful as an early warning system: Virus levels may rise in wastewater before an outbreak is detected otherwise, because people can shed virus in their waste several days before they might get symptoms and get tested.

Wastewater surveillance has been used to spot Covid-19 upticks in college dorms, prisons and other congregate settings. In some cases, officials have then gone in to test people individually.

“That could be a really important strategy to use if we’re trying to pick up on infections early and prevent transmission,” said Darlene Bhavnani, an infectious disease epidemiologist at the University of Texas at Austin. Dr. Bhavnani and other public health experts said the strategy is most useful when cases are low rather than when the virus is raging and wastewater tests positive everywhere.

Wastewater surveillance starts with collecting raw sewage from treatment facilities or manhole sites. Researchers perform a type of molecular PCR test, the most common test used to detect Covid-19 in patients, to search for the virus. Researchers and health officials across the globe have screened wastewater for years to monitor scourges including the polio virus. Some countries, cities and schools began monitoring for the Covid-19 virus soon after the pandemic began last spring.

It wasn't clear right away that the technique would work for the new pathogen. "There did need to be some development of the science," said Joan Rose, a water microbiology and public health safety expert at Michigan State University who started testing wastewater samples for Covid-19 in March 2020. Her work, along with that of other pilot laboratories in Michigan, helped prompt the state to commit \$49 million to wastewater surveillance into 2023, including over \$3 million for her lab.

The Department of Health and Human Services in June contracted with Biobot Analytics to fund a 12-week wastewater collection and analysis program at 320 treatment plants that cover roughly 100 million people.

Cambridge, Mass.-based Biobot Analytics has grown from working with seven communities in Massachusetts and North Carolina at the beginning of the pandemic to nearly 500 across all 50 states, said co-founder and Chief Executive Mariana Matus.

In Missouri, health officials and researchers are also screening wastewater samples for Covid-19 variants. The state's Sewershed project first detected the Delta variant in a sample on May 10, though the first Delta patient sample in Missouri wasn't sequenced and publicly posted until June.

"We had a heads-up," said Marc Johnson, professor of microbiology and immunology at the University of Missouri and a lead researcher on the Sewershed project. He said sequencing variants is trickier in sewage because samples come from a composite of many people and could contain multiple variants that need to be teased out.

Another challenge with wastewater surveillance is the weather; storms and flooding can dilute sewage and interfere with readings. In Missouri, Dr. Johnson is controlling for that by using the amount of caffeine in waste as a measuring stick: "It's remarkably consistent in terms of milligrams per person per day."

Some researchers and health officials said the systems they are building now will help them expand surveillance to other substances and pathogens in wastewater after the pandemic ebbs.

"We can get an amazing amount of information about the community from a quarter cup," Dr. Johnson said.

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