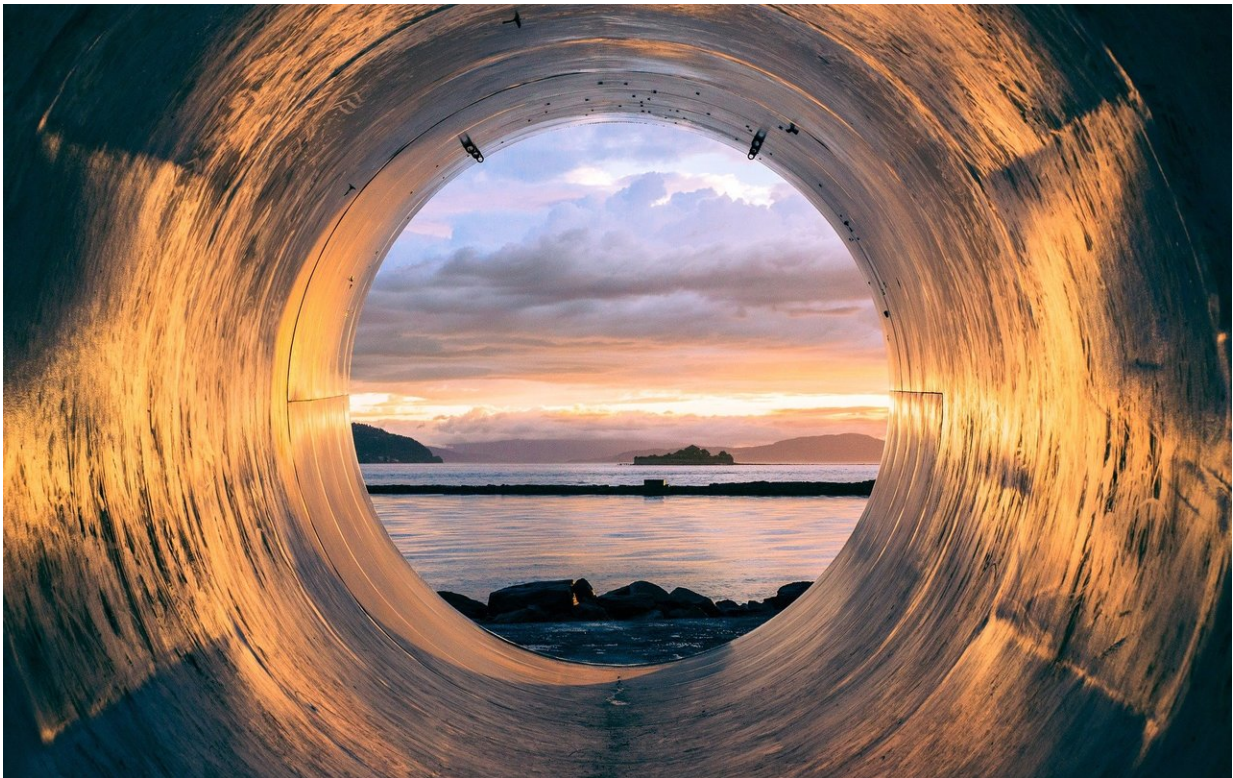


A community's fecal matter could give early warning of COVID-19 outbreaks, study finds

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By studying sewage at a New Haven wastewater treatment facility, a team of Yale researchers has determined that genetic code embedded in feces could be used as an early warning sign of COVID-19 outbreaks.

The team, led by Jordan Peccia of the Yale School of Engineering and Applied Science, tested daily samples of sludge for bits of coronavirus code, known as RNA. They then found that they could use just their own data to recreate the curve of COVID-19 cases in the New Haven area.

"Except we see it seven days earlier," Peccia said.

The study, which was posted online Friday but has not yet been peer-reviewed, has implications for Connecticut's coronavirus response. For the first two months of the pandemic, the state struggled to increase testing capacity. Even now, after a major testing ramp-up, clinical testing focuses on those who have symptoms.

That means patients often aren't tested until they begin showing symptoms, or may not be tested at all if they remain asymptomatic. In the meantime, they could be silently spreading the virus.

But [sewage](#) keeps a record of all cases.

"Before you're symptomatic and after you're infected, you can certainly shed that virus and be infectious," Peccia said. "As soon as you start shedding it, whether you feel it or not, we're gonna see it in the wastewater."

For their study, Peccia and his team collected daily sewage samples from the East Shore Water Pollution Abatement Facility in New Haven, from mid-March until May 1. They tested each [sample](#)'s concentration of coronavirus RNA and then compared those daily concentrations to actual data on COVID-19 cases and hospitalizations in the towns served by the water treatment facility.

They found that the concentration of coronavirus RNA increased and decreased several days before corresponding fluctuations in actual

COVID-19 cases and hospitalizations, as reported by the local hospital and the state.

According to the study, the sludge samples predicted hospitalization fluctuations three days before they occurred, and testing data fluctuations seven days before they occurred.

"I think it's pretty self-evident that if you can see what's going on earlier, that's better," Peccia said.

Sewage has been used as a public health indicator long before COVID-19 came on the scene, Peccia said. For instance, the World Health Organization has used sewage samples to monitor for polio outbreaks. And in Oregon, researchers have used wastewater samples to map [drug use](#).

Even within the COVID-19 research, there have been similar wastewater studies in Massachusetts, Australia and France.

But in those cases and in the Yale study, the data can only tell one part of the story.

Peccia emphasized that the sewage sludge data is "a unique piece of information," not a replacement for traditional clinical testing. Because the sewage data is not individualized, it can't tell officials where to start the contact tracing process or who to direct into quarantine. Clinical testing is "irreplaceable," Peccia said.

But the sludge samples could be used to predict COVID-19 upticks and potentially give officials time to prepare before a cluster of cases hits. This lead time could be life-saving.

Peccia said he sees this data as an additional tool that officials could use

to inform their reopening plans—or, if an area does see a spike in cases, as an early warning that those reopenings need to be rolled back.

"It could be helpful ... because these are tough decisions to make," Peccia said. "If you look at other states, it is not a stretch to imagine that the curve could go back up."

Because Peccia and his team pulled samples from what is known as "primary sewage sludge"—which is a more concentrated form of sewage—the process they used is fairly straightforward and inexpensive, he said. He thinks the process is "easily scaleable" and could be used in other municipalities across Connecticut.

For now, Peccia and his team have continued collecting daily samples at the treatment plant in New Haven, and they plan to present their data to the city next week.

"All of us wanted to do something that's useful and really hoped that it could somehow work out well enough that it could be useful for at least the city that we're living in," Peccia said. "And I think it could be."

More information: Jordan Peccia et al. SARS-CoV-2 RNA concentrations in primary municipal sewage sludge as a leading indicator of COVID-19 outbreak dynamics, (2020). [DOI: 10.1101/2020.05.19.20105999](https://doi.org/10.1101/2020.05.19.20105999)

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