Sewer systems are a window into the coronavirus pandemic

With limitations on COVID-19 testing making it hard to know how many people actually have the disease, some public health experts are turning to the sewer systems for a clearer snapshot.

“Sewage is a source of information on human health, and can really be transformed into a public health observatory,” says Newsha Ghaeli, president and co-founder of Biobot, a startup that analyzes wastewater.

Wastewater-based disease monitoring is a relatively new strategy, but it’s already been able to predict potential outbreaks of illnesses before cases appear. In Israel, for example, officials found the poliovirus in the sewage system in 2013 and mounted a vaccination campaign in response. Research shows that the new coronavirus is found in feces, so it’s a good candidate for this approach.

In collaboration with researchers at the Massachusetts Institute of Technology, Harvard, and Brigham and Women’s Hospital, Biobot analyzed sewage samples taken in Massachusetts in the middle of March. Based on the amount of virus, it predicted that there were a few thousand people infected in the area. At the time, there were only just over 400 confirmed cases. Currently, there are almost 40,000.

Now, Biobot is analyzing samples from over 100 sewage treatment facilities in 30 states. Ghaeli told *The Verge* she hopes the data can give local communities a snapshot of their outbreak and help them determine when it’s safe to loosen distancing recommendations.

This interview has been lightly edited for clarity.

What was the company focused on before the COVID-19 pandemic?

We asked as many government and public health officials as we could one question: what is your biggest public health concern? The answer was the opioid epidemic, really across the board here in North America. We focused our first product around that, which was, up until two months ago, one of the biggest public health concerns in the US. We launched our opioid product in late 2018, and from there, we had scaled to about seven communities to sample for opioid levels.

We looked for heroin, fentanyl, fentanyl analogs, and a dozen specific prescription opioid drugs. But then we also were measuring methadone and Suboxone, which are substitution therapies, and Narcan, the overdose reversal drug, to understand their update in a community. If a community is opening a new methadone clinic, you would want to see methadone consumption increasing.

Why did you decide to jump in on COVID-19 surveillance?

When the scope of the coronavirus outbreak became clear both here in the US and globally, we knew that as a company we had to respond. That's why we started Biobot. We started a partnership with a lab at MIT, together with other researchers at Harvard and Brigham and Women's Hospital in Boston, in order to actually develop the methods and the protocols to measure the virus in sewage.

What did you find when you started examining sewage samples for the coronavirus?

In late March, we published a paper outlining that work on samples collected in the Massachusetts area. We were able to successfully detect the virus and start quantifying the amount of virus that we were seeing. From there, we put forward an estimate of the number of individuals we think are infected

with the virus and contrast that with the number of confirmed cases.

We then knew that this source of data would be extremely complementary to data on confirmed patients. Public health departments could use this information to refine their response and to understand the true scope and magnitude of the outbreak. It could also help them evaluate when and how to start scaling back quarantine-style policy policies and recommendations.

Public health experts have other tools to estimate the true prevalence of COVID-19 in a community, like antibody testing, which can hint at how many people have been sick. How does wastewater analysis fit in with those other techniques?

It's important to look at different sources of data because each different source is painting a separate sort of vignette of the outbreak. We need all of these vignettes in order to actually manage this crisis as effectively as possible.

When it comes to sewage prevalence estimates, there are no privacy implications, and the data is not HIPAA protected. As a result, it can be shared a lot more effectively between response teams, which makes it important as a layer of data.

Another thing that we can think about with sewage data is, for example, why do we have these discrepancies where clinical cases are so low when this data from sewage saws that they should be high? One of the reasons is obviously that individual testing is limited, so not everybody who is sick has access to a test. Sewage testing could also be accounting for individuals who are asymptomatic or individuals with very mild symptoms. Those are people who aren't even seeking out testing, but they're still shedding the virus and they're still using the toilet – so they come up in our samples.

COVID-19 is a problem all over the country, not just in Massachusetts. How are you expanding the program?

We launched a campaign soliciting wastewater samples from wastewater treatment facilities all over the US. This is pro bono. We're just asking that the treatment facilities pay for the shipping cost for the samples. We're collecting samples in over 100 locations across the US, representing about 30 states. Almost all the participants are sending weekly samples. The hope is this data is going to start showing where the outbreak is trending, and where we are in that curve.

What are you seeing in that data so far?

We're generating data on an ongoing basis, and sharing it directly back with the wastewater facilities who have looped in local health departments and COVID response teams. Our data does more or less correlate with the clinical case rankings or hotspots across the US in the limited sites that we are testing.

Is Biobot going to keep tracking infectious disease even after the coronavirus outbreaks die down?

Even prior to the COVID outbreak, we knew we wanted to eventually work in infectious diseases as well as continuing with the opioid product. I think that's what's so great about this technology: we don't need to choose one public health issue over another. We can actually look at data across multiple different public health priorities at once. It's all contained in this same data source.

https://www.theverge.com/2020/4/20/21227995/sewage-wastewater-poop-coronavirus-survellience-biobot