Biobot Analytics

Testimony before the House Committee on Science, Space, and Technology Subcommittee on Investigations & Oversight

"The New Normal: Preparing for and Adapting to the Next Phase of COVID-19"

March 31, 2022

Mariana Matus, PhD
Co-Founder and CEO
Biobot Analytics

Testimony

Good morning Chairman Foster and Ranking Member Obernolte. I am Mariana Matus, the CEO and Co-Founder of Biobot Analytics, a wastewater epidemiology company based in Cambridge, MA. It is an honor to testify before you today about how wastewater epidemiology (WBE) can help the United States and the world better manage the next phase of the Covid-19 pandemic.

Growing up in Mexico City, I saw how many rivers and lakes were polluted because much of the city's wastewater was dumped back into the environment without being treated. I became motivated to find solutions to these types of public health and environmental issues, which is what led me to pursue my PhD at MIT in computational biology. At MIT I focused on how wastewater epidemiology can be used to study the collective microbiomes of cities, and this research formed the basis for what would eventually become Biobot.

Biobot was founded in 2017 with a mission to transform wastewater, or sewage, into actionable public health data. Everything we eat, the infectious pathogens in our bodies, and the medicines we use are excreted in our urine and stool and end up in wastewater. We collect and analyze city wastewater to understand population health trends, and this is the basic premise of wastewater epidemiology.

In March 2020, our team was the first in the United States to successfully report the detection and measurement of SARS-CoV-2 in wastewater. Excited by the promise of applying WBE to Covid, Biobot set up a pro-bono campaign to encourage municipalities across the United States to monitor the spread of SARS-CoV-2 in wastewater.   For six months, we tested wastewater samples from more than 400 communities across the country, helping local officials track the spread of the virus and its variants in near real-time. Building on this experience, Biobot expanded coverage of wastewater monitoring across the country in 2021, resulting in a successful program that covered nearly 90 million Americans.

To date, we have tested wastewater samples from more than 700 communities across all 50 states, including U.S. territories and tribal nations. In collaboration with academic partners, we

have demonstrated that wastewater data is a leading indicator of new Covid cases because infected individuals shed the virus in their waste several days before exhibiting symptoms.

Moreover, wastewater monitoring is a holistic and equitable public health tool because it captures anyone who uses a bathroom, including people who are asymptomatic or lack access to healthcare. This means wastewater data allows us to better understand the presence of Covid regardless of socioeconomic status or racial composition. Another advantage is that it preserves individual privacy, as sewage represents an aggregate sample of all human waste in a community. One sample drawn from a wastewater treatment plant is representative of tens of thousands of people, and testing wastewater is much cheaper than what it would cost to test each person individually.

At this stage in the pandemic, we are witnessing fewer reported Covid cases because take-home antigen tests are now widely available and vaccination has boosted the population's immunity. As a result, clinical testing data has become less reliable, and public health officials are forced to rely on lagging indicators of viral spread, such as hospitalizations and deaths. This is why we believe wastewater monitoring will play an even more important role in containing the spread of the virus as life returns to normal. During the Omicron wave, for example, virus concentrations in Boston's wastewater peaked a full two weeks before clinical cases reached their apex.

Massachusetts was one of the earliest adopters of wastewater monitoring and Governor Baker is briefed weekly on wastewater data alongside other public health indicators tracked by the state's Covid-19 Command Center. Since then, we have also seen communities across the country use wastewater data to help determine when it is safe to relax mask requirements, reopen schools and businesses, and more efficiently allocate testing resources.

Currently, the majority of wastewater testing is run by treatment plants, who send the samples to a public or private lab for analysis, and then the data is shared with local and state public health agencies. The CDC now operates a program called the National Wastewater Surveillance System (NWSS) that invites state public health officials to share their wastewater data with CDC, who can analyze the data to glean regional trends and insights.

However, we continue to see several challenges to broader adoption of WBE:

1. A lack of consistent federal support and funding creates uncertainty among local officials when considering whether to dedicate time and resources to wastewater testing.
2. Different states and localities do not share the same methodologies and reporting requirements, which makes it very hard for CDC and other public health officials to compare wastewater data across state lines.
3. There is no long-term effort or coordinating function to develop wastewater epidemiology into a pathogen-agnostic platform. Rather, different federal agencies are using WBE for different purposes in isolation from each other.

To improve this situation, Congress and the federal government should:

1. Assist forward-thinking states and localities who have started their own wastewater monitoring programs through consistent funding.
2. Empower relevant federal agencies to support wastewater monitoring efforts across the country, especially by standardizing testing and data collection methods.
3. Align federal support behind WBE as a pathogen-agnostic technology that can monitor for many different public health threats beyond Covid-19. For instance, Biobot has already demonstrated that WBE can be used to monitor for seasonal influenza.

To conclude, As Covid-19 becomes endemic, wastewater monitoring can play a critical role in keeping our nation safe and healthy, while also ensuring we are prepared for the next pandemic or biological threat. To meet its full potential as a pathogen-agnostic platform, however, the U.S. government will need to play a more active role in developing the infrastructure to support wastewater testing. I look forward to answering your questions and thank you again for this opportunity.

Appendix:

**"Accelerating wastewater-based epidemiology for pandemic preparedness
and biosecurity in the United States"[1]**

Throughout the course of the Covid-19 pandemic, wastewater-based epidemiology (WBE) has been used effectively by state and local governments, federal agencies, universities, and private businesses to monitor the spread of the virus and its variants, inform public health responses, and help predict the level of new cases in a community several days in advance. WBE offers several advantages over traditional public health reporting mechanisms:

- WBE can track many pathogens, but is particularly well suited to detect and mitigate disease outbreaks that cannot be easily monitored by syndromic surveillance, such as diseases with nonspecific symptoms (e.g. respiratory viruses of pandemic potential), diseases with a pre-symptomatic shedding period (e.g. SARS-CoV-2) or diseases spread primarily by asymptomatic carriers (e.g. Hepatitis C).
- WBE is an equitable public health tool because it does not rely on an individual's access to (or willingness to pursue) healthcare, and WBE data can provide public health officials with a more holistic and inclusive view of viral trends.
- WBE produces aggregated and anonymized data from community wastewater samples, avoiding difficult personal data and privacy issues. WBE is also cost-effective because one sample is representative of an entire community (e.g. a town or city).
- WBE has the potential to definitively and rapidly identify new emerging infectious diseases (EIDs), as well as pathogens intentionally or accidentally released into the population.

Here are a few examples of how government officials and business leaders have been incorporating wastewater data into their public health response:

- In Massachusetts, Governor Baker is briefed weekly on data from wastewater alongside other public health indicators tracked by the state's Covid-19 Command Center. (Source: NBC) Several school districts in Massachusetts also rely on wastewater data to inform reopening plans (Source: Cambridge Public Schools).
- In December 2021, Boston Children's Hospital canceled elective surgeries for Q1 2022 based on a surge in virus concentration in local wastewater. A decline in virus concentration in wastewater in the middle of January 2022 is prompting the hospital to consider rescheduling these activities for early spring. (Source: New York Times)

---

[1] Recommendations Submitted to White House Office of Science and Technology Policy on January 27, 2022

- In New Castle County, Delaware, the County Executive's Office allocates clinical testing capacity based on virus concentration surges observed in the wastewater. (Source: Delaware Online)
- The City of Cedar Rapids, Iowa, uses wastewater to support its local hospital system in planning and preparation as the pandemic continues to evolve. (Source: City of Cedar Rapids)
- Miami-Dade County, Florida, has incorporated wastewater data into their "Moving to a New Normal Daily Dashboard," as part of their risk assessment approach. (Source: Miami-Dade County)

Many state and local officials have already recognized the value that WBE provides in not only countering the spread of Covid-19 but also as a powerful tool to combat the opioid epidemic and fentanyl misuse. However, making WBE a foundational part of the nation's pandemic preparedness and biosecurity infrastructure requires existing efforts to be streamlined and centralized.

A patchwork WBE network has evolved out of necessity in response to the Covid-19 pandemic, but without greater support from the federal government, WBE is ill-equipped to scale or meet its potential as an early warning system for future EIDs and biothreats. Given this, we recommend that the Administration take the following steps to expand and improve implementation of WBE across the United States:

Recommendation 1: Elevate wastewater-based epidemiology as a standard monitoring strategy for Covid-19 and actively recommend the approach as part of pandemic response.

- *Risk*: A lack of consistent support for WBE at the federal level contributes to uncertainty among state and local governments when making decisions about whether to adopt WBE. For example, when the HHS-Biobot Covid-19 monitoring program ended last year, 98% of participants indicated via survey that they wanted to continue but did not have the budget or expertise to perform WBE services on their own.
- *Path forward*: The Administration should recommend the inclusion of WBE data for community-level Covid-19 response. Federal funding for WBE should be made available not only to federal agencies such as HHS, CDC, and EPA, but also to relevant state and local government entities to ensure funding reaches wastewater treatment plants.

Recommendation 2: Standardize testing and data collection methodologies and streamline requests sent to wastewater treatment plants.

- *Risk*: Wastewater treatment plants (WWTPs) provide the majority of samples for WBE services and are easily overwhelmed by multiple sampling requests from local, state, and

federal agencies, leading to logistical bottlenecks. Moreover, different localities use different testing and data collection methodologies, making it hard to compare wastewater data across state lines.

- *Path forward*: Convene an interagency working group among entities interested in WBE to align on testing and data collection methodologies, as well as establish clear channels for sampling requests to avoid overburdening WWTPs.

Recommendation 3: Align federal support of WBE as a broad public health monitoring tool beyond Covid-19.

- *Risk*: Without adequate federal funding and support, the full potential of WBE as a pathogen-agnostic early warning system may not be realized.
- *Path forward*: Raise awareness of the many potential applications of WBE in disease prevention, as well as its usefulness in areas like measuring drug consumption and antimicrobial resistance, to identify federal agencies that could benefit from this technology and provide support for its development and implementation.