

Biobot Analytics

Biobot is a spin-off from MIT

Newsha Ghaeli

PRESIDENT & COFOUNDER

Background:

Architecture & Engineering
MIT Research Fellowship on
smart city technologies



senseable
city lab.



Mariana Matus, PhD CEO & COFOUNDER

Background:

Computational Biology &
Microbiology
MIT PhD dissertation on
wastewater epidemiology



Wastewater Epidemiology

What is wastewater epidemiology?

- Wastewater epidemiology is the science of **leveraging wastewater samples to identify the public health impact** of certain **pathogens** and substances of interest within a population.

What can wastewater analysis detect?

- Wastewater analysis can detect **SARS-CoV-2 and its variants**, the influenza virus, licit and illicit substances (like fentanyl, cocaine, and methamphetamines), and more.

How does the analysis work for Covid-19?

- Infected individuals **shed the SARS-CoV-2 virus** in their **stool**, whether they are asymptomatic or pre-symptomatic, vaccinated or unvaccinated.
- Biobot's lab then measures the presence of SARS-CoV-2 in their wastewater—usually collected from a wastewater treatment plant or manhole for community-level sampling.

Biobot works across the U.S. and is trusted by:



THE WORLD BANK



50+ states,
territories,
provinces

20,000+ samples
tested

>30% of U.S.
population

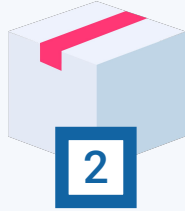
700+ sampling
locations

Working with Biobot



Ordering

- Customers order Biobot sample kits, which are shipped directly to customer site



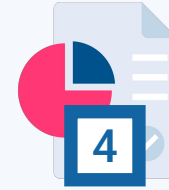
Collect and Ship Sample

- Customers collect composite wastewater samples and ship them using pre-paid, Fed-Ex overnight labels to Biobot's lab in Cambridge, MA



Lab and Data Analysis

- qPCR analysis for Covid-19 and variants.
- Results undergo a rigorous quality control process



Reporting

- Reports (sent via email) provide an overview of SARS-CoV-2 concentrations, their trends over time, and how they compare to other samples in our database

Public Applications for Wastewater Data



1. **(Early) Detection:** Is there SARS-CoV-2 in my community?

- a. Wastewater levels usually rise before infected people are detected by clinical testing.



2. **Trend estimation:** Is disease activity rising, falling, or steady?

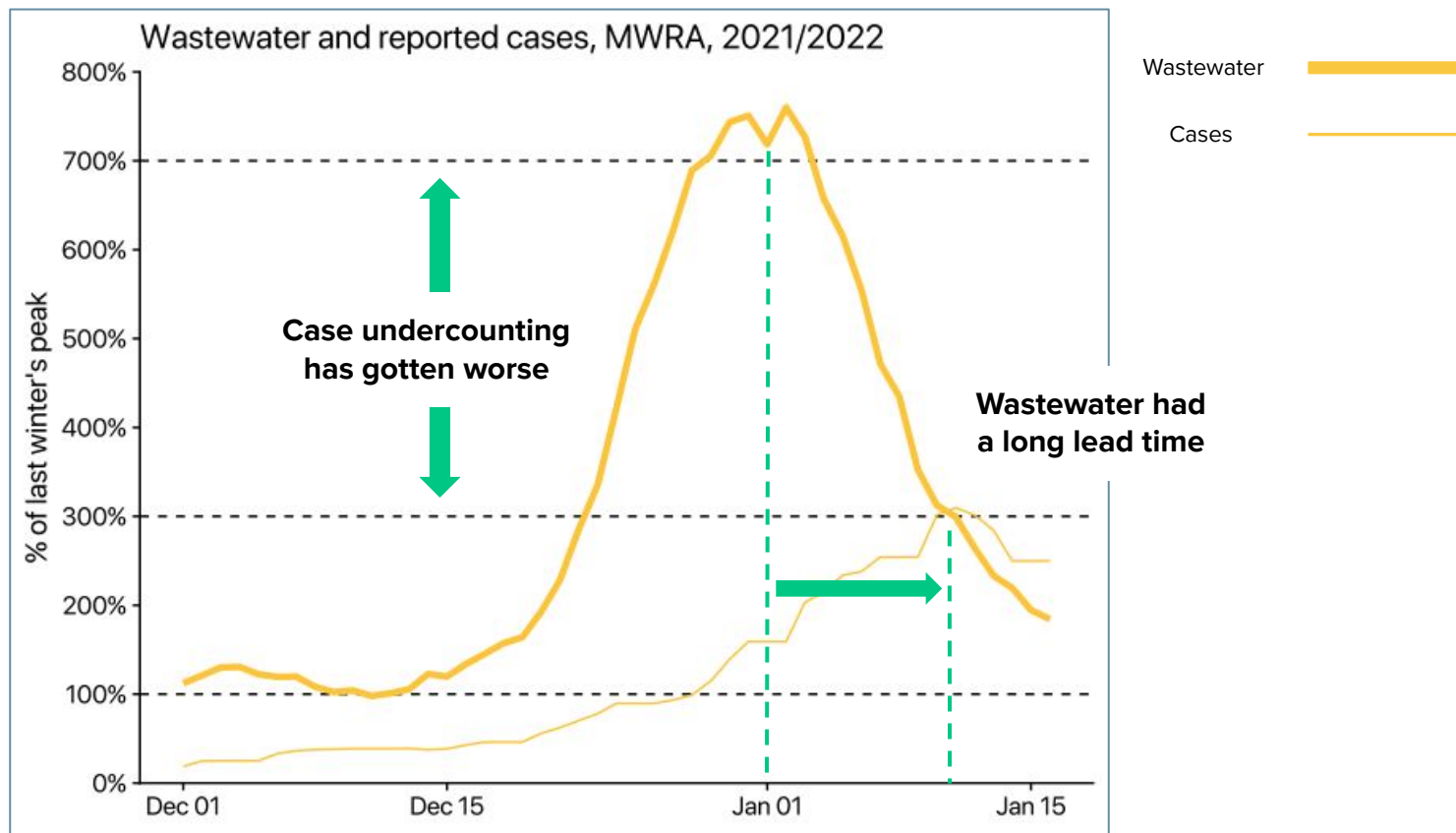
- a. At least 3 samples are needed for trend estimation



3. **Prevalence estimates:** How many people are roughly infected?

- a. Clinical data may or may not reliably measure disease activity
 - Irregular reporting; testing fatigue/hesitancy; gaps in healthcare access; limited test availability; inadequate testing (due to at-home tests, asymptomatic cases, etc.)

Wastewater and Clinical Data in Boston, MA during Omicron Wave



Wastewater data is an increasingly essential public health tool as the pandemic evolves

Regions Selected:

Suffolk County, MA

NATIONWIDE

— Wastewater

— Clinical

NORTHEAST

— Wastewater

— Clinical

SOUTH

— Wastewater

— Clinical

MIDWEST

— Wastewater

— Clinical

WEST

— Wastewater

— Clinical

SUFFOLK

COUNTY, MA

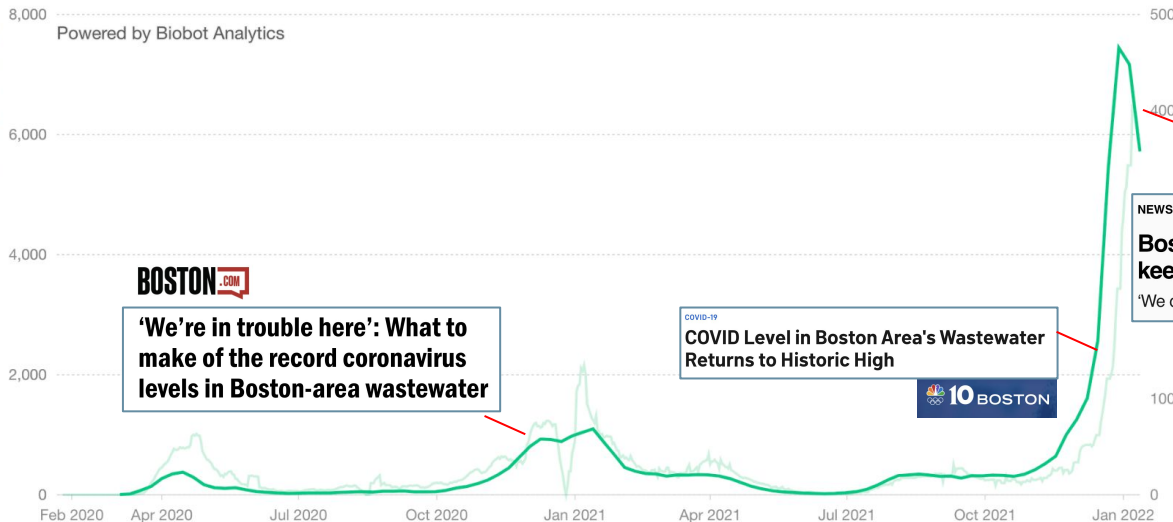
— Wastewater

— Clinical



Wastewater: 8,000
Normalized
SARS-CoV-2
virus
concentration
(copies / mL of
sewage)

Powered by Biobot Analytics



BOSTON.com

'We're in trouble here': What to make of the record coronavirus levels in Boston-area wastewater

COVID-19
COVID Level in Boston Area's Wastewater Returns to Historic High

10 BOSTON

NEWS HEALTH
Boston-area coronavirus wastewater data keeps dropping: 'I'm cautiously optimistic'
'We don't want to relax our guards'

Boston Herald

Applications of Wastewater Data to Monitor COVID-19

- 1. Publish wastewater data on online dashboard to inform public of day-to-day Covid trends**
 - a. Boston's MWRA Data became a vital disease indicator during the Omicron wave
- 2. Share community-wide wastewater results directly with key stakeholders**
 - a. December 2021: Boston Children's Hospital canceled upcoming elective surgeries, citing the spike in wastewater data.
 - b. Cambridge Public Schools: uses this data as 1 of 3 indicators to determine whether classes will be in-person or remote
- 3. Evaluate the effectiveness of preventions/response measures over time**
 - a. Vaccination rollouts, face covering mandates, business restrictions, isolation/quarantine)
- 4. Inform Targeted, Neighborhood-Level Data Collection and Outreach**
 - a. Strategize mobile testing unit deployment, pop-up vaccination clinics, contact tracing programs, text alerts, door-hanging, neighborhood listservs, multilingual educational materials, face mask distribution, etc.
- 5. Guide policy decisions**
- 6. Contact local media, press release**
- 7. Increase sampling frequency and/or locations to gain more granular data**
- 8. Employ testing on a building-level**
 - a. Useful for enterprises, universities, detention centers, hospitals, schools, assisted living facilities and more

Your Report: 3/31

B I O
B O T

COVID-19 Community Report
Report provided: March 31, 2022
Kit ID: KIT-46214

Sewer Authority Mid-Coastside WWTP

Sample collection date: March 29, 2022

SARS-CoV-2 virus in wastewater

DETECTED

Virus concentration
(copies per liter of sewage)

325,900

Effective* virus concentration
(copies per liter of sewage)

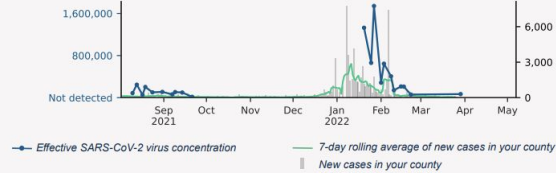
67,564

**Effective virus concentration value is derived by adjusting the raw virus concentration to account for dilution and other factors.*

Effective virus concentration over time

Effective SARS-CoV-2 virus concentration (copies / L of sewage)

New cases in county on sampling date



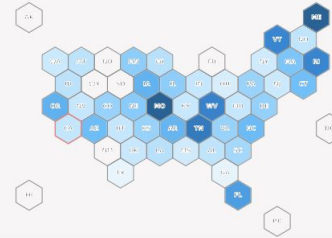
Overview of effective virus concentration levels

State-level mean of samples (collected in the past 6 weeks)

lower higher

Color indicates effective virus concentration level

Your state outlined in red



Your Report: 3/31

B I O
B O T

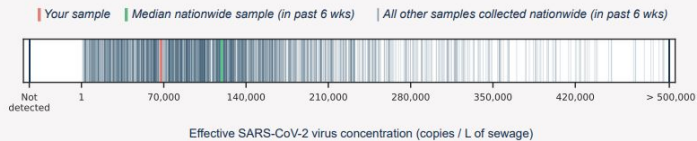
COVID-19 Community Report
Report provided: March 31, 2022
Kit ID: KIT-46214

Effective virus concentrations trend with new cases



Effective virus concentrations in comparison

Your sample has higher concentration levels than **26%** of all quantifiable samples collected in the past six weeks.



Learn more about Biobot's protocols and methodology by visiting
<http://www.biobot.io/covid19-report-notes>

Your Report: 4/5



COVID-19 Community Report
Report provided: April 7, 2022
Kit ID: KIT-46311

Sewer Authority Mid-Coastside WWTP Sample collection date: April 5, 2022

SARS-CoV-2 virus in wastewater

DETECTED

Virus concentration
(copies per liter of sewage)

919,379

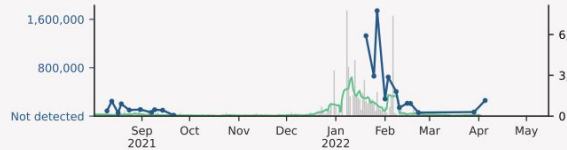
Effective* virus concentration
(copies per liter of sewage)

259,183

**Effective virus concentration value is derived by adjusting the raw virus concentration to account for dilution and other factors.*

Effective virus concentration over time

Effective SARS-CoV-2 virus concentration (copies / L of sewage)

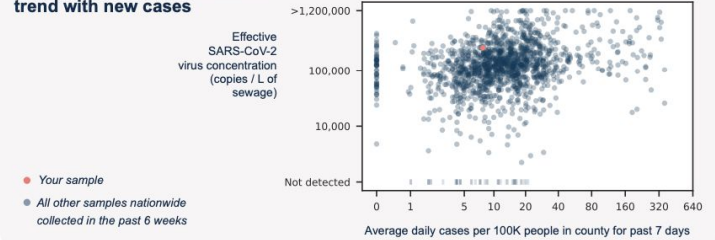


— Effective SARS-CoV-2 virus concentration

— 7-day rolling average of new cases in your county

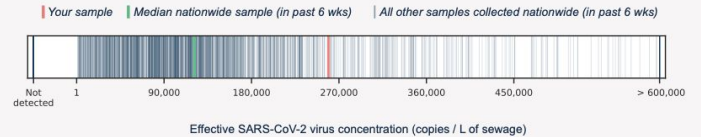
■ New cases in your county

Effective virus concentrations trend with new cases



Effective virus concentrations in comparison

Your sample has higher concentration levels than **82%** of all quantifiable samples collected in the past six weeks.



Learn more about Biobot's protocols and methodology by visiting
<http://www.biobot.io/covid19-report-notes>

The background is a deep blue color with intricate, organic patterns that resemble biological cells or microscopic structures. These patterns are composed of various shades of blue and white, creating a textured, almost crystalline appearance. There are numerous small, circular bubbles or droplets scattered throughout the composition, particularly in the upper and lower right areas. The overall effect is one of depth and complexity, suggesting a scientific or natural theme.

Discussion