Biobot Analytics

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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

alm lab

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

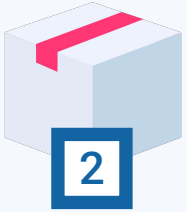
>30% of U.S. population

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

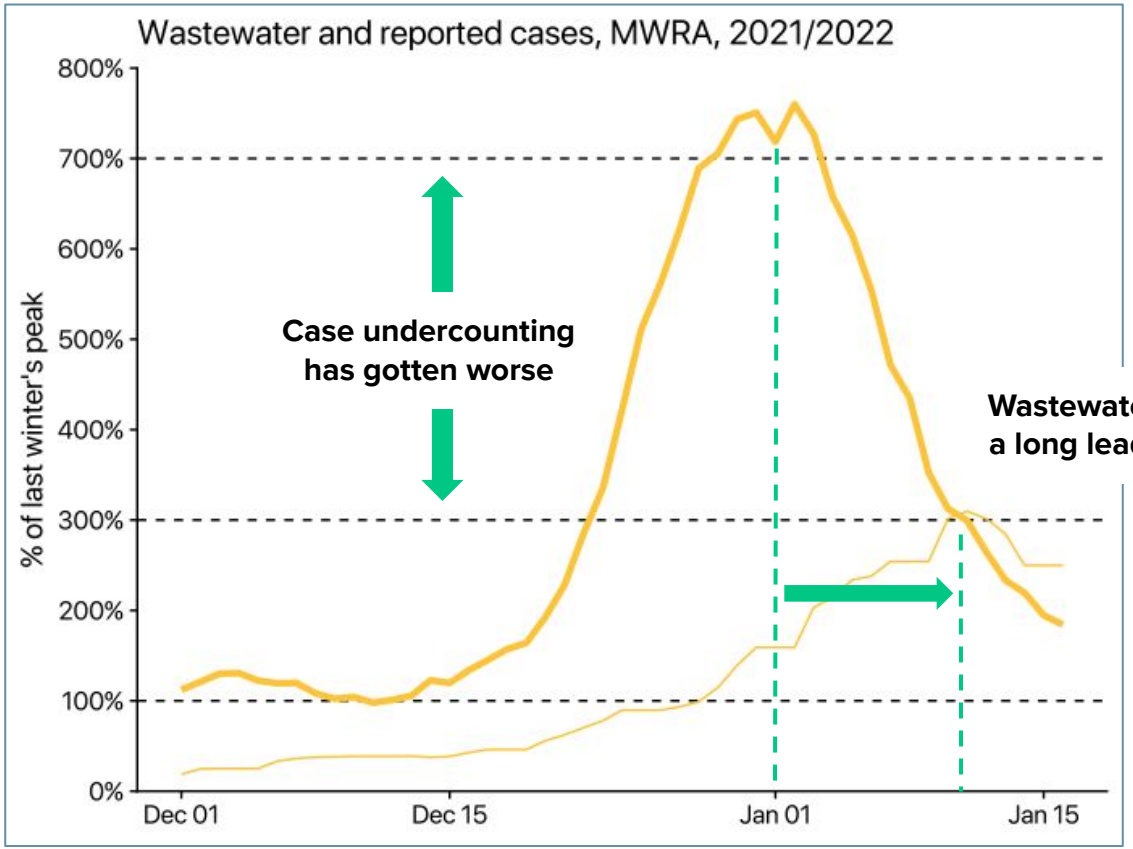
Public Applications for Wastewater Data

1. **(Early) Detection**: Is there SARS-CoV-2 in my community?
    a. Wastewater levels usually rise before infected people are detected by clinical testing.

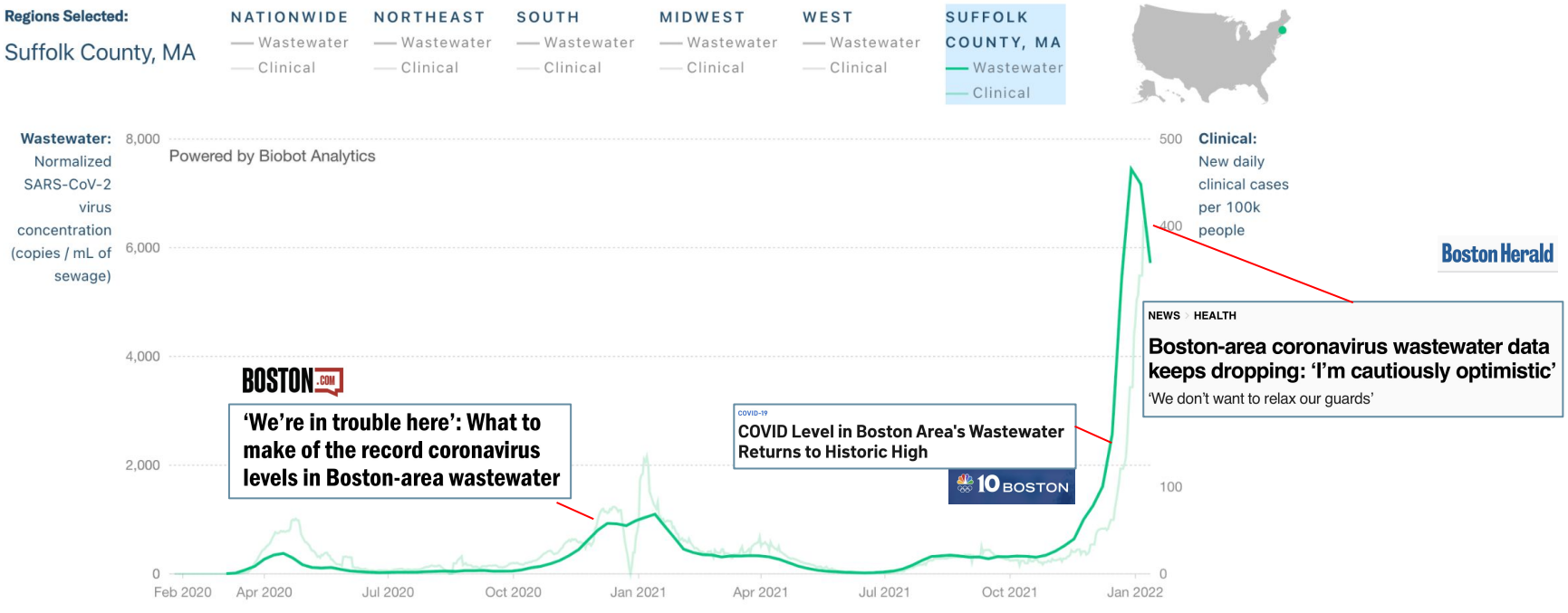
2. **Trend estimation**: Is disease activity rising, falling, or steady?
    a. At least 3 samples are needed for trend estimation

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



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

BIO BOT

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)	Effective* virus concentration (copies per liter of sewage)
	325,900	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

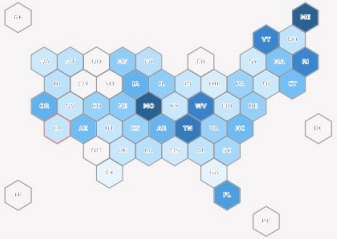
Overview of effective virus concentration levels

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

lower — higher

Color indicates effective virus concentration level

Your state outlined in red

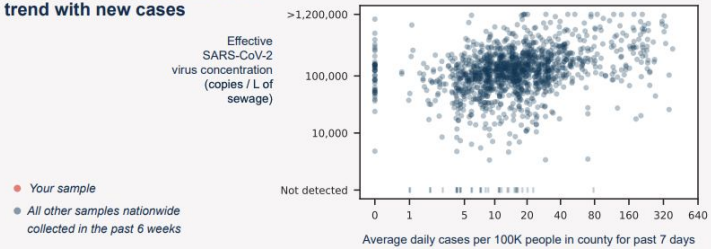


Your Report: 3/31

BIO BOT

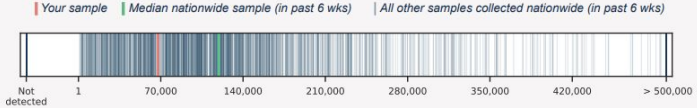
COVID-19 Community Report
Report provided: March 31, 2022
Kit ID: KIT-46214

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

BIO BOT

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

Sewer Authority Mid-Coastside WWTP

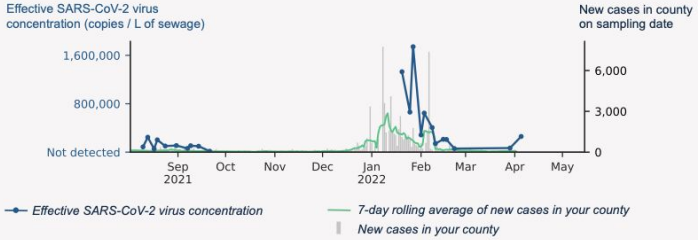
Sample collection date: **April 5, 2022**

SARS-CoV-2 virus in wastewater

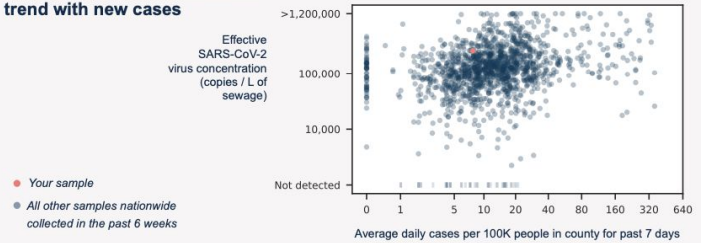
DETECTED	Virus concentration (copies per liter of sewage)	Effective* virus concentration (copies per liter of sewage)
	919,379	**259,183**

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

Effective virus concentration over time

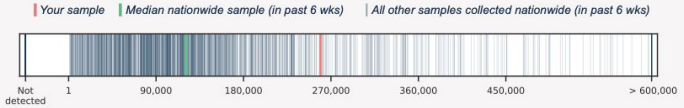


Effective virus concentrations trend with new cases



Effective virus concentrations in comparison

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



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Discussion