

Biobot Analytics

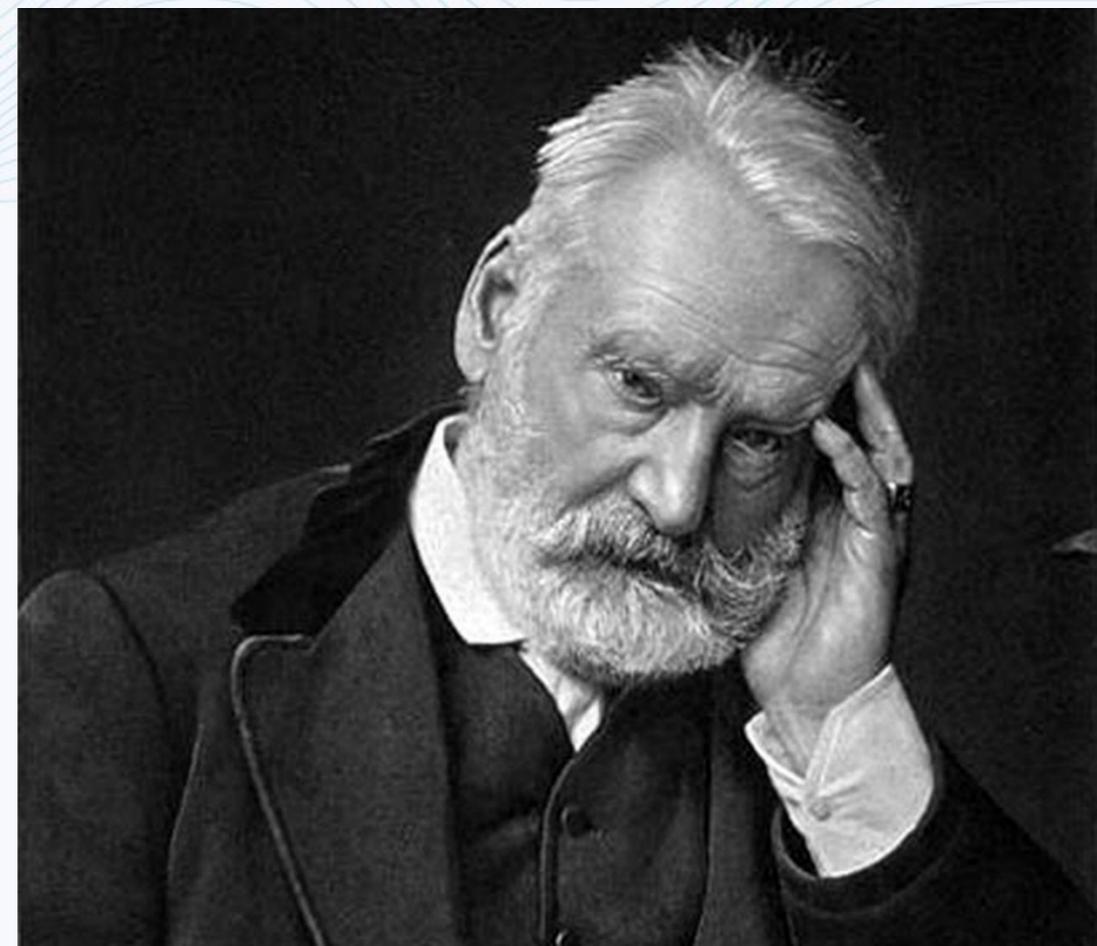
Mariana Matus, PhD

CEO and Cofounder

Sewers are the
conscience of the city.

Everything there converges and
confronts everything else. In that
livid spot there are shades, but
there are no longer any secrets.

Victor Hugo
Les Misérables



Wastewater intelligence to deliver untapped insights on human health & behavior



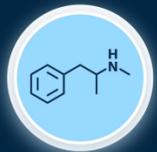
Prevent the next **pandemic** before it happens



Monitor **changes in mental health** of a population



Uncover **invisible infectious disease outbreaks**



Detect **waves in illicit drug use** and manufacturing



Improve **national security** through identification of manmade threats

Biobot is an MIT Spinoff

Newsha Ghaeli

President & Cofounder

BACKGROUND:

- Architecture & Engineering
- MIT Research Fellowship on smart city technologies



senseable
city lab.



UNIVERSITY OF
WATERLOO



TIME100 NEXT

Mariana Matus, PhD

CEO & Cofounder

BACKGROUND:

- Computational Biology & Microbiology
- MIT PhD dissertation on wastewater epidemiology

alm lab



MIT Computational
& Systems Biology

We are the leaders in the wastewater intelligence market

Health
Your Poop Might Be Key For Predicting the End of the Pandemic
Looking for the new coronavirus in wastewater could give us a heads up about where the outbreak is spreading – and when it has started to dissipate.

VICE

THE NEW YORKER
DEPT. OF GLITS JANUARY 25, 2021 ISSUE
AN UNTESTED SOURCE OF PANDEMIC DATA? THE SEWER
By looking at what people flush down their toilets, Biot Analytics can track the spread of COVID-19 and other problems, such as opioid use.
By Sheeloh Kolhatkar January 18, 2021

THE DAILY SHOW WITH TREVOR NOAH

The New York Times
Watching What We Flush Could Help Keep a Pandemic Under Control

MARIANA MATUS, PHD
BIOBOT, CEO & CO-FOUNDER

Bloomberg Businessweek
Poop could help stop the pandemic. Really.
Wastewater offers a promising way to track the virus, a top CDC doctor says.

POLITICO

STAT
New research examines wastewater to detect community spread of Covid-19
By SHRADDHA CHAKRADHAR @scchak / APRIL 7, 2020

npr
How What You Flush Is Helping Track The Coronavirus

The Washington Post
Democracy Dies in Darkness
An early warning system for coronavirus infections could be found in your toilet
From the U.S. to Europe to Australia, scientists have detected the virus in wastewater ahead of spikes in local cases

Bloomberg Businessweek
June 1, 2020, 6:00 AM EDT
A Startup Is Testing Sewage to Trace the U.S. Spread of Covid
● About 400 U.S. wastewater-treatment facilities have turned to Biot Analytics for help assessing the pandemic's prevalence.
By Nick Leiber

WASTEWATER TESTING TO TRACK THE SPREAD OF COVID-19
CNBC

STAT
Co-founders Newsha Ghaffari and Dr. Mariana Matus. PHOTOGRAPHER: MEGHAN MARIN FOR BLOOMBERG BUSINESSWEEK, M. SCOTT BRAUER FOR BLOOMBERG BUSINESSWEEK

Our wastewater intelligence platform **helps us understand population health more inclusively**



Predictive



Wastewater data is a leading indicator for new infectious disease cases.



Inclusive



Everyone has a voice in the sewer. Our data includes everyone, not just people who access clinical care.

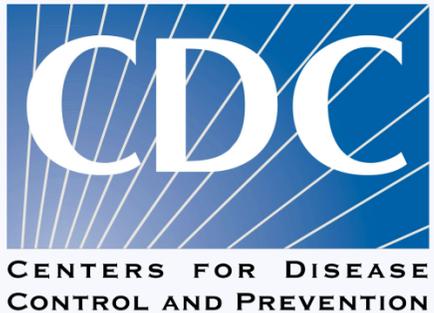


Versatile



Wastewater is a rich source of health data, including Covid-19, influenza, opioids, RSV, diet, and more.

Now, throughout North America, Biobot is a trusted partner of:



50+ STATES,
TERRITORIES,
PROVINCES

30,000+ SAMPLES
TESTED

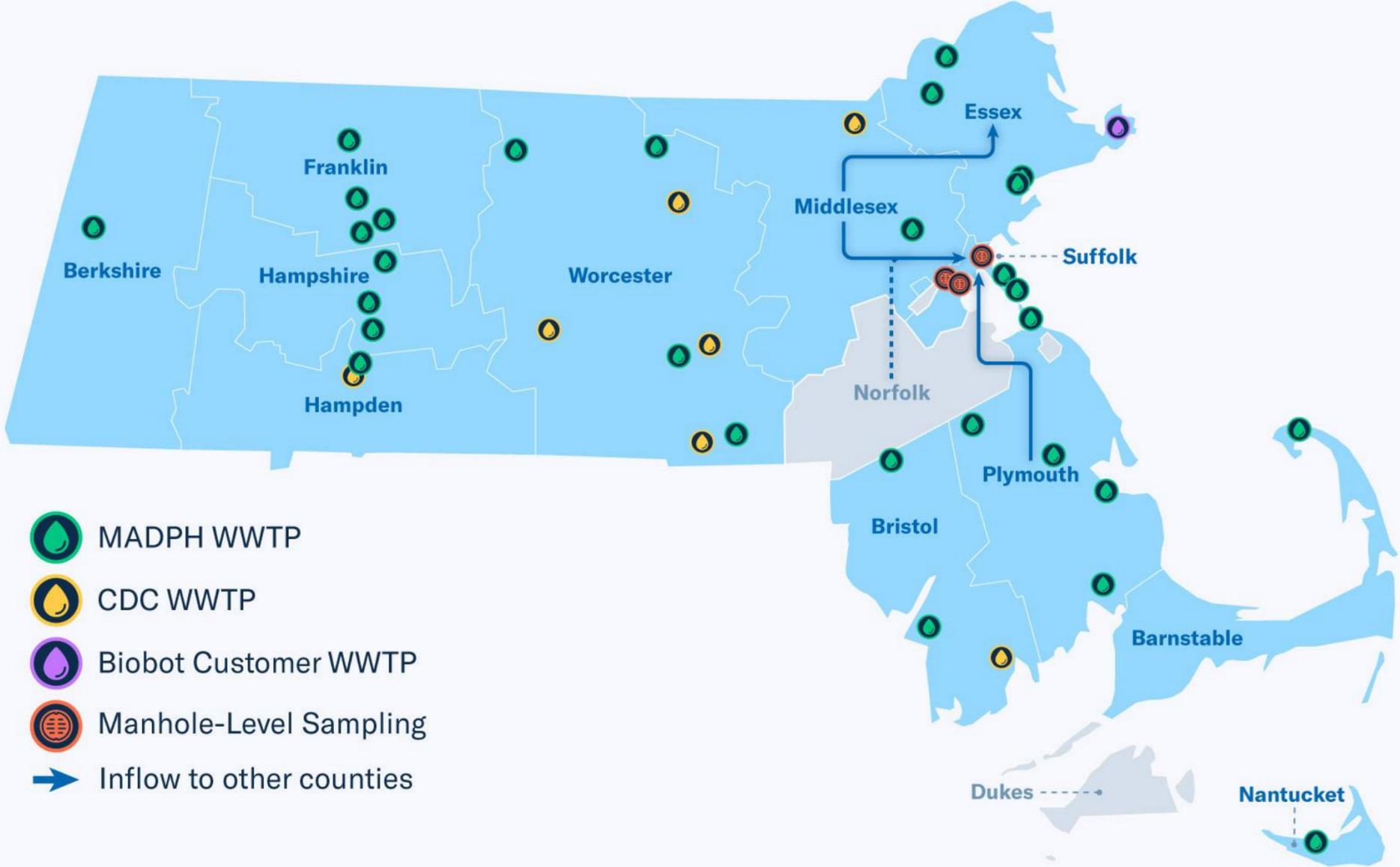
>30% OF U.S.
POPULATION

1,000+ SAMPLING
LOCATIONS IN
DATABASE



→ CONFIDENTIAL PROPRIETARY

Biobot has been conducting wastewater monitoring for Covid-19 in Massachusetts since March 2020



→ Partnership with the Governor’s Office COVID-19 Command Center and MA DPH

→ We cover almost all of the State between the MADPH, CDC NWSS and municipal wastewater monitoring programs

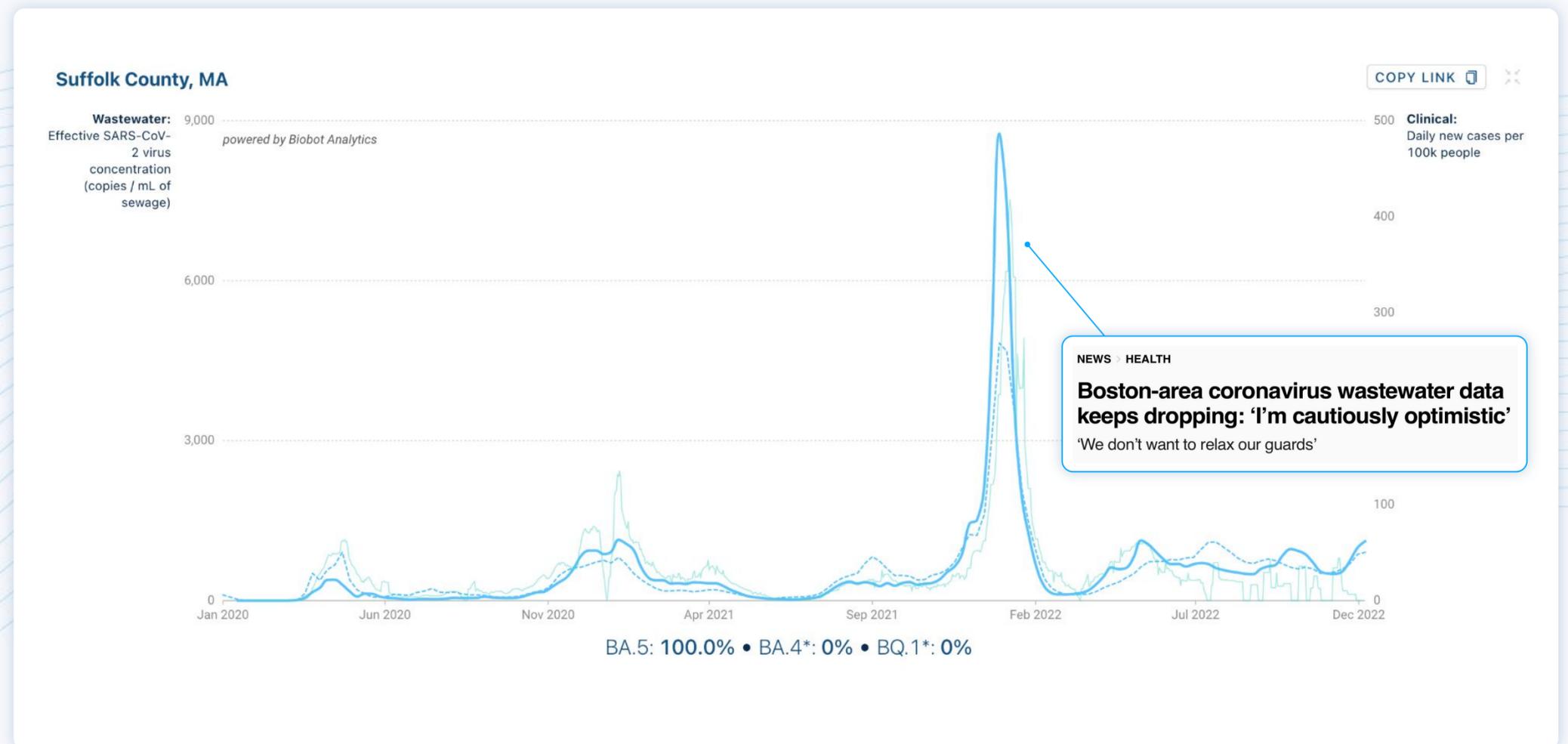
How has wastewater data been used since Covid-19 began?

Population level: Empower citizens

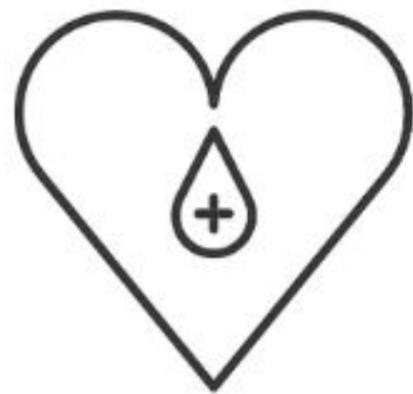
Publish wastewater data online to **inform public of day-to-day Covid-19 trends**



Boston's MWRA data became a vital community-risk indicator during the Omicron wave



How has wastewater data been used **since Covid-19 began?**



THE
CHELSEA
PROJECT

Community-level: Inform Targeted, Neighborhood-Level Strategies

Strategically deploy mobile testing units, pop-up vaccination clinics, contact tracing programs, text alerts, door-hanging, neighborhood listservs, multilingual educational materials, face mask

How has wastewater data been used since Covid-19 began?

The New York Times

Community Healthcare system level:
Inform hospital operations & planning

Chief Medical Officer,
Boston Children's Hospital

Knowing when the peak has passed can be useful, too. In recent weeks, Boston Children's Hospital has been limiting or postponing some nonemergency procedures, said Dr. Vincent Chiang, the hospital's chief medical officer. Now that Omicron appears to be in

In Sewage, Clues to Omicron's Surge

Tracking the virus in wastewater is helping some cities and hospitals respond to the most recent wave of the coronavirus, but a more coordinated national effort is needed, experts say.

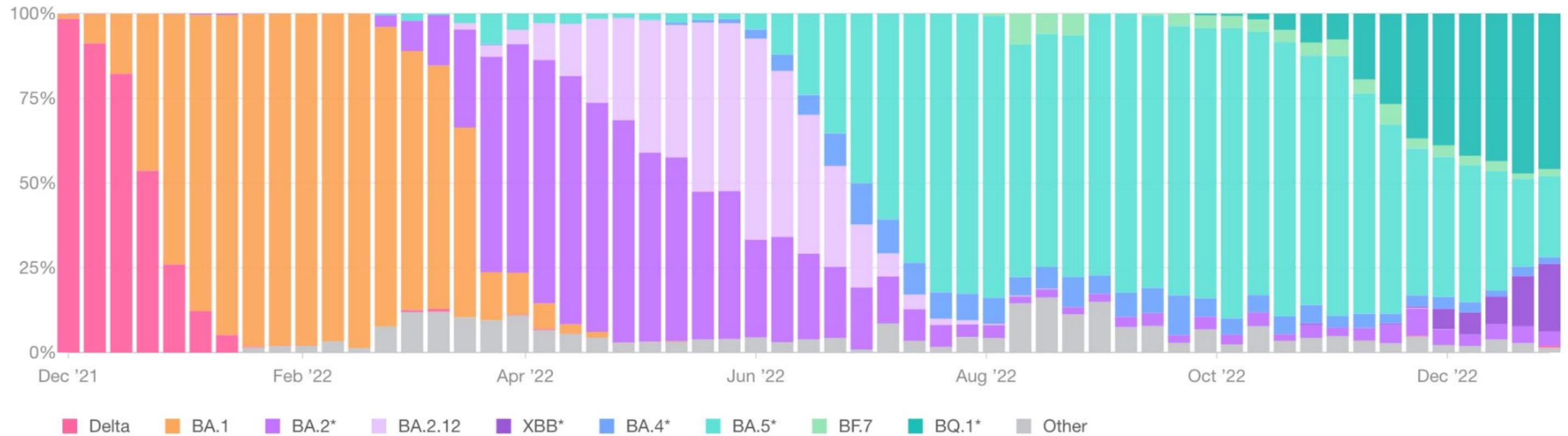
Because COVID hospitalizations lag behind cases, the crush is unlikely to let up immediately. But if the wastewater data looks encouraging, Boston Children's Hospital may begin scheduling more elective procedures for the second half of February, Dr. Chiang said.

"I love looking at the wastewater data," said no one prior to the Covid pandemic," he said. "But here we are."

National-scale SARS-CoV-2 variant data

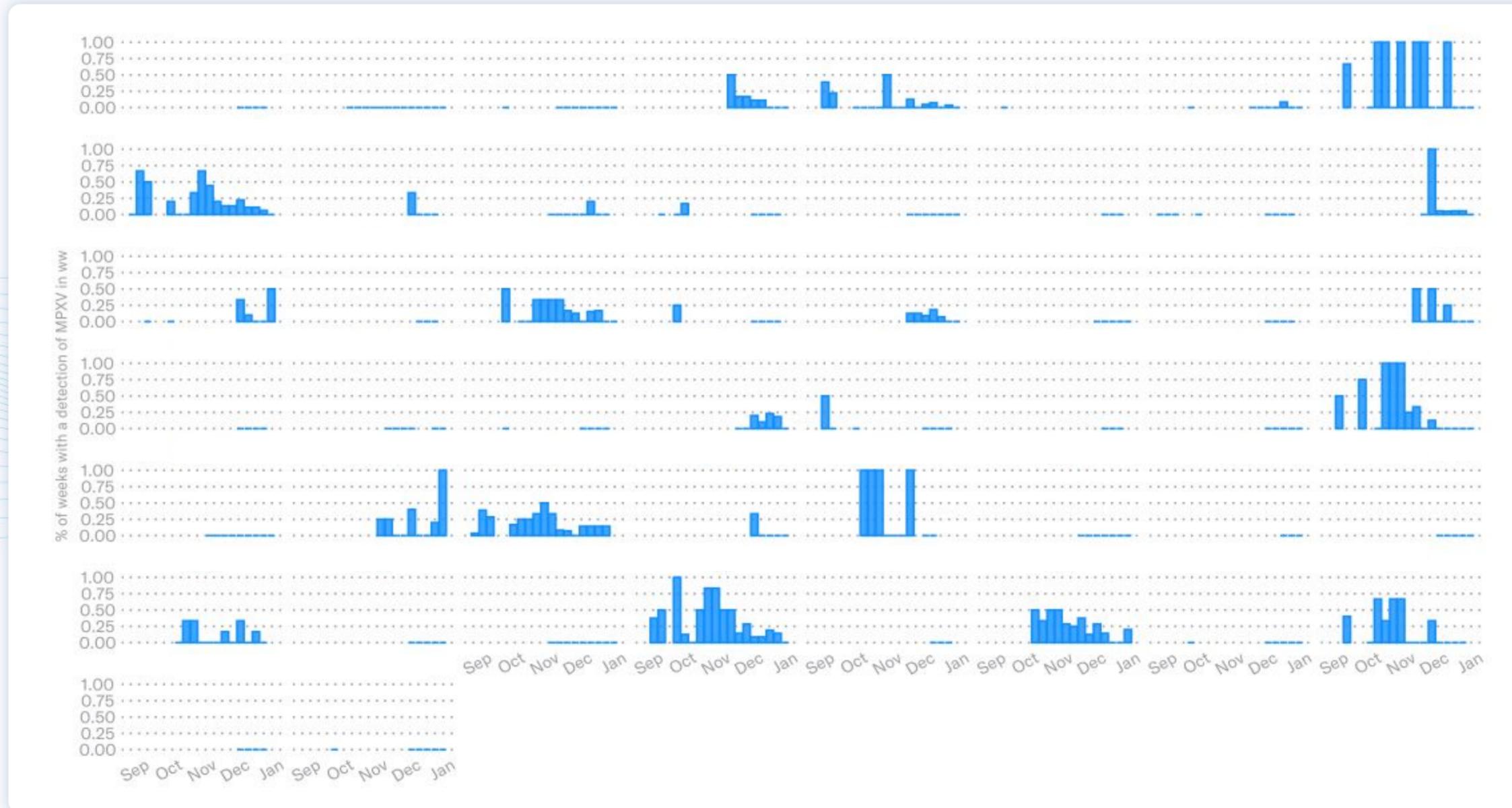
Dec. 2021- Dec. 2022

Variants: Percentage of variant lineage sequenced from SARS-CoV-2 genome found in wastewater

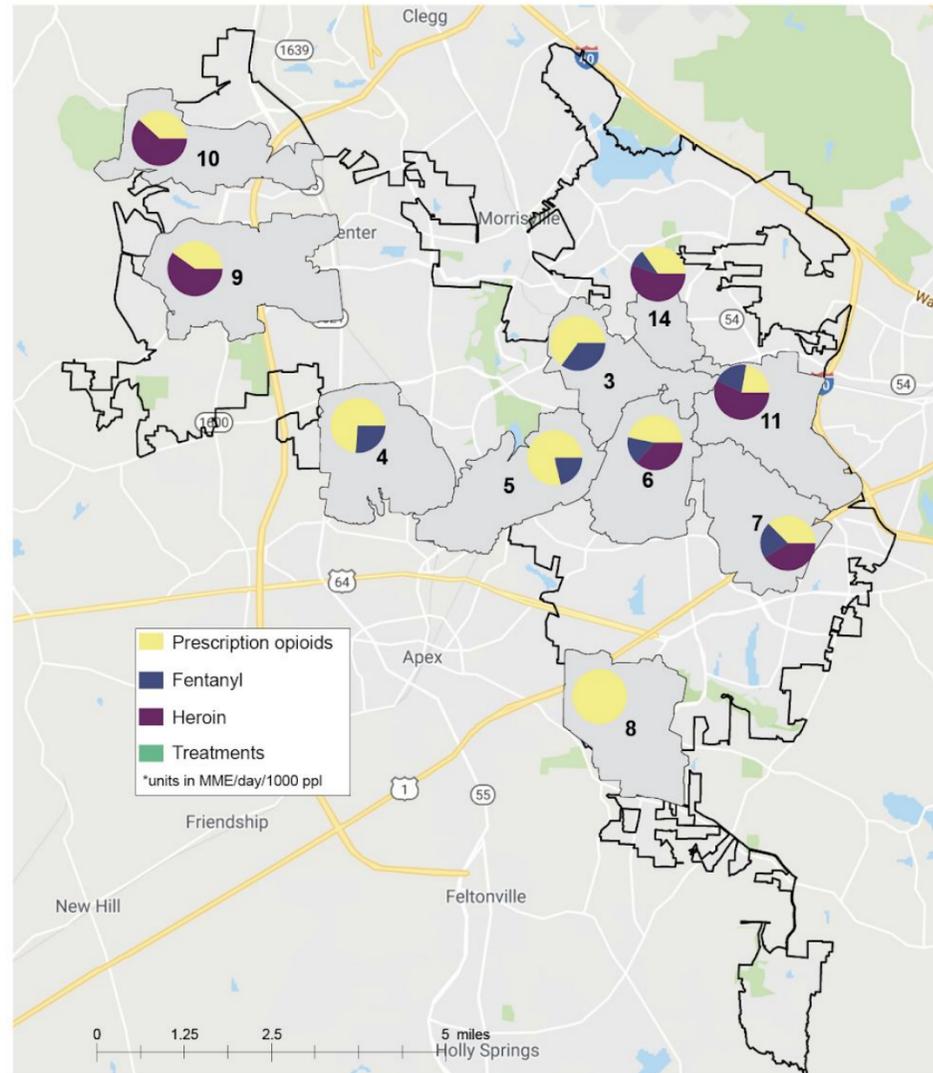


MPXV monitoring across all 50 states

State-level % of weeks with a detection of MPXV in wastewater



In 2018, we started with neighborhood-level data on high-risk substance use, overdose & treatment



Site ID	Population	Median age	Median HH income	Demographic breakdown [%]	Hispanic	Total MME
03	6,557	36	~\$100k	~80% white, ~10% black, ~10% other	10%	~100
04	7,896	36	~\$100k	~80% white, ~10% black, ~10% other	5%	~50
05	8,368	38	~\$150k	~80% white, ~10% black, ~10% other	5%	~100
06	10,853	42	~\$180k	~80% white, ~10% black, ~10% other	15%	~200
07	6,622	47	~\$150k	~80% white, ~10% black, ~10% other	5%	~150
08	5,306	44	~\$100k	~80% white, ~10% black, ~10% other	3%	~50
09	9,332	34	~\$100k	~80% white, ~10% black, ~10% other	4%	~100
10	5,503	46	~\$200k	~80% white, ~10% black, ~10% other	4%	~100
11	7,408	35	~\$150k	~80% white, ~10% black, ~10% other	25%	~1500
14	4,490	34	~\$100k	~80% white, ~10% black, ~10% other	13%	~100

Our data helped the Town of Cary decrease overdoses by 40% in in 2018

“By having this data, we were able to go out and do 50-some interviews and presentations, and talk to our community about what is going on in our neighborhoods, in our neighbors homes.”



**Bloomberg
Philanthropies**

**MAYORS
CHALLENGE**

[Link to video interview](#)

Mike Bajorek

Deputy Town Manager / Cary, North Carolina



We monitor substances of **high public health concern**



Fentanyl

Over 50% of drug overdose deaths involve synthetic opioids like fentanyl



Methamphetamine

Psychostimulant overdose deaths, from drugs such as methamphetamine, have **increased 317%** since 2013



Cocaine

Over 5 million Americans report cocaine use, and it is involved in nearly **1 in 5 drug overdose deaths**



Nicotine

35% of 12th graders report vaping nicotine

Insights into nationwide consumption trends

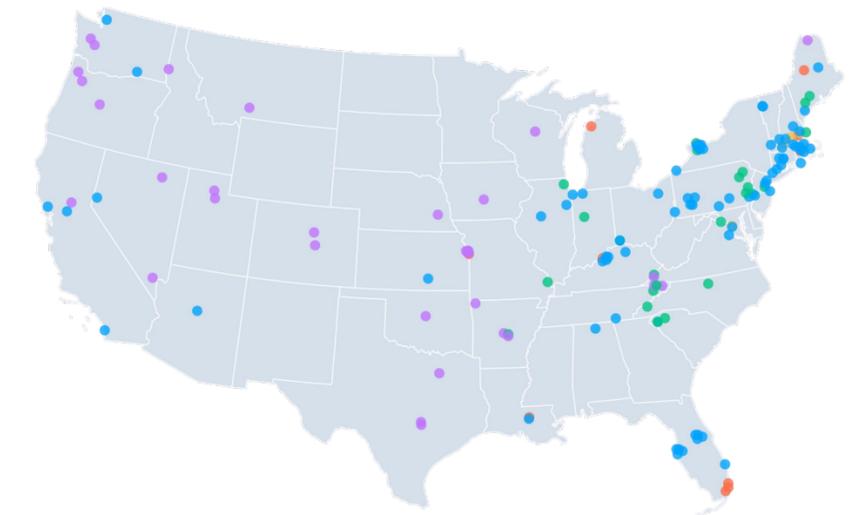
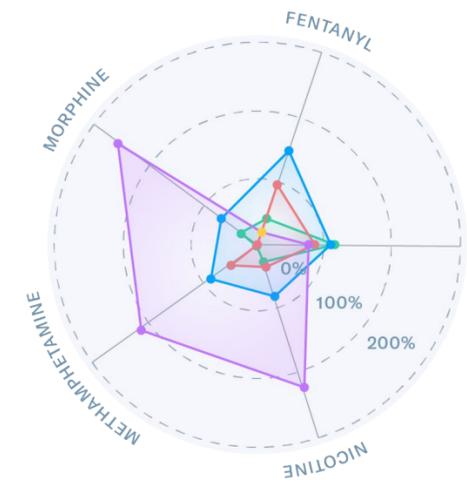


Our **database and proprietary machine learning algorithms** enable us to generate unique insights on population health



This information gives policy-makers & data customers the ability to **make more informed decisions**

Uncovering trends in drug co-consumption



- HIGH MORPHINE, NICOTINE, AND METHAMPHETAMINE USAGE**
- MODERATE GENERAL USAGE WITH ELEVATED FENTANYL**
- LOW GENERAL USAGE WITH MODERATE COCAINE**
- LOW GENERAL USAGE WITH MODERATE COCAINE AND FENTANYL**

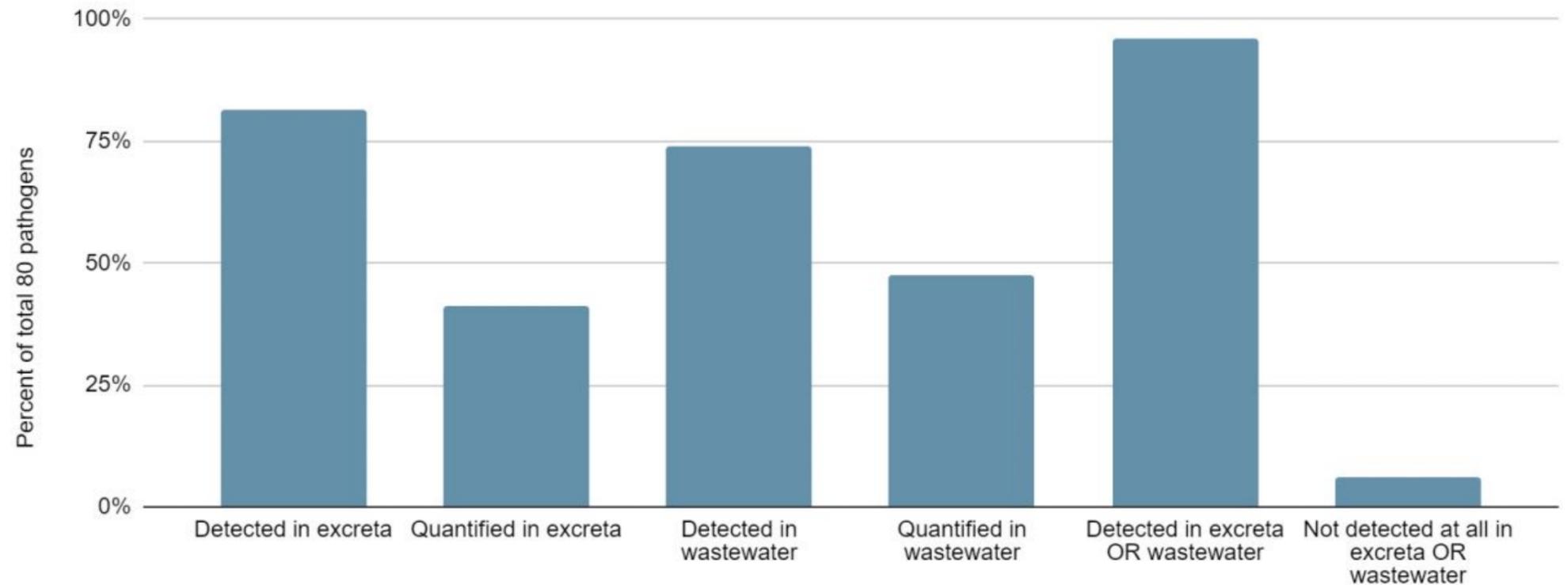
94% of pathogens detected in **WW, stool, or urine**

BIO BOT Biobot Analytics

→ APRIL 2022

Pathogen biomarkers in wastewater, stool, and urine: an informal survey

Percent pathogens detected and quantified



Application Roadmap



Infectious Diseases

Respiratory
Covid-19 +
Variants

Emerging Pathogens
Monkeypox

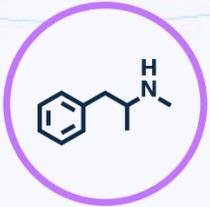
GI
Norovirus

Emerging Pathogens
Wildcard

Respiratory
Influenza,
RSV

STI
Gonorrhea

Bloodborne
Hep C



High Risk Substances

Illicit Use
Cocaine,
Meth,
Fentanyl,
Nicotine

Illicit Use
Xylazine

Substance Use Prevention
Naloxone,
Narcan,
Methadone,
Buprenorphine

Do you have
suggestions for
what to add?

Mariana Matus, PhD

CEO & Cofounder



mariana@biobot.io



biobot.io