Wastewater-based approaches to measuring COVID-19

Campus Pilot Overview

September 25, 2020
Wastewater-based (WB) COVID-19 pilot

Housing & Residential Services

Alm Lab | Department of Biological Engineering

MIT Medical

Campus Services & Stewardship
- Environmental Health & Safety
- Facilities Engineering
- Repair & Maintenance

WB Pilot @MIT
- Establish & validate WB COVID-19 detection
- 7 buildings
- Fall semester

COVID Monitoring Team
COVID Decision Team
Legal, Ethical, Equity committee
The University of Arizona says it caught a dorm’s covid-19 outbreak before it started. Its secret weapon: Poop.

Utah State quarantining 287 students after elevated COVID-19 levels found in wastewater

Somerville Wastewater Testing To Act As Coronavirus “Smoke Alarm”
What is wastewater-based (WB) epidemiology?

• The use of biomarkers and other molecules found in wastewater to understand public health at an aggregate level
• Successfully used to mitigate past outbreaks (example: polio in Israel, 2013-14)
What are the advantages of WB approaches?

- Many pathogens are detectable in wastewater via fecal excretion.
- Wastewater provides evidence of both symptomatic and asymptomatic infections, including non-compliant individuals.
- Wastewater-based testing (WB) can provide an early warning system ahead of clinical detection.
Viral dynamics in WB foreshadow clinical trends

(Wu et al., 2020a)
What are the advantages of WB approaches?

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- Wastewater provides evidence of both symptomatic and asymptomatic infections, including non-compliant individuals.
- Wastewater-based testing (WB) can provide an early warning system ahead of clinical detection.
- Because it is not limited by clinical testing availability, WB provides an unbiased view of disease dynamics.
- WB detection is highly sensitive: we detected SARS-CoV-2 in Deer Island wastewater (2.3 million people) as of March 3, when there were 2 confirmed cases in MA (likely representing 50-100 infections).
A timeline of viral dynamics in Eastern MA

(Wu et al., 2020b)
Wastewater monitoring detected uptick in MA infections during reopening, before clinical data

(Alm Lab, unpublished data)
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- Because it is not limited by clinical testing availability, WB provides an unbiased view of disease dynamics.
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- WB monitoring can be implemented at multiple scales, affording different scales of understanding and intervention.
Wastewater-based testing at different scales

**Multi-county**
- millions of residents
- sampled at wastewater treatment facility

**Neighborhood**
- thousands of residents
- sampled at manholes

**Individual buildings**
- hundreds of residents
- sampled at exit pipe or manhole

Monitors broader disease dynamics and informs public-health decision-making at the state and municipal scale.

Early detection of cases can guide ultra-localized public health interventions.
Implementation of wastewater-based COVID-19 detection on campus
7 PILOT BUILDINGS
- Sloan School (E62)
- Random Hall (NW61)
- Sidney-Pacific (NW86)
- McCormick Hall (W4)
- Simmons Hall (W79)
- Tang Hall (W84)
- Westgate (W85)
WB workflow @MIT

- 24-hour semi-continuous sampling to capture all flushes
- Daily sample collection
- Composite samples collected in late morning, after peak toilet use
- Samples will be inactivated (sterilized) prior to processing
- Sample collection, processing, and analysis is expected to take <24 hours
**COVID-19 Monitoring Team** (Coordination): Constantly monitors to determine cross-Institute issues and impacts, makes recommendations for action and initiates notifications, coordinates actions and operations

- Suzanne Blake (Lead)
- Steve Bradt
- Rich Crook
- Rick Danheiser
- John Dozier
- Andrea Finnin
- John Fernandez
- Suzanne Glassburn

- Ron Hasseltine
- Joe Higgins
- Peko Hosoi
- Xinzhou Li
- Suzy Nelson
- Mark Silis
- Cecilia Stuopis
- Jay Wilcoxson

**WB workflow @MIT**

- 10:00 - 11:30 am
  - Collect samples
  - Deliver samples to Alm Lab
  - qRT-PCR for SARS-CoV-2

- Results sent to COVID-19 monitoring team
Key takeaways

• WB offers complementary information to clinical testing for COVID-19.
• Campus WB pilot will be limited to COVID detection only.
• WB detection is aggregate: it will not identify individuals.

• Any validation against MIT Medical PCR testing will be done with aggregated, anonymized data. If you test positive at MIT Medical, your individual anonymized result will ONLY be used if you specifically consent to it.

• If we detect COVID-19 in a building’s wastewater, we may ask residents to get tested at MIT Medical sooner than otherwise scheduled.

• We are working with EHS and MIT Medical to ensure the safety of facilities personnel, research personnel, the MIT community, and the public.

• This system could provide a platform for future monitoring of community health (e.g. influenza, norovirus, and other health concerns)
WB pilot team @MIT

**Housing Team**
David Friedrich – Sr. Associate Dean  
Rich Hilton – Director of House Operations  
Suzy Nelson – Vice Pres. & Dean for Student Life

**Alm Laboratory Research Team**
Prof. Eric J. Alm (PI) – BE, CEE  
Katya Moniz – Research Lead  
Fuqing Wu – Postdoctoral Associate  
Amy Xiao – Graduate Student

**MIT Medical**
Brian Schuetz – Chief of Staff, MIT Medical  
Cecilia Stuopis – Medical Director & Head

**MIT COVID-19 Alliance**
Prof. Simon Johnson – Prof. of Entrepreneurship, Sloan School of Management

**Campus Services & Stewardship**
Damon Baptista – Biosafety Officer, EHS  
Keith Diggans – Director, Campus Services & Maintenance  
Carlo Fanone – Director, Facilities Engineering  
Joe Higgins – Vice President of CSS  
Ed Rita – Manager, Repair & Maintenance

**COVID Monitoring Team (CMT)**

**COVID Decision Team (CDT)**

**Legal, Ethical, Equity (LEE) committee**
Questions / Discussion

Contact our team:
wb-pilot@mit.edu