Slowing the Spread of COVID-19, Part 1 of 3: Examining Wastewater to Detect Community Spread of COVID-19
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SARS2 Early Warning Wastewater Surveillance Platform

• Mary Collins – SUNY ESF – spatial modeling
• Hyatt Green – SUNY ESF - microbiology
• Brittany Kmush – SU – epidemiology
• David Larsen – SU – epidemiology
• Lee McKnight – SU – information systems
• Frank Middleton – SUNY Upstate – microbiology
• Teng Zeng – SU – chemistry
Challenges in current surveillance

- Limited diagnostic availability or testing behavior
- Delays in treatment seeking behavior
- Asymptomatic infections and pre-symptomatic transmission
- Lag time between transmission and entry into health system surveillance

1. Pre-symptomatic transmission
   - Infection Day 0
   - Infectious Day 5-9
   - Symptoms appear Day 9-14

2. Asymptomatic cases
   - Diagnosis or hospitalization Day 9-14

3. Inadequate testing

Limited diagnostic availability or testing behavior
- Delays in treatment seeking behavior
- Asymptomatic infections and pre-symptomatic transmission
- Lag time between transmission and entry into health system surveillance

Infectious

Day 9-14

Infection Day 0

Symptoms appear Day 5-9
Goals of the SARS2 Early Warning Wastewater Surveillance Platform

1. Estimate SARS-CoV-2 transmission trends in real time
2. Provide instant feedback on social distancing and reopening phases
3. Predict hospitalizations from COVID-19
4. Give confidence in absence of transmission for areas with zero cases
COVID-19

Real-Time Transmission Tracking

Data Collection
Sample wastewater from treatment centers or pump stations

Identify/Analyze
Analyze wastewater for SARS-CoV-2 RNA. Quantify viral load in catchment.

Aggregate & Relay
Aggregate and relay information. Deploy mobile response centers to enhance control.

Classify Transmission
Classify geographic areas as transmission present or absent. Identify early trends of increasing or decreasing transmissions

Save Money
Allocate Limited Resources
Lower Rate of Spread
Get us back to normal
Environmental surveillance for poliovirus

Presence of SARS-Coronavirus-2 in sewage.

Authors and their affiliations

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Title: SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases

Authors: Wu FQ(1); Xiao A(1); Zhang JB(1); Gu XQ(2); Lee WL(2); Kauffman K (3); Hanage WP(4); Matus M (5); Ghaeli N(5); Endo N(5); Du Prelot CJ(5); Moniz K(1); Erickson TB(6); Chai PR (6); Thompson J(7); Alm EJ(1,2)

Temporal detection and phylogenetic assessment of SARS-CoV-2 in municipal wastewater

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SARS-CoV-2 Wastewater Surveillance Workflow (Total: 5.5 hours following delivery of sample to laboratory)

**What**
- County collects and delivers wastewater (250 mls)
- Load tubes (20 mls)
- Spin for @ 150,000 X g
- Resuspend pellet
- Nucleic Acid Extraction

**Time**
- 24-hour composite or morning/evening grab sample
- 20 min
- 45 mins
- 20 min
- 2 hours
SARS-CoV-2 Wastewater Surveillance Workflow (Total: 5.5 hours)

Quantitative PCR/RT-qPCR (2 hrs)
- SARS-CoV-2
  - IP2 and IP4
- crAssphage
  - Benign, abundant, cosmopolitan member of the human gut flora
  - Indicates what level of human fecal material we are actually testing
- Likely retrieving the data the next morning
Detecting SARS-CoV-2 RNA:

Three separate RNA diagnostic tests done on the pellet

1- Provide a number out of three of positive hits

Useful for low transmission communities and providing confidence around communities being from transmission

2- For samples with three positive hits, provide the average number of RNA copies

Useful as transmission increases and sensitive to rise and fall of transmission in communities
Wastewater catchments around Syracuse, Onondaga County, NY
Number of positive hits in wastewater out of three
For areas with three positive hits, number of RNA copies found

- Baldwinsville Influent
- Brewerton Influent
- Harbor Brook Pump Station
- Ley Creek Pump Station
- Liverpool Pump Station
- M/L Influent
- Metro Influent
- Metro Main Interceptor Outfall
- Oak Orchard Influent
- Westside Pump Station
- Wetzel Rd. Influent
Our group next steps

• Expansion – currently in 11 catchment areas in Onondaga county.
  • Expanding to more catchments in Onondaga County
  • First samples arrived today from Cayuga County
  • More counties?

• Funding
  • Multiple funding applications going out to various funding bodies
  • We have a price model ready for scale (~$200 per sample)

• Modeling
  • Ready to provide first evidence of reopening central New York
  • Need 100-150 data points and 1-2 months’ time before beginning to model hospitalizations and trends
How can this platform help your county?

1. Estimate SARS-CoV-2 transmission trends in real time
2. Provide instant feedback on social distancing and reopening phases
3. Predict hospitalizations from COVID-19
4. Give confidence in absence of transmission for areas with zero cases
What can your county do to scale wastewater surveillance?

1. Work with us as a county.
   • Email Pruthvi Kilaru (pkilaru@syr.edu) to set up consultations with our team

2. Request statewide scale from the Governor’s office, Congress, and Senate. We can scale this statewide within weeks for $4 – 5 million.
   • Would inform reopening.
   • Would be early warning for second wave, which could be mitigated with early intervention
Thank you

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Q & A

• www.nysac.org