



**Massachusetts Department of Public Health**

# **MA Wastewater Surveillance System Timeline and Application of Laboratory Activities**

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**Brandon Sabina**

**Monina Klevens DDS, MPH**

**Bureau of Infectious Disease and Laboratory Sciences**

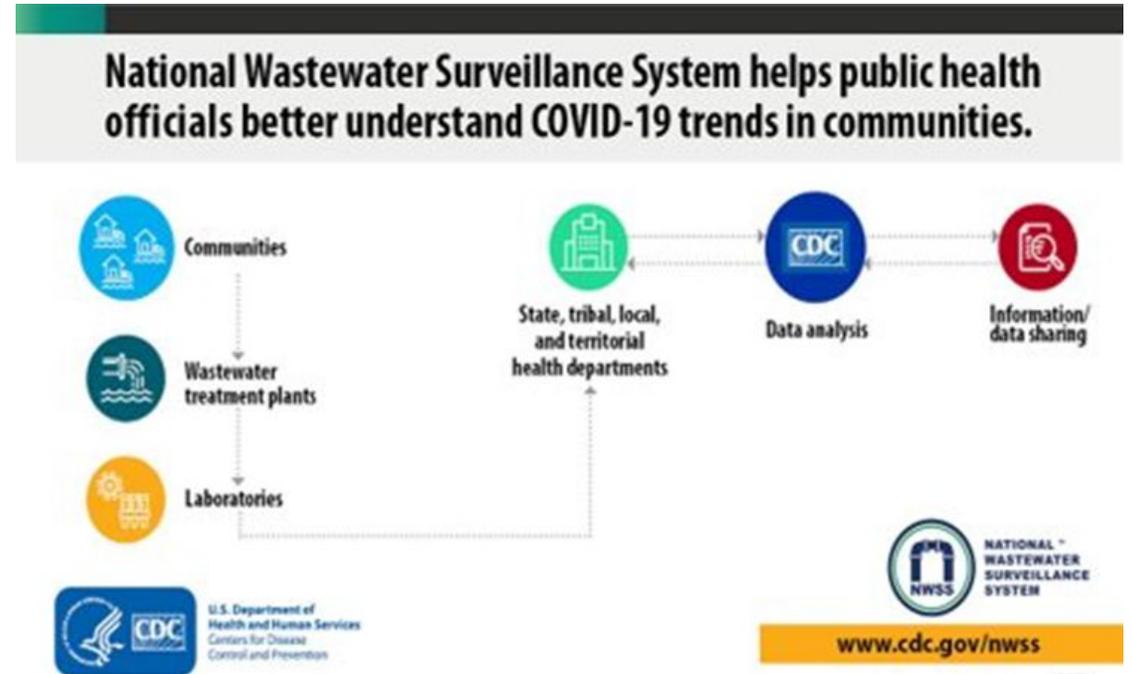
# What Is Wastewater Surveillance (WWS)?

- The process of monitoring untreated wastewater to detect the presence of pathogens (SARS-CoV-2) in populations
- People infected with SARS-CoV-2 shed virus in feces, even if with no symptoms
  - RNA detected in wastewater
- Dates back to the 1850s in England
- Useful in poliovirus monitoring where clinical surveillance is challenging



# Background

- Wastewater includes water from buildings (i.e., toilets, showers, sinks) that can contain human fecal waste, as well as water from non-household sources (i.e., rainwater and industrial use)
- Reported to DPH and CDC (NWSS)
- Wastewater surveillance is an early indicator of increasing or decreasing COVID-19 present in the community
  - Can provide a ~7-day lead over clinical testing/reporting
- Wastewater surveillance is complementary to clinical indicators — “piece of the pie”



# Value of Wastewater Surveillance

- By measuring SARS-CoV-2 levels in untreated wastewater over time, public health officials can determine if infections are increasing or decreasing in a sewershed.
- Unlike other types of COVID-19 surveillance, wastewater surveillance does not depend on people having access to health care, people seeking health care when sick, or availability of COVID-19 testing.
- Wastewater surveillance can be implemented in many communities since nearly 80% of U.S. households are served by municipal wastewater collection systems.
  - In Massachusetts, only about 70% of residents are covered.

# DPH and Wastewater Surveillance

- Collaboration between local partners and CDC to track the presence of SARS-CoV-2 RNA through wastewater analysis.
- EOHHS announced first call for vendors July 2020 as the COVID-19 Wastewater Surveillance Testing (WaSTe) Services.
  - Contractors conducted sample collection and testing
  - Program sites include:
    - Communities
    - Congregate care settings
    - Correctional facilities
- The State Public Health Laboratory (MA-SPHL) began establishing partnerships and implementing Wastewater Surveillance in November 2021.

# Wastewater Testing Workflow

- As of 10/03/22, composite specimens collected 3-4x/week at 22 WWTPs and sent to DPH and/or contractor
- In the process of transitioning sites from contractor to DPH



Specimen pour-off from autosamplers



Wastewater Treatment Plant (WWTP)

# Wastewater Testing Workflow

Sample  
Collection



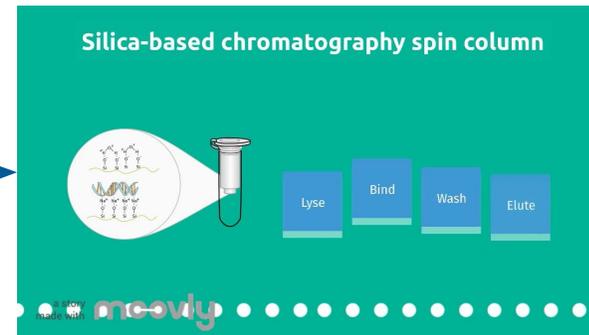
Autosampler

Sample  
Concentration



Concentrating  
Pipette-ultrafiltration

RNA  
Extraction



Manual-based Zymo  
Quick-RNA Viral Kit

ddPCR  
Quantification



Bio-Rad QX200  
Auto DG Droplet  
Digital PCR System  
(ddPCR)

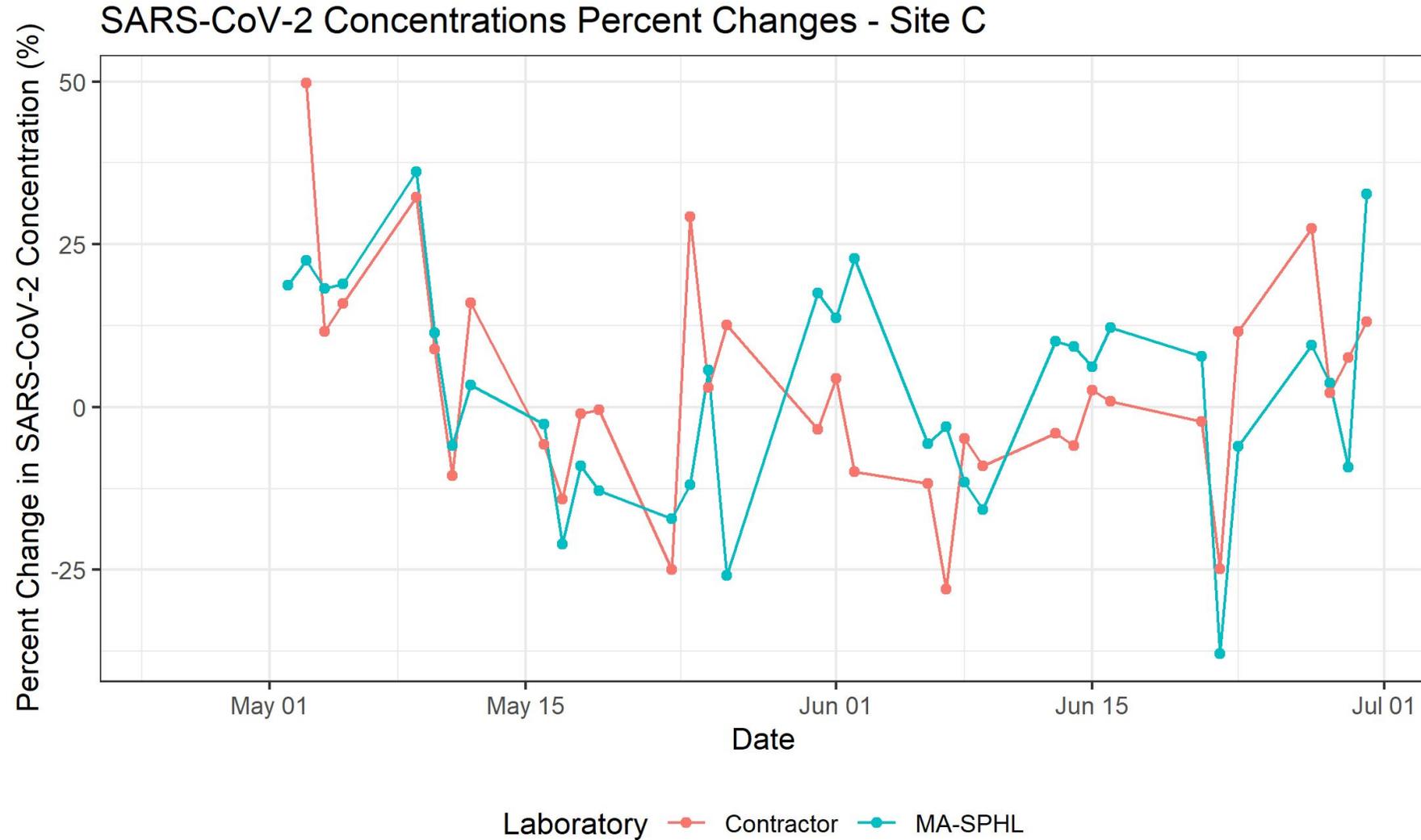
# Laboratory Integration Timeline

- March-July 2022: Process Verification

# Process Verification

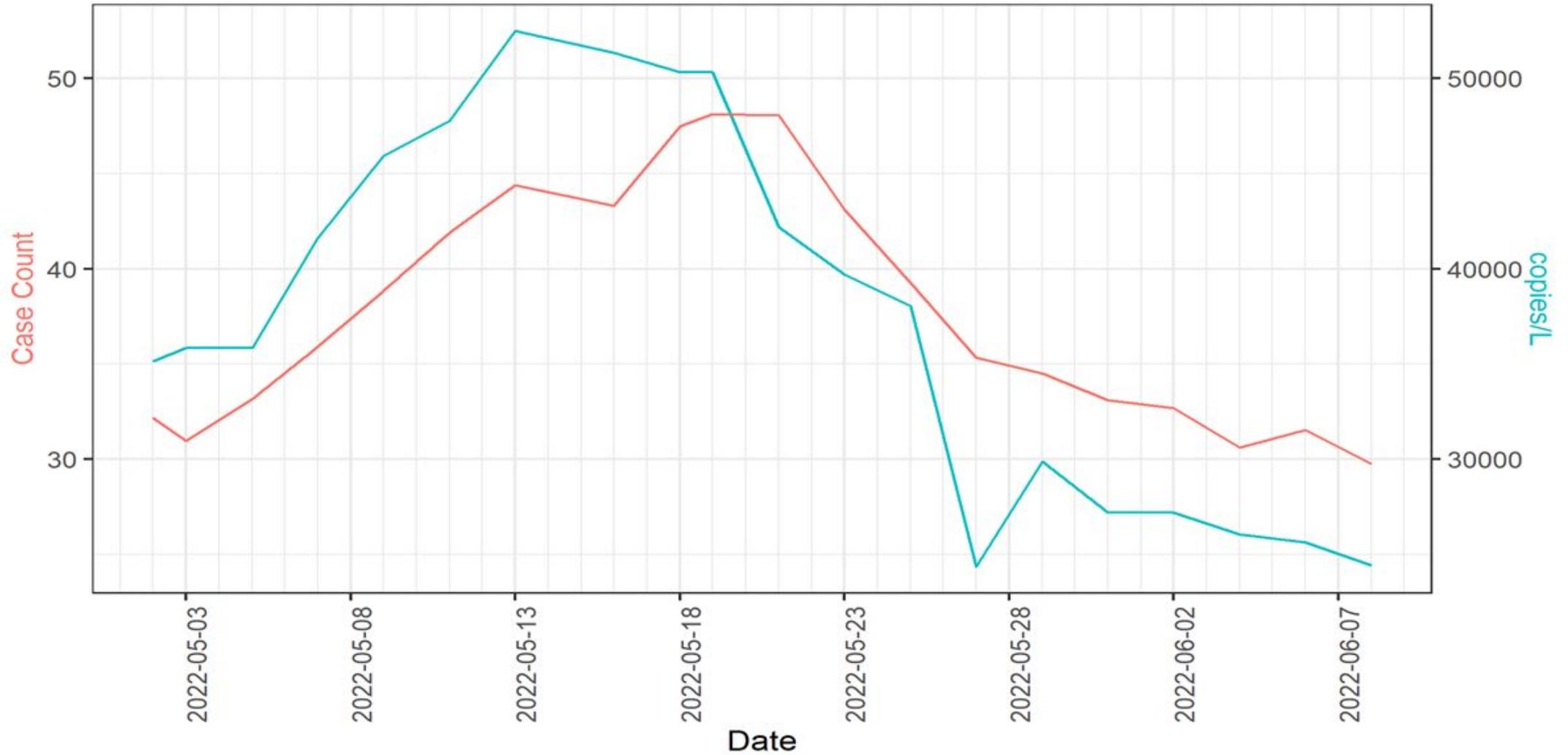
- Compare the percent change of the *N2* gene target using methods developed at MA-SPHL and Contractor- raw concentration only

# Results



# Results

MA-SPHL Raw Concentrations vs. Catchment Area New Cases - Site D

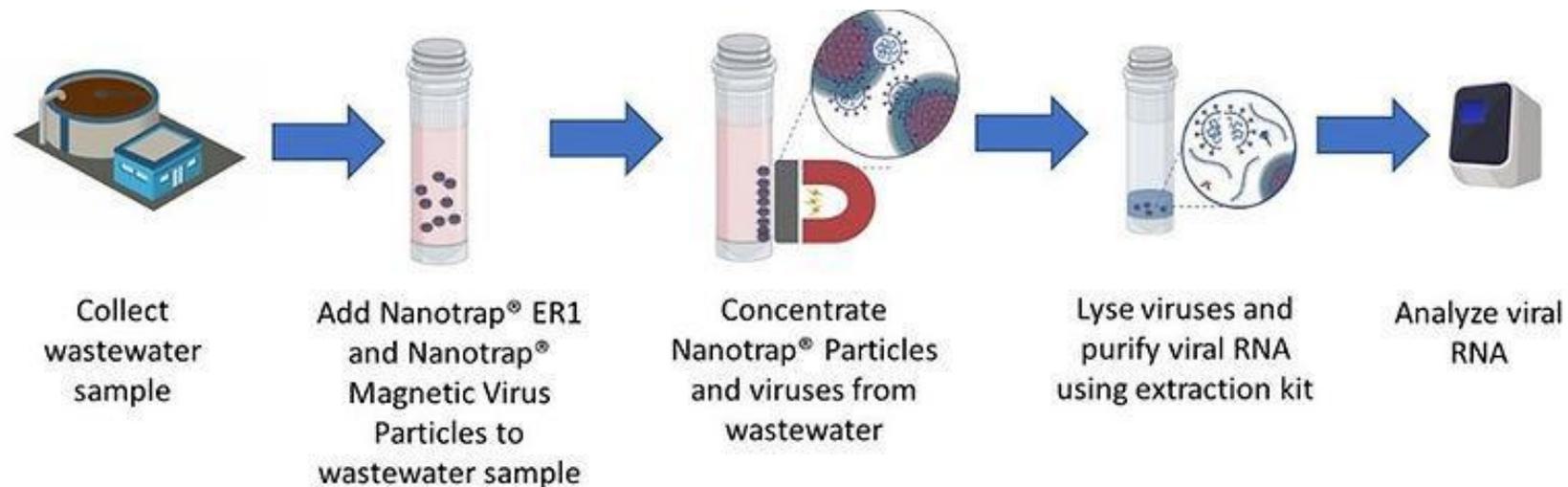


# What did we learn?

- In-house testing is feasible.
  - Refining the protocol is ongoing.
  - State Public Health Labs are working together to standardize this process.
- Accurate inter-laboratory comparisons with the national vendor are difficult due to differences in methodology. However, our preliminary data confirms that monitoring upward trends correlates with early clinical detection.

# Future Lab Methods

- Actively exploring transitioning from manual-based sample concentration and RNA isolation to automated methods
  - King Fisher Flex-concentration and extraction on 1-platform using Ceres Nanotrap Particles



# Current Sites

- As of October 2022:
  - 25 community wastewater treatment facilities
  - 15 congregate care facilities
  - 8 correctional facilities
- New sites in discussion or implementation:
  - 2 correctional facilities
  - 3 state college campuses

# Dissemination

- Public
  - 3 Community WWTPs publicly release data
  - July 2022: MDPH public dashboard of WW surveillance
  - Fall 2023: MDPH public dashboard becomes interactive
- Internal
  - All facility level data are shared only with facilities and DPH
  - Governor and Secretary of Health and Human Services receive weekly WW reports

**Ongoing research question: How can we measure the utilization and impact of these surveillance data?**

# Laboratory Potential Future Applications

- hMPXv
  - Currently program has limited testing via external labs
    - SCAN
    - CDC
    - BioBot
- Poliovirus, AR targets, opioids, influenza, norovirus
- Wastewater surveillance is constantly evolving, and the lack of background data on viral concentration levels makes it difficult to establish actionable criteria

# NWSS Current Focus

- Is hMPX virus viable and/or infectious in untreated influent wastewater?
- Can the CDC published clinical assays be adapted (and feasible) for wastewater samples?
- How will hMPX DNA levels in wastewater correlate to clinical cases?
- Is there a lead time of hMPX DNA levels in wastewater relative to clinical cases?
- What is the best sampling frequency?
- Sample type?

# Future Directions

- Expansion of coverage
- Genomic Sequencing (WGS)
  - Detection of variants
  - Quantification
- Antimicrobial resistance
- Emerging infectious disease threats
- Continued need to evaluate public health impact

# Acknowledgments

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# Questions?



[MAWWInquiries@mass.gov](mailto:MAWWInquiries@mass.gov)

# Criteria to Determine Short-Term Inclusion in Wastewater Program

- Size of population covered by sampling site
- Availability of staff and ease of collecting samples
- Plan for action with results
- Geographic considerations
- Neighboring area already covered
- Representation across Massachusetts
- Priority sites include the Vaccine Equity Initiative sites ([mass.gov/info-details/covid-19-vaccine-equity-initiative#20-prioritized-communities-](https://www.mass.gov/info-details/covid-19-vaccine-equity-initiative#20-prioritized-communities-))

# Connect with DPH



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