# Wastewater-based Surveillance (Epidemiology) for COVID-19

Francis L. de los Reyes III, Ph.D., BCEEM

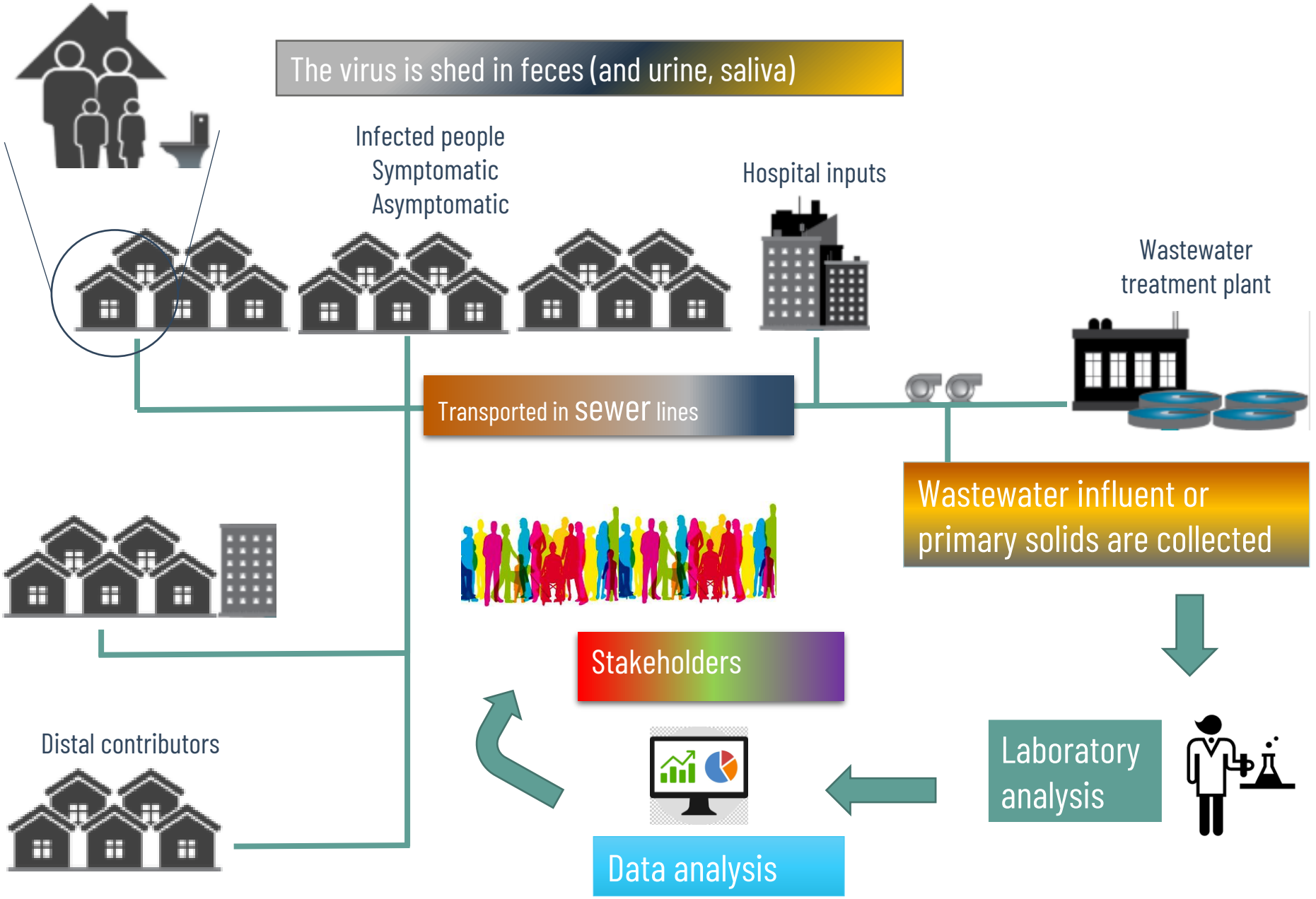
Glenn E. and Phyllis J. Futrell Distinguished Professor of Environmental Engineering

Alumni Distinguished Undergraduate Professor

University Faculty Scholar

North Carolina State University

# Wastewater Surveillance for SARS-CoV-2

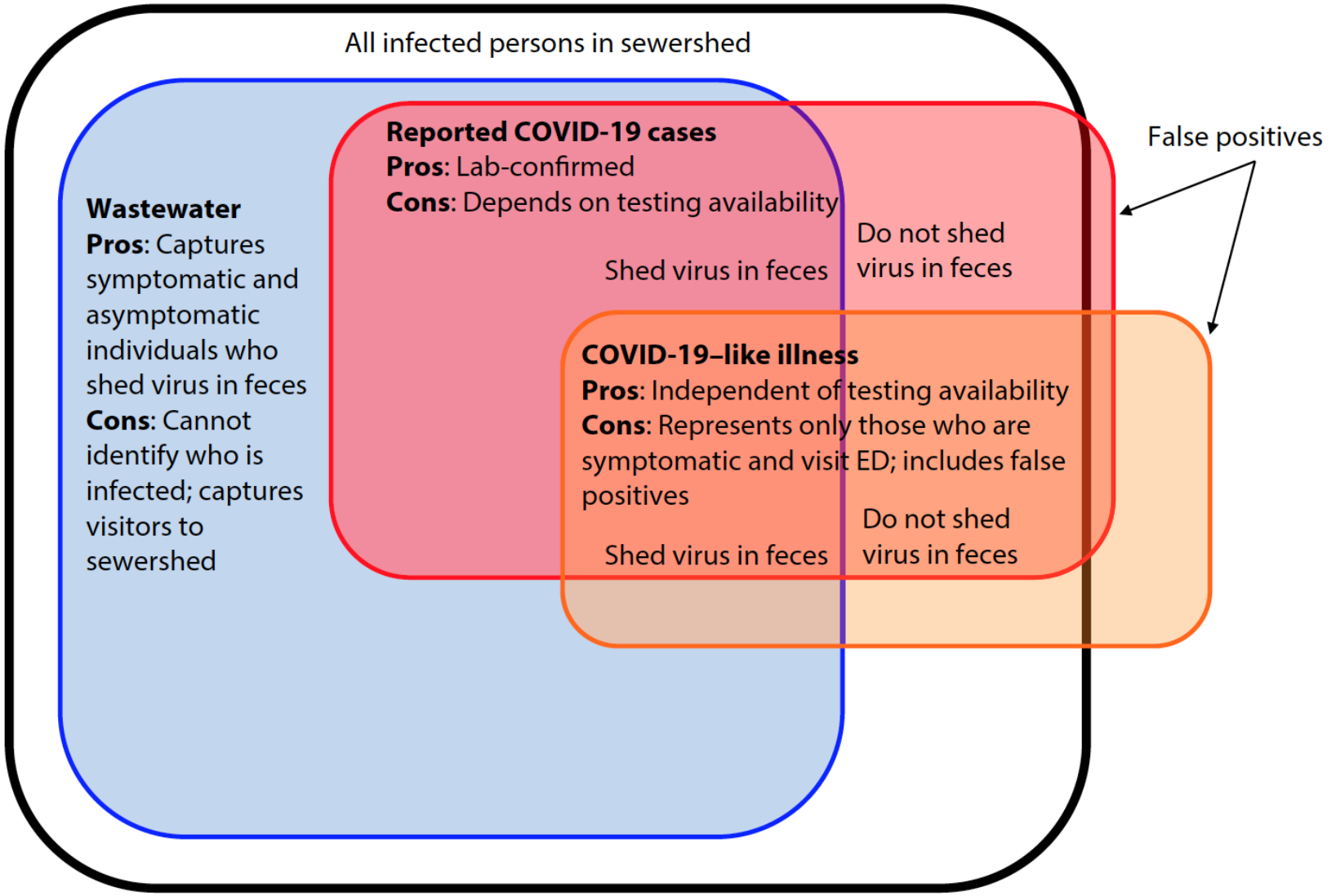


# Uses of SARS-CoV-2 wastewater data

1. **Trends tracking** (relative changes over time)
    - Early detection (e.g., a second wave)
    - Tracking impact of interventions
    - Co-occurrence with other infections (e.g., flu)

2. **Viral evolution**
    - Diversity of circulating strains (is there a predominant strain?)
    - Relationships with other strains in the world (can give information about source of a specific outbreak)

3. **Identification of geographic areas of concern** (i.e., hotspots)
    - More targeted direction of health interventions


All infected persons in sewershed
Wastewater
Pros: Captures symptomatic and asymptomatic individuals who shed virus in feces
Cons: Cannot identify who is infected; captures visitors to sewershed
Reported COVID-19 cases
Pros: Lab-confirmed
Cons: Depends on testing availability
Shed virus in feces
Do not shed virus in feces
False positives
COVID-19–like illness
Pros: Independent of testing availability
Cons: Represents only those who are symptomatic and visit ED; includes false positives
Shed virus in feces
Do not shed virus in feces

# “Wastewater + COVID”



Environmental Science & Technology Letters

pubs.acs.org/journal/estlcu

Letter

## Presence of SARS-Coronavirus-2 RNA in Sewage and Correlation with Reported COVID-19 Prevalence in the Early Stage of the Epidemic in The Netherlands

Gertjan Medema,* Leo Heijnen, Goffe Elsinga, Ronald Italiaander, and Anke Brouwer

Cite This: *Environ. Sci. Technol. Lett.* 2020, 7, 511–516

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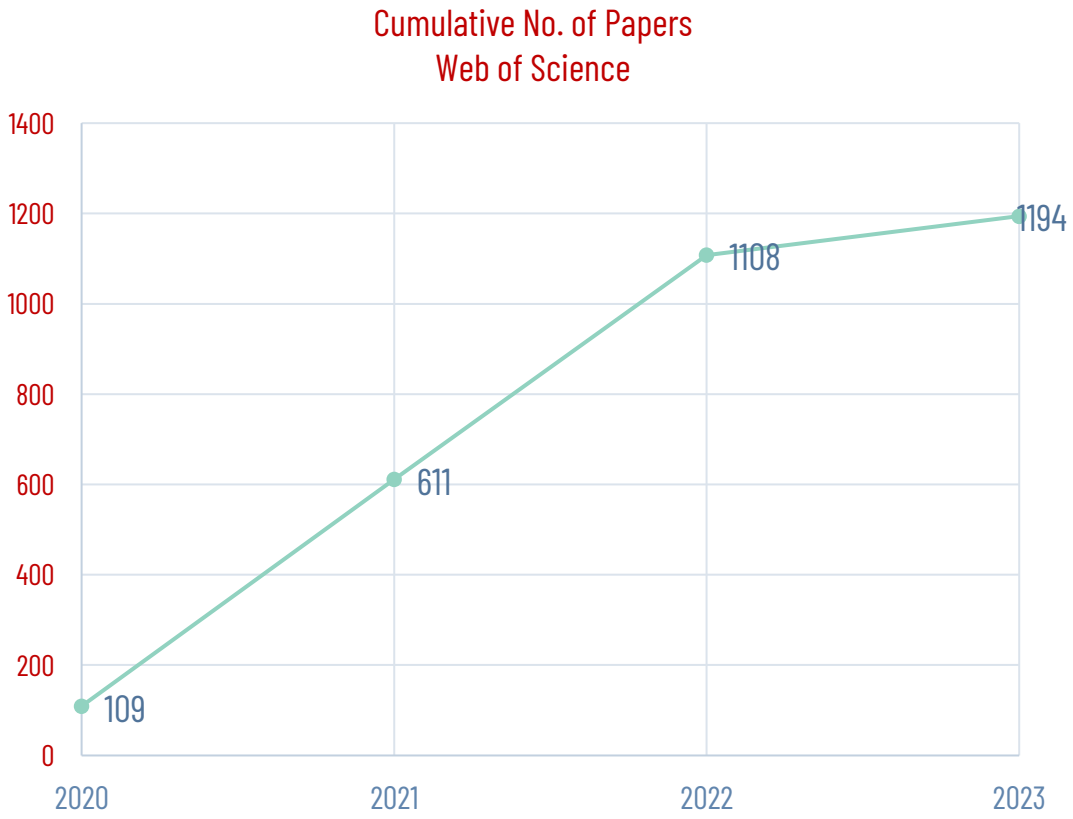

# Chronology of SARS CoV-2 surveillance in NC

- February 2020 –WW researchers thinking about surveillance
- March 2020- NSF RAPID proposal submitted
- April 2020 – NC Collaboratory funding, establishment of NC Wastewater Surveillance Network

ONLINE REPORT

# SARS-CoV-2 Wastewater Surveillance for Public Health Act

Jill S. McClary-Gutierrez,[1] Mia C. Mattioli, Perrine Marcenac, Andrea I. Silverman, Alexandria B. Boehm, Kyle Bibby, Michael Balliet, Francis L. de los Reyes III, Daniel Gerrity, John F. Griffith, Patricia A. Holden, Dimitrios Katehis, Greg Kester, Nathan LaCross, Erin K. Lipp, Jonathan Meiman, Rachel T. Noble, Dominique Brossard, Sandra L. McLellan

RESEARCH ARTICLE AJPH

# Timing and Trends for Municipal Wastewater, Lab-Confirmed Case, and Syndromic Case Surveillance of COVID-19 in Raleigh, North Carolina

*Nadine Kotlarz, PhD, David A. Holcomb, PhD, A. B. M. Tanvir Pasha, MS, Stacie Reckling, EA, Judith Kays, Yi-Chun Lai, PhD, Sean Daly, Sivaranjani Palani, Erika Bailey, Virginia T. Guidry, PhD, Ariel Christensen, Steven Berkowitz, Jane A. Hoppin, ScD, Helena Mitasova, PhD, Lawrence S. Engel, PhD, Francis L. de los Reyes III, PhD, and Angela Harris, PhD*

ACS ES&T Water

https://pubs.acs.org/estwater?ref=pdf

pubs.acs.org/estwater

Article

# Comparing Rates of Change in SARS-CoV-2 Wastewater Load and Clinical Cases in 19 Sewersheds Across Four Major Metropolitan Areas in the United States

Mitham Al-Faliti, Nadine Kotlarz, Camille McCall, Angela R. Harris, Adam L. Smith, Lauren B. Stadler, Francis L. de los Reyes, III, and Jeseth Delgado Vela*

Cite This: https://doi.org/10.1021/acsestwater.2c00106

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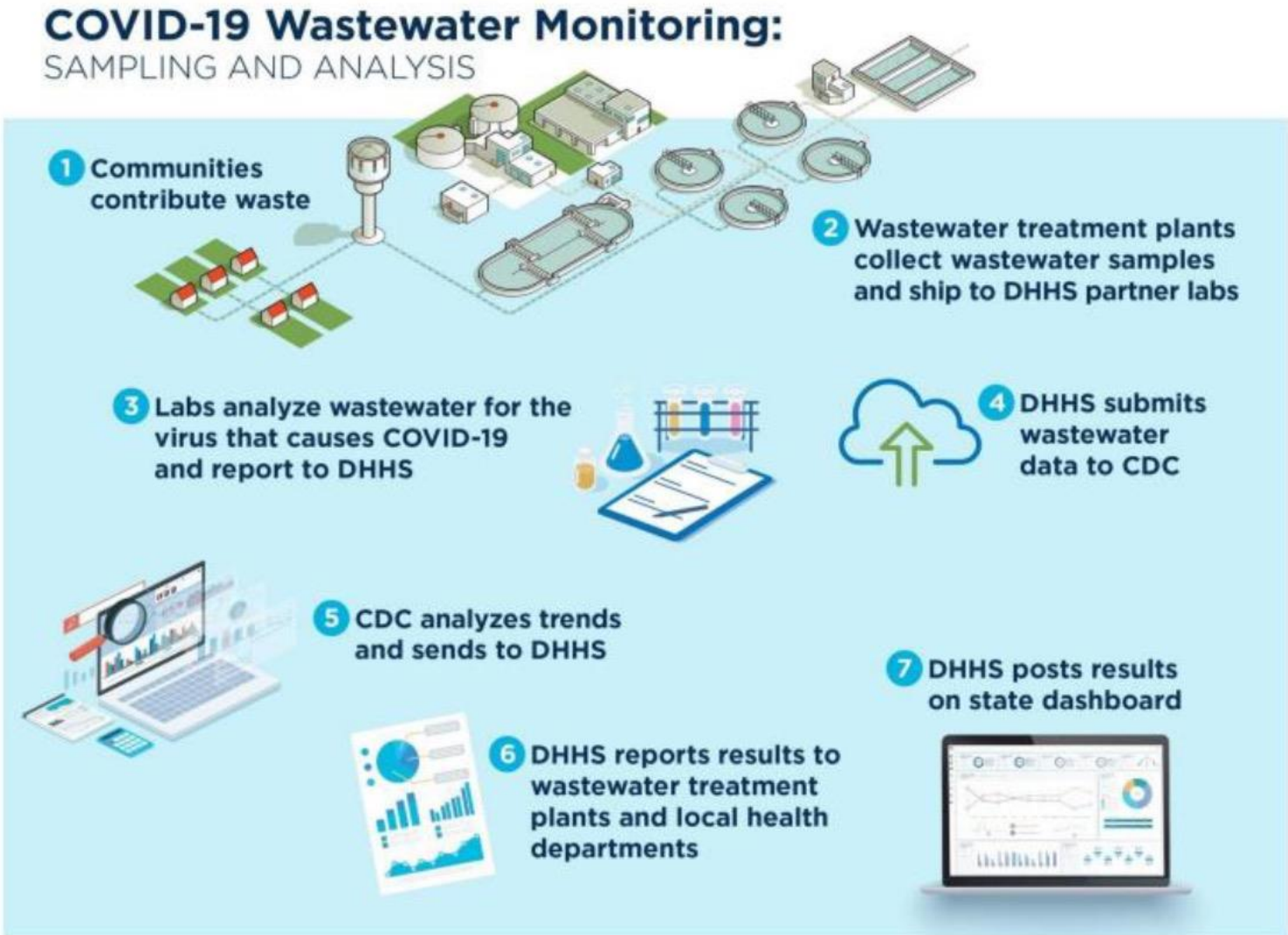
# Assessing Wastewater SARS-CoV-2 Loads as a Leading Indicator of Fluctuations in COVID-19 Cases at Fine Temporal Scales: Correlation Analysis of Twenty Sewersheds Across North Carolina

[Kelly Hoffman (co first author), David Holcomb (co first author), Stacie Reckling, Tom Clerkin, Denene Blackwood, Rachelle Beattie, Francis de los Reyes, Angela Harris, Helena Mitasova, Jane Hoppin, Nadine Kotlarz, Jill Stewart, Larry Cahoon, Arthur Frampton, Mariya Munir, Allison En-Chuan Lee, Steven Berkowitz, Rachel Noble, Virginia Guidry, Lawrence Engel (co senior author), Marc Serre (co senior author), Ariel Christensen (co senior author)]

# NC Wastewater Monitoring Network Process

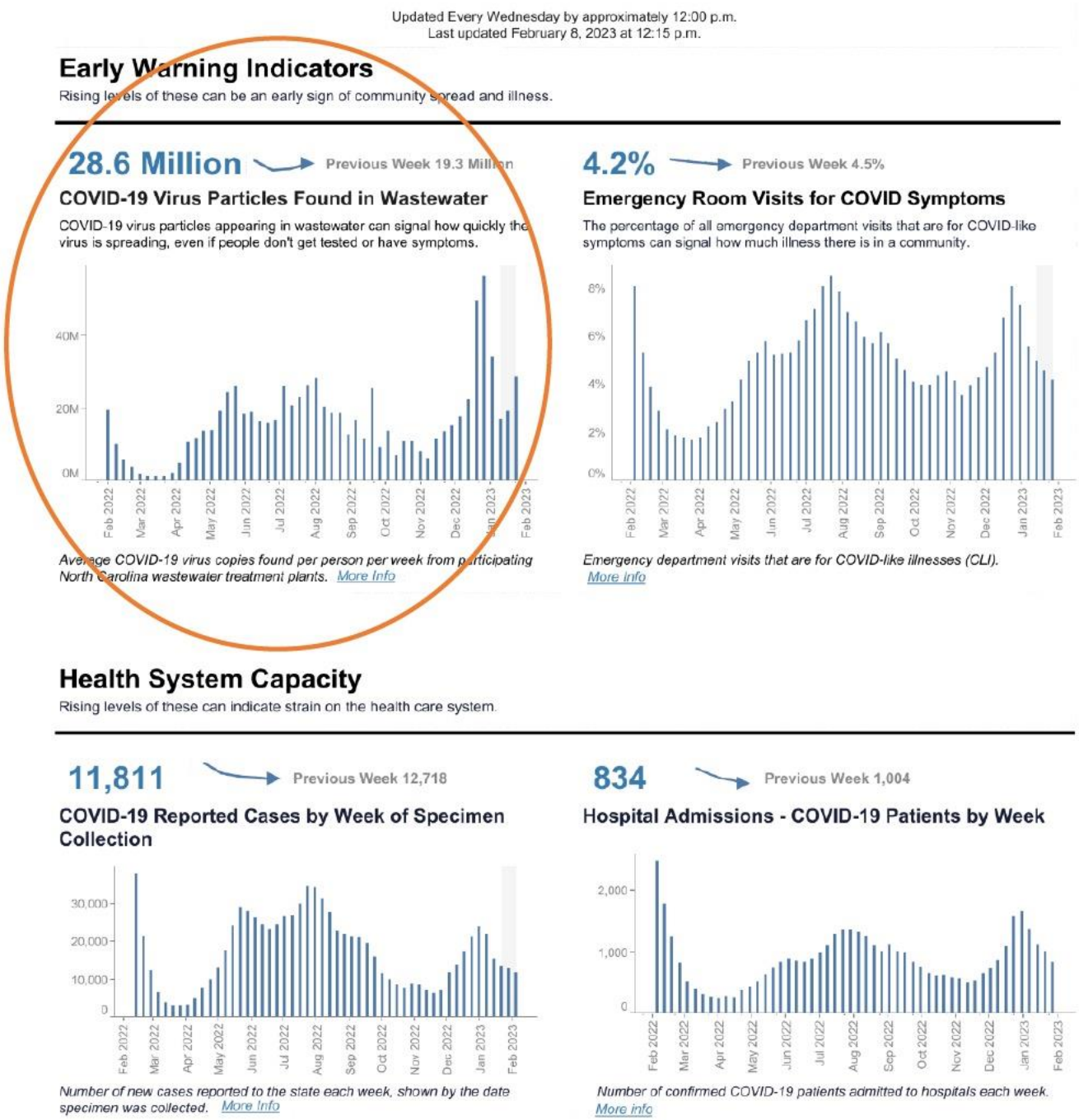


For the past year, wastewater monitoring has been one of four key metrics for North Carolina!

https://covid19.ncdhhs.gov/dashboard

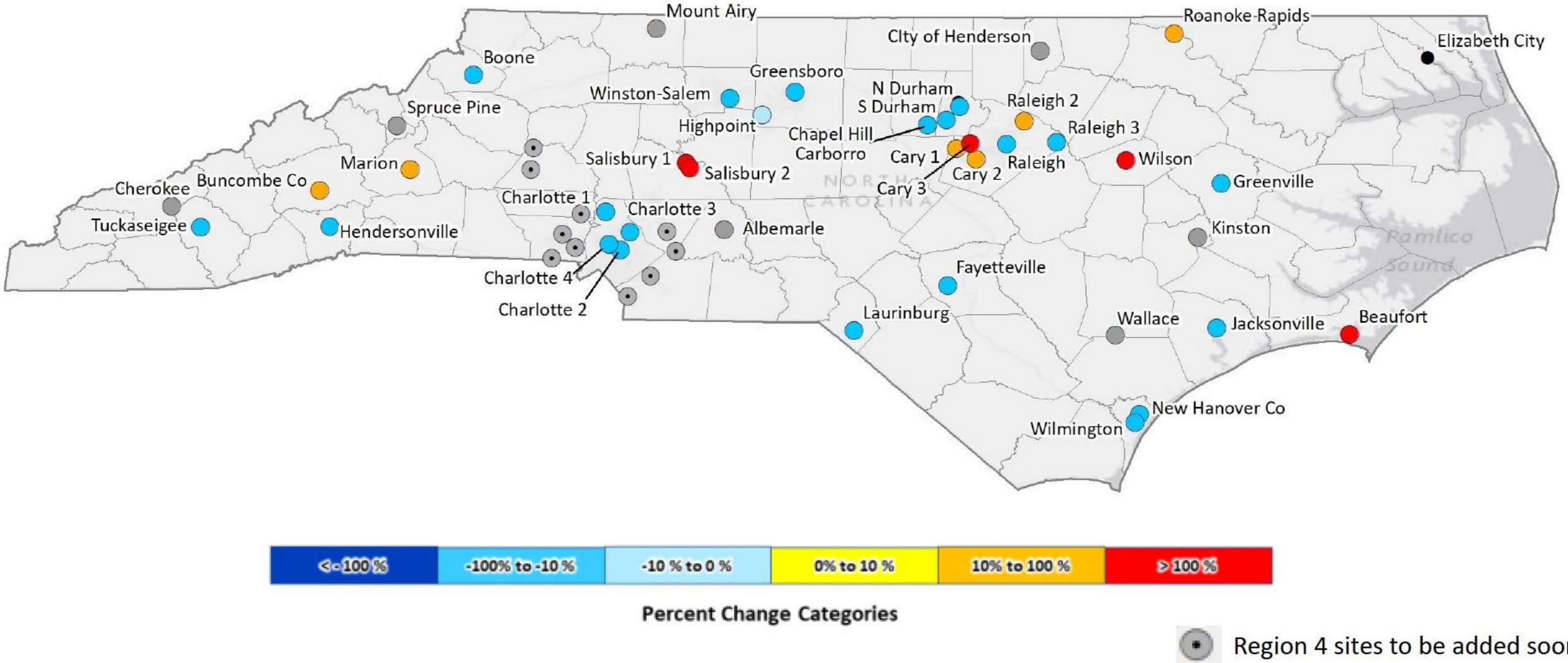
(Updated Noon Each Wednesday)

This Week: 28.6 Million (from 19.3)



# SARS-CoV-2 Wastewater Percent Change

**NC Sites** (32/39 sites current as of 2/8): **21/32 sites decreasing**




Region 4 sites to be added soon!

# National Wastewater Surveillance System (NWSS)

## A new public health tool to understand COVID-19's spread in a community

Español (Spanish) | Print

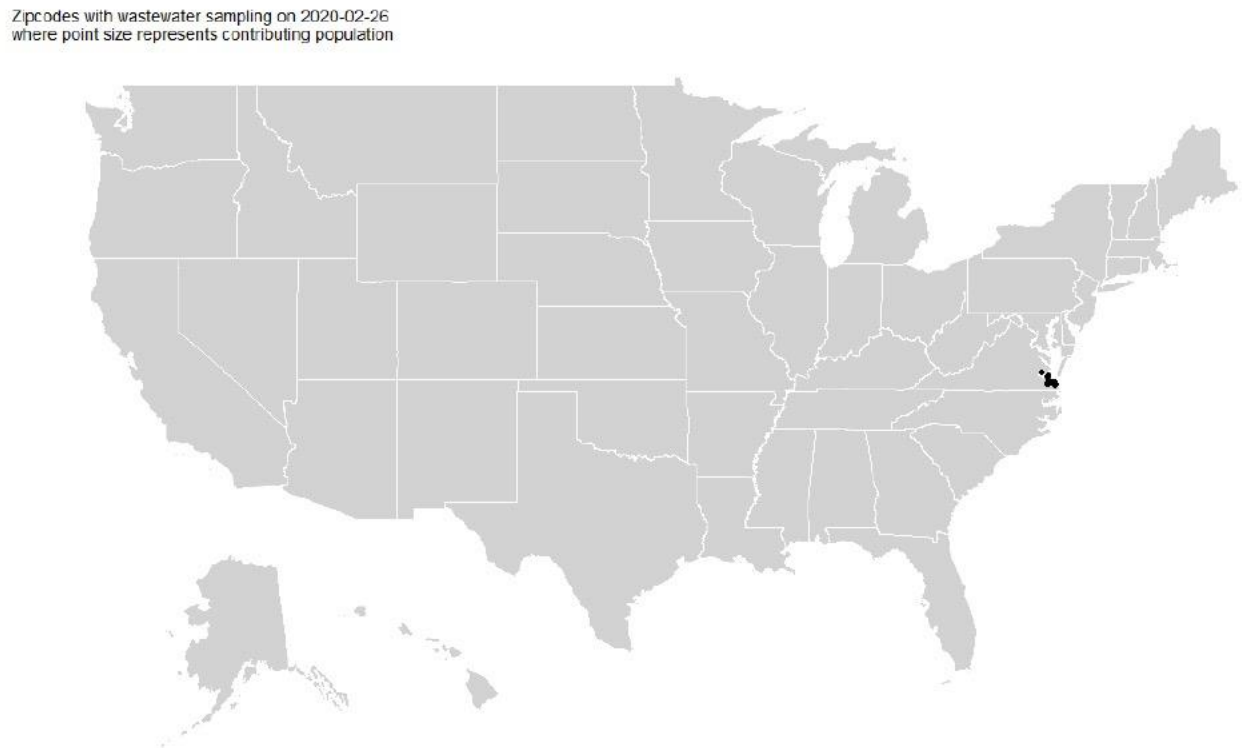
In response to the COVID-19 pandemic, CDC launched the National Wastewater Surveillance System (NWSS) in September 2020. CDC developed NWSS to coordinate and build the nation's capacity to track the presence of SARS-CoV-2, the virus that causes COVID-19, in wastewater samples collected across the country.

CDC's NWSS works with health departments to track SARS-CoV-2 levels in wastewater so communities can act quickly to prevent the spread of COVID-19. NWSS is transforming independent local efforts into a robust, sustainable national surveillance system.

### On This Page

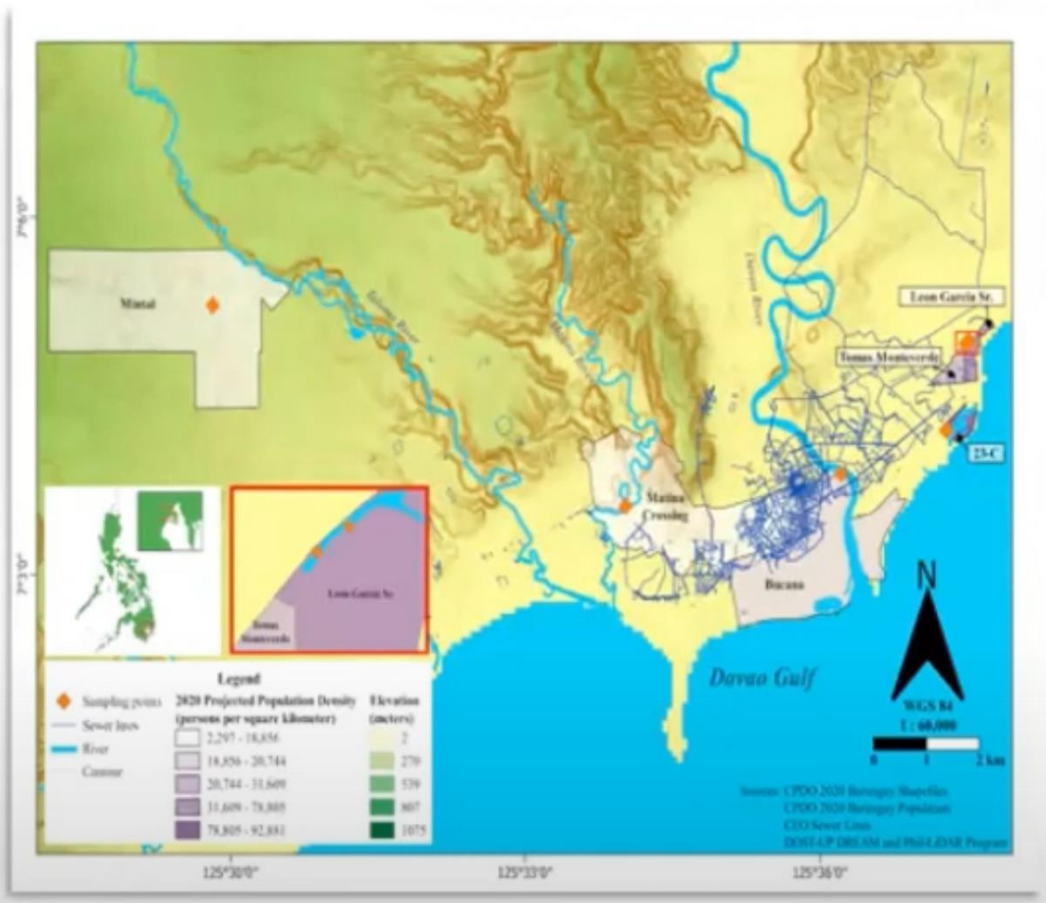
# CDC's National Wastewater Surveillance System Expanding Coverage

- Began with 8 reporting jurisdictions, now 48 NWSS reporting jurisdictions with 1,149 wastewater sampling sites
- Samples Submitted: 75,344 jurisdiction samples, 84,550 total samples (including contract samples)
- Median time from test to submit date July 2021-July 2022 is 3 days
- 130,000,000 of the US population covered.
- **Biobot contract will continue until July 2023!**



# WBE in the Philippines

## Methodology:



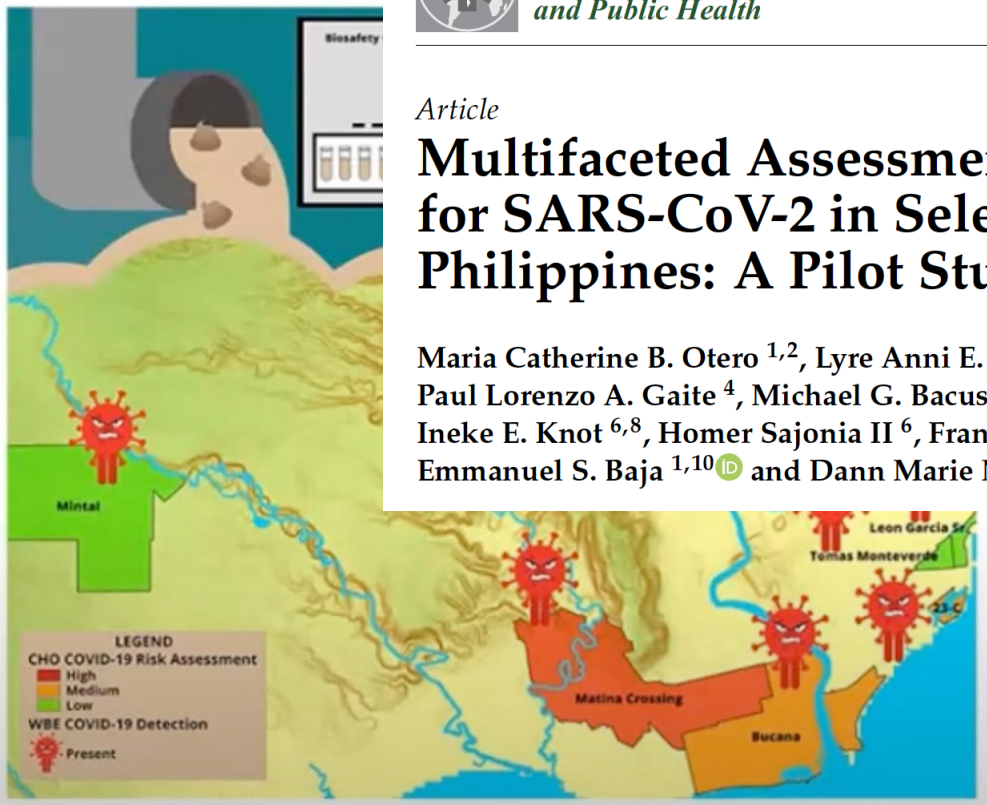

Weekly sampling (Nov – Dec 2020)
Barangay Risk Categories (CHO): Low, Moderate, High


SARS-CoV-2 RNA Detection

Whole-genome Sequencing (WGS)

# WBE in the Philippines

**Results:**




International Journal of *Environmental Research and Public Health*

MDPI

*Article*

## Multifaceted Assessment of Wastewater-Based Epidemiology for SARS-CoV-2 in Selected Urban Communities in Davao City, Philippines: A Pilot Study

Maria Catherine B. Otero [1,2], Lyre Anni E. Murao [3,4], Mary Antoinette G. Limen [5], Daniel Rev A. Caalim [3], Paul Lorenzo A. Gaite [4], Michael G. Bacus [4], Joan T. Acaso [3,4], Refeim M. Miguel [3], Kahlil Corazo [6,7], Ineke E. Knot [6,8], Homer Sajonia II [6], Francis L. de los Reyes III [9], Caroline Marie B. Jaraula [5], Emmanuel S. Baja [1,10] and Dann Marie N. Del Mundo [11,*]

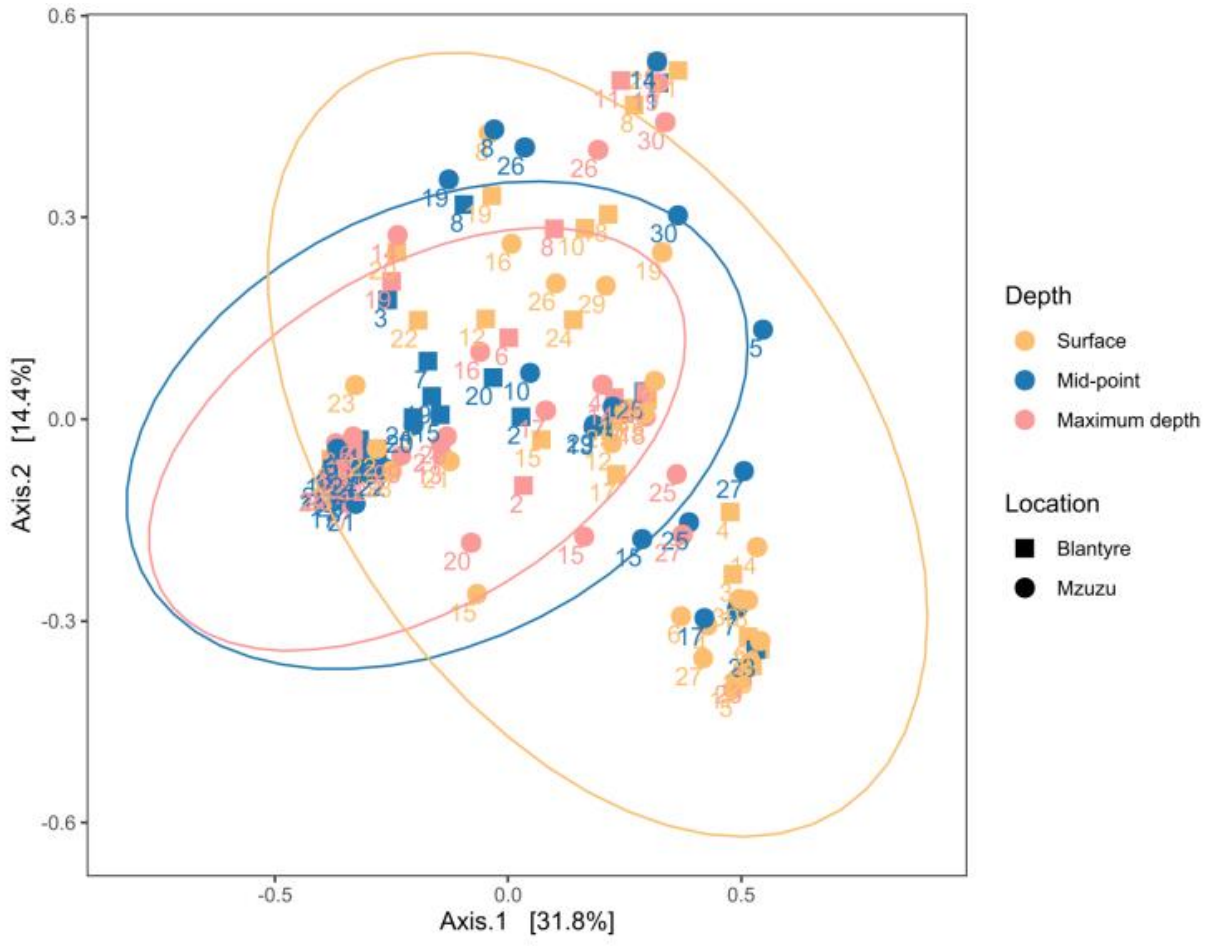
urveillance in
**firmed** the
viously reported
**identifying**
**yet registered in**
**llance**

have come from **pre-symptomatic** or **asymptomatic cases**, or **symptomatic** individuals who **did not self-report** to their local health monitoring unit

nomic surveillance
**arly detection of mutations** using **lesser resources**, given that **pools of individuals** are represented in every wastewater sample

# Future of WBE?

Wastewater-based Epidemiology (Centralized WWTPs) to Waste-Based Epidemiology (Non-Sewered Systems)



# Future of WB - Global cooperation and collaboration

- Sharing of methods
- Research Collaboratory Networks
- Funding


Welcome to the NSF Research Coordination Network (RCN) on Wastewater Surveillance for SARS-CoV-2 and Emerging Public Health Threats! This RCN aims to increase connections and collaborations across wastewater surveillance research programs in order to maximize research success and output. All activities are presented virtually and are freely accessible to the research community. Explore the menus on the left to learn more about our past and upcoming events and resources.

| | |
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