

Wastewater-based Disease Surveillance For Public Health Action

Guy Palmer, Committee Chair

Stephanie Johnson, Study Director

Statement of Task

- Describe wastewater-based disease surveillance and how it differs from other disease surveillance.
- Review how wastewater surveillance has been useful in understanding COVID-19 in communities and informing public health decisions.
- Examine the potential value of wastewater-based disease surveillance for understanding and preventing disease and illness beyond COVID-19 and factors that may limit its application in the U.S.
- Describe the general characteristics of a robust, integrated approach for national use of wastewater-based disease surveillance.
- Discuss broad approaches to increase the public health impact of wastewater surveillance in the U.S and the most effective strategies for federal, state, and local coordination.

Study Process: Phase 1

- 2 hybrid information-gathering meetings, 9 virtual meetings over 6 months
- Peer-reviewed consensus report
 - Publicly available 11 AM January 19th
- Phase 2 to begin ~Feb. 2023
 - Define specific characteristics a robust, integrated wastewater-based infectious disease surveillance program and discuss technical constraints and opportunities associated with wastewater sampling, testing, and data analysis
 - Identify significant technical limitations that could impact the feasibility of using wastewater surveillance as a platform for generating data for indicators of public health status and risk.
 - Describe research, development, and information sharing needs.

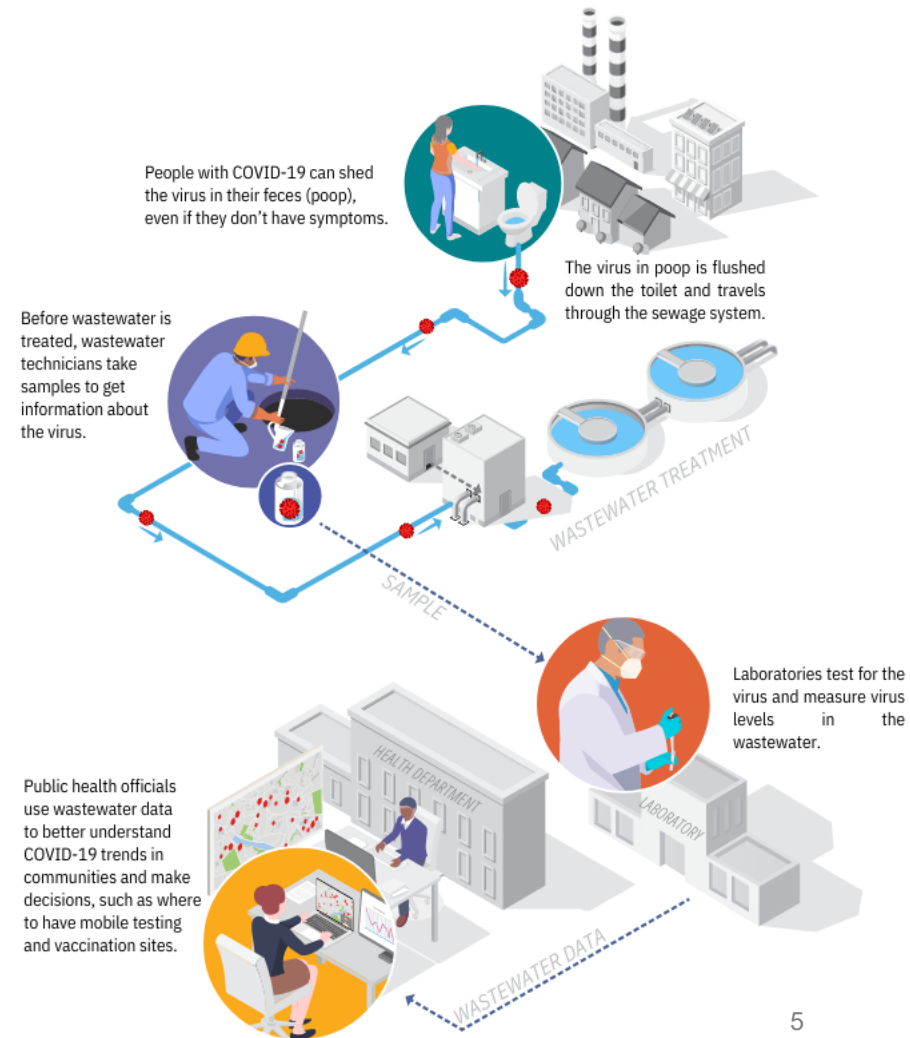
Committee Membership

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**Attending briefing*

What is Wastewater Surveillance?

- Collect samples of untreated municipal wastewater
- Analyze for biomarkers of infection shed by infected persons
- Provides aggregate data from community sewershed
- 84% of U.S. households connected to a wastewater treatment plant
- Used in global polio eradication efforts

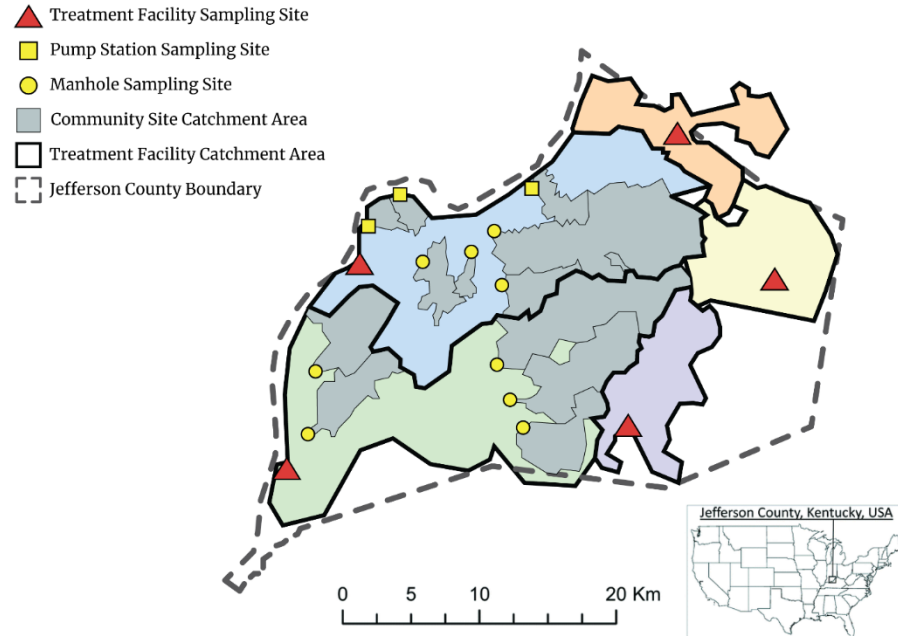


Diversity of Community Sewersheds

- Wastewater plants range in size from hundreds to millions served
- Sewershed scale influenced by factors including population size, density, geopolitical boundaries, topography
- May be impacted by transient populations
- Spatial detail and precision varies dramatically across sites

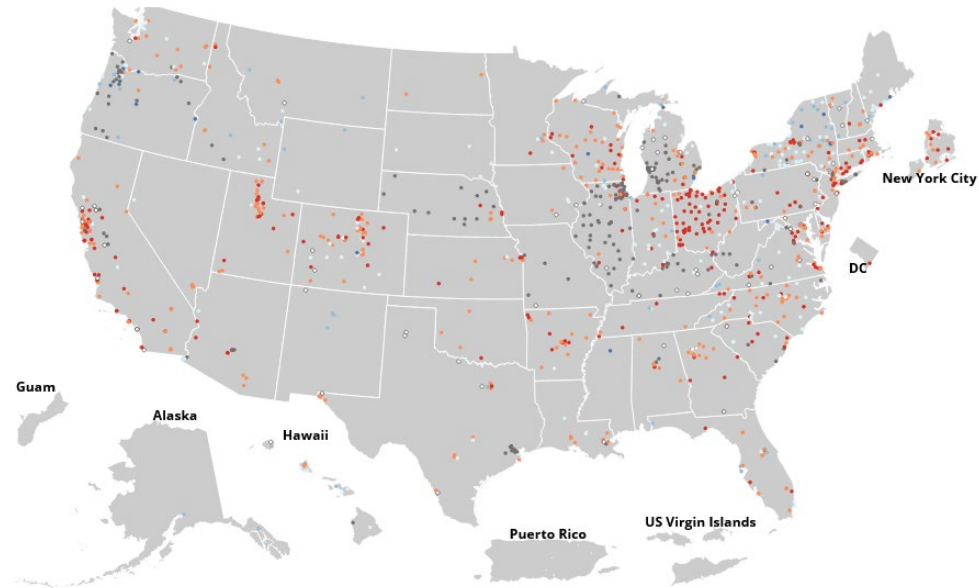


Photo by brewbooks, Flickr



National Wastewater Surveillance System (NWSS)

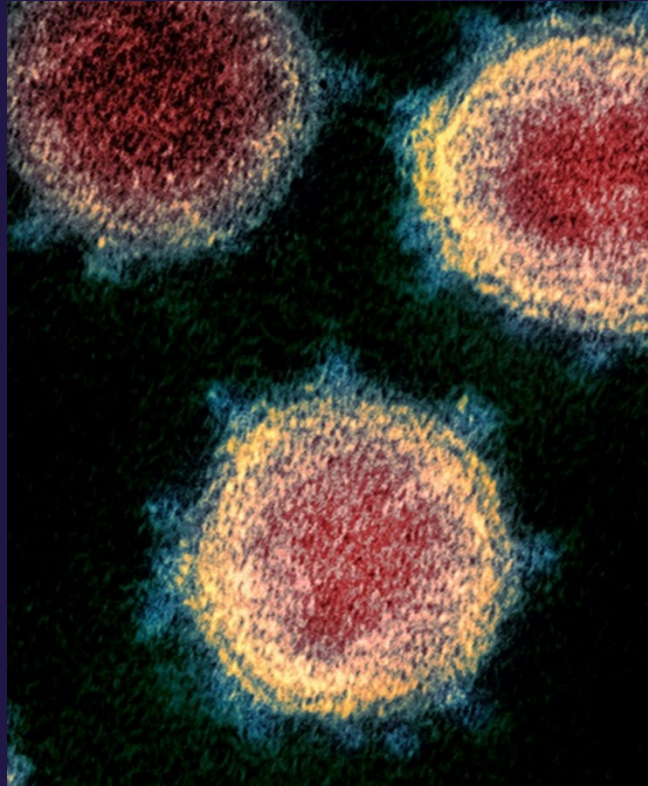
- CDC piloted in September 2020 in 8 states
- As of Oct. 2022, >1250 sampling sites, covering >133 million people
- CDC and federal govt. provides:
 - Funding (FY22 supported 42 states, 5 cities, and 10 tribes)
 - Data aggregation
 - Coordination/collaboration (Communities of Practice; Centers of Excellence)



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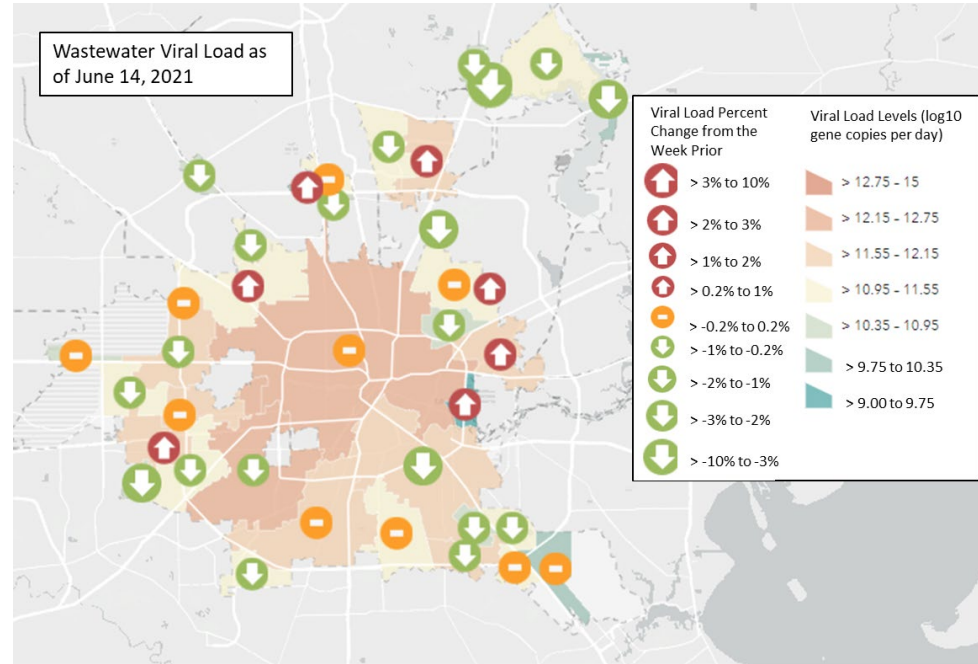
○ New site ● 0% to 19% ● 20% to 39% ● 40% to 59% ● 60% to 79% ● 80% to 100% ● No recent data

Wastewater Surveillance for COVID-19



Value of WWS Data for Understanding COVID-19 in Communities

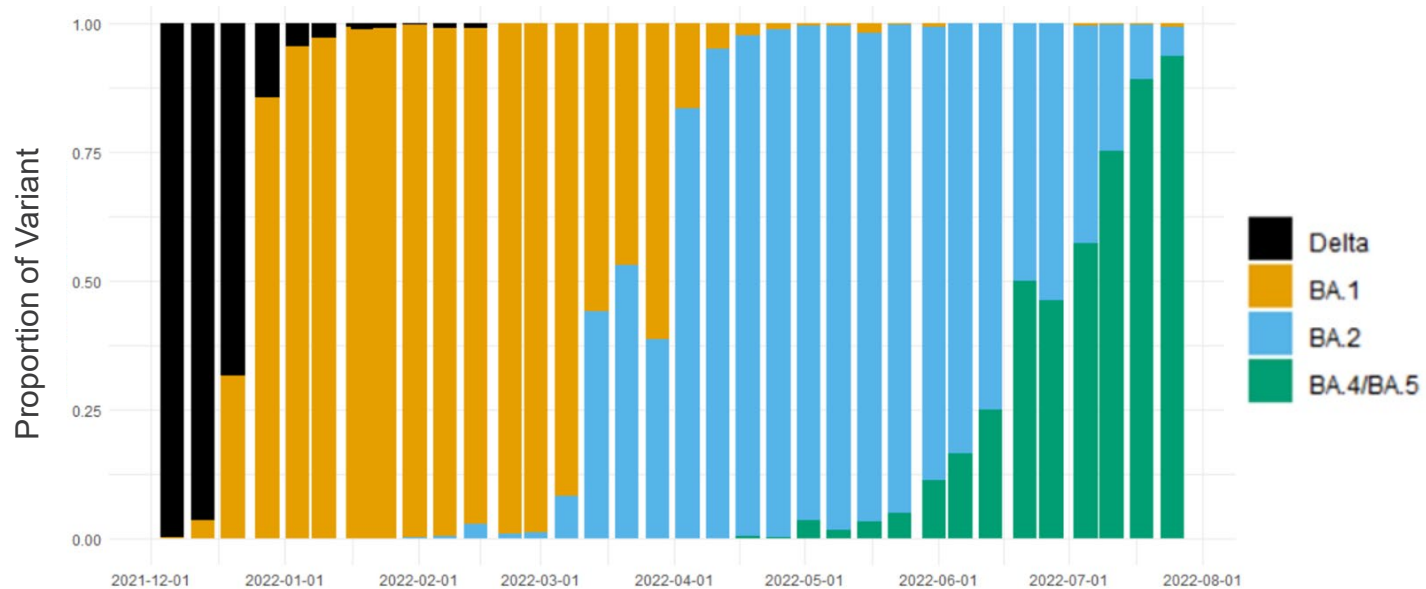
- Useful to assess trends in COVID-19 prevalence
 - Unbiased
 - Increasingly important with more at-home testing
 - Can identify spatial & temporal differences
- Data consistently lead hospitalization data



Monitoring at 39 WWTPs in the City of Houston, TX

Value for Understanding COVID-19 in Communities: Emergence and Spread of SARS-CoV2 Variants

Effective strategy to monitor variants among a large population

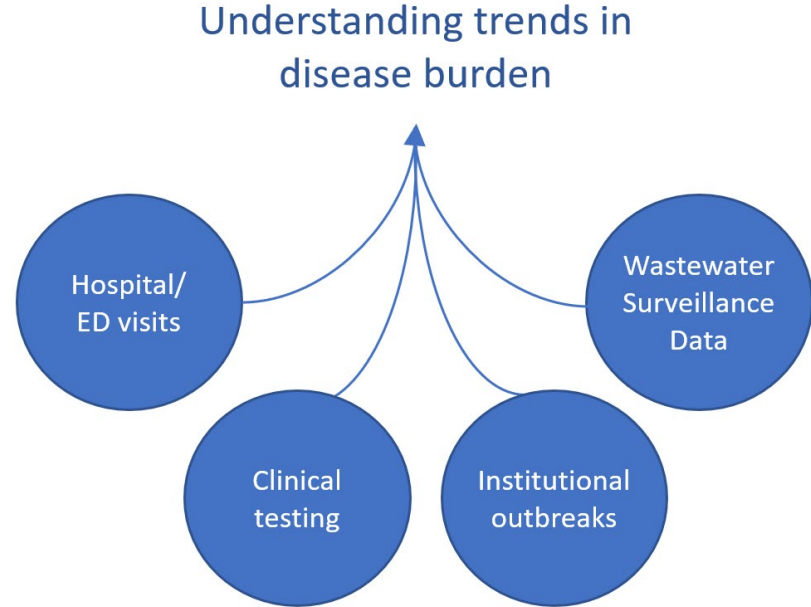


Source: Hampton Roads Sanitation District

Informing Public Health Actions

Wastewater surveillance data particularly valuable for:

1. Identifying and confirming trends through comparison with other data,



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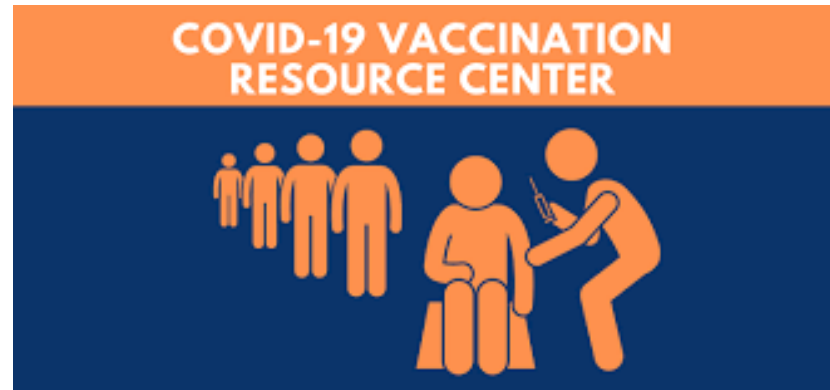
1. Identifying and confirming trends through comparison with other data,
2. Informing masking, social distancing, and stay-at-home policies,



Informing Public Health Actions

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1. Identifying and confirming trends through comparison with other data,
2. Informing masking, social distancing, and stay-at-home policies,
3. Informing public health resource allocations,



Informing Public Health Actions

Wastewater surveillance data particularly valuable for:

1. Identifying and confirming trends through comparison with other data,
2. Informing masking, social distancing, and stay-at-home policies,
3. Informing public health resource allocations, and
4. Informing clinical resource allocations (e.g., beds, staffing).



Wastewater Surveillance for COVID-19

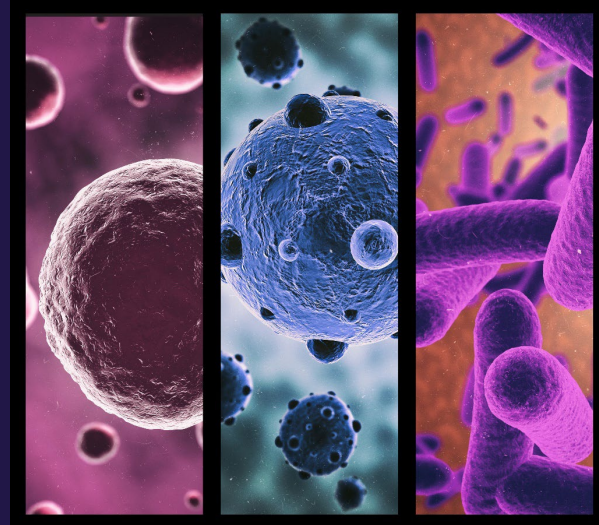
NWSS worthy of further development and continued investment

With rapid innovation and implementation, challenge now to:

- unify sampling design, analytical methods, data interpretation
- create representative national system
- maintain innovation

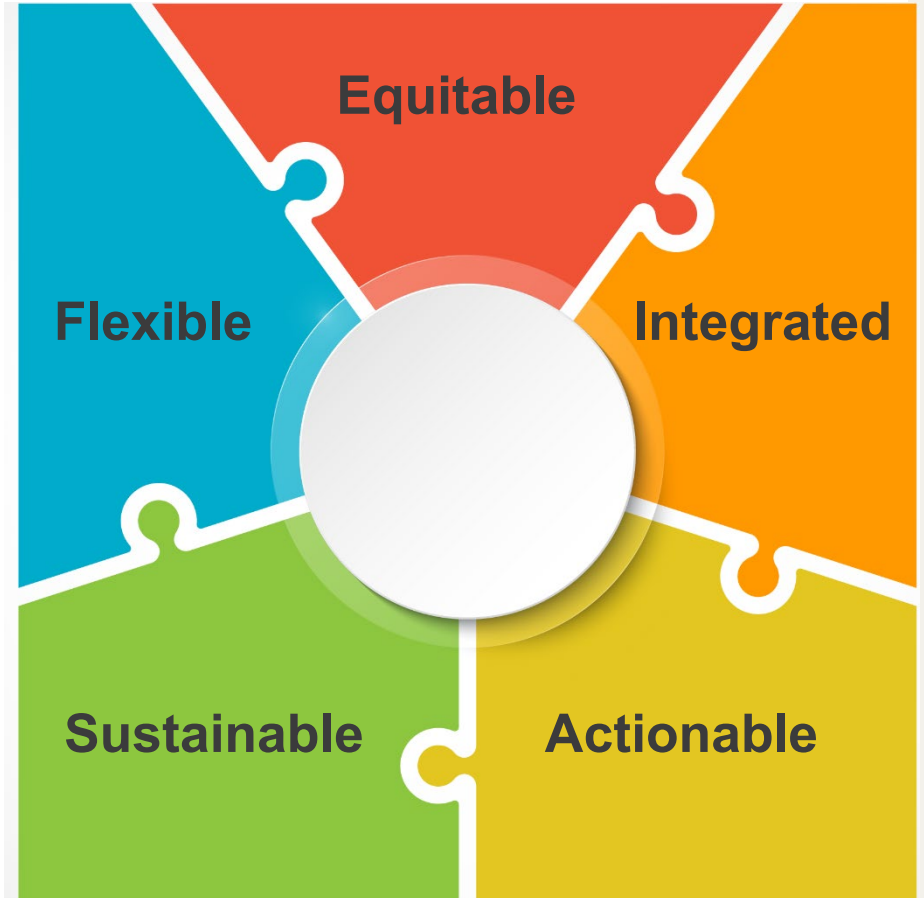


Vision for a National Wastewater Surveillance System



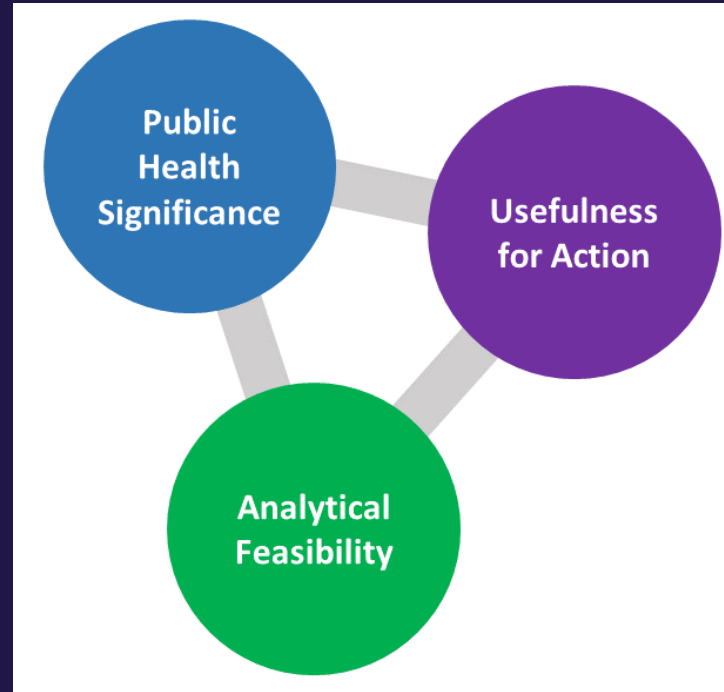
Vision for a National System: Key Characteristics

Community-based wastewater surveillance will continue to be a valuable part of managing infectious disease outbreaks



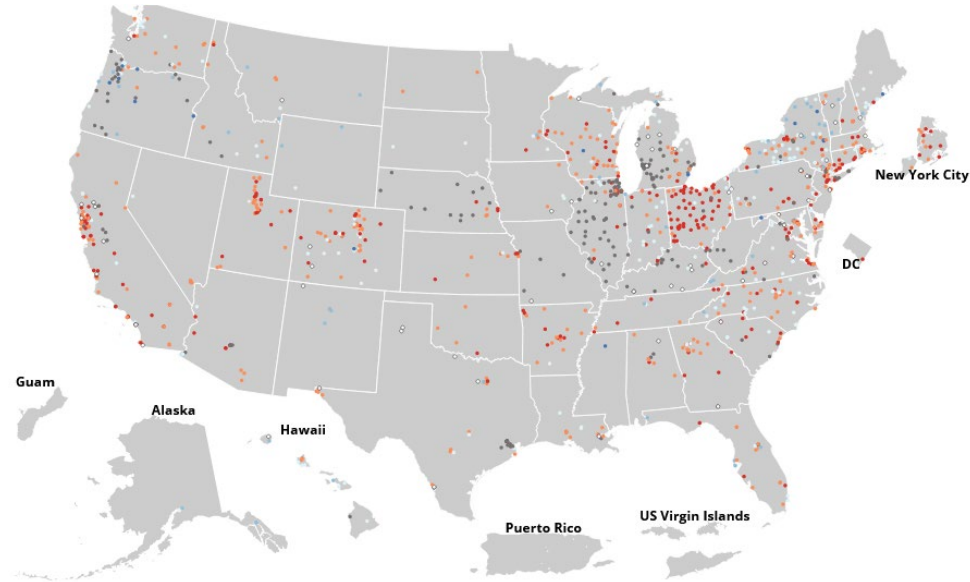
Framework for Evaluating Future Targets

(beyond ongoing COVID-19 surveillance)



Temporal and Spatial Resolution

- Current system based on willingness to participate
- Current distribution not fully representative, equitable, optimally actionable; may not be sustainable
- NWSS should be intentionally designed spatially & temporally based on rigorous analysis of data for priority pathogens



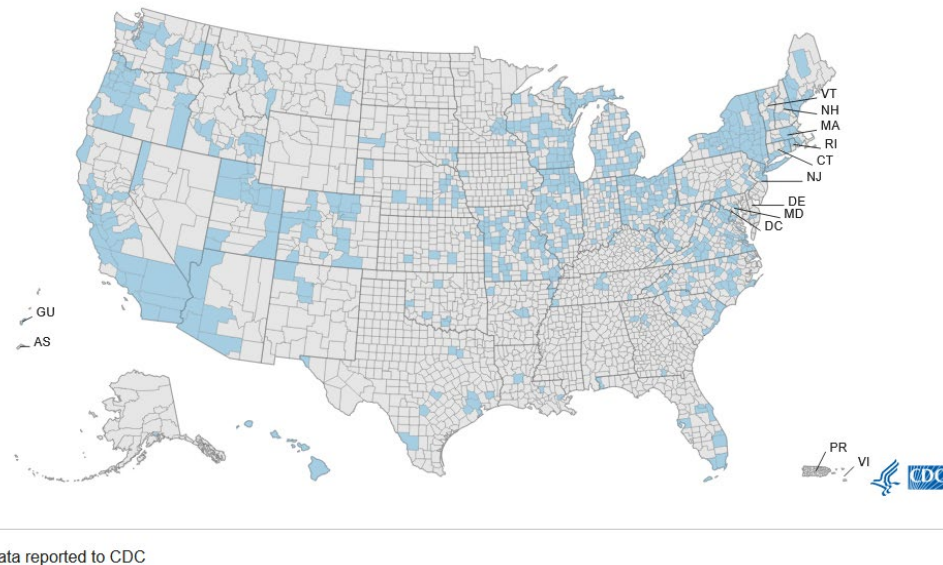
Source: CDC

Improving the Distribution of NWSS Benefits

Based on intentional design CDC should:

1. Create a comprehensive outreach program to states/localities not currently participating
2. Reduce financial and capacity barriers
3. Assess capacity to extrapolate data to areas without wastewater surveillance

Jurisdictions with data reported to CDC



Source: CDC

Sentinel sites

- Intentionally selected sites would provide important, distinct benefits in a national surveillance network
- Allow early detection of emerging pathogens at points of entry
- Could include:
 - Major international airports
 - Zoos and wildlife parks
 - International athletic events

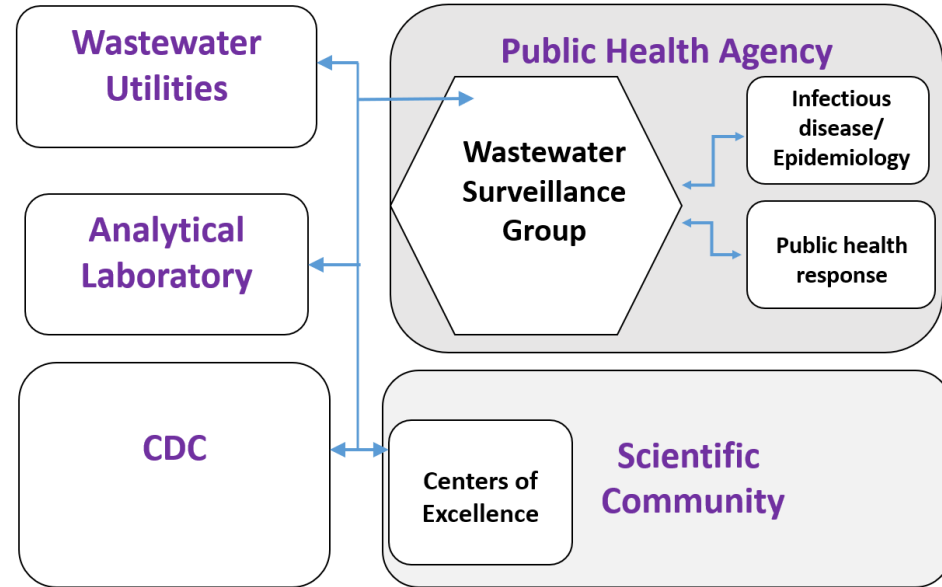


Strategies for Achieving the Vision



Strategies for Achieving the Vision

- CDC should develop an open and transparent process for prioritizing targets
- Close coordination among public health agencies, analytical labs, and utilities is essential
- Scientific community essential to drive innovation
- Effectiveness of NWSS will depend on predictable, sustained federal investments



Addressing Privacy Concerns

CDC should:

- Convene an ethics advisory committee, modeled after data use committees
- Clearly communicate how data are used with public
- Maintain strong firewall that precludes use by law enforcement
- Revisit data sharing policies as technology evolves



Summary

- Wastewater surveillance has proven to be a valuable component of the COVID-19 pandemic response with increasing importance to understand trends and variants
- Looking forward, a national wastewater surveillance system should be equitable, sustainable, integrated, actionable, and flexible.
- CDC should develop a transparent process for prioritizing new targets and work to address privacy concerns
- Predictable and sustained federal funding and coordination/collaboration among many partners will be critical to the effectiveness



Next Steps

- Full report at <http://www.nap.edu/>
- Webinar posted online in ~1 week
- Phase 2 to start in early 2023, due mid-2024

