The Future of NWSS

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National Wastewater Surveillance System
Waterborne Disease Prevention Branch
Division of Foodborne, Waterborne and Environmental Diseases
Old NWSS
Looking back and improving
NWSS Implementation

Laboratory Wastewater Analysis Sars-Cov

CDC Funds Jurisdictions to Support Wastewater Surveillance

- 46 States
- 2 Territories
- 5 Cities
- 2 CoEs
NWSS Growth

- >152,000 unique wastewater samples
- >1400 sites in 50 states, 3 territories, and 7 tribal communities
- Representing >138M people
NWSS Centers of Excellence
The National Wasteawater Surveillance System leads and participates in 3 communities of practice.

Other communities supporting NWSS include the NWSS Data Analysis Group, Implementation Cohorts, DCIPHER workgroups, and more to come!

1. **Health Departments**
   Hosted by CDC, 200+ participants, 56 jurisdictions, Provides CDC updates, peer-to-peer sharing, coordination

2. **Laboratories**
   Hosted by APHL, 100+ participants, 39 states, 65+ labs represented. Provides best practices, corporate pricing, and workflow pilot project

3. **Utilities**
   Hosted by WEF. 230+ members, 40+ jurisdictions. Provides information, discussion, and support
DCIPHER dashboard | One-stop shop for implementers

Current Percent Total Change (Flow-Population Normalization) Over 15 Days

<table>
<thead>
<tr>
<th>Metric</th>
<th>What does this show us?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentiles</td>
<td>Relative levels of virus present in a community over time</td>
</tr>
<tr>
<td>Percent Change</td>
<td>Magnitude and direction of virus levels in a community</td>
</tr>
<tr>
<td>Detection Proportion</td>
<td>How frequently is the virus detected in a community</td>
</tr>
<tr>
<td>Variant Specific Metrics</td>
<td>If a known variant is present, and at what proportion</td>
</tr>
</tbody>
</table>

Also includes-
- Resource library
- Contact list
- Automated QC reports
- Automated utility reports
- Support forum
NWSS Sequence Data Visualization Dashboard

DCIPHER Dashboard Dominant Variant of Concern Map of US

Variant Distribution in Wastewater

Relative lineage abundance by collection week, United States
NWSS Public Dashboards

SARS-CoV-2 Trends

SARS-CoV-2 Variants

Mpx Detections

COVID Data Tracker
Wastewater Surveillance

COVID Data Tracker
Variant Surveillance

Mpx Wastewater Public Data
Wastewater Surveillance for Rapid Response

Nimble structure to **rapidly adapt** to changing public health needs

<table>
<thead>
<tr>
<th>Emergency Response</th>
<th>Emerging Infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local or regional activations in the wake of natural disasters to detect outbreaks</td>
<td>Short-term activations to assess the prevalence and distribution of emerging threats</td>
</tr>
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<table>
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<tr>
<th>Pandemic Preparedness</th>
<th>Bioterrorism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid activation and increased sampling frequency to detect pandemic spread into communities to target mitigation efforts</td>
<td>Rapid local or regional activation with increased sampling frequency to detect and track bioterrorism threats</td>
</tr>
</tbody>
</table>
What’s coming down the pipe?

More than COVID
Phased Target Expansion

**Phase 1: Core**

- Regular surveillance for endemic or common diseases, such as flu or antibiotic resistance genes
- Provides regular, consistent, cost-effective surveillance
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**Phase 2: Emergency**
- Rapid response for outbreaks, emergencies, natural disasters
- **Sporadic but expected** diseases, such as shigellosis or polio
- Rapidly deployable portfolio of validated assays
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**Phase 3: Pandemic preparedness**
- Horizon scanning for potential epidemic or pandemic threats
- Evaluation of potential **rare, unexpected** diseases such as Ebola or Mpox
- National Biosecurity Strategy Early Warning
Evaluating a New Wastewater Target

Are there meaningful public health actions at the community level?
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   Fecal shedding prevalence, magnitude, duration, and infectivity?
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Can clinical assays be adapted for wastewater?
  Can virus be recovered and quantified reliably?
  Are other, non-specific targets detected (false positives)?
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What is the geographic distribution of cases?
  Are there enough cases in a sewershed to be detectable?
  What is the case ascertainment rate and timing?
NWSS Panel for Core Targets

- Normalization and Process Controls
  - Pepper Mild Mottle Virus
  - Crassphage
  - Bovine Coronavirus
- Antibiotic resistance genes
  - Carbapenemases
  - ESBLs
  - Colistin resistance
  - Vancomycin resistance
- Pathogen targets
  - SARS-CoV-2
  - Influenza A and B
  - Respiratory Syncytial Virus
  - Adenovirus 40/41
  - Shiga-toxin-producing *E. coli*
  - *Campylobacter*
  - Norovirus
  - *Candida auris*
  - Mpox (non-Variola Orthopox)

**Timeline**
- Piloted in NWSS Centers of Excellence in early 2023
- Anticipated system-wide rollout August 2023
- Data integrated into DCIPHER for real-time access
- Develop NWSS dashboard for public data sharing
- Reviewed annually by CDC NWSS Advisory Committee
Transition to a single test type

The NWSS testing panel must be
Quantitative
Highly parallel or multiplexed
Readily adapted
Robust to inhibitors present in wastewater
Low limits of detection

Digital PCR satisfies all of these requirements and is already in use by many NWSS laboratories
Developing assays that are compatible with both BioRad and Qiagen dPCR systems
Challenges for NWSS development and sustainability

- Extending coverage, 20% unsewered
- Improved metrics including estimating disease prevalence
- Optimal geographic and temporal sampling frame for multiple targets
- Improved methods, streamlined workflow
- Impact of vaccination and variants
- Improved data submission, dissemination, messaging
- Ethical transparency, especially around sample archiving
Thank you.

Visit NWSS webpage for more.
https://www.cdc.gov/nwss/wastewater-surveillance/

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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