Wastewater Testing to Track and Respond to COVID-19

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NGA Center for Best Practices

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Today’s Speakers

**Erica Gaddis**  
Director, Division of Water Quality, Utah Department of Environmental Quality

**Dr. Nathan LaCross**  
Assessment Manager and Epidemiologist, Environmental Epidemiology Program, Utah Department of Health
Today’s Speakers

Nicole Rowan
Clean Water Program Manager, Colorado Department of Public Health and Environment

Dr. Brian Erly
Medical Epidemiologist, Colorado Department of Public Health and Environment

Suzanne E. Dorsey, PhD
Assistant Secretary, Maryland Department of the Environment
Wastewater Surveillance for Public Health

After wastewater is processed, the virus is no longer detected as facilities remove all pathogens, including viruses.

Wastewater samples are collected at the influent to the treatment plant and is then tested for the virus.
Utah’s Approach

Goal: Support Utah’s response to COVID-19 by tracking trends in wastewater virus across the state

Sample locations
• 30 large treatment plants (>10,000 people)
• 14 rural treatment plants
• ~85% of Utah’s population

Frequency
• Weekly samples July – December
• Surge sampling available and used as needed

Costs
• Total estimated cost over 6 months: $475,000 (sample collection and transport costs are significant)
• Funding source: CARES Act through 2020
Analytical Methods

- RT-qPCR method
- Consistency in sample preparation is critical
- Results are expressed as gene copies per mL and converted to gene copies/100k pe
- Utah standardizes data to account for seasonal infiltration and industrial flows
Data Dashboard

Salt Lake City WRF
Estimated population served: 209,645

Sewage monitoring
Non-detections plotted at 1. MGU = million gene copies.

Daily new case rate
Sewers with 1-5 cases plotted at rate of 2.

wastewatervirus.utah.gov
Roles and responsibilities

Wastewater Treatment Facilities
- Sample collection
- Chain of custody

University Laboratories
- Sample analysis
- Analytical method development

Utah Division of Water Quality
- Project coordination
- Data management
- Sample transport

Utah Department of Health
- Data interpretation
- Communication to local health and health response teams
University Campus Sampling
Sub-sewershed monitoring
Limitations & Interpretation

- Often variability in the data, from many potential sources:
  - **Environmental**: differences in sewer system infrastructure; infiltration of runoff and groundwater; wastewater transit time; temperature; other constituents of the wastewater stream; industrial sources
  - **Biological**: which people/populations tend to shed virus; how much virus is shed; how long virus is shed

- Data are not easily compared between facilities
  - More useful to look at data within a facility for changes over time

- As with most surveillance data, wastewater data is best interpreted in conjunction with other available information
Early detection of rising infection rates

Provo City WWTP
Estimated population served: 102,624
Monitoring of areas with lower testing
Confirmation of declining case rates

Salt Lake City WRF
Estimated population served: 209,645

Salt Lake County

Wastewater Surveillance
MOG = millions of gene copies. Note that the y-axis scale will vary based on the selected sewershed.

Daily Incidence per 100,000
Note that the y-axis scale will vary based on the selected sewershed.
Capturing transient events

Travel & tourism, large gatherings, etc.

Price River WID
Estimated population served: 17,312
Other Uses

- Contact tracing prioritization
- Identification of high infection rate areas for intensive clinical sampling
- Targeting of outreach, education, and other interventions
Lessons

• A pilot study demonstrates utility of the tool and work out logistical and method issues at relatively low cost.

• Collaboration across many fields and agencies is critical. The value of effective communication, coordination, and logistical support cannot be overstated.

• We still have much to learn, but wastewater surveillance can already provide useful information for public health efforts.

• Sampling and analytical methods should be selected with public health uses in mind.

• Be adaptable and prepared for rapidly changing science and best practices.
Thank you!

Public dashboard: wastewatervirus.utah.gov

Questions?

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Nathan LaCross
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Questions for Speakers?

- Use the ‘Q&A’ or ‘Chat’ icons on the control panel at the bottom of your screen to submit your questions
- We suggest including your title and affiliation
Colorado’s SARS-CoV-2 Wastewater Monitoring COllaborative
PRESENTERS

Nicole Rowan, Clean Water Program Manager, CDPHE

Brian Erly, Medical Epidemiologist, CDPHE
Resources

University Labs
Lab analysis

CDPHE and Gov. Office
Data analysis and financing

Wastewater Utilities
Sample Collection

60-65% of Colorado Population
WASTEWATER SAMPLING

- Samples collected at wastewater facility
- 2x per week at entry
- Part of routine sampling
Sewershed testing

- Everybody stools eventually
- Efficient pooled testing
- Quantitative signal
  - Interpretation more complex
- Far-reaching response
  - Pooled sample from many thousands of people
  - Validates other surveillance data
Other wastewater sampling in CO

- Institutions of Higher Education
  - Residence-hall level sampling

- Individual Counties
  - Sampling and rapid individual response

- Department of Corrections
  - Facility-level testing

- CDC NWSS
How is the state using the data?

- ALERT to regions of concern
- INFORM about limitations in other surveillance systems
- CONFIRM trends seen elsewhere

All data is interpreted in context of other indicators and what is going on in the state
## Long-term vision

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Sewer Sentinel Initiative

Measuring the quantity of SARS-COV-2 virus in wastewater to **monitor** infection levels in defined communities.

Use pooled data to measure virus load and rapidly **respond** to outbreaks.
Phase I Lessons Learned

- Proof of concept
  - 5 locations
  - qPCR -- virus load
- Cannot determine # of infected individuals
- Best where clinical data aligns
- Pooled monitoring is cost-effective
- Provides actionable information

Data provided by MDH epidemiologists
Phase II

- **Find and Respond to Outbreaks**
- Downscale
- Congregate housing
- Vulnerable populations
- Weekly testing
Sewer Sentinel Initiative Phase II

Congregate Housing → Composite sampling → Laboratory

Action

Maryland Department of Health
Phase 2 Locations & Costs:

Non-transient residential:
- Incarceration facilities
- Juvenile and pre-release systems
- Baltimore Housing Authority locations
- Subsidized housing
  - Elderly

- **Costs: $1 million**
  - Weekly testing
  - 50 sites

- **Response:**
  - Testing/Tracing
  - Increased Cleaning
  - Behavior – Mask, Distance, Hand Washing
COVID Sewer Sentinel Initiative Phase 1 → 2

**Monitoring**
- Larger Scale: Community/neighborhood level
- Changes in virus load
- Response:
  - Testing
  - Shutdown
- Cost
  - $50,000 for 90 days
- Federal Funding
- Requires WWTP cooperation

**Outbreak**
- Smaller Scale: Buildings/Campus
  - Dorms
  - Subsidized Congregate Housing
    - Seniors
    - Incarceration facilities
- Response:
  - Clinical Testing
  - Contract Tracing
  - Behavior
  - Cleaning
- Cost:
  - $1 million for 6 months
- Require access and engagement from housing community
Conclusions

Wastewater sampling -- cost-effective tool to detect outbreaks in well defined communities.

Must have engagement and cooperation of health leaders to respond.

Measuring the quantity of SARS-COV-2 virus in wastewater to **monitor** infection levels in defined communities.

Use pooled data to measure virus load and rapidly **respond** to outbreaks.
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Thank You!