

Missouri Wastewater Surveillance for Respiratory Viruses: Expanding Pathogen Monitoring to Enhance Public Health Preparedness



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Program Summary

The Missouri Wastewater Surveillance Program monitors community sewersheds for pathogens and chemicals of public health concern. Initially established to detect SARS-CoV-2, the virus responsible for COVID-19, wastewater-based epidemiology has been instrumental in tracking viral levels and identifying emerging SARS-CoV-2 lineages in Missouri.

Building on this success, the program has expanded to include other respiratory viruses of concern, such as Influenza and Respiratory Syncytial Virus (RSV) and other non-respiratory diseases and chemicals.

Current Sampling Sites and Analyses



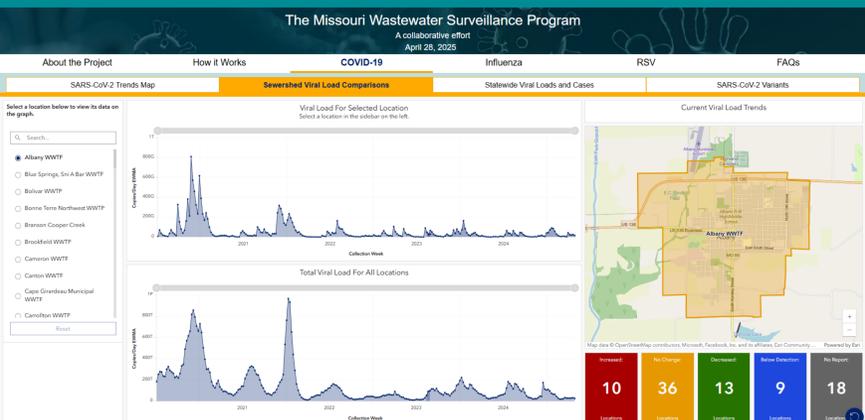
- Influent
- 24 hr composite
- Weekly/bi-weekly

Targets:

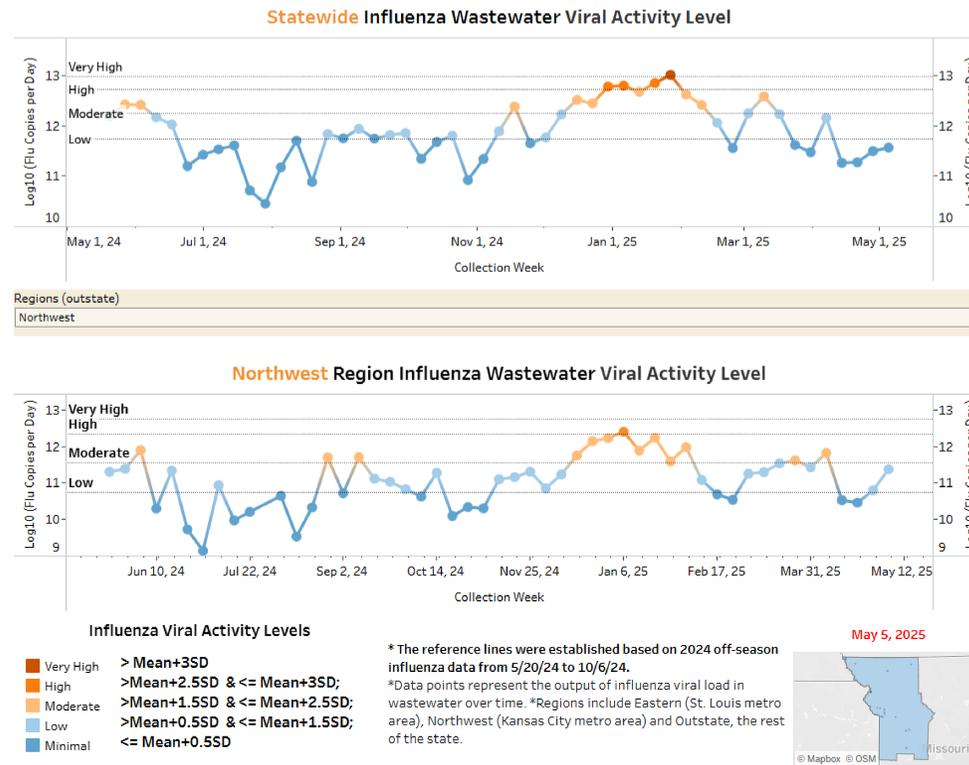
- Respiratory Illnesses
 - SARS-CoV-2
 - Influenza
 - RSV
- Non-respiratory Illnesses
 - C. Auris
 - Mpox
 - Measles
- Drugs
 - Opioids- school testing



Highlight #1: Public Dashboard with COVID-19, Influenza and RSV



Highlight #2: Influenza and RSV Wastewater Viral Activity Levels (WVALs)



Why is the WVAL useful?

• Simple, standardized communication

We developed a classification system (Minimal to Very High) based on the mean and standard deviation of viral load during the off-season. This approach turns raw data into clear, actionable categories for public messaging and decision-making.

• Enables consistent comparison

The thresholds allow us to track trends over time, compare across regions within the state, and meaningfully summarize statewide patterns.

• Early adoption and alignment with national practices

We have been implementing this method since the 2023 flu season. The CDC NWSS later used a similar framework, helping align surveillance efforts across systems.

• Backed by effective visualization

We adapted a control chart format to display wastewater viral activity levels clearly over time. This allows users to quickly spot shifts in trends and interpret data at a glance.

How does it work?

Phase I: Establishment of baselines

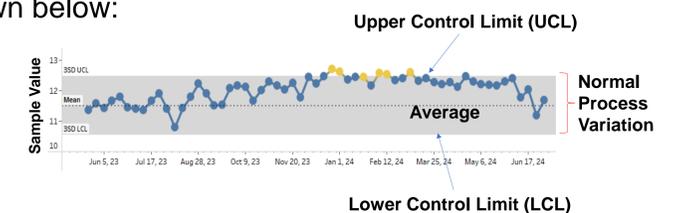
Off-season data were used to establish the baseline for highly seasonal diseases such as influenza and RSV.

- Select the facility that continuously submitted the sample during the off-season without a pause.
- At least 20 weeks' data points from each wastewater facility are needed.
- Testing of baseline data normality within each region and statewide.
- Log-transformation for the baseline dataset.
- Non-detections were replaced with "10" in the log-transformation.
- Calculate the mean and standard deviation for each region and statewide.
- Calculate the thresholds or limits for all five WVALs.

Phase II: Continuously monitoring influenza/RSV viral load (log-transformed) against the established WVAL limits.

Phase III: Visualization on the dashboard

WAVL chart was adapted from a statistical process control chart. An example of a control chart and why it has been used is shown below:



1. By setting WVAL thresholds, it can quickly detect when the number of viral loads in wastewater exceeds the expected variation.
2. Control charts support continuous monitoring of disease trends, which can reveal seasonal patterns or long-term trends.
3. It helps in identifying data points that deviate significantly from the norm, indicating possible data errors or unusual events.
4. It is straightforward to implement and interpret.
5. Most importantly, control charts produce early warning signals of coming increase in human cases, and we will continue this work to make these charts a consistent early warning system.

ACKNOWLEDGEMENT

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