National Wastewater Surveillance System (NWSS)

Public Health Interpretation and Use of Wastewater Surveillance Data

Use this guidance to implement wastewater-based disease surveillance. Wastewater-based disease surveillance is a rapidly developing science, and CDC will continue to update guidance and information as it becomes available.

Overview of wastewater surveillance data interpretation and use

Appropriate public health interpretation of wastewater surveillance data depends on understanding the surveillance sampling strategy and testing limitations, as well as valid data processing and analysis. Wastewater surveillance data are primarily used in three ways:

1. **Monitoring** for presence of infection within a community.
2. **Tracking** trends in infection within a community.
3. **Screening** for infections at a targeted site (e.g., building or facility) to trigger additional individual-based testing and mitigation measures. Review CDC's guidance on targeted wastewater surveillance to use wastewater surveillance data for screening.

Interpretation of wastewater surveillance data

Wastewater surveillance data collected at the municipal level, when analyzed appropriately, can provide information on:

1. Presence of infected individuals contributing to a wastewater system.
2. Infection trends within the community contributing to a wastewater treatment plant (known as a "sewershed"). Sewersheds with largely transient populations, such as areas with high tourism, may provide less stable signals, which should be considered when designing the wastewater surveillance plan for public health action.

Presence

Detection of SARS-CoV-2 in wastewater depends on the sampling design, the sensitivity of the test used, and the amount of SARS-CoV-2 being shed by the community sampled. If SARS-CoV-2 is detected in wastewater, this means that there is at least one individual in the sewershed shedding SARS-CoV-2. Whether individual(s) are infectious or symptomatic cannot be determined from wastewater surveillance data. If SARS-CoV-2 is not detected in wastewater, this could indicate that there is no SARS-CoV-2 in the sampled community or that the concentration of virus in wastewater is below the level the test can detect.

Low virus levels in the wastewater of a community could indicate: 1) a small total number of people are shedding the virus into the sewer system; or 2) the amount of virus being shed per infected or recently infected person is low. The minimum number of individuals shedding SARS-CoV-2 into the system needed to detect a viral RNA signal in wastewater is not known at this time. As more information on fecal shedding titers are collected, it may be possible to determine the number of individuals shedding the virus within a sewershed needed to detect SARS-CoV-2 RNA in wastewater.

Trends

Wastewater trend classification is the statistical analysis of changes in the normalized concentration of SARS-CoV-2 in wastewater (i.e., not by qualitative visual assessment). Trends in these wastewater data can be used to assess COVID-19 trends (reported and unreported) within the community contributing to the sewer system. Trends can be classified into categories based on the duration and direction of change in viral quantities. The frequency of wastewater sampling will dictate the time period for which trends can be assigned.

A benefit of trend analysis is that:

- Data from wastewater treatment plants can be compared, despite differences in population size and wastewater volume.
- Trends in wastewater may be known prior to COVID-19 reported case trends, given that normalized concentration of SARS-CoV-2 in wastewater has been shown to coincide with or lead new reported cases within a sewershed by days.

Using wastewater surveillance to support the COVID-19 response

SARS-CoV-2 wastewater surveillance data can help state, tribal, local, and territorial (STLT) health departments detect, understand, and respond to the COVID-19 pandemic. Wastewater surveillance can provide an early indicator of the presence of, or trends in, COVID-19 cases in a community.

Wastewater surveillance complements existing COVID-19 surveillance systems and should not be interpreted alone to inform public health action. Wastewater surveillance does not provide insights into the social and behavioral factors underlying changes in transmission.

Wastewater surveillance provides:

- A pooled community sample
- Data for communities where timely COVID-19 clinical testing is underutilized or unavailable
- Data at the sewershed level, which often is smaller than a county
- Information on emergence or reemergence of infections within a community prior to case reporting
- Additional information that is not affected by certain limitations of clinical indicators, such as variability in healthcare-seeking behaviors

SARS-CoV-2 wastewater surveillance data can be used to inform clinical testing and community mitigation strategies, such as:

- Increased testing of individuals in the affected community

- Increased public health communication about how individuals can [protect themselves from COVID-19](#) and outreach in the affected community
- Monitoring and impact evaluation of community mitigation strategies

When evaluating wastewater-based signals for changes in SARS-CoV-2 infection levels within a community, consider the following:

- Other epidemiologic knowledge is needed, such as locations of populations at higher risk of COVID-19, to determine where to deploy clinical testing resources in sub-sewershed areas.
- Lack of SARS-CoV-2 detection in wastewater alone should not be used to justify relaxing community mitigation measures.
- Using sampling points upstream from wastewater treatment plants to monitor sub-sewershed infection trends requires additional work to understand the boundaries and unique characteristics of that area before it can be used for wastewater surveillance.

Public communications and data sharing

Sharing surveillance data is a critical public health function. Use of wastewater surveillance data is an evolving science. When interpreting wastewater data and preparing it for public presentation, consider the following:

- Presenting trend classifications, rather than concentration data, allows for comparison across different sewersheds and is a more intuitive interpretation for a wide audience.
- Changes in wastewater concentration data that have not been normalized by flow and population size may not indicate meaningful differences in levels or direction and cannot be compared across wastewater treatment plants.
- Consistent numerical scales on figures allow for appropriate visual interpretation of normalized concentration data.
- Presenting analyzed wastewater data with other COVID-19 case surveillance indicators can provide a more complete picture of disease trends in communities.
- Always note on figures that the amount of virus measured in wastewater is not equivalent to the total number of cases or the amount of increase or decrease in cases in communities.

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