SARS-CoV-2 wastewater monitoring in K-12 schools

CSTE Stories FROM THE Field

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CATEGORY: **Epidemiology and Laboratory Capacity (ELC)**

The Pennsylvania Department of Health's Wastewater Surveillance System implemented a pilot program to examine the utility of performing SARS-CoV-2 wastewater monitoring in K-12 schools. They found that wastewater positivity preceded clinical testing positivity, providing a solution for early warning in this setting, usually one week or more in advance. Wastewater surveillance infrastructure can be deployed to provide advanced warning of pathogen spread in congregate settings.

The "What"

Following an increase of in-school COVID-19 testing fatigue after 3 years of operating during a pandemic, it became clear that schools would benefit from a passive monitoring system for COVID-19 in their community that placed less of an operational burden on faculty, staff, and students. The Pennsylvania Department of Health's (PA DOH) Wastewater Surveillance System, which receives funding through the Epidemiology and Laboratory Capacity for the Prevention and Control of Emerging Infectious Diseases (ELC) cooperative agreement established a pilot program for wastewater monitoring in schools. This program aimed to examine the utility of performing SARS-CoV-2 wastewater monitoring in K-12 schools that are already conducting routine asymptomatic pooled testing, to demonstrate the efficacy of wastewater testing in this setting.

Wastewater autosamplers were installed at three sites on the campus at an independent boarding and day school in Franklin County, Pennsylvania. The school continued weekly clinical asymptomatic pooled polymerase chain reaction (PCR) testing, in addition to as-needed, symptomatic rapid antigen testing of both students and staff.

Wastewater samples were collected three times per week and positive samples were sequenced over the course of 33 weeks. The program also aimed to demonstrate the utility of a K-12 school as a sentinel site in rural areas lacking centralized municipal wastewater for analysis.

The "So What"

The school was provided a weekly dashboard of results in an easily digestible format to allow for non-experts to interpret and operationalize as needed. "I'm really finding this a lot easier to digest than I expected." mentioned a Health & Wellness Director & Testing Supervisor on talking about weekly dashboards.

These data are actionable sooner than clinical data and can **minimize learning disruptions, pre-empt outbreaks, and allow for schools and communities to make educated decisions** on prevention and containment measures.

"I'm really finding this a lot easier to digest than I expected."

Health & Wellness Director & Testing Supervisor

Building-level wastewater positivity preceded clinical pooled testing positivity, providing a solution for early warning in this setting, usually one week or more in advance (Figure 1). Building-level detection was also very sensitive during this program. It was able to alert positive viral concentrations in the water with as little as 1% of the total population on campus shedding the virus and contributing to positivity. In this instance specifically, wastewater positivity signals were used to support a mandatory screen-testing response, which further identified six positive cases out of a population of 600 people on campus. Those six positive cases were quarantined and treated, preventing a larger outbreak.

These data are actionable sooner (increase in diagnostic testing to identify positives quicker, increased social distancing measures to prevent spread) than clinical data and can minimize learning disruptions, pre-empt outbreaks, and allow for schools and communities to make educated decisions on prevention and containment measures. These data can also be used in tandem with clinical testing, as was done in this case, to confirm spikes in clinical cases of COVID-19 on campus. Results also allowed for a relative understanding of where on campus an outbreak may be present.

The school increased student and staff clinical testing based on program data presented to the medical center director after the first outbreak and continued to do so throughout the year. A school Testing Supervisor said, "We used the wastewater and clinical data to show why testing was necessary this week; there was pushback for testing despite the 8 positive kids. I said, 'enough is enough, we are testing this week.'" The Supervisor and their team's confidence in the data resulted in them being able to ramp up pooled testing participation from 25% to close to 100%.

From an epidemiology perspective, several times these data also provided insight of emerging/rare viral strains in the state through effective sequencing of positive samples.

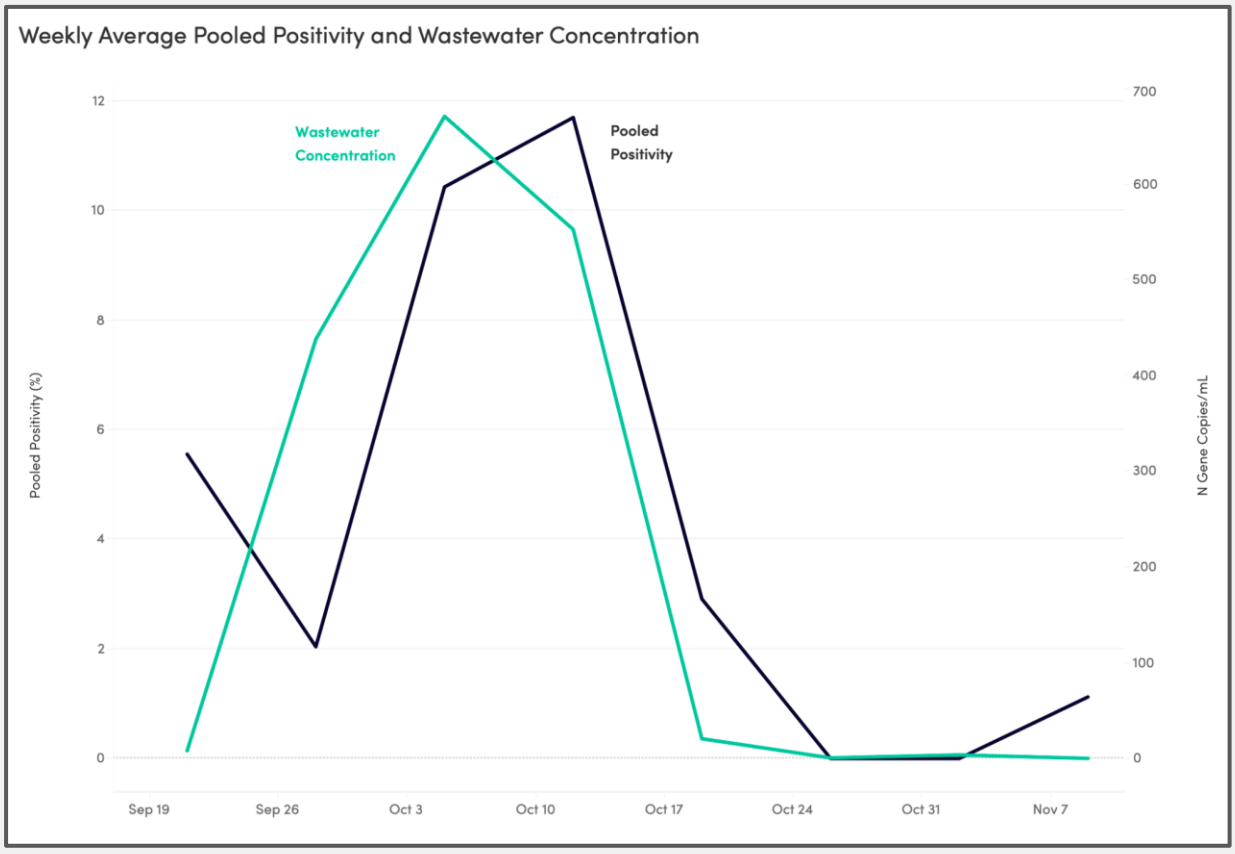

Figure 1. Weekly average SARS-CoV-2 wastewater concentration versus pooled positivity, September – November 2022.

The "Now What"

Building effective facility-level passive pathogen surveillance infrastructure beyond COVID-19 is contingent on sustainable, scalable, pathogen-agnostic funding. Wastewater surveillance infrastructure can be deployed to provide advanced warning of pathogen spread in congregate settings such as schools, nursing homes, and prison systems. This can deliver actionable results to decision makers that incorporate bioinformatic analysis, in order to protect vulnerable populations.

However, sustainable funding is needed to ensure 1) passive surveillance infrastructure is in place and 2) additional assays for new or emerging pathogens can be deployed quickly. For example, in the event of another tripledemic this fall, the team could quickly deploy assays for flu and respiratory syncytial virus (RSV) upon request.

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Funding source: This work was supported in part by the Centers for Disease Control and Prevention (CDC) cooperative agreement #NU38OT000297. Its contents are solely the responsibility of the authors and do not necessarily reflect the views of the CDC.