Wastewater Surveillance as a Public Health Tool

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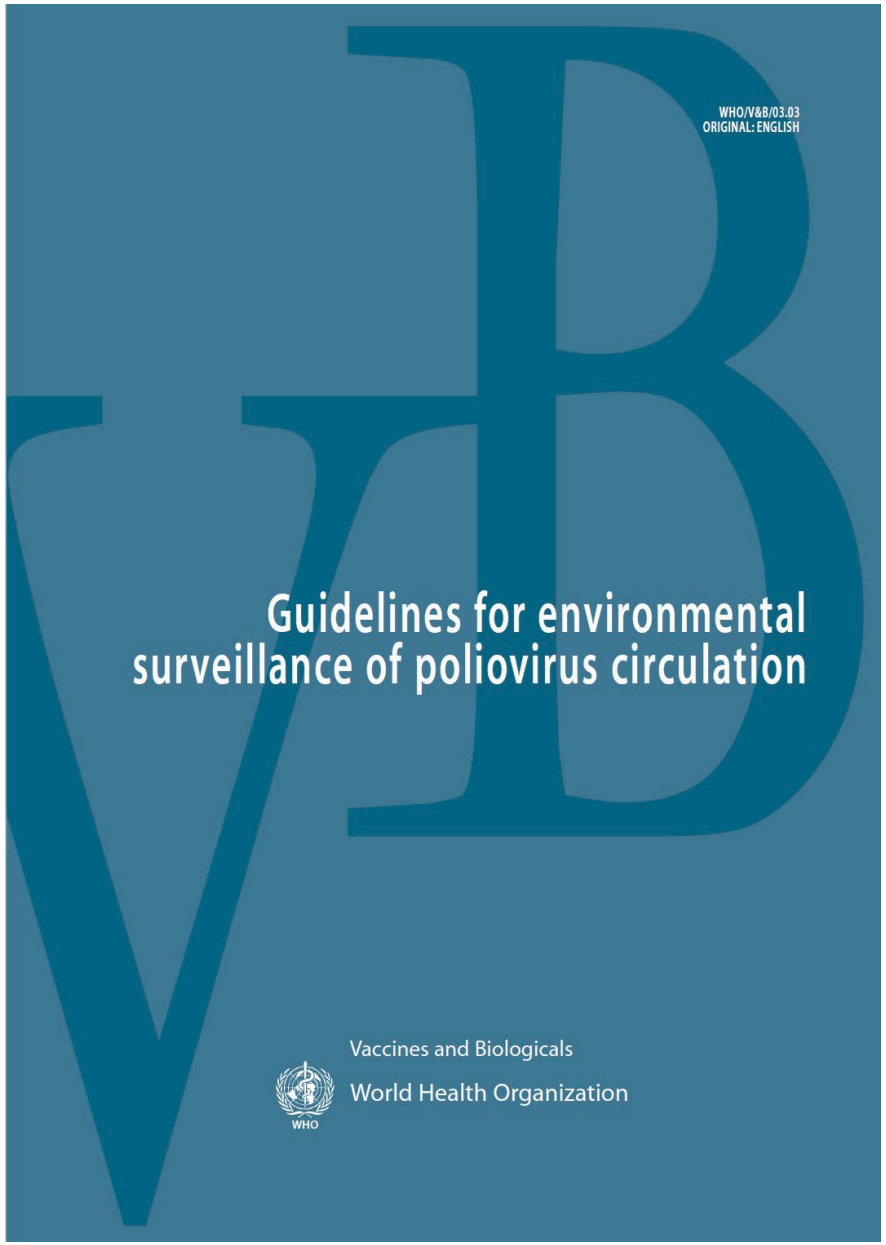


Wastewater Surveillance Success Story: Poliovirus

REUTERS

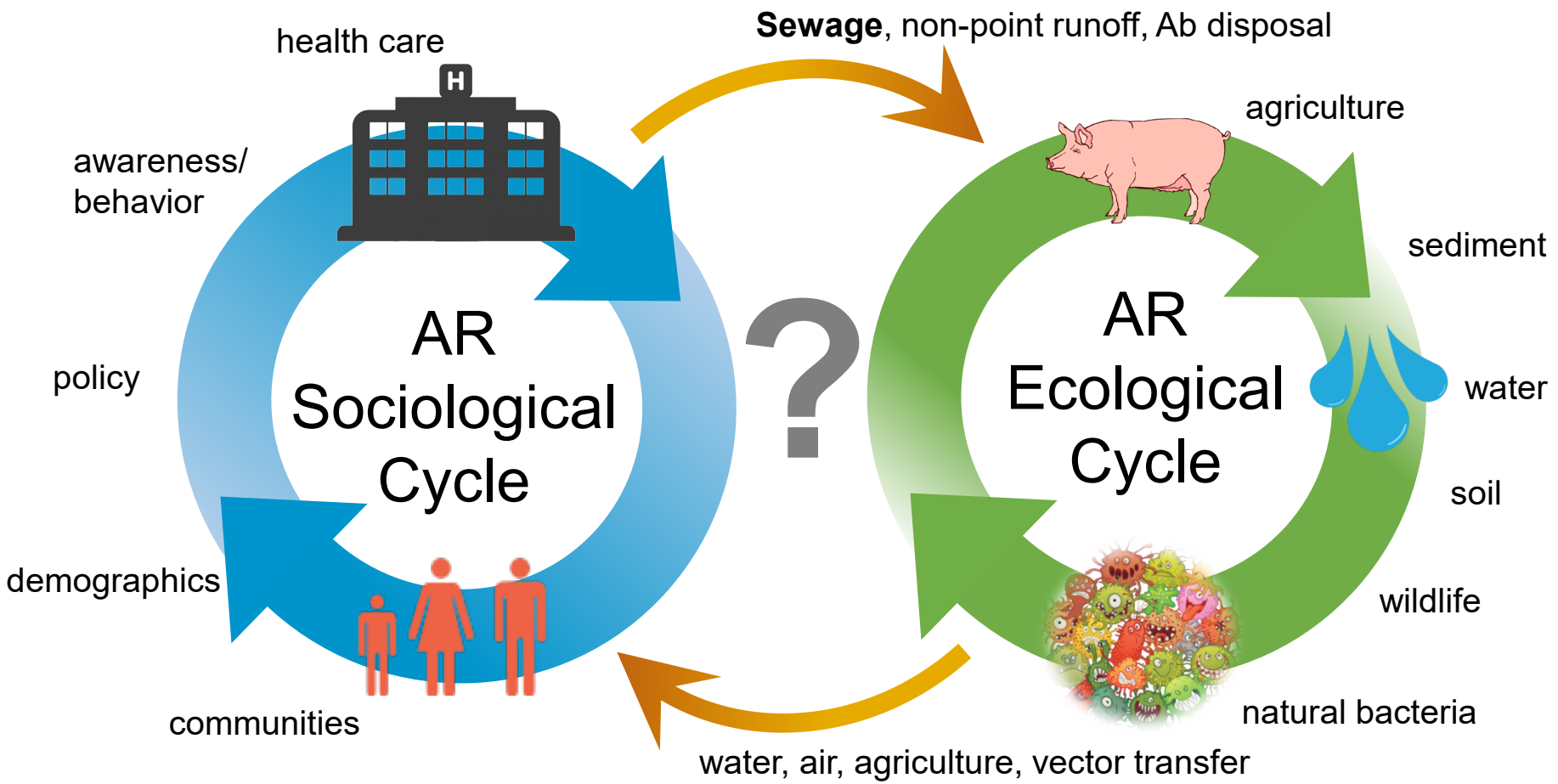
PUBLIC HEALTH

India to Vaccinate 300,000 Children after Polio Strain Found in Sewage

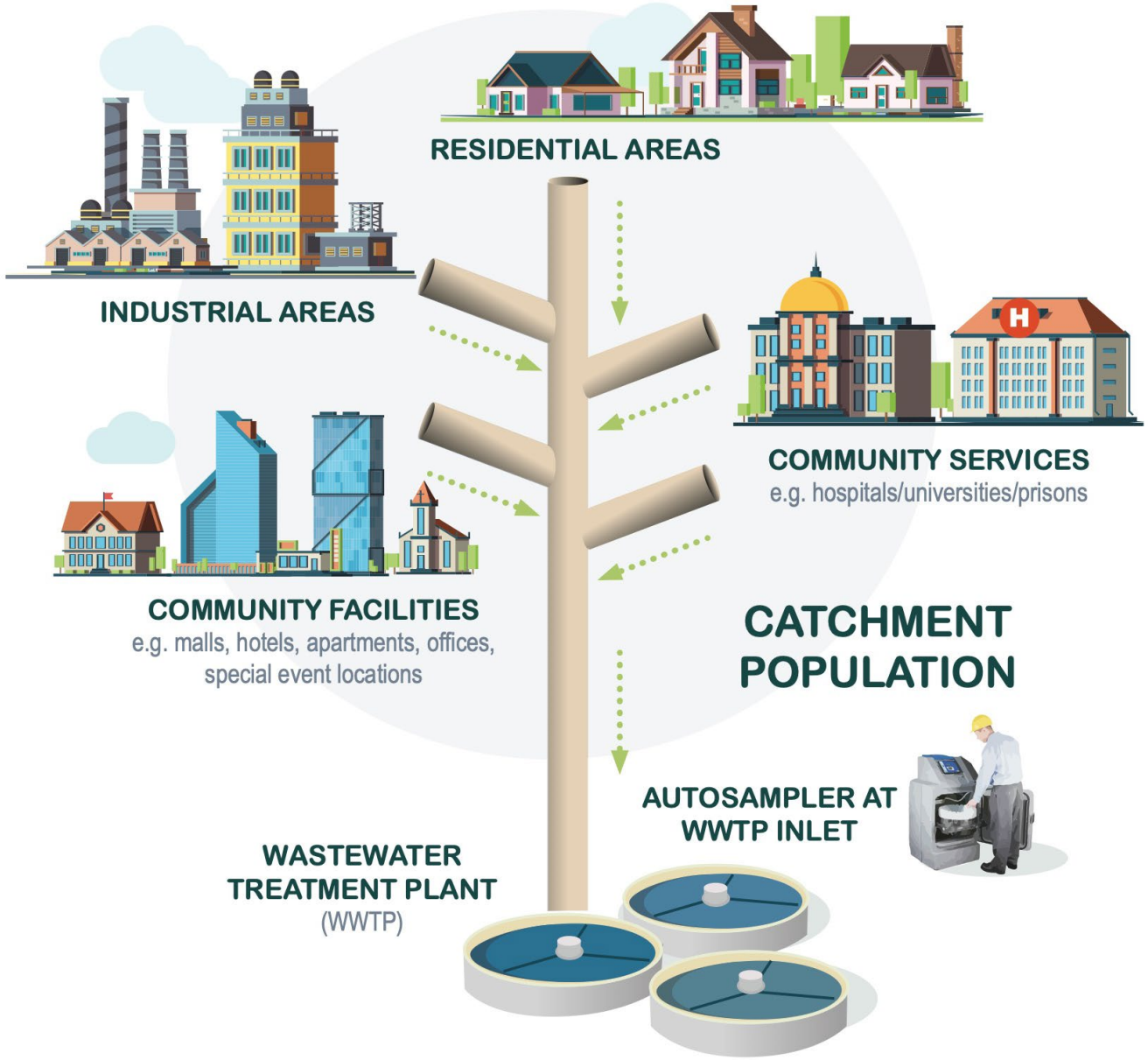
14 samples collected between January 2015 and May 2016 tested positive for a strain of the virus

June 15, 2016

BC: Socio-Ecological Coupling of Resistance



Why Wastewater?



COVID-19: Using Sewage Surveillance to Track Community SARS-CoV-2 Abundance

Benefits:

- Wastewater is an efficient pooled sample of community (or sub-community) infection prevalence
- Captures sub-clinical infections
- Independent of healthcare-seeking behavior and testing access
- Data available within days of shedding onset versus up to 2-week lag for other surveillance data

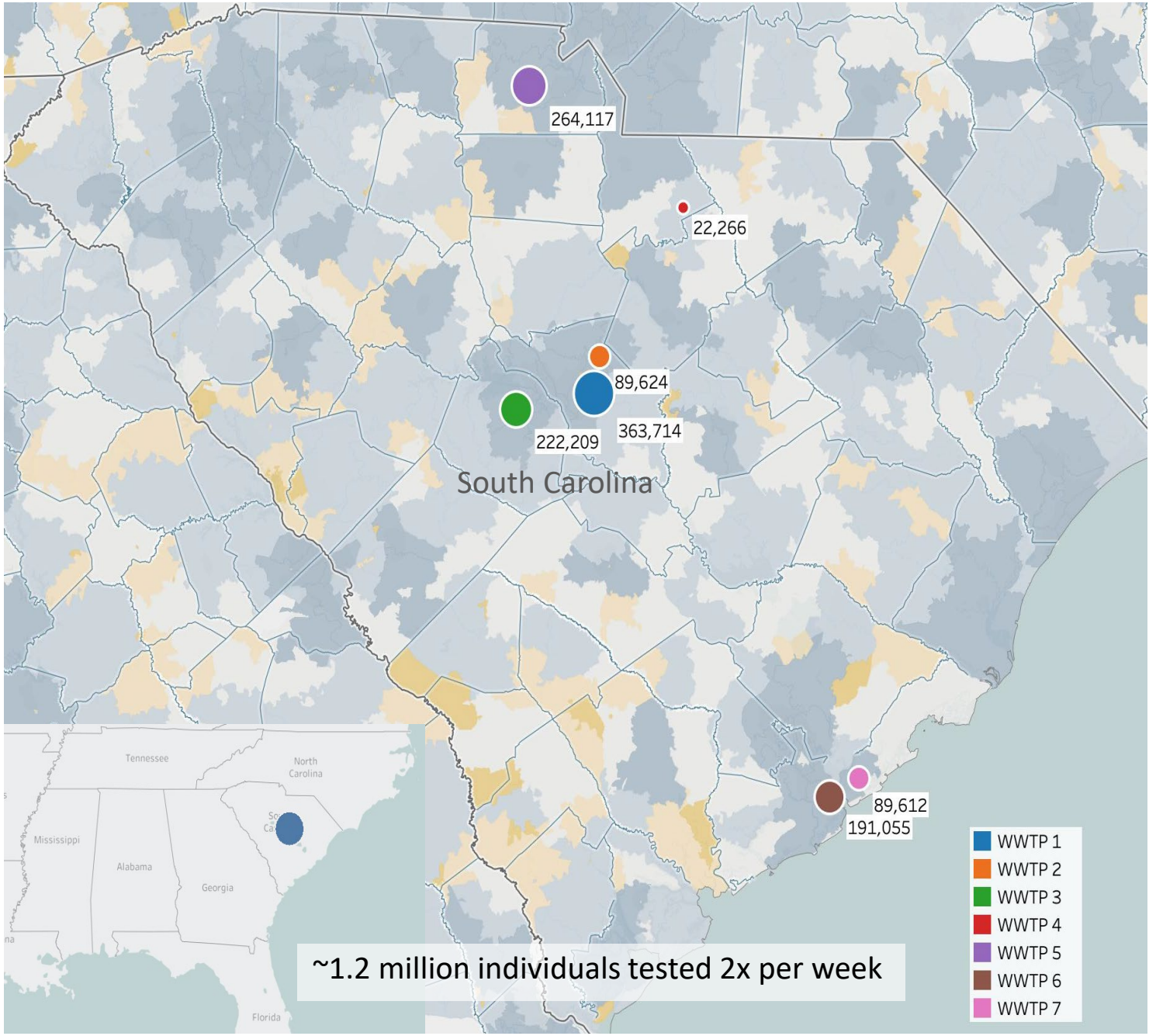
Considerations:

- Viral shedding in feces
- Dilution
- Viral decay
- Viral recovery
- ~25% of US residences are not connected to sewer
- Low incidence may be below the limit of detection

Project: ‘GLANCE’

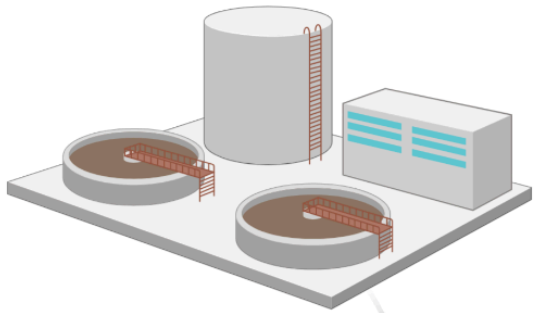
Using sewage surveillance to examine the relationship between SARS-CoV-2 and antibiotic resistance

CDC/DHEC

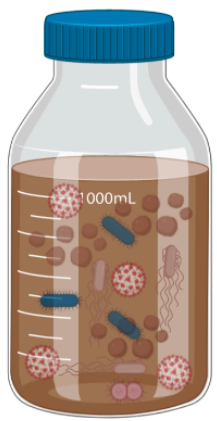


1

Collect wastewater sample from WWTP or other location



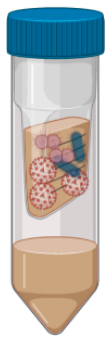
1 liter composite samples are collected over a 24h period and processed within 12-24h after collection



2

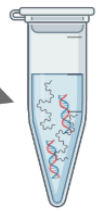
Laboratory processing of samples

Samples are homogenized and solids removed



Volumne concentrated using ultrafiltration (MWCO 30kDa)

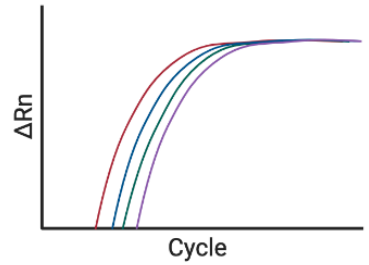
RNA extracted using Qiagen PowerViral RNA/DNA kit



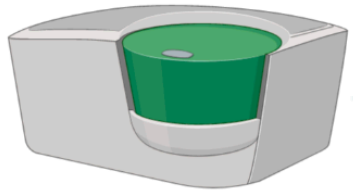
3

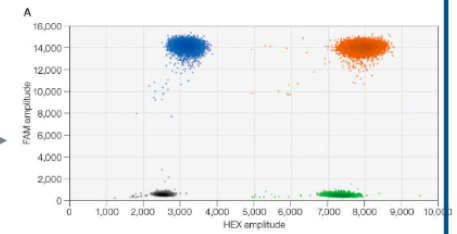
Molecular analysis for viral abundance and variant tracking

Relative quantitation using RT-qPCR

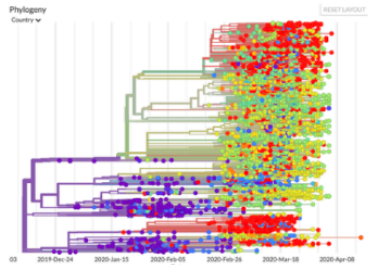


Absolute quantitation using ddPCR



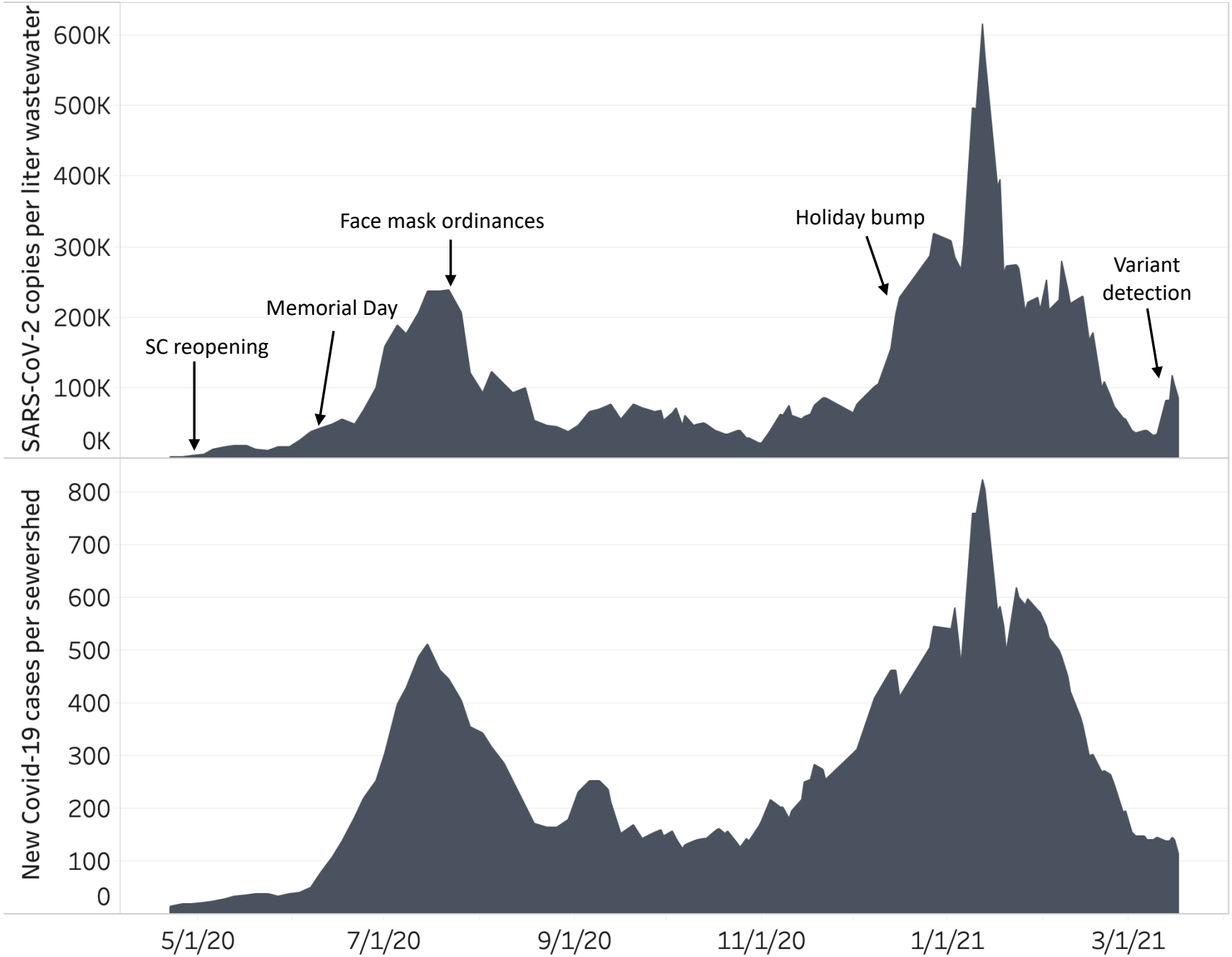


Viral genome sequencing using Gridion



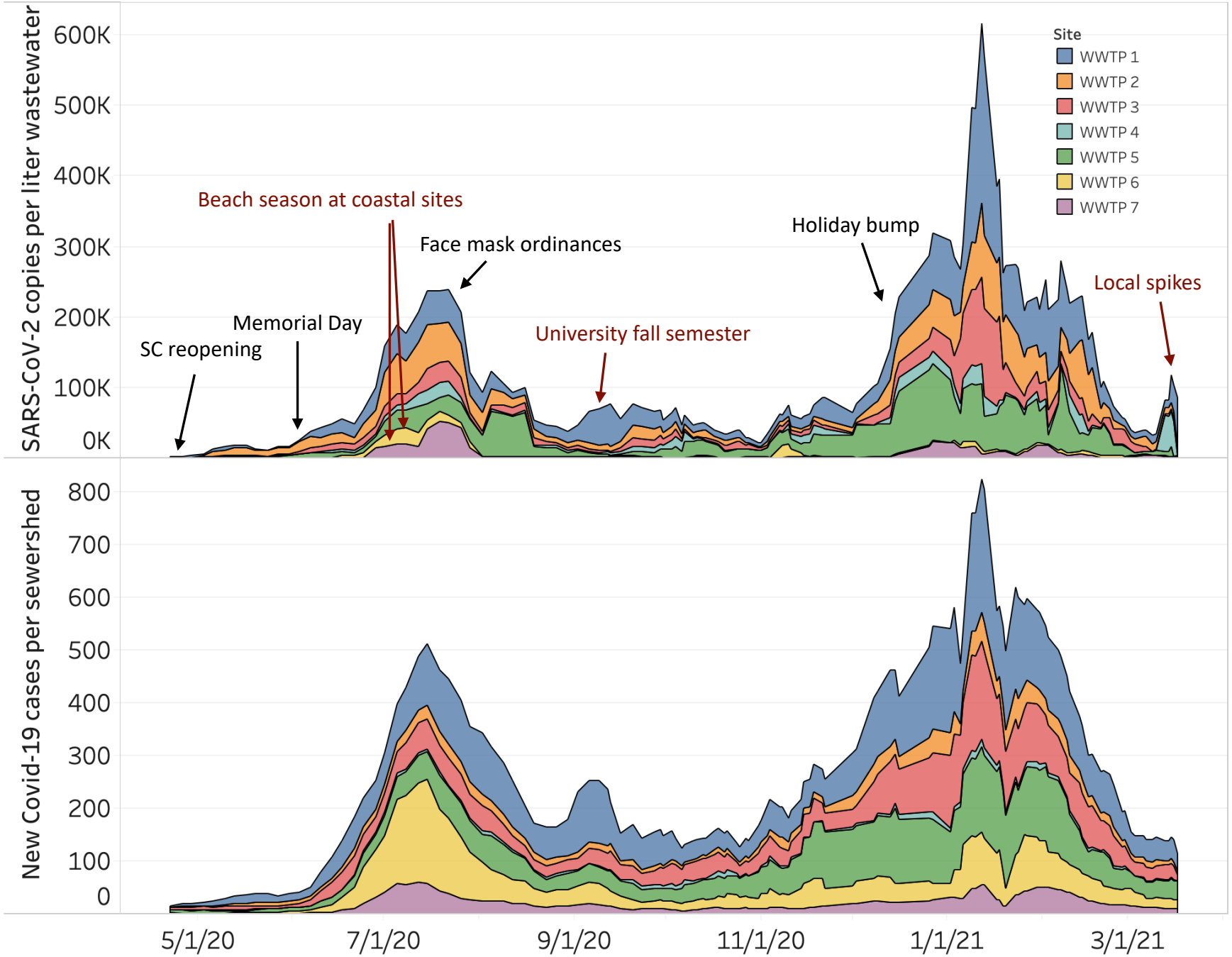
Temporal trends in SARS-CoV-2 abundance across seven South Carolina sewersheds

Temporal trends in daily Covid-19 new cases across seven South Carolina sewage catchment populations

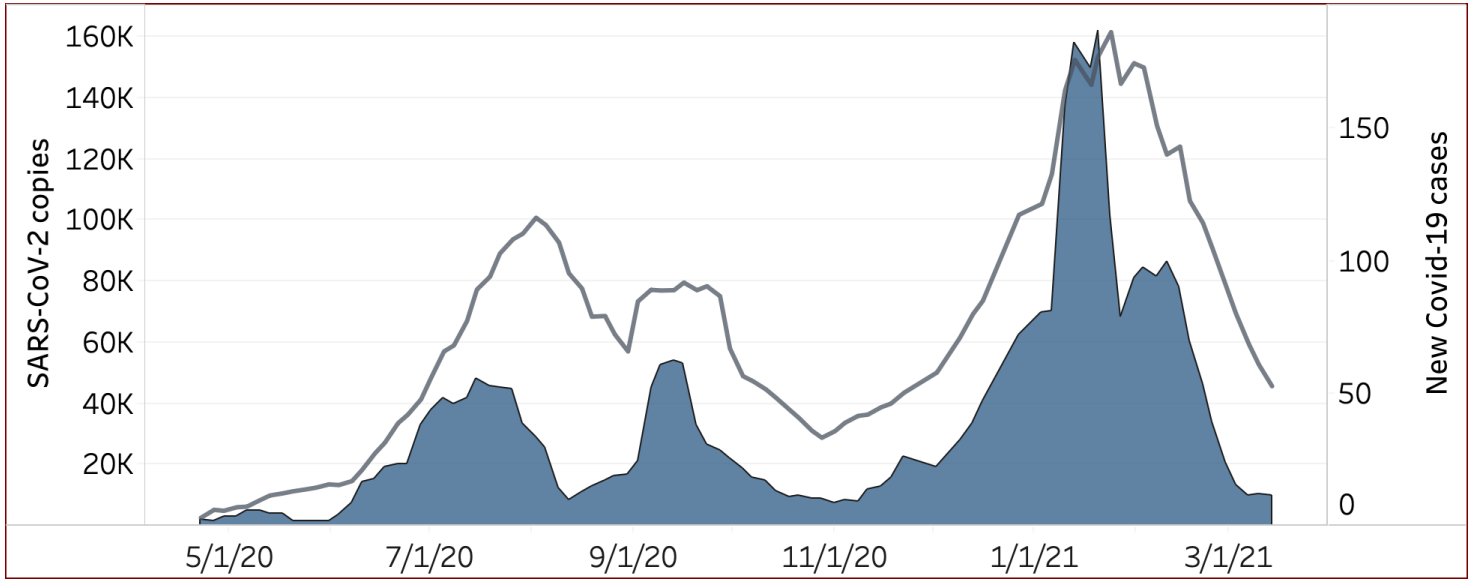


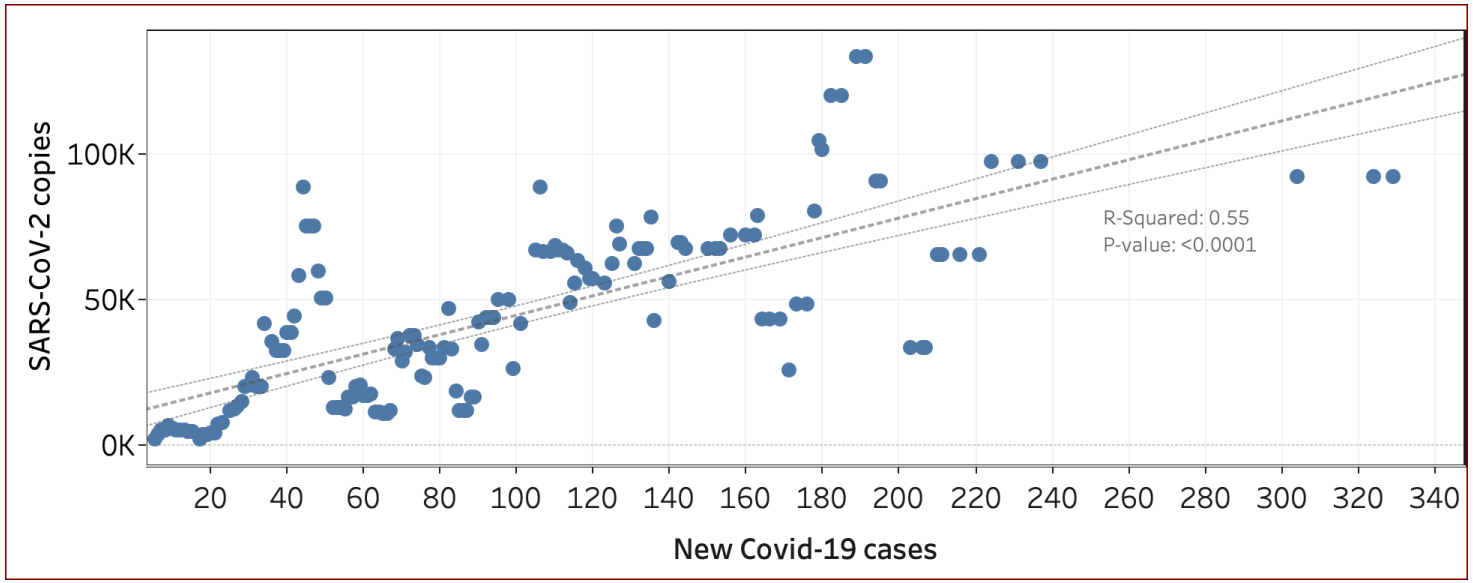
Spatial and temporal trends in SARS-CoV-2 abundance across across seven South Carolina sewersheds

Spatial and temporal trends in daily Covid-19 new cases across seven South Carolina sewage catchment populations



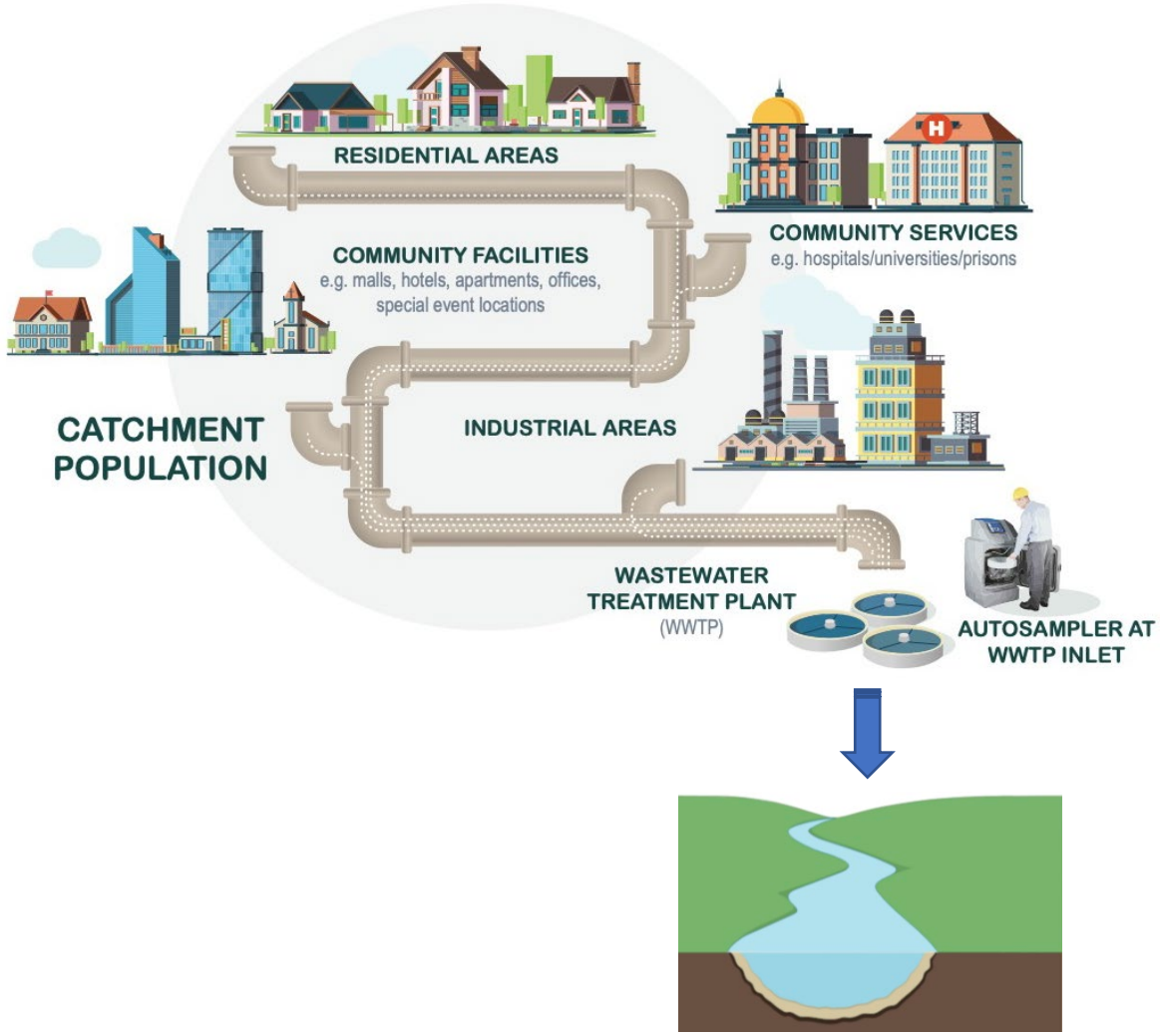
SARS-CoV-2 abundance in wastewater is correlated with sewershed community case counts



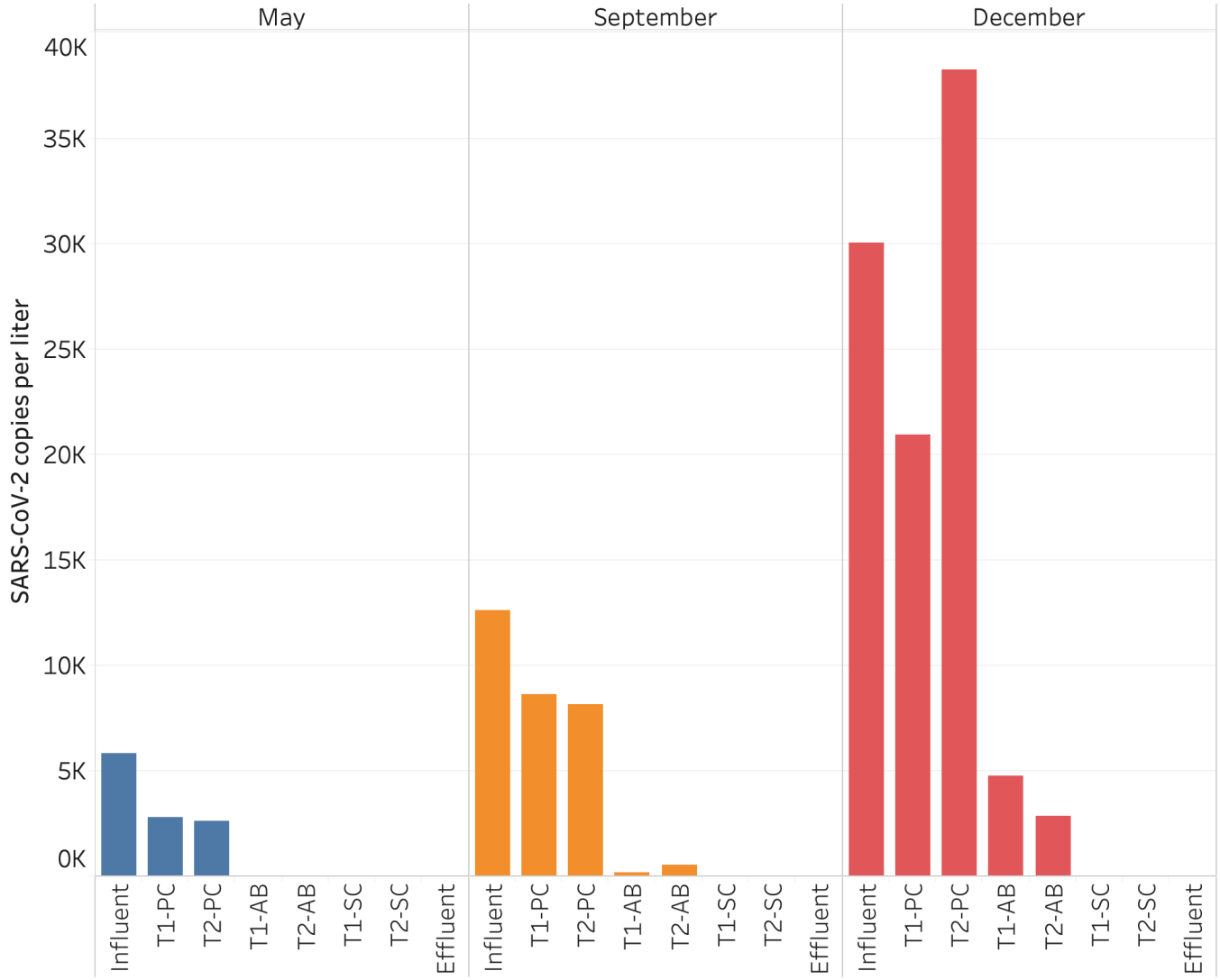


Surveillance Conclusions

- Wastewater surveillance of SARS-CoV-2 detects trends in community viral abundance.
- The approach can assess the impact of social policies and public health mitigation strategies.
- Provides an additional tool for measuring community viral spread.
- Can be used to watch for local spikes and variant detection
- Can be scaled to sub-sewershed for more granular data.



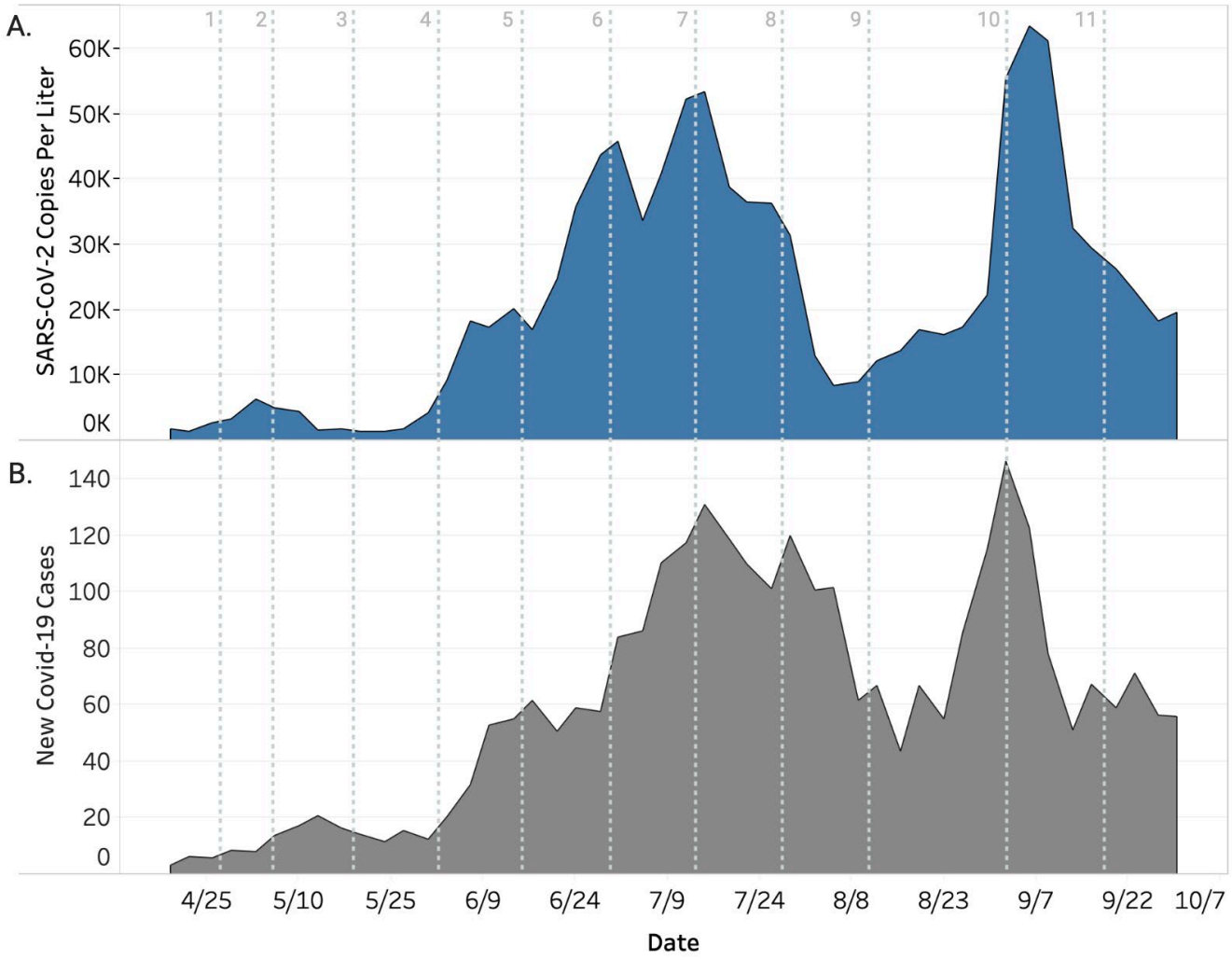
Detection of SARS-CoV-2 Across the Wastewater Treatment Process



Can SARS-CoV-2 be Aerosolized From Wastewater?

- Air samples collected for 4 hours at sites around the WWTP for 2 days
- Filtered 18,000 liters of air per site per day through liquid impingers
- PMMV control detected in all air samples
- **No SARS-CoV-2 detected in any air samples**

Investigating SARS-CoV-2 Rates of Infection in Wastewater Treatment Plant Workers



Methods/Results

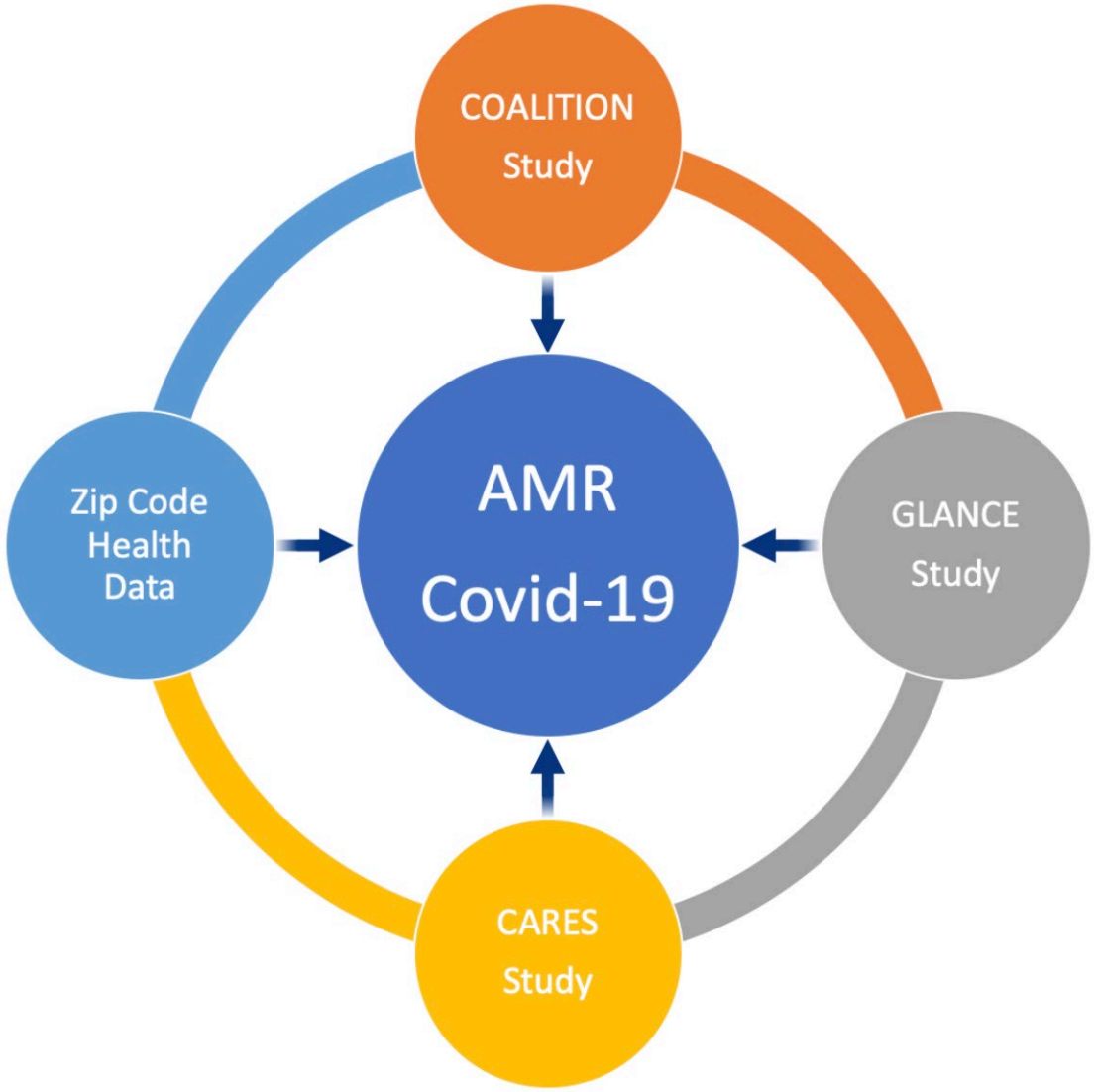
- NP/saliva samples collected from WWTP study participants at 11 points from April to September 2020
- Health questionnaires collected to determine risk factors
- **No SARS-CoV-2 detected in participant NP/saliva samples**

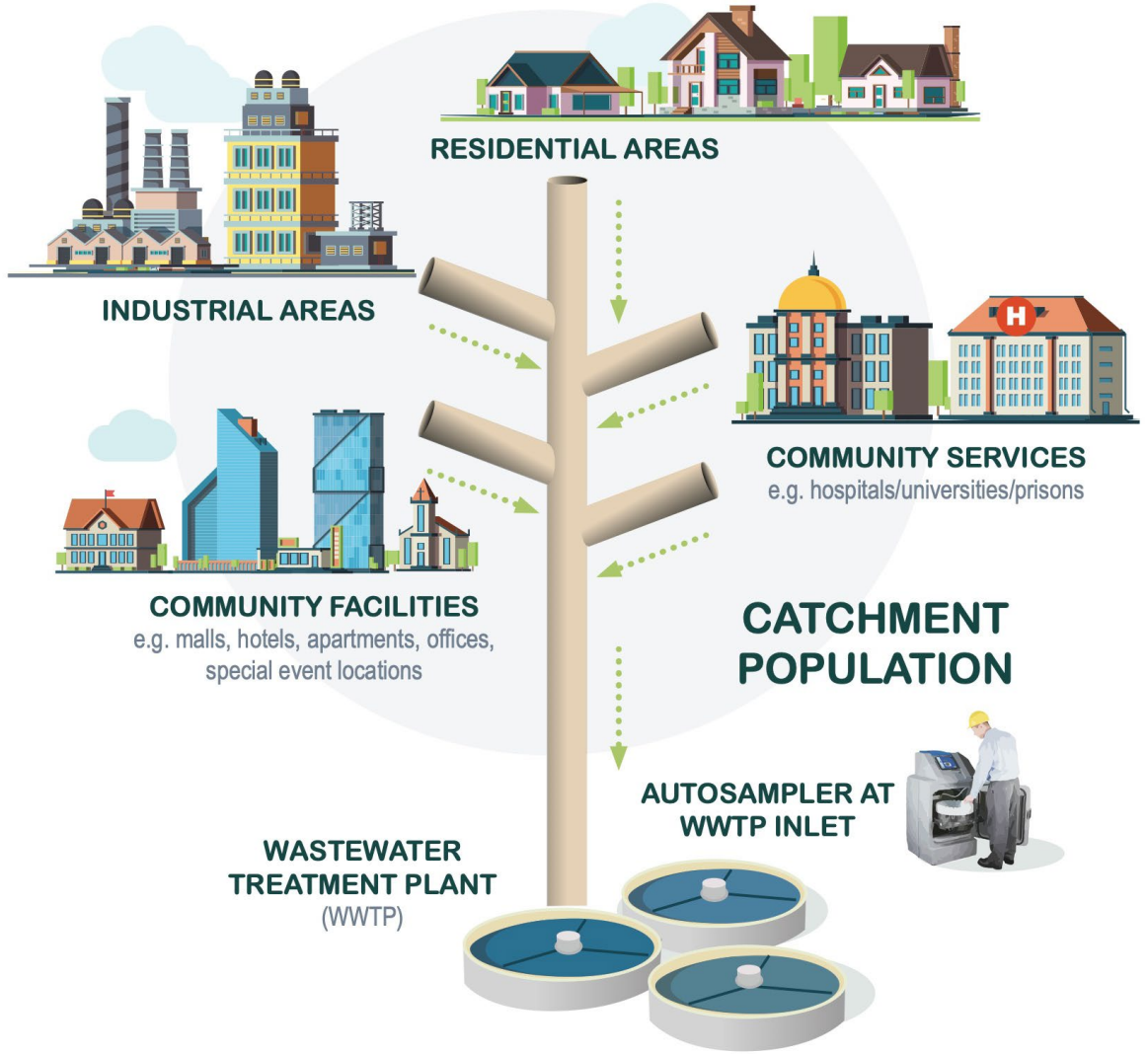
Implications

The lack of a significant difference between COVID-19 positive cases within wastewater workers as compared to positive cases observed in the surrounding community suggests that **viral transmission from wastewater to workers is unlikely and that workers within this job sector are at no greater risk of contracting COVID-19 than the broader community.**

Isanovic M, Correa Velez KE, Kirby AE, Norman RS. Investigating SARS-CoV-2 Rates of Infection in Wastewater Treatment Plant Workers. *In Review*

Project Integration: Using sewage surveillance to examine the relationship between Covid-19 and AMR within communities





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