Environmental Health Science
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CDC
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Relationship between SARS-CoV-2 Wastewater Surveillance Trends and Reported COVID-19 Cases in Athens-Clarke County, 2021-2022

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Introduction

Wastewater-Based Epidemiology (WBE)

Infection by Severe Acute Respiratory Syndrome Coronavirus 2 **(SARS-CoV-2)**, otherwise known as having **COVID-19**, is followed by the shedding of viral particles by multiple excretory functions, including stool and urine production [1,2].

Subsequently, these viral particles can be detected in wastewater influent via RNA extraction, followed by Reverse Transcriptase Quantitative Polymerase Chain Reaction (RT-qPCR) utilizing SARS-CoV-2 specific primers [3].

Wastewater-based detection methods have been utilized across the globe as an independent indicator of SARS-CoV-2 viral prevalence and, depending on community-specific factors, as a leading indicator of clinical case trends [4].

Wastewater Surveillance in Athens-Clarke County

After the start of the COVID-19 Pandemic, Dr. Erin Lipp's lab began monitoring wastewater for SARS-CoV-2 in Athens-Clarke County (ACC) sewersheds, accompanied by a public dashboard providing weekly updates [6].

Data collection began June 2020 and continued through December 2022 when efforts were taken over by Georgia Department of Public Health, whereby data is now contributing to the CDC National Wastewater Surveillance System [7].

Surveillance Year Two Analysis Goals

The relationship between year one surveillance data (06/2020-06/2021) and corresponding clinical case data in ACC has recently been described [8].

The goal of this work is to explore correlations between year two wastewater surveillance data (07/2021-12/2022) and clinical case data to aid in generating further analyses.

Methods

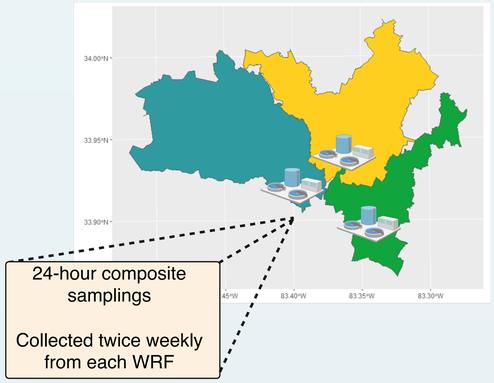

Figure 1. Shaded map of Athens-Clarke County showing Water Reclamation Facilities (WRFs) and corresponding catchment zones.

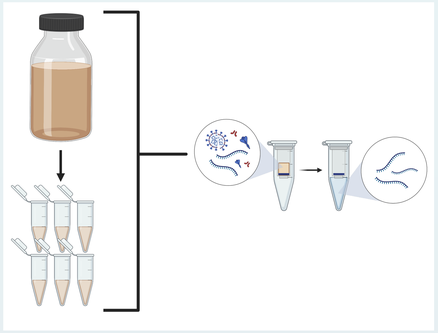

Figure 2. Digital schematic of wastewater sample collection, extraction replicate preparation, and direct, non-concentrated, column-based RNA extraction
Created with BioRender.com

Methods cont.

Sample Collection, Processing, and Extraction

24-hour composite samples collected twice weekly, stored at 4C until ready for extraction. See Figure 1.
6 extraction replicates were performed for each collection date at treatment facility. See Figure 2.

RT-qPCR

2019-nCoV N1 and N2 primer-probe sets were used for universal detection of SARS-CoV-2 [x]

Estimating SARS-CoV-2 Viral Load

The concentration per reaction of each gene target was determined by the corresponding standard curve, then sample concentration in copies per liter was determined by Equation 1. Total daily copies per day per WRF was determined by Equation 2 [8].

$$C_{WW} = C_{RXN} \cdot \left(\frac{V_{qPCR}}{V_{cDNA}}\right) \cdot \left(\frac{V_{RT}}{V_{RNA}}\right) \cdot \left(\frac{V_{Elution}}{V_{WW}}\right) \cdot \frac{1.0 \times 10^6\ uL}{1\ L}. \quad \longrightarrow \quad L_{WW} = C_{WW} \cdot V_{Influent}.$$

Results

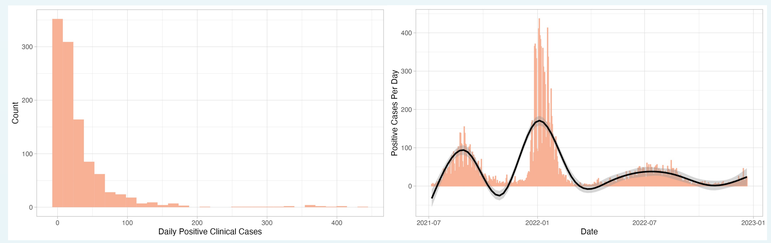

Figure 3.

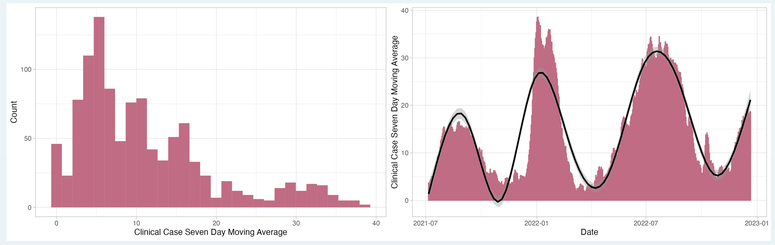

Figure 4.

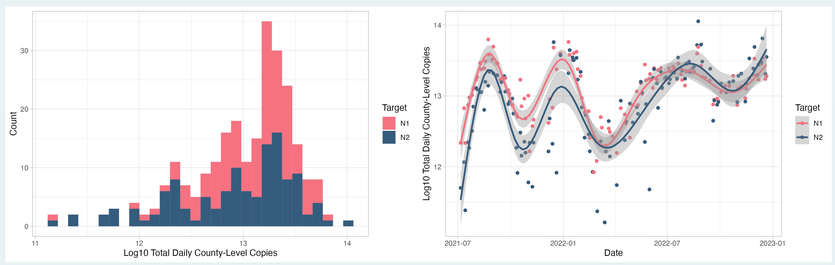

Figure 5.

Wastewater Reclamation Facility	Predominant input	Population served [x]
A	UGA campus, residential, industrial	56,500
B	Residential and two hospitals	49,500
C	Residential and septic dumping	25,500

Table 1.

Results

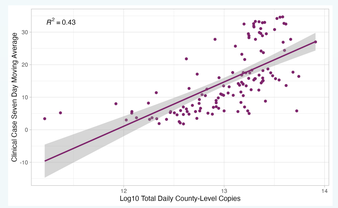

Figure 6.

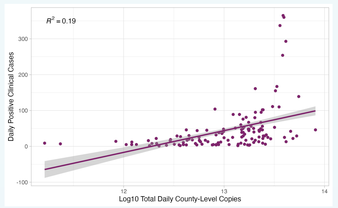

Figure 7.

Discussion

Next steps

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References & Acknowledgements

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