

Introduction and Background

As SARS-CoV-2 and other viral infections continue to evolve, organizations are expressing needs for early detection among congregate settings.

Since April 1st, 2023, the Genesee County Health Department has been participating in a pilot project with the Water Environment Federation (WEF) and the Centers for Disease Control and Prevention (CDC), utilizing the GeneXpert from Cepheid. The GeneXpert, which is typically used in healthcare settings to test patients for different illnesses, is being employed in this pilot program for rapid Polymerase Chain Reaction (PCR) analysis in wastewater. The machine is testing for SARS-CoV-2, Influenza A and B, and Respiratory Syncytial Virus (RSV).

We joined this pilot program to see how this process compares to traditional digital PCR testing, which we do onsite. The goal of this pilot program is see if the GeneXpert is capable of detecting accurate respiratory illnesses in wastewater.

Methods

Two nursing homes participate in the wastewater sampling: Premier Genesee in Batavia, NY and LeRoy Village Green in LeRoy, NY. The GeneXpert exercises a fully automated PCR technology for sample extraction, amplification and detection. A closed cartridge technology allows for the reduction of risk of contamination while enabling random-access testing capabilities.

A passive sampling method, utilizing tampons, is used to collect wastewater samples three times a week at both nursing homes.

1. A tampon is secured and inserted into a sewage pipe or manhole for approximately 24 hours before it is collected and transported back to the laboratory.
2. Wastewater is then extracted from the tampon and pipetted into the GeneXpert cartridge for analysis.
3. Analysis takes approximately 40 minutes for results to be received from each cartridge.

References/Acknowledgements

We would like to thank the Water Environment Federation (WEF) and Cepheid for their assistance with this pilot program. We'd also like to thank Premier Genesee Nursing Home and LeRoy Village Green Nursing Home.

Procedure



1. Tying the tampon

With fishing line we thread the line through the string of the tampon and secure it. We also attach a fishing weight to the fishing line.



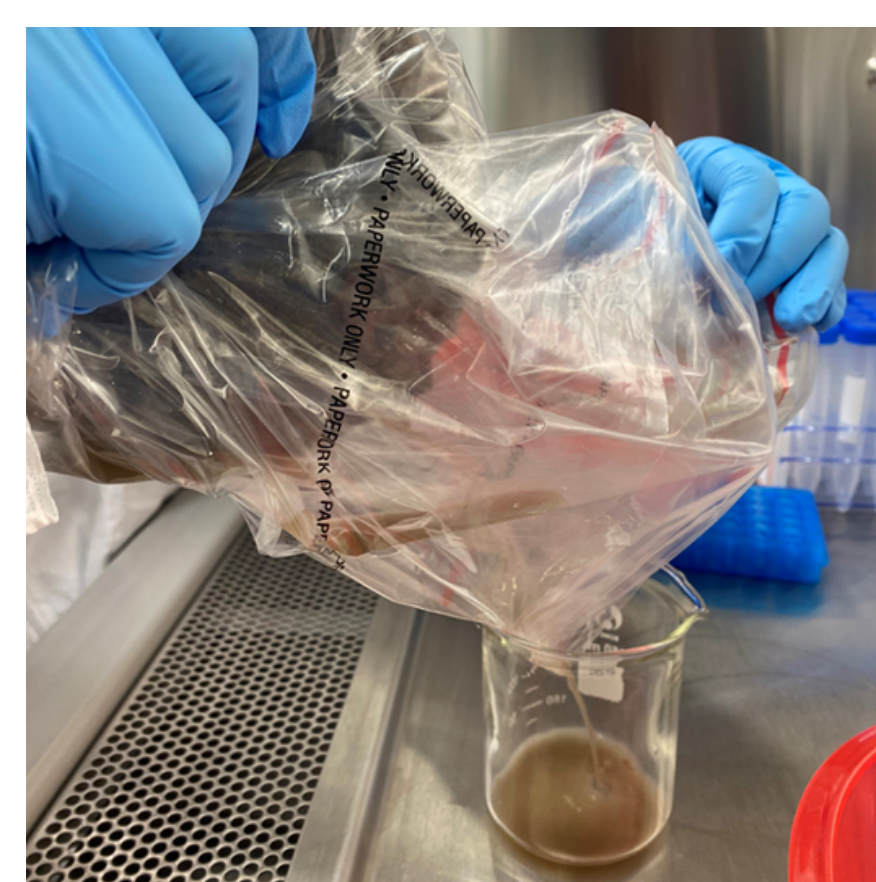
2. Collecting the tampon

We use a crowbar or unscrew the cover off of the sewage hole to collect the tampon.



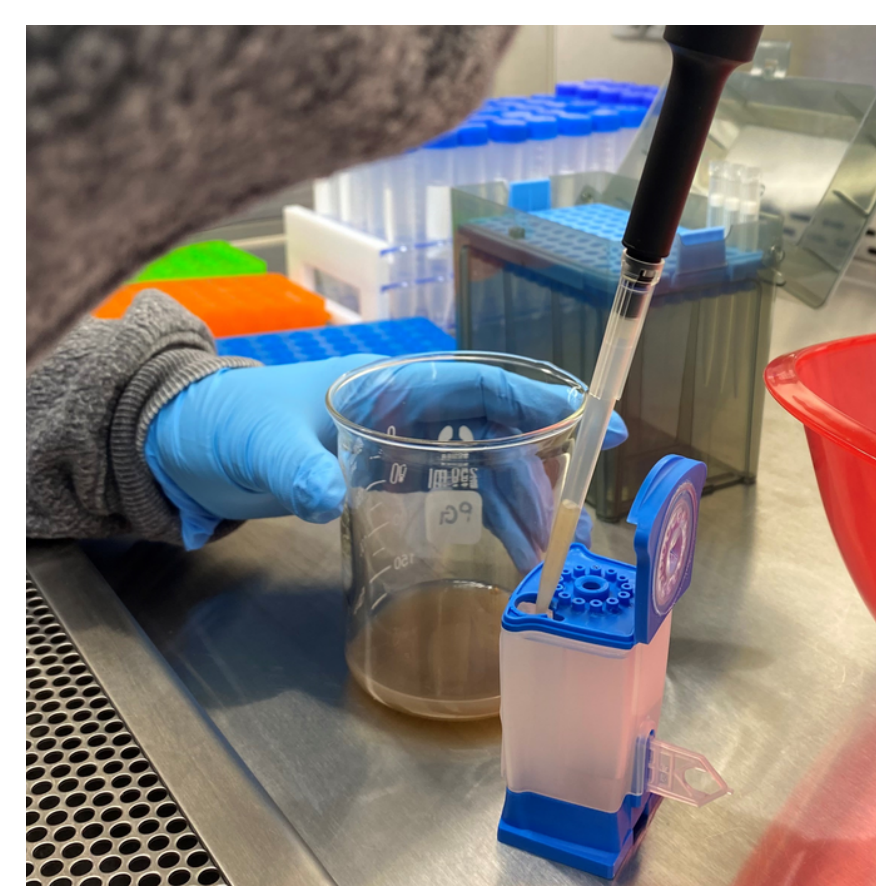
3. Bagging the tampon

We seal the tampon in a biohazard bag and place it in a cooler for transport.



4. Collecting the sample

We squeeze the tampon in the bag and put the sample into a beaker.



5. Pipetting sample into cartridge

We pipette 300 microliters into the Cepheid cartridge.



6. Running the sample

We scan the barcode on the cartridge and place it into the GeneXpert.

Data and Findings

After each sample is run, the results are submitted to WEF and the nursing homes on a weekly basis. Figures 1 and 2 depict the percentage of positive and negative results for each illness at their respective nursing home from April 1st to November 22nd.

Premier Genesee Results:

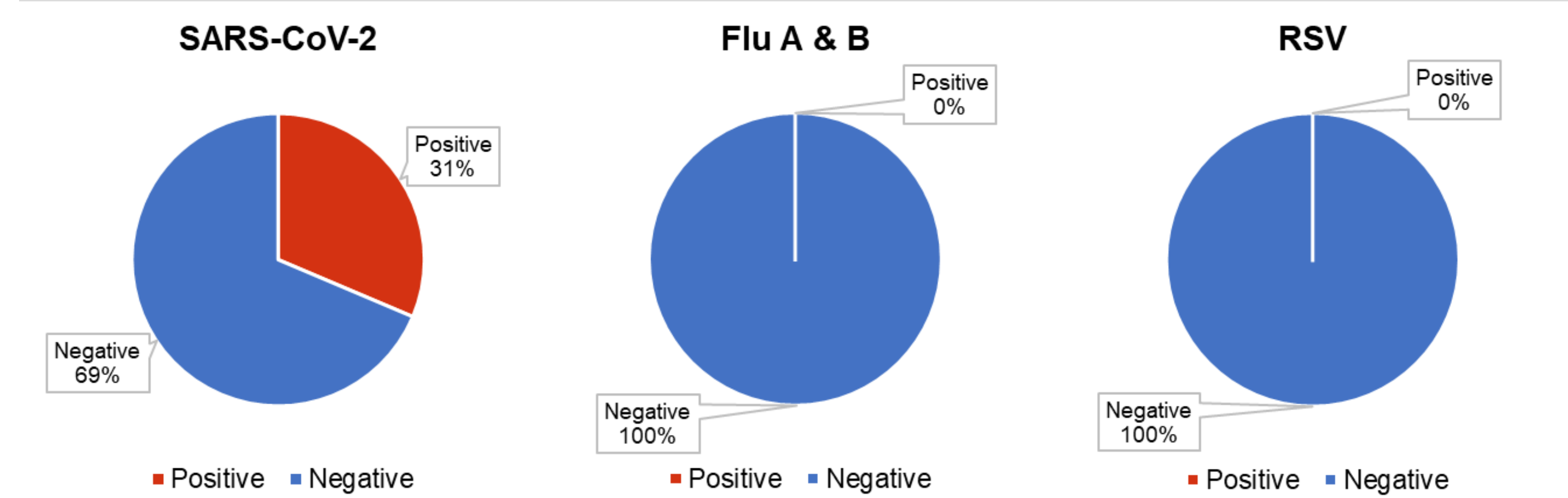


Figure 1. Results from Premier Genesee

LeRoy Village Green Results:

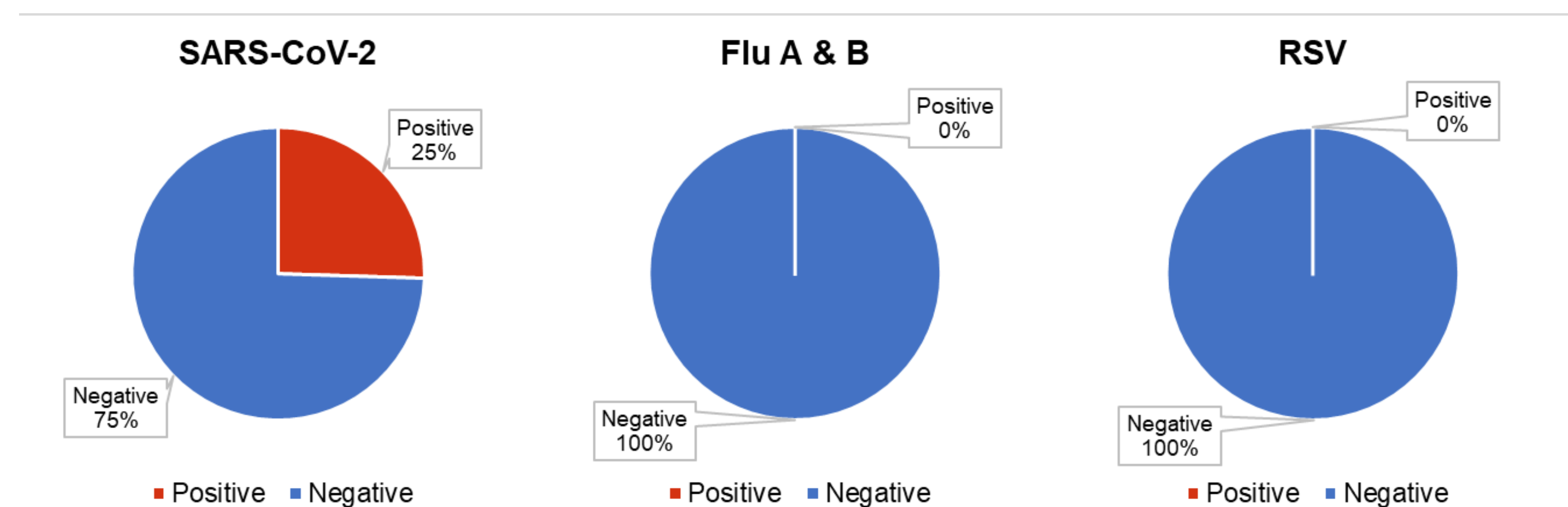


Figure 2. Results from LeRoy Village Green

Conclusion and Future Research

The GeneXpert system is easy to use for wastewater analysis of congregate settings. This system can also be useful for community wide sewer sheds where laboratory capacity might not be available for digital PCR analysis. Our pilot project shows that this passive sampling method can detect infection in a nursing home setting.

Barriers we faced during implementation were:

- The fishing line was cut by facilities causing us to lose the sample. We worked on our communication with facilities to improve this.
- The flow in the pipe was variable from time to time, causing the tampon to come up dry.

Compared to traditional digital PCR wastewater testing, the GeneXpert is capable of identifying respiratory illnesses in wastewater.