

Temporal Detection and Phylogenetic Assessment of SARS-CoV-2 in Municipal Wastewater

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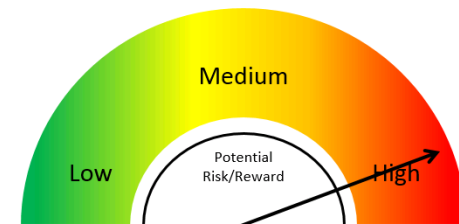
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Nemudryi A, and Nemudraia A, et al *Cell Reports Medicine*

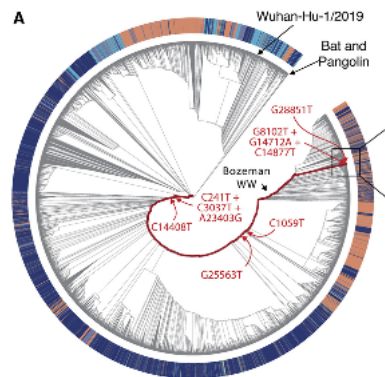
<http://doi.org/10.1016/j.xcrm.2020.100098>



The punchline



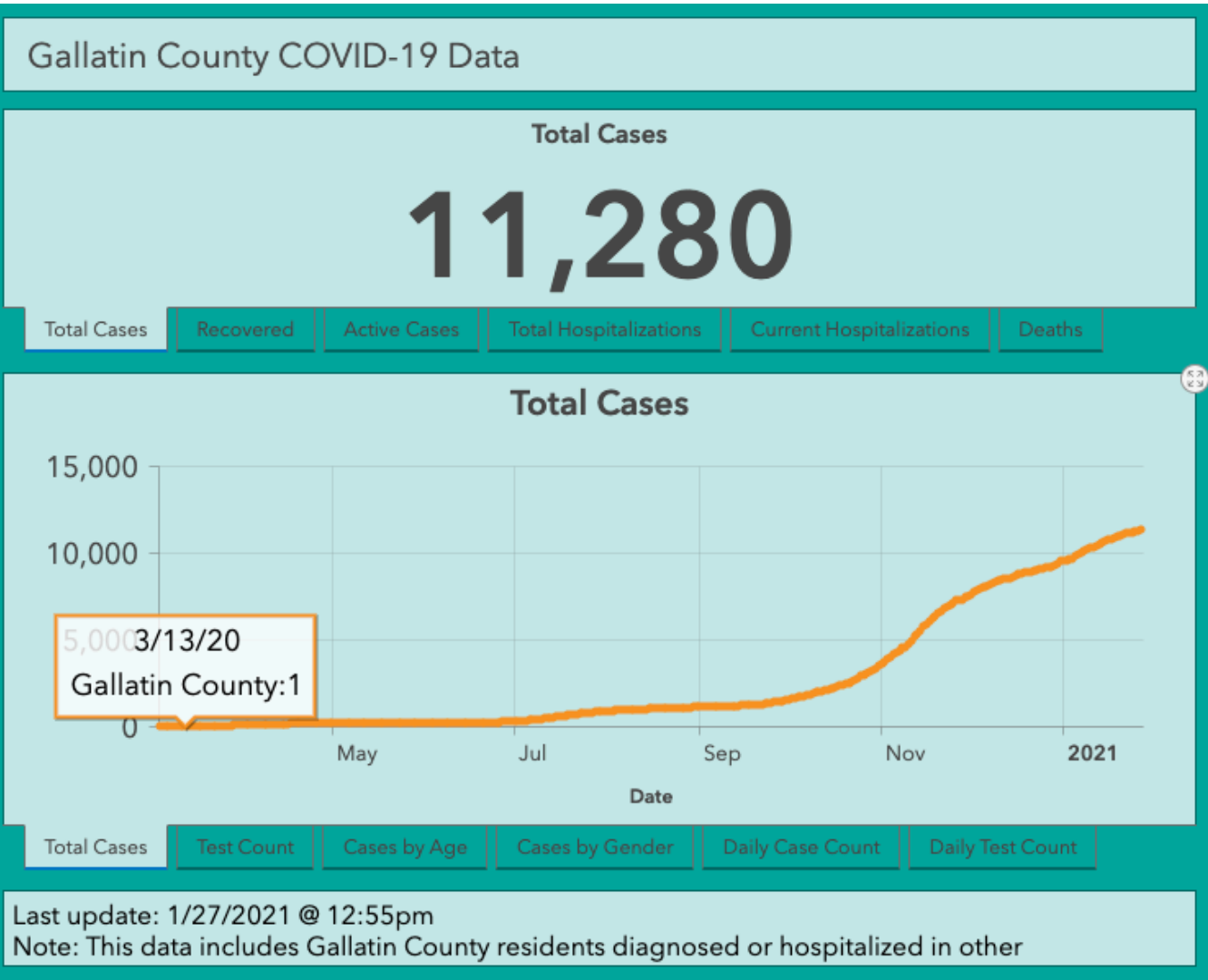
- Wastewater provides real-time information on SARS-CoV-2 prevalence in the community



- Sequencing wastewater can be used to identify SARS-CoV-2 strains that are circulating in a community



Can we detect SARS-CoV-2 in municipal wastewater?



Bozeman Water Reclamation Facility

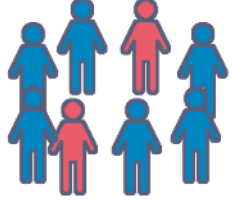
Population served: 49,831
Daily flow: ~ 6 million gallons per day

Sample is positive!

Wastewater captures a snapshot of community spread

COVID-19
■ Negative
■ Positive

Community

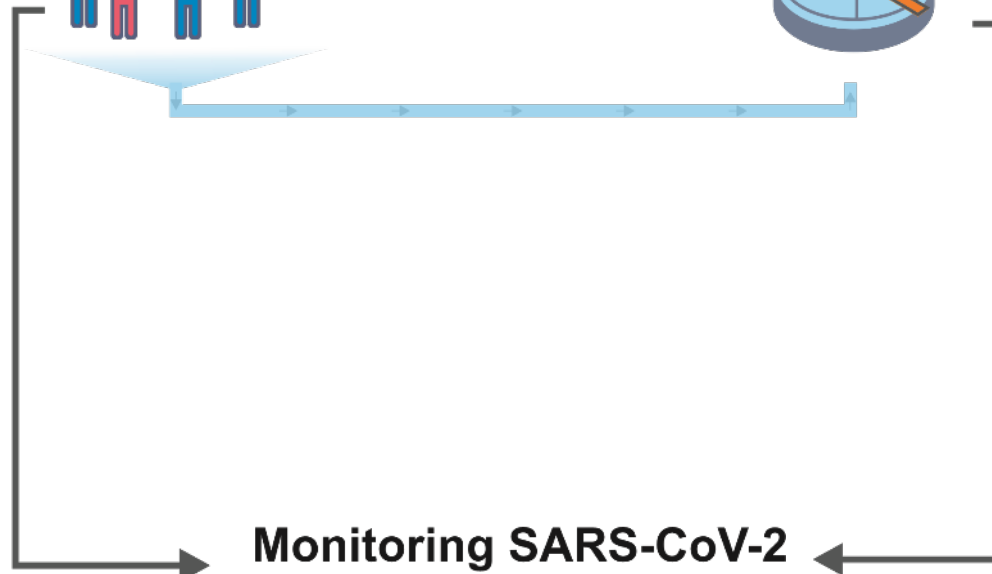


Wastewater Treatment Plant



We hypothesized that wastewater can be used to monitor viral prevalence in the community

Individual testing



Monitoring SARS-CoV-2 pandemics

Wastewater testing

Pipeline



Wastewater (500 ml)

Filtration



Concentration

Sample (~100 ul)

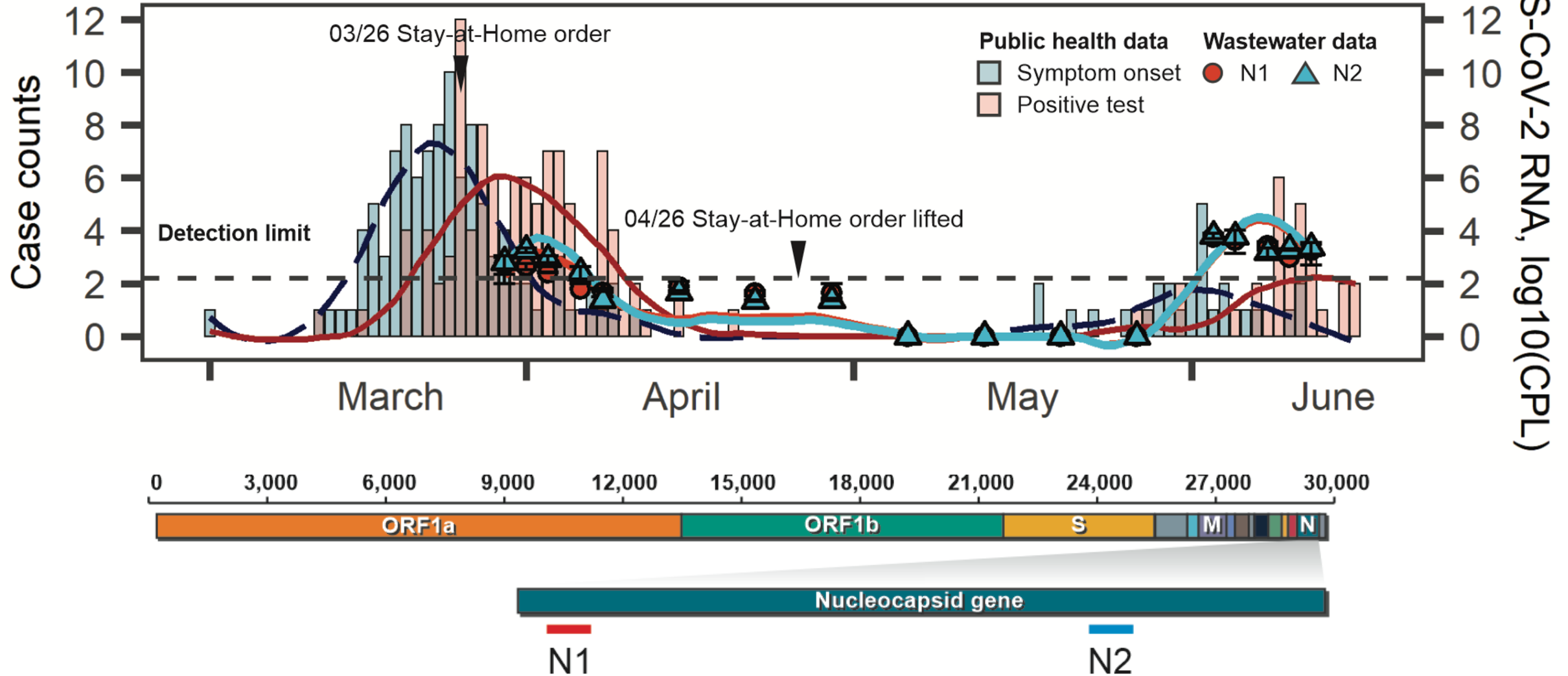
RNA isolation

RT-qPCR

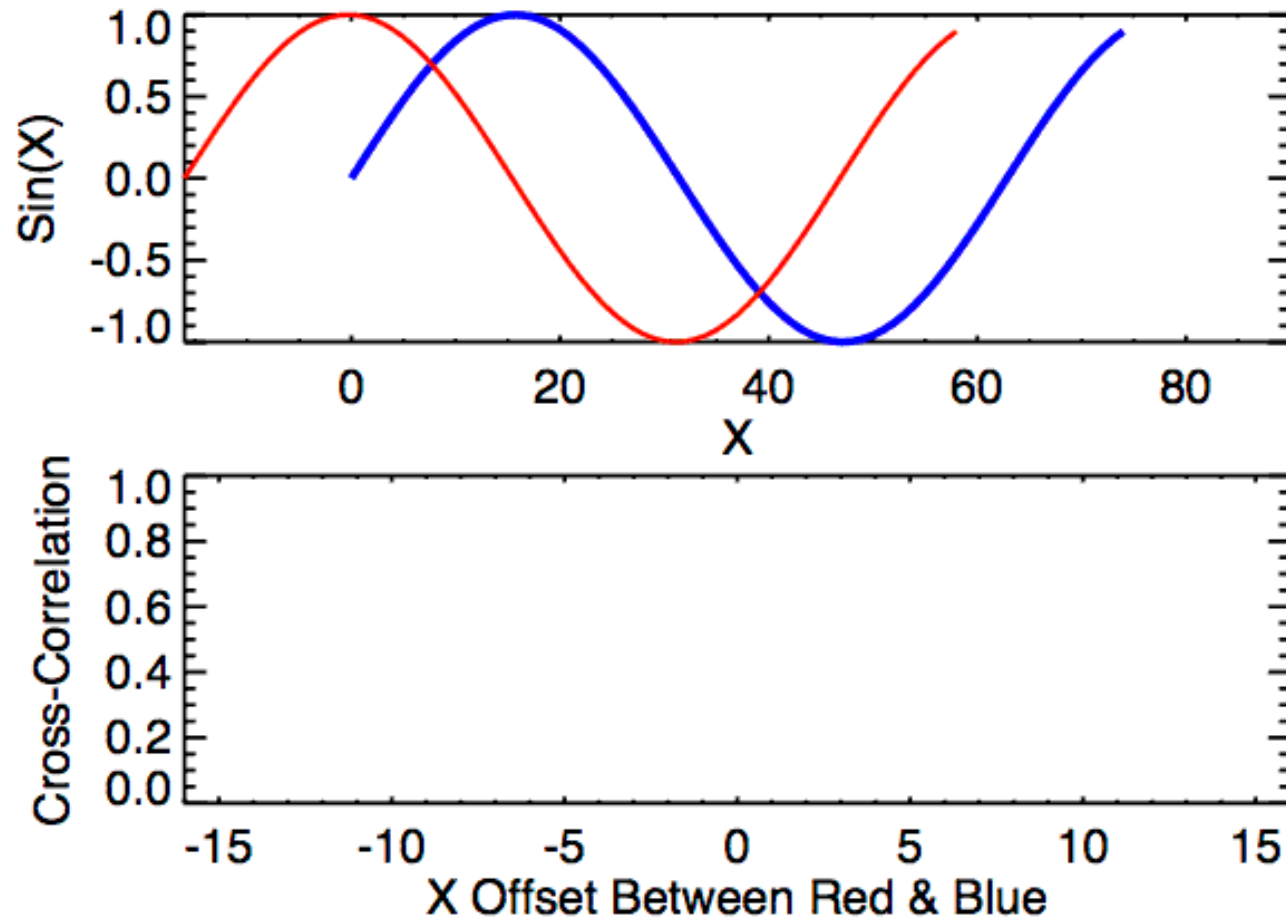


Arden Nemudryi, a postdoctoral researcher at Montana State University, uses a bottle top filter to separate SARS-CoV-2 virus RNA from a waste water sample.
Mike Greener/High Country News

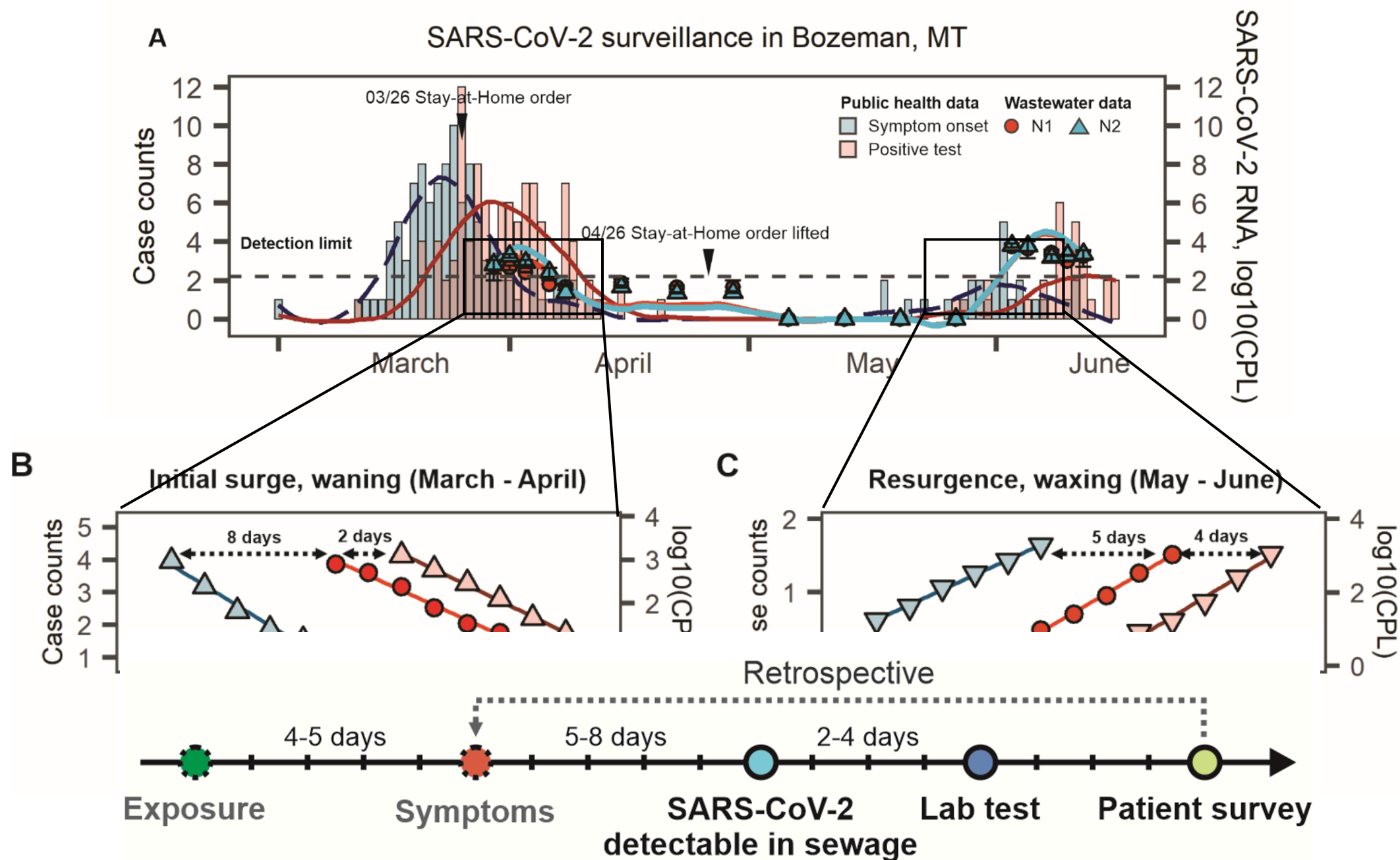
SARS-CoV-2 surveillance in Bozeman, MT



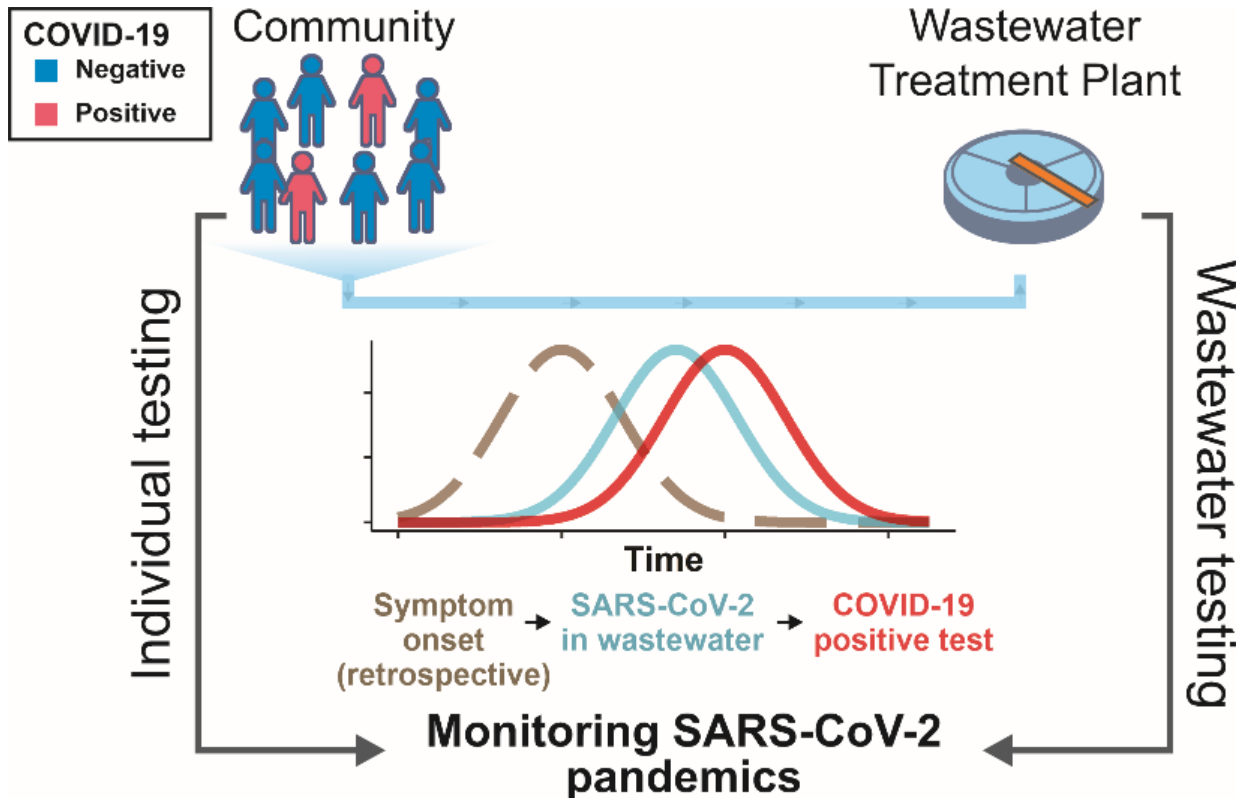
Cross-correlation analysis



Wastewater surveillance is the earliest real-time measure of SARS-CoV-2 prevalence

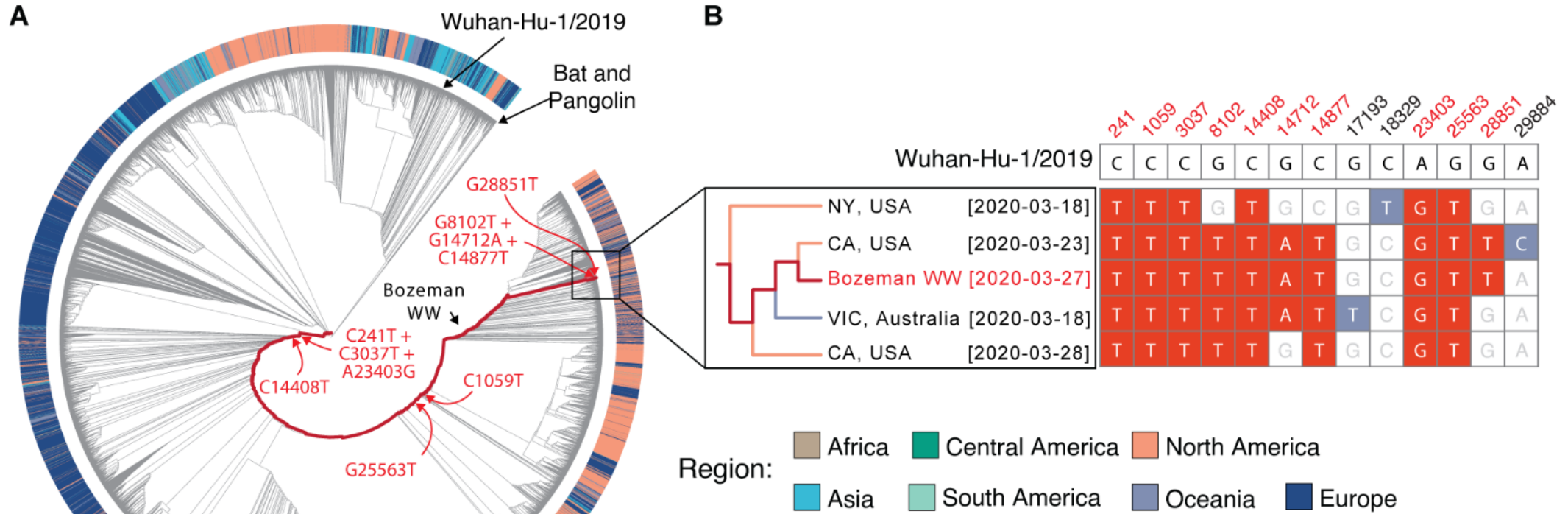


Wastewater surveillance is a real-time measure of SARS-CoV-2 prevalence in the community



- **WW surveillance provides advanced warning of SARS-CoV-2 surge**
- **WW surveillance is independent of healthcare-seeking behaviors and access to clinical testing**
- **WW surveillance offers quick and cost-effective method for tracking the outbreak**

Phylogenetic analysis of SARS-CoV-2 sequence isolated from wastewater



Tanner Wiegand

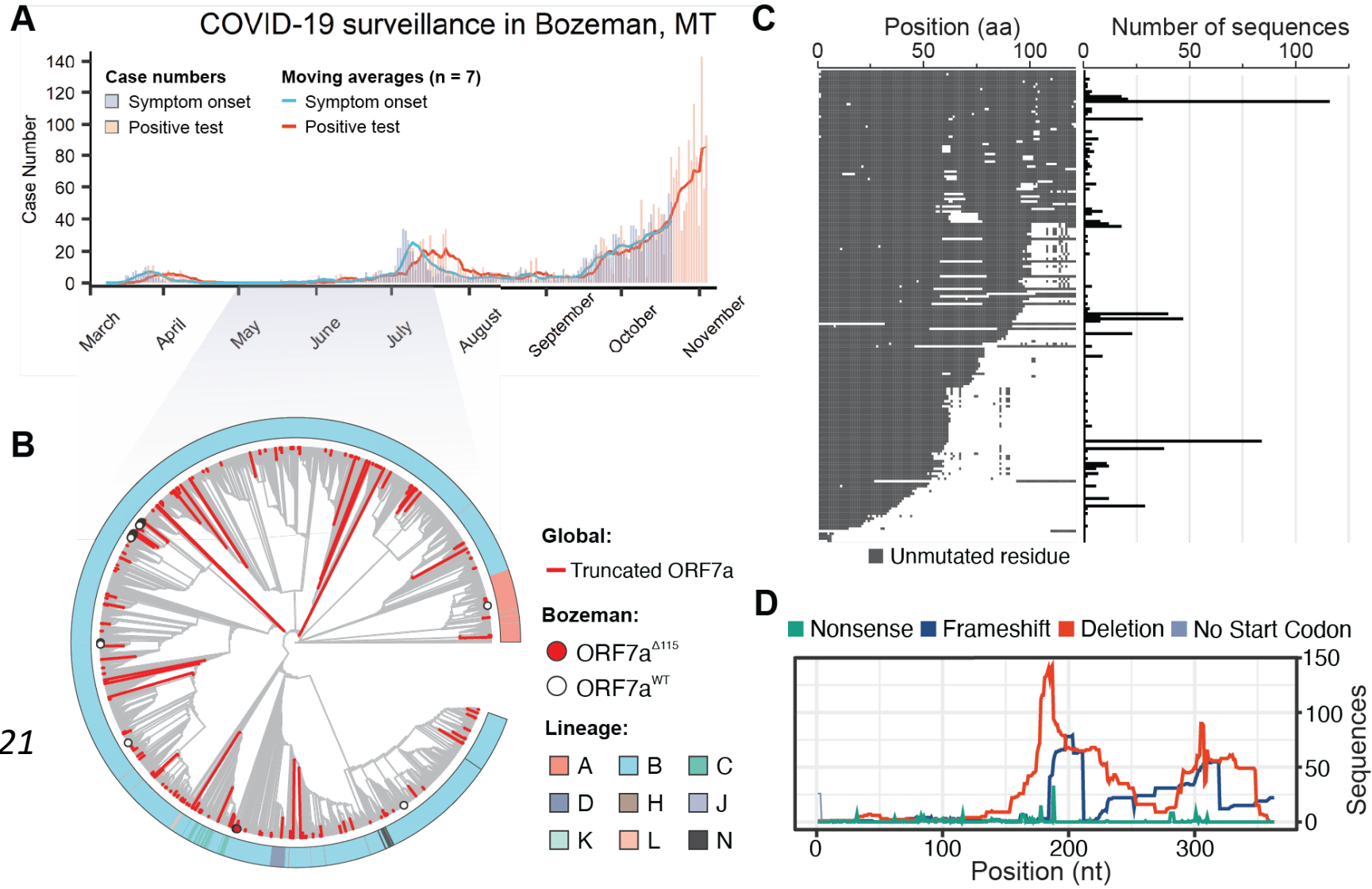


Kevin Surya



Murat Buyukyoruk

Local SARS-CoV-2 surveillance identifies variant that reoccurs around the globe.

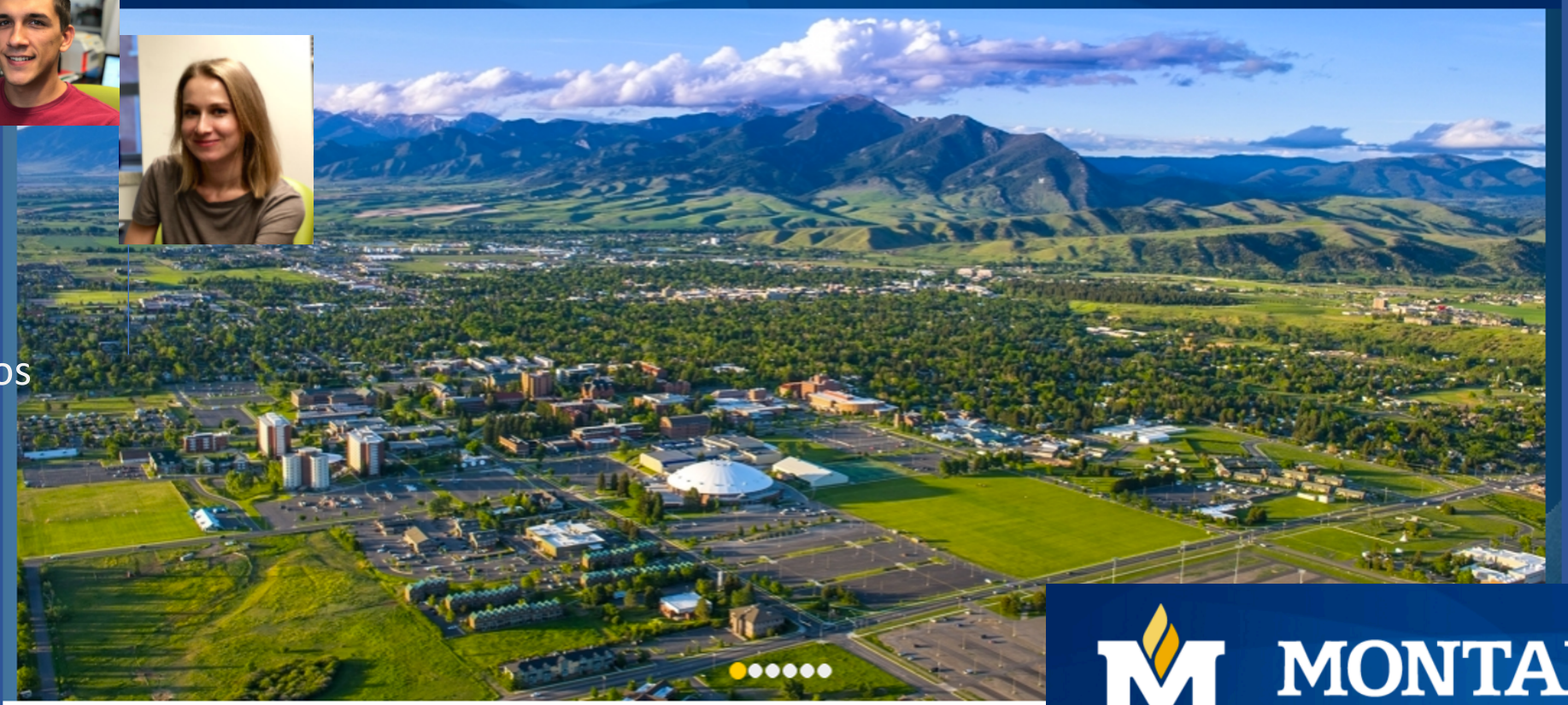
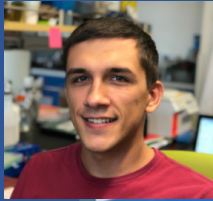


*Nemudryi et al., 2021
Unpublished data*

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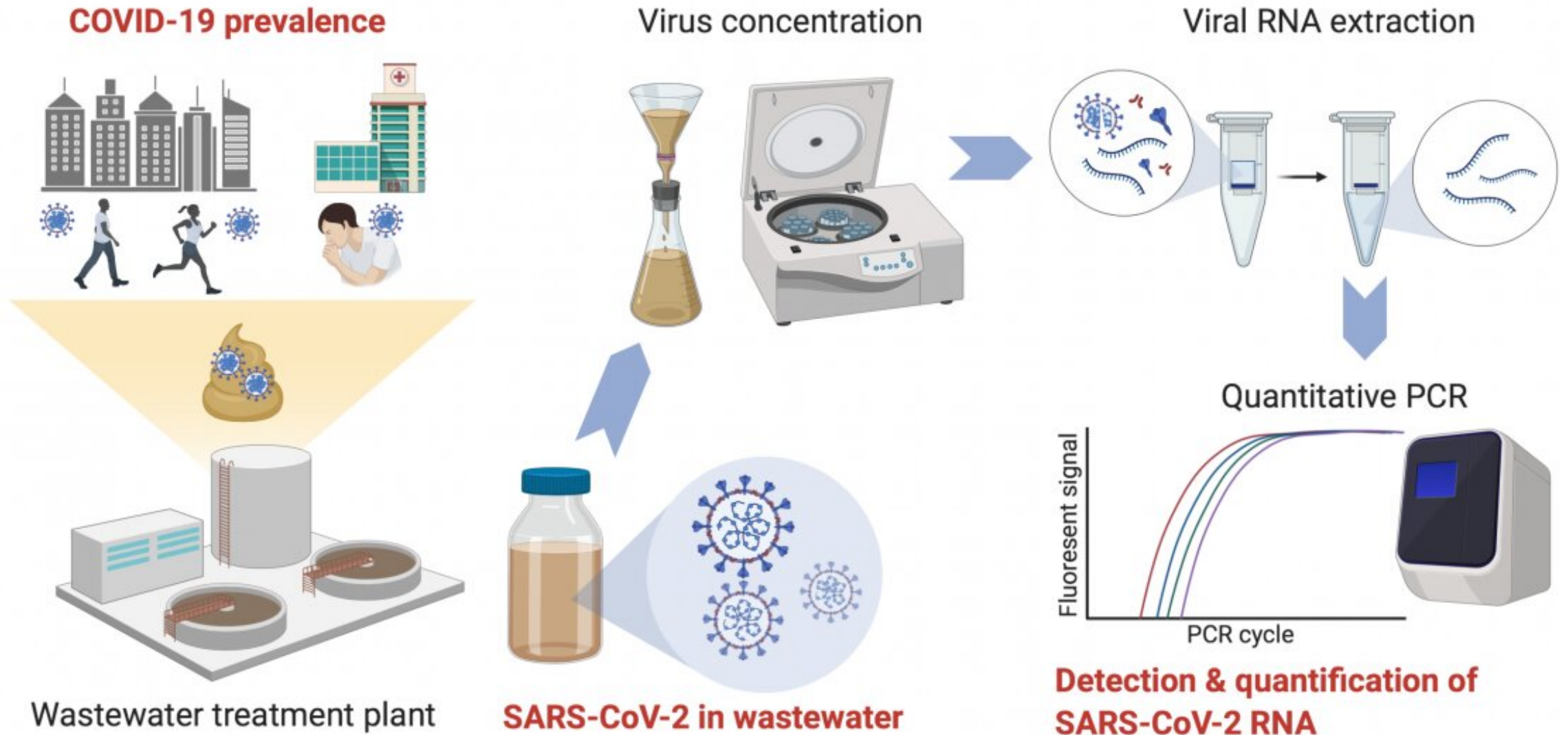
Karl K. Vanderwood



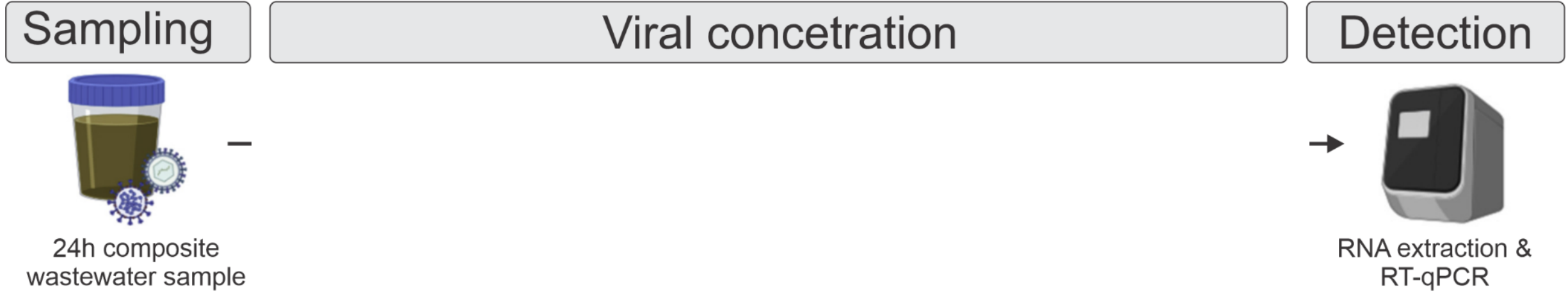
Mitch Reister
Josh French
Justin Roberts



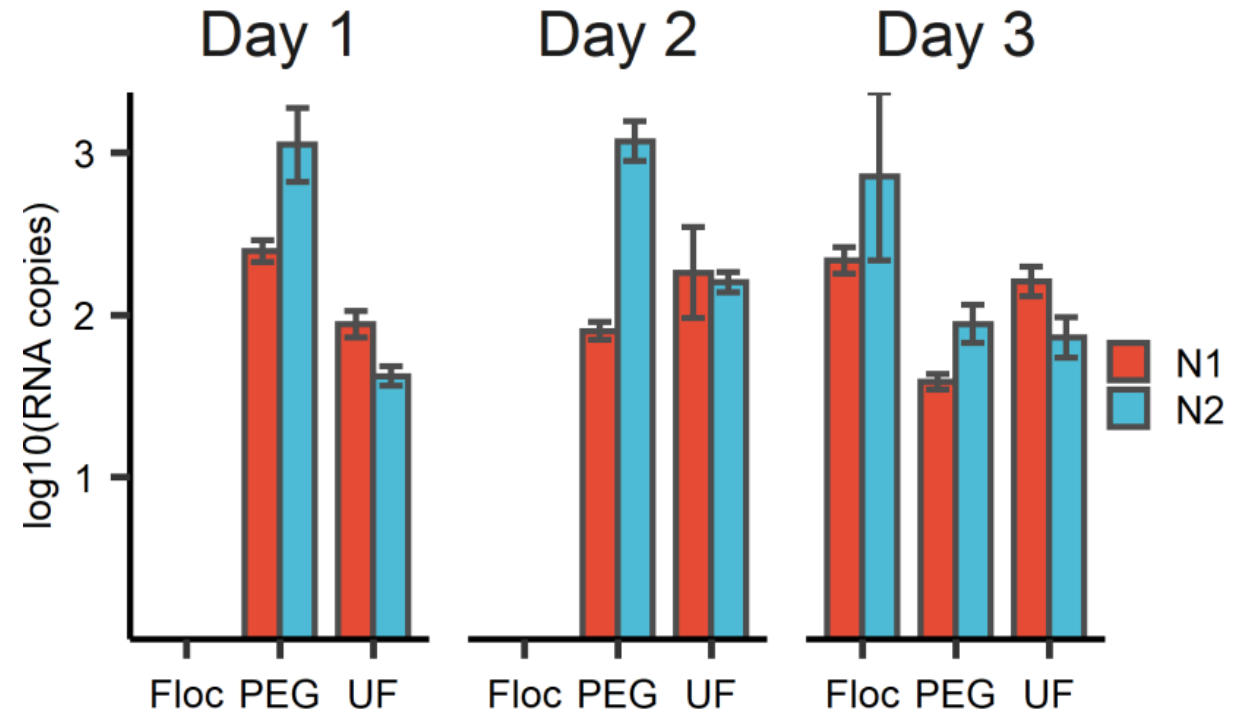
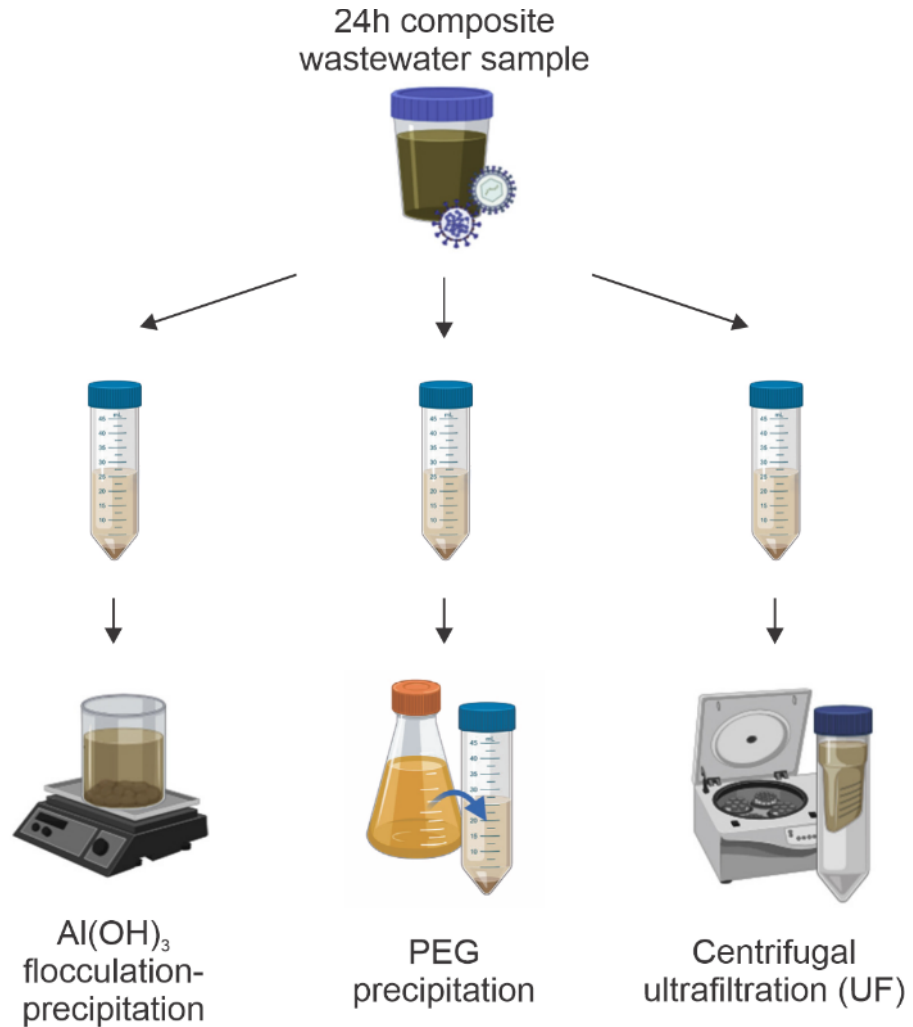
There is no standard method for concentrating SARS-CoV-2 from the wastewater!



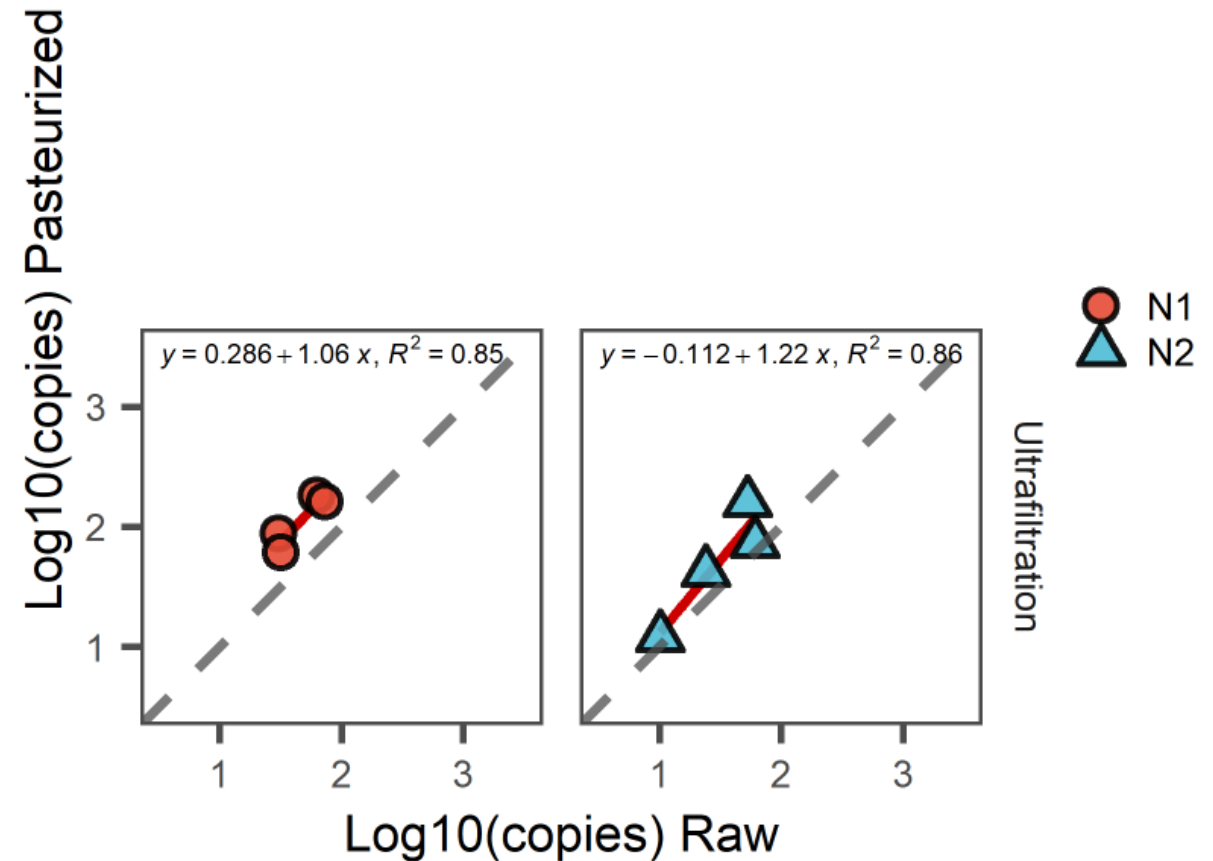
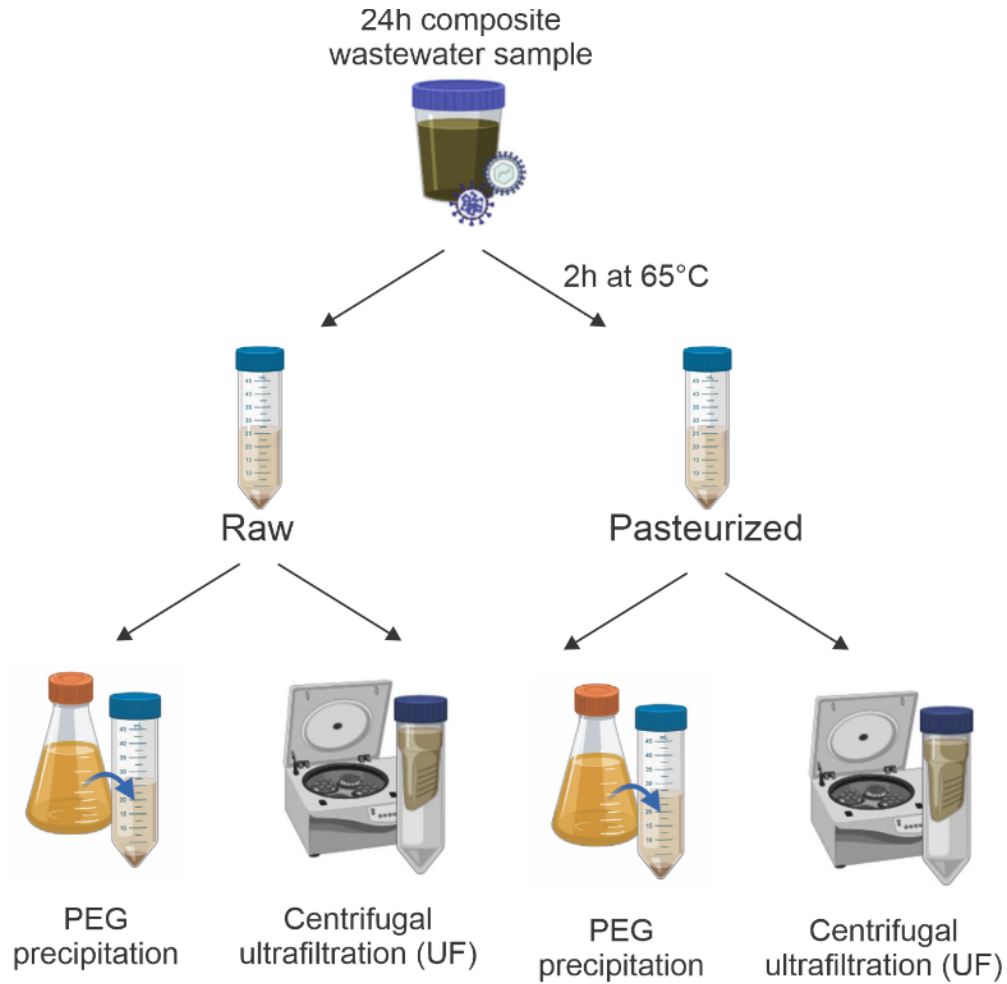
Methods to concentrate SARS-CoV-2 from wastewater



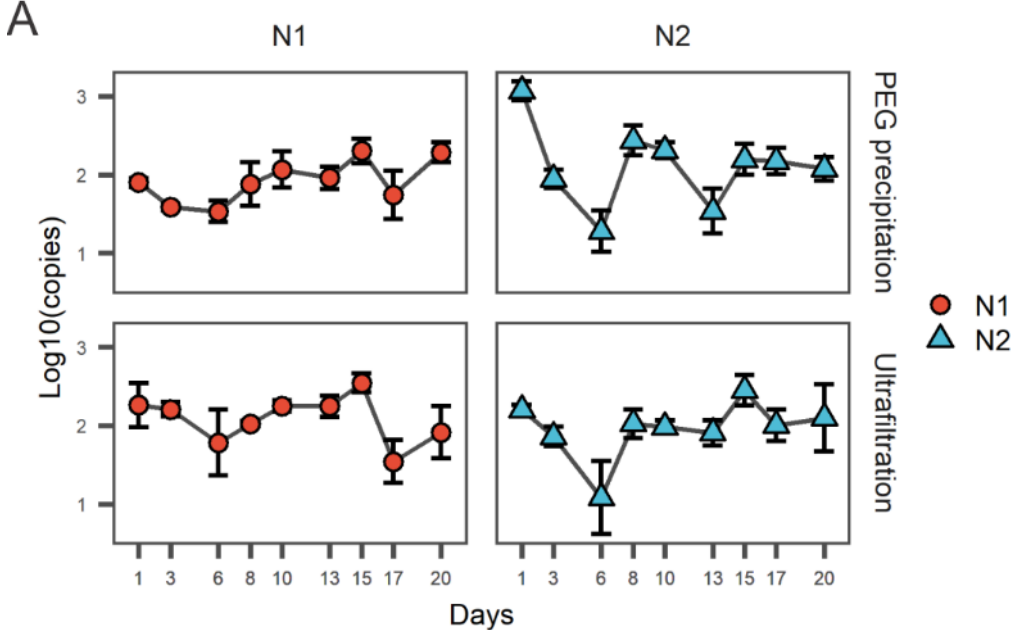
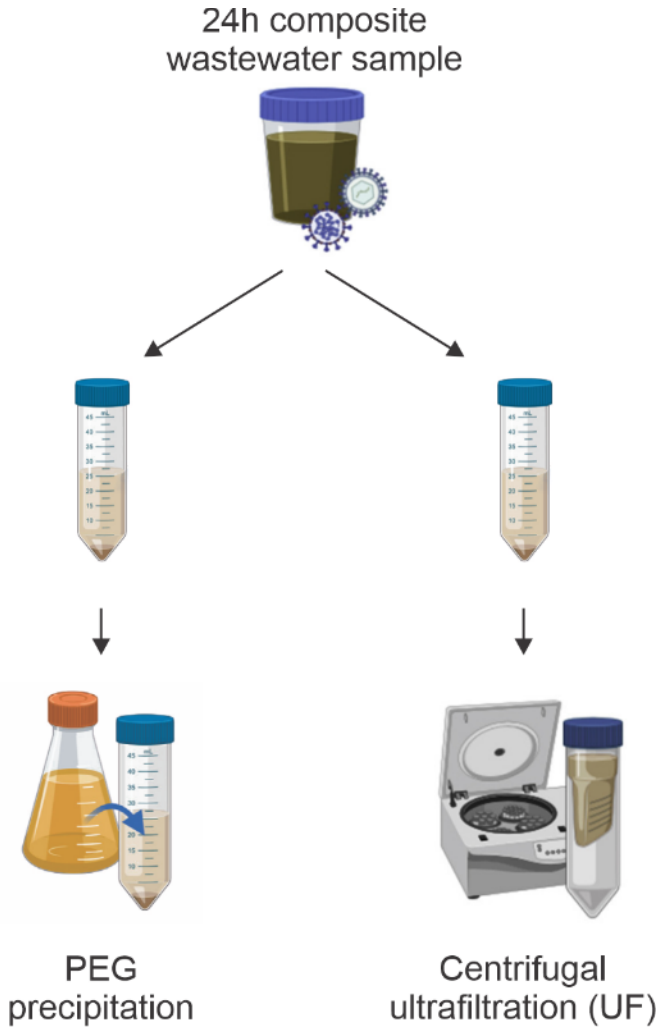
PEG precipitation and ultrafiltration performed better



Pasteurization does not significantly reduce detected viral titers.



PEG precipitation and ultrafiltration show moderate to high correlation



We compared two methods over the course of 20 days