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Covid-19 in Boise Sewage Anticipates Hospitalizations and Deaths by 1-2 Weeks

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TRIO
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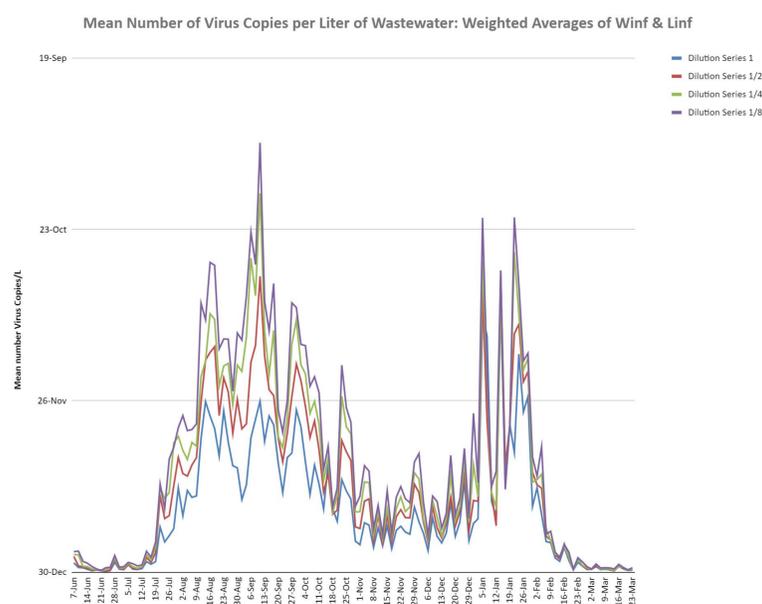
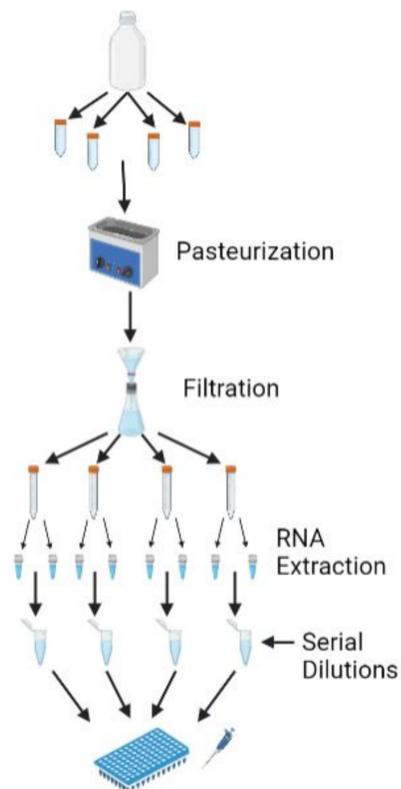
Abstract: COVID-19 virus concentration in Boise sewage predicts rises in clinical cases, hospitalizations and deaths. This is done through wastewater-based epidemiology, which provides a convenient and rapid method of testing pooled samples from over 200,000 residents. Wastewater viral counts prepare health care services for spikes in cases. COVID-19 continues to be a major health concern as it undergoes mutations, resulting in new variants that have produced several spikes in COVID-19 cases over the past two years. Spikes can cause care shortages in testing, treatment and hospitalization. Wastewater testing (unlike patient testing) can detect asymptomatic infections and symptomatic non-testing individuals, leading to improved tracking of viral spread (Layton et al, 2021). Wastewater counting is done primarily by extracting and measuring the concentration of SARS-CoV-2 RNA in the wastewater. In this project, two local wastewater treatment facilities were tested for SARS-CoV-2 RNA on a tri-weekly basis. Wastewater viral counts mirror trends in Idaho case counts and provide a significant lead time ahead of changes in hospitalization rates. Early results indicate that spikes of SARS-CoV-2 RNA concentrations in wastewater occur 1-2 weeks before spikes in COVID-19 related hospitalizations. This study demonstrates why wastewater-based epidemiology is an effective tool for tracking the COVID-19 pandemic, and can be used to improve public health responses to future outbreaks.

INTRODUCTION

On September 15th, 2021 The Idaho Department of Health and Welfare activated Crisis Standards of Care due to increased COVID-19 patients and limited resources. Wastewater-based epidemiology is the identification of infection rates through analyzing local wastewater. This project examines the accuracy of wastewater-based epidemiology and demonstrates its effectiveness in tracking COVID-19 infection rates in Boise Idaho .

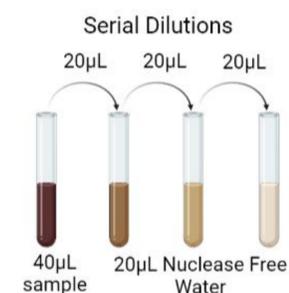
METHODS / PROCEDURE

- Performed for both Winf and Linf Samples.



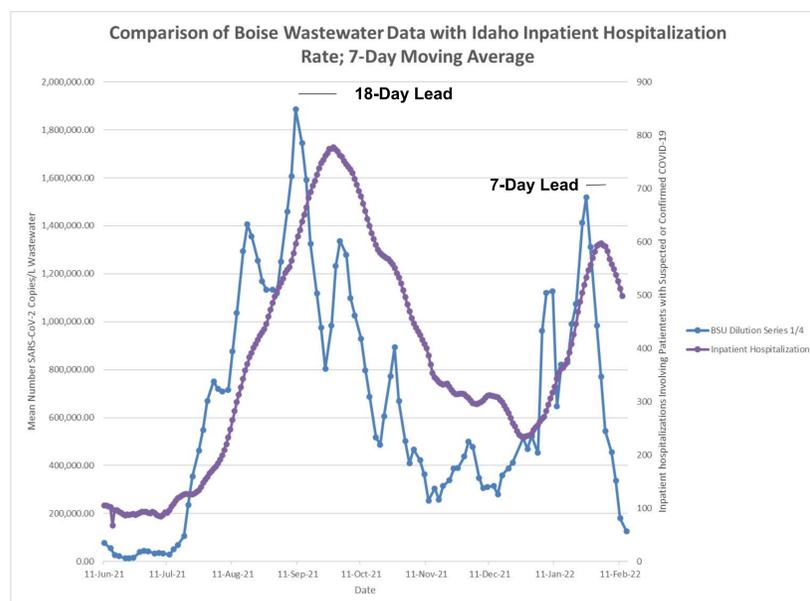
DILUTION SERIES

- Performed four serial dilutions (neat to 1/8 dilution).
- Dilution reduces the concentration of chemical inhibitors.
- 1/4 dilution (green) was chosen as the best dilution
 - Reduced inhibition, maintained SARS-CoV-2 levels.



CONCLUSIONS

- Peaks in COVID-19 hospitalizations followed peaks in wastewater by 1-2 weeks.
- Dilution series were performed to increase the accuracy of the SARS-CoV-2 concentrations measurements by diluting and consequently decreasing the inhibition caused by wastewater substances that inhibit the PCR process. It was determined that the 1/4 dilution provided the best results.
- Wastewater-based epidemiology is a potential predictor of serious illness (hospitalization rates), which could be applied to plan for future resource needs.



WASTEWATER COUNTS ANTICIPATE HOSPITALIZATIONS

- 1/4 BSU dilution versus "inpatient COVID-19 or suspected COVID-19 inpatient hospitalizations".
- Inpatient hospitalization data obtained from Idaho Division of Public Health
- Peaks in wastewater concentration occurred roughly 1-2 weeks prior to hospitalization peaks.
- Represents the predictive potential of SARS-CoV-2 wastewater data to hospitalization rates.

FUTURE WORK

- Utilization of QIAcube for automated purification of RNA and QIAcuity digital PCR machine for more accurate data.
- Metagenomics to determine all organismal composition of wastewater.
- Determining the concentration of other substances in wastewater (i.e. flu virus, stress compounds, opioids).

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