

Wastewater Coronavirus Levels and Critical Care Demand

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Introduction

The COVID-19 pandemic led to increased use of veno-venous extracorporeal membrane oxygenation (VV-ECMO) for severe respiratory failure¹. Wastewater surveillance is a known early indicator of COVID-19 hospital burden², but its predictive value for interventions like VV-ECMO remains unclear. Systems that identify early warning signs for ECMO demand could help improve equitable care distribution.

Minnesota ECMO Consortium



Aims and Objectives

To determine whether increases in SARS-CoV-2 wastewater viral loads correlate with subsequent surges in VV-ECMO utilization in Minnesota, especially during periods dominated by specific COVID-19 variants.

Methods

ECMO Consortium Data (4 centers)
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Identify COVID-19 ARDS patients on VV-ECMO
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Gather wastewater SARS-CoV-2 viral load data (Twin Cities metropolitan area)
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Define variant periods: alpha/beta/gamma, delta, omicron
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Pre-whitening to account for autocorrelation³
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Cross-correlation analysis
↓
Compare wastewater load vs VV-ECMO utilization

Results

Patient Demographics & Clinical Outcomes	
Patients	109
Mean Age (years)	46
Male (%)	72%
Mean ECMO Duration (days)	33
Survival Rate (%)	54%

Variant Period	Approximate Lag Time
Alpha/Beta/Gamma	3 weeks
Delta	3 weeks
Omicron	None observed

Conclusions

While visual inspection suggested a potential correlation during more virulent variant periods, statistical analysis did not confirm this relationship. The pattern was inconsistent, with one delta-period ECMO surge lacking a preceding wastewater peak and omicron-period wastewater peaks not leading to increased ECMO use. Study limitations included a relatively modest statewide VV-ECMO cases. Overall, wastewater SARS-CoV-2 surveillance was not consistently associated with VV-ECMO utilization patterns for COVID-19 patients in Minnesota. Future studies with larger datasets and additional variables may better clarify how we can anticipate and prepare for ECMO resource allocation in future pandemics.

References

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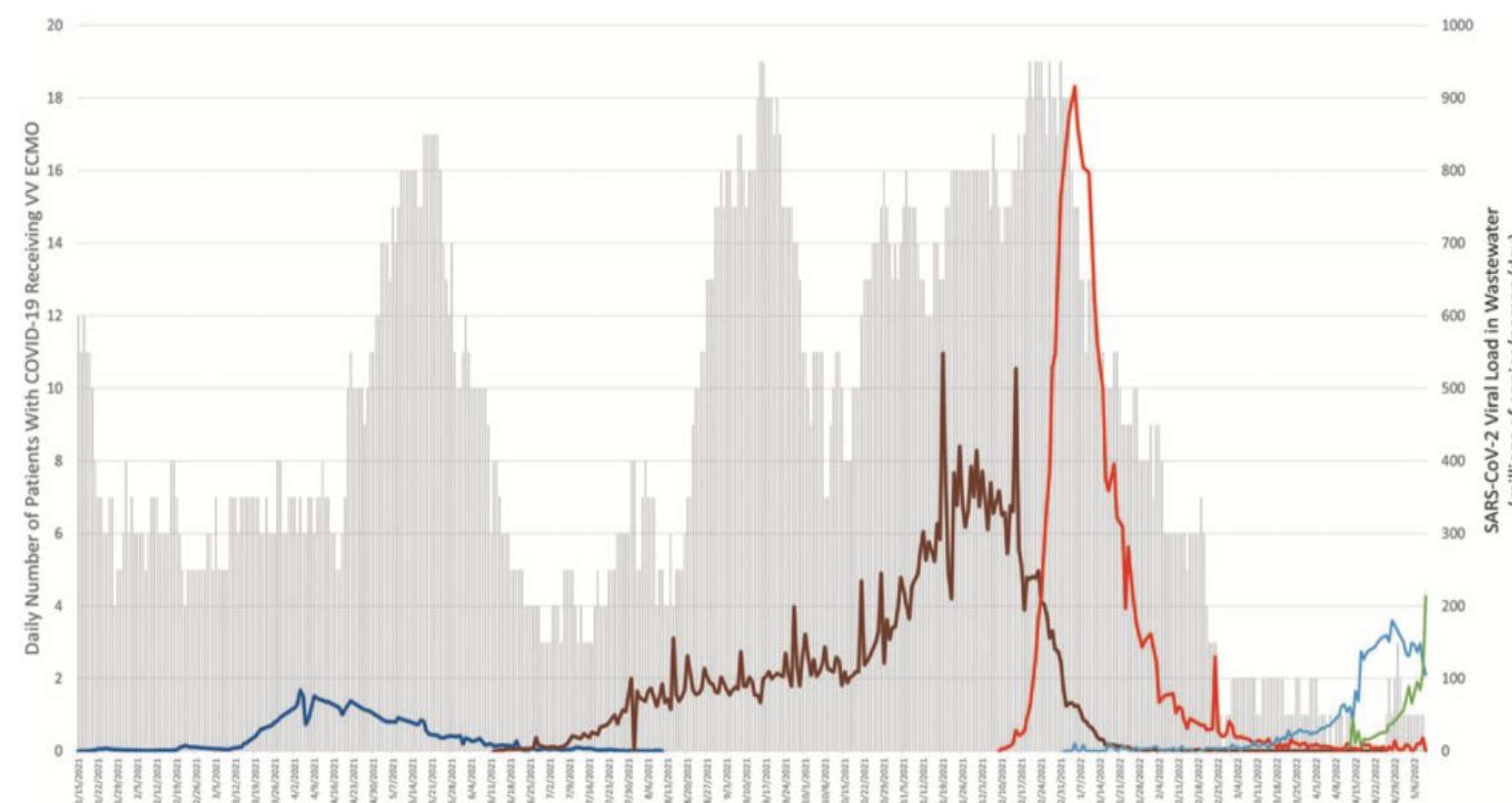


FIG. 1. Veno-venous extracorporeal membrane oxygenation (VV-ECMO) cases and severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) wastewater viral load by pandemic week. The daily census of adults with coronavirus disease 2019 (COVID-19) acute respiratory distress syndrome (ARDS) receiving VV-ECMO in Minnesota (gray solid), and the daily copies of SARS-CoV-2 variants in wastewater surveillance in one metropolitan sewershed district in Minnesota (a/b/g variants, dark blue; delta variant, brown; BA.1 variant, red; BA.2 [excluding BA.2.12.1], light blue; BA.2.12.1, green) are plotted per pandemic week from January 15, 2021 until May 13, 2022.⁴