

# Study reveals impact of ICU demand on COVID-19 patient mortality in Colorado

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A new study conducted by researchers at the Colorado School of Public Health has revealed critical insights into how ICU capacity influenced patient mortality during the height of the COVID-19 pandemic in

Colorado. A major public health objective during the pandemic was to "flatten the curve" to prevent overwhelming hospital and ICU capacities, which would have led to deteriorated standards of care and high mortality rates. While Colorado successfully avoided such a crisis, this study delves into the subtler effects of high ICU occupancy on patient outcomes.

The research, which was [published](#) in *BMJ Open*, spanned from August 2020 to March 2022, and tracked patients admitted to intensive care units (ICUs) with COVID-19 across 34 hospital systems with large ICUs in Colorado. By examining ICU occupancy levels during patients' stays, the study aimed to determine whether higher patient loads contributed to increased mortality rates among COVID-19 patients.

Utilizing a robust modeling approach that accounted for patient age, sex, and [vaccination status](#), the study uncovered significant findings:

- Increased mortality during high ICU loads: During the delta variant era, the period marked by the most harmful COVID-19 variant, patients in ICUs operating at high capacity (levels seen above 75% of the time) faced approximately 26% greater odds of death. This trend was not observed during the pre or post-delta period.
- Increased mortality with higher ventilator use: Across both the delta and omicron periods, COVID-19 patients in ICUs with a high number of ventilators in use also experienced a greater risk of death.
- Collaboration between public health and providers is essential: Access to data and a collaborative working partnership proved invaluable to this study. It allowed each sector to better monitor crisis responses, as with a pandemic and potential other health crises, natural disasters, or community response efforts. A key strength of this study lies in its access to patient-level data,

offering detailed insights that align with previous research based on group-level data. These findings underscore the importance of managing ICU capacity not just to avoid surpassing full capacity but also to mitigate the impact on patient survival rates even before maximum capacity is reached.

"Our study highlights that the stress experienced by ICUs operating at high capacity, even if not completely full, can significantly affect [patient outcomes](#)," said Elizabeth Carlton, Professor at the Colorado School of Public Health. "This underscores the critical need for tools to anticipate surges and effective resource management in health care systems, particularly during pandemics."

These findings provide valuable lessons for planning for future pandemics and infectious disease outbreaks. They show that ICU stress can impact patient outcomes. By recognizing and addressing the nuances of ICU capacity stress, health care systems can better prepare for and respond to similar [public health](#) crises in the future.

**More information:** David R Johnson et al, Did COVID-19 ICU patient mortality risk increase as Colorado hospitals filled? A retrospective cohort study, *BMJ Open* (2024). [DOI: 10.1136/bmjopen-2023-079022](#)

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