Lack of ICU beds tied to thousands of excess COVID-19 deaths

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A new study by Yale researchers found a significant association between the availability of hospital resources—particularly ICU beds—and patient mortality during the early weeks of the COVID-19 pandemic.

This was especially true at hospitals in the northeastern U.S. which were hardest hit by the first surge of patient cases, according to the study published in the *Journal of Hospital Medicine*.

"There is a general narrative among people in healthcare that the more resources there are, the better we can take care of patients," said lead author Dr. Alexander Janke, a Yale Emergency Scholar in the fourth year of a five-year combined residency and health services research fellowship. "This study begs the question—are case fatality rates driven by changes in resources?"

According to their findings, the answer is "yes." In an analysis of 306 hospital referring regions (HRRs) in the U.S. from March 1 to July 26, 2020, researchers found that geographic regions with fewer resources per COVID-19 patient—including ICU beds, intensivists or critical care physicians, emergency physicians, nurses, and general hospital beds—were statistically associated with more deaths in April, 2020. The study looked at 4,453 hospitals overall.

The strongest association was related to ICU bed availability. According to the findings, for every additional ICU bed per COVID-19 case, there was an associated one-fifth decrease in incidence rate of death during the month.

According to their estimates, 15,571 COVID-19 patients died at these hospitals due to lack of ICU beds during the month of April. Most of the hospitals with greatest numbers of excess deaths were located in the Northeast, specifically HRRs in New York City, Boston, Philadelphia, Hartford, and Camden, N.J.

The findings provide important insights as, nearly a year later, the country continues to see high rates of COVID-19.

"As the country enters one of the darkest periods of the COVID-19 pandemic, with cases and hospitalizations anticipated to continue unabated in the coming months, the lessons of this work is clear—our hospital resources are finite, and a failure to implement the policies to prevent hospital overload is certain to result in deaths that could have been avoided," said Dr. Arjun Venkatesh, associate professor of emergency medicine at Yale School of Medicine, a co-author of the study.

"Our paper is a worst-case scenario for what resource limitations might mean for mortality," said Janke.

"This is a phenomenon that's close to the hearts of everyone in emergency medicine," he added. "Sometimes patients have to wait hours or days to get a bed. Emergency medicine is really good at managing a patient's first few hours of care, but that

transition [to an ICU bed from the emergency department] needs to happen."

Although Janke noted that it may not be worthwhile for hospitals to have excess resources ready in case of a pandemic, he said that there are opportunities for hospitals to engage flexible transitions to accommodate mass illness events in the near term. The paper found that after April 2020, the relationship between hospital resources and patient deaths was more muted, suggesting that hospitals were able to implement innovations to better manage rising caseloads over time.

Yale New Haven Hospital provided one such example, he said.

"Yale was especially successful at mobilizing space," he said. "In the [hospital pavilion] where the medical ICU is, whole floors had to be converted to ICU beds. That required additional staffing, both ICU doctors and nurses, as well as overcoming the logistical challenge of clearing floors and creating new negative pressure [isolation] rooms."

Such examples, he said, can provide important models for other hospital systems as COVID-19 cases again surge across the country.

More information: Analysis of Hospital Resource Availability and COVID-19 Mortality Across the United States
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