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CHEST

# What Can Simulations Tell Us About Triage Protocols in a Real Pandemic?

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Until the COVID-19 pandemic, we had not seen wide-scale emergency allocation of critical care resources in developed countries. Previous pandemics had prompted development of early triage protocols based on 4 decades of empiric prognostic models,[1-3] which were met with critiques from both the scientific community and public. However, the COVID-19 pandemic and ensuing health-care system overload led to reports of rationing of life-saving technology in highly resourced health systems. They contained disturbing narratives of rushed triaging protocols leading to fallible clinical decisions and moral distress in health care workers.[4] Triage protocols for potential impending overload were quickly reassessed or crafted for other health systems in response, with little real-world-tested evidence on which to base policy.[5-7]

In this issue of *CHEST*, Darvall et al[8] describe their retrospective multicenter observational cohort study using ICU administrative data merged with a death registry from the state of Victoria to assess an Australian triage protocol. Unlike similar simulation studies, they were able to study long-term survival among patients assigned to different triage categories. Stratification of patients on the basis of age, comorbidities, and Sequential Organ Failure Assessment (SOFA) scoring for illness severity found that even patients in the lowest priority categories had significant numbers of long-term survivors. Approximately one-third of those who would have been excluded from critical care were alive at 5 years, and almost one-quarter were alive at 10 years. There are legitimate criticisms of this study, including high loss to follow-up for long-term outcomes, censoring of data, use of comorbidity data not collected for triage purposes, and the clear inability to assess performance in patients with COVID-19. Despite these, this study suggests that emergency triage protocols can exclude patients who might benefit from critical care resources. More important than any methodologic analysis of this study is the question of how simulations of triage criteria in general ICU populations can inform their use in an actual pandemic.

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There are several issues that may render a simulation based on historical data less applicable to pandemics. Darvall et al[8] argue that the observed long-term survival of patients in the low-priority elderly and comorbid group is evidence of failure of the protocol. However, it is important to note that patients in this group had low rates of mechanical ventilation and dialysis. Many may very well have survived without ICU admission. Simulations using data of patients admitted to an ICU cannot tell us how these patients would do with care in other areas, possibly overestimating the magnitude of inappropriate triage.

Although simulations of triage protocols may accurately model outcomes for nonpandemic diseases, these simulation-based decisions may be inaccurate for patients with a pandemic illness. For example, patients with COVID-19 have been shown to produce a lower SOFA score compared with patients with other forms of critical illness, despite having high mortality and disability.[9] Resource allocation protocols using factors such as illness severity may not lead to consistent results between different pandemics, or even among different stages of the *same* pandemic. Early evidence from Canada's third wave of COVID-19 suggests that younger patients are more frequently and severely affected by SARS-CoV-2,[10] perhaps due to early vaccination of elderly groups or to differences in pathogenicity of variants of concern. This variability in affected populations and clinical presentations among

pandemics and within the same pandemic makes these studies based on historical data somewhat less useful in predicting their performance across the COVID-19, or any future, pandemic.

Simulations based on registry data for other purposes may not adequately reflect data collected during triage. For example, protocols often incorporate comorbid conditions or clinical frailty scores, which predict poor longer term survival. Simulation studies of these protocols rely on registry data collected from the medical record for other purposes. However, physicians determining the histories of patients in actual life-or-death triage situations might collect different data.[5-7] Triage protocols often incorporate complex adjudication procedures to handle ties or appeals that cannot be easily simulated. Finally, this study assesses only the admission decision. It does not tell us what to do for patients already using scarce critical care resources, whose prognoses may be worse than those of new patients.

There are some questions on emergency allocation that simulations can empirically evaluate. Different allocation philosophies can be compared, as done by Wunsch et al,[11] to measure their variable population impacts. Potential bias against marginalized populations, including elderly, disabled, racialized, and low socioeconomic populations, can be discovered and mitigated. The authors from this study conclude that survival rates in low-priority groups suggest a critical failing in their triage protocol. Yet, this protocol did separate out a group of patients with lower survival from those with better outcomes. No triage protocol will ever perfectly identify individual patients who will or will not benefit from critical care. Some patients who would have survived under nontriage conditions will die. Stakeholders must decide how many preventable deaths are acceptable during an emergency. A 20% survival rate in "low priority" groups may be unacceptable during routine care, but when resources become scarce during a pandemic, it is better to use an ICU bed for someone with a 60% probability of survival than 20%. Simulations can help inform these decisions by providing the public with a general idea of what could happen when we must use these protocols.[12]

Simulations cannot replace real-world studies of triage in answering questions such as the following: How many beds were made available by withdrawal of life-sustaining treatments? How many patients were denied critical care? What was the survival of these low-priority patients? How were triage criteria modified to improve their application? Despite reports of rationing of intensive care in some hospitals, scientific studies of this practice are not available. We worry that fear of criticism or guilt concerning implementation of triage protocols may explain the lack of scientific reports of actual, not simulated, triage. Society has placed the profound responsibility of rationing life-saving treatments in the hands of frontline physicians. With this comes the obligation to report what we have done and how. Until then, these imprecise simulations of triage are all we have.

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