Further, the separation of the two populations is not always done in cardiac arrest studies. For example, the HYPERION trial (7) investigated the impact of targeted temperature management on cardiac arrest outcomes in both IHCA and OHCA patients. We believe it would be best to include both populations and analyze them both together and separately to determine if the benefits of interventions exist for each population.

We chose to analyze the two populations separately in a subgroup analysis and focused our conclusion on the benefits of corticosteroids in IHCA patients who received corticosteroids as part of a VSE regimen. Although there is still a possibility that OHCA patients may benefit from corticosteroids, there are currently limited data to support this, and further studies are warranted.

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Higher Than Expected Severity-Adjusted Mortality in ICU Patients With Coronavirus Disease 2019: Time to Consider the Contributions of Pandemic-Related Transformations in Structure and Process

To the Editor:

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In a recent study by Higgins et al (1) published in *Critical Care Medicine*, the investigators sought to compare Acute Physiology and Chronic Health Evaluation-IVb (APACHE-IVb)-adjusted mortality between ICU admissions with coronavirus disease 2019 (COVID-19) and those with other viral pneumonia. No other risk-adjustment covariates were used. The authors found that the standardized mortality ratio for hospital mortality was increased among the COVID-19 patients and was markedly higher than that among patients with other viral pneumonia.

The investigators speculated that APACHE-IVb underpredicts mortality in COVID-19 patients due to unmeasured differences between them and the APACHE-IVb development set. The authors considered insufficient data on

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other organ system failures as the only other potential contributor to the comparatively higher mortality in the COVID-19 population.

However, beyond adjustments for patient-level factors, several interrelated structure and process changes in the care of critically ill patients brought forth by the COVID-19 pandemic should be considered in estimating risk-adjusted mortality among affected patients.

First, the rapidly growing shortage of ICU beds led to incremental use of other spaces for care of COVID-19 patients. In a recent multicenter study by Toth et al (2) on the impact of increased surge in New York City, the odds of in-hospital mortality of COVID-19 patients were 40% higher at high surge levels (defined as use of operating rooms, general wards, and parking spaces), following adjustment for numerous patient-level factors. Notably, "boarding" critically ill patients in ICUs of a different specialty (which was used as reference in the study by Toth et al [2]) was associated with increased adjusted risk of death in the general population (3). The investigators hypothesized that discoordination and delays of care, and disruption of established team operations related to disrupted geographic colocation contributed to the adverse outcomes of boarding (3).

Second, the corresponding shortage in critical care-trained clinicians was addressed through multiple strategies, including among others increased patient-clinician ratios, asking clinicians to work longer hours or extra shifts, and using non-ICU clinicians to "extend" ICU teams (4). Several of these approaches were previously reported to increase patient mortality, and it may be postulated that the other ones may have adversely affected patient outcomes. However, the prognostic impact of the individual strategies used to address COVID-19-related staffing shortages or their combinations remains unknown.

Last, the patient isolation measures mandated by the COVID-19 pandemic were unprecedented in scale and challenges in availability of required personal protective equipment and effects on care processes in otherwise high-resource health systems. Lesser measures of patient isolation were shown to reduce, as expected, time of clinicians' interactions with patients and were associated with increased risk of adverse outcomes (5). It is plausible that COVID-19–related isolation measures had adverse impact on outcomes of the critically ill.

Future studies are needed to better understand the contribution of each of the abovementioned changes in structure and process, overall and over time, on patients' outcomes to both create benchmarks and to inform future efforts to identify scalable models for the current pandemic and future public health crises.

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