EDITORIAL

Survival by the Fittest: Hospital-Level Variation in Quality of Resuscitation Care

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Despite several advances in resuscitation care over the last decade, in-hospital cardiac arrest (IHCA) remains common and is linked to poor survival. Approximately 200 000 hospitalized patients suffer IHCA and undergo cardiopulmonary resuscitation in the United States annually, with fewer than 20% surviving to discharge.[1–3] Not surprisingly, a great deal of attention has been placed on reducing IHCA event rates and improving outcomes. Although there is some indication that this focus is improving risk-adjusted survival over time, little is understood about the underlying mechanisms behind these trends. It remains unknown what specific hospital factors or processes of care are responsible for delivering high-quality resuscitation care and what modifiable quality metrics best address outcomes.

To begin to address these questions first requires the ability to identify the best hospitals. This is no easy task given the inherent heterogeneity of patients suffering IHCA—ranging from those with acute illnesses, such as acute myocardial infarction or sepsis, to those with chronic end-stage diseases like cancer. However, a risk-adjustment model for survival was recently developed and validated that included 9 clinical variables, using data gathered from nearly 50 000 patients within the Get With The Guidelines (GWTG)-Resuscitation registry.[1] Good discrimination and excellent calibration of the model permits it to be employed, for the first time, to facilitate benchmarking across hospitals as an initial step toward improving quality in resuscitation.

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The study published by Merchant et al[4] in this edition of *Journal of the American Heart Association* (JAHA) builds on this critical work.[5] It documents wide variability in risk-adjusted survival rates across hospitals. Based on data compiled from 135 896 index IHCA events at 468 hospitals within the GWTG-Resuscitation registry, the investigators found the observed median in-hospital survival rate for the bottom decile was 8.3% (range 0% to 10.7%) and for the top decile it was 31.4% (28.6% to 51.7%)—a nearly 4-fold difference. After adjusting for 36 predictors of in-hospital survival, significant variation remained across sites: the bottom decile with a median in-hospital survival rate of 12.4% (0% to 15.6%) versus the top decile with a median rate of 22.7% (21% to 36.2%). Only 24 of 46 hospitals (52%) remained in the top decile for IHCA survival after risk adjustment, which highlighted the importance of accounting for patient case-mix. Perhaps the most compelling finding was the median odds ratio for risk-adjusted in-hospital survival of 1.42 (95% CI 1.37 to 1.46). This statistic indicates a 42% difference in the odds of survival for patients with a similar case-mix at 2 different randomly selected hospitals.

So why might such large variation in outcomes exist across hospitals? Resuscitation-specific factors remain to be fully elucidated and are not readily apparent from the study by Merchant et al. However, many possibilities have been suggested in prior studies. Duration of resuscitation varies across hospitals and may contribute to differences in survival. Based on our recent work, we found that patients at hospitals with longer durations of resuscitation had higher rates of return to spontaneous circulation (adjusted risk ratio 1.12, 95% CI 1.06 to 1.18, $P<0.0001$) and survival to discharge (1.12, 1.02 to 1.23, $P=0.021$), independent of measured patient characteristics.[6] We also found that the median duration of resuscitation was just 20 minutes for nonsurvivors and many received shorter attempts. Importantly, these findings suggest that hospitals that reliably implement processes that systematically extend resuscitation care may have better outcomes. If so, duration of resuscitation could potentially serve as a quality metric for assessing IHCA care. However, further investigation is needed to establish the optimal duration of resuscitation attempts.

Another resuscitation-specific factor that may contribute to a wide variation in case-survival may be time to defibrillation.[7,8] Current expert recommendations suggest hospitalized patients with pulseless VT or VF receive defibrillation within 2 minutes after recognition of cardiac arrest. In spite of this, prior work has found that delayed defibrillation (beyond the 2-minute threshold) occurs in almost one-third of hospitalized patients (30.1%) with a VF or pulseless VT arrest. Patient factors associated with delayed defibrillation included black race and a non-cardiac admitting diagnosis. Significant hospital-related factors included small hospital size (less than 250 beds), occurrence of cardiac arrest in an unmonitored inpatient bed, and occurrence of cardiac arrest after hours (ie, 5 PM to 8 AM or weekends). Delayed defibrillation was associated with a significantly lower probability of survival to hospital discharge (22.2% versus 39.3% when defibrillation was not delayed; adjusted odds ratio 0.48; 95% confidence interval 0.42 to 0.54, $P<0.001$). Thus, in this vulnerable high-risk population of patients with VF or pulseless VT, rapid defibrillation may be a marker of high-quality resuscitation care.

What about other hospital factors outside of resuscitation care? For example, it is plausible that top performing institutions with respect to resuscitation are simply better at implementing and monitoring the general processes of care needed to deliver high-quality care for multiple conditions. However, hospitals that perform better on publicly reported outcomes for 3 common medical conditions (acute myocardial infarction, heart failure, or pneumonia) do not have better cardiac arrest survival rates.[2] This indicates that the quality signal from cardiac arrest is distinct from that conveyed by the other measures.[2] Indirectly, these data point toward the need for quality improvement efforts specific to resuscitation care to improve survival for patients with IHCA. While the aforementioned studies have focused on survival after IHCA, it is also plausible that hospitals with high case-survival rates do a poor job of preventing cardiac arrests among their critically ill hospitalized patients in the first place. However, prior work has found that hospitals with exceptional rates of survival for IHCA are also better at preventing cardiac arrests, even after adjusting for patient case mix.[3]

The extent to which significant variation in hospital survival may be related to differences in care prior to IHCA, acute resuscitation care, and post-resuscitation care remains to be determined. Specifically, interventions targeted at preventing cardiac arrests (eg, telemetry monitoring, rapid response teams, remote intensive care unit monitoring, etc.), improving acute resuscitation care (eg, times to defibrillation and vasopressors, high-quality chest compressions with minimal interruptions), optimizing post-resuscitation survival (eg, therapeutic hypothermia) as well as strengthening training and teamwork through better resuscitation systems of care (eg, simulations of and debriefing after cardiac arrest) need to be investigated (Figure). High-fidelity simulation studies have established the critical role of effective leadership, teamwork, and communication in resuscitation performance.[9] Indeed, this emphasis on teamwork and leadership skills for advanced cardiovascular life support (ACLS) and pediatric advanced life support (PALS) providers is reflected in a Class I, Level of Evidence B recommendation in the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[10] An eclectic array of methodological strategies, both quantitative and qualitative, will need to be employed to further elucidate best practices at top-performing institutions and to make these strategies available to a greater number of hospitals.[11]

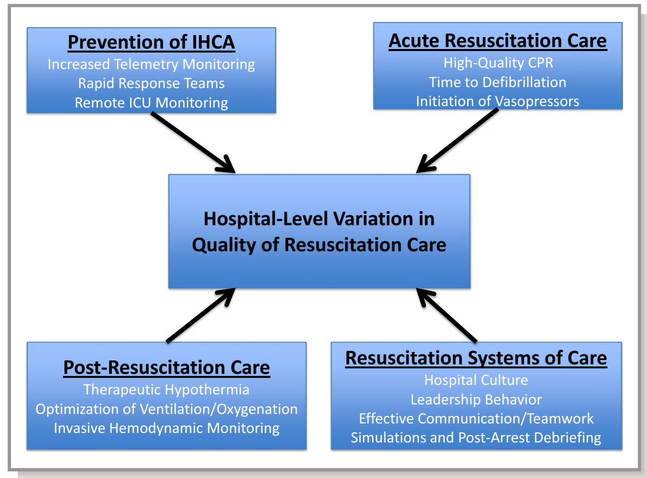

Figure. Putative hospital factors or processes of care contributing to differences in quality of resuscitation care. Prior investigations have suggested that resuscitation performance and quality may be related to prevention of IHCA, delivery of acute and post-resuscitation care, and organizational aspects with respect to systems of care. CPR indicates cardiopulmonary resuscitation; ICU, intensive care unit; IHCA, in-hospital cardiac arrest.

By documenting wide variation in survival after IHCA, Merchant et al.'s study[4] makes evident both the challenges and opportunities for improving care for patients who undergo cardiac arrest. Future studies should identify those resuscitation-specific interventions that are likely to have the greatest effect on survival after IHCA and thereby provide a larger number of institutions with the tools for improving their performance.

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Disclosures

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