Supplementary Online Content

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eAppendix. Methods

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix. Methods

Risk-Standardized Survival Rate

We obtained 2012-2014 data from the Get With the Guidelines (GWTG)-Resuscitation registry for all adult in-hospital cardiac arrest (IHCA) patients for participating hospitals. The sample was restricted to only hospitals that participated during all three years and reported at least 20 IHCA cases during this period (n=192).

We used patient-level data from the above hospitals to calculate risk standardized survival rate (RSSR) for each hospital during each calendar year using multivariable hierarchical regression models that have been previously validated.[1] The use of hierarchical models for RSSR calculation ensures that our estimates account for clustering of patients within hospitals. A model which includes a total of nine variables: age (<50, 50-59, 60-69, 70-79, ≥80), initial cardiac arrest rhythm (asystole, pulseless electrical activity, ventricular fibrillation, pulseless ventricular tachycardia), hospital location (non-monitored unit, monitored ward, intensive care unit, emergency room, procedural or surgical area, other), hypotension, sepsis, metastatic or hematologic malignancy, hepatic insufficiency, mechanical ventilation, and treatment with intravenous vasopressors at the time of arrest) and a random hospital intercept was found to have excellent discrimination and calibration properties.[1] We used the hospital specific estimates (i.e., random hospital intercepts) to estimate each hospital's RSSR as the ratio of predicted to expected number of survivors at that hospital each year multiplied by the overall unadjusted survival rate during that year. This approach ensures that all hospitals, including those with small case volumes, would have adequate risk standardization of their survival rates.

The above calculations were repeated for each of the 3 years of data. Hospitals were designated as top-performing if they were consistently in the highest quartile of RSSR during each year (2012-2014), intermediate if consistently in the middle two quartiles and bottom-performing if consistently in the lowest quartile.

Selection of Study Hospitals

Selection of study hospitals was purposeful and based on the concept of information power,[2] which offers a practical approach to sampling based on relevant dimensions (e.g., aim, sampling specificity, application of theory) to provide rich information about the research question. Accordingly, we oversampled

top-performing hospitals as they would likely be most informative with regards to best practices for management and prevention of IHCA, while including a smaller number of intermediate- and bottom-performing sites for comparison (collectively referred to as non-top-performing hospitals). Such an approach has been used in prior qualitative studies.[3-5] In addition to hospital performance on RSSR, we also considered hospital teaching status, number of beds, and geographic census region (variables obtained from the American Hospital Association data) in our selection to ensure maximum diversity among our included hospitals.

Based on the above approach, a total of 12 facilities were identified and invited for participation in the study, of which 9 agreed to participate. One top-performing hospital that had initially agreed, later declined to participate due to unanticipated personnel issues. Another top-performing and 1 bottom-performing hospital declined due to the workload that would be involved.

Selection of Study Participants

Once study sites were selected and agreed to participate, we engaged each site's GWTG-Resuscitation liaison (usually the site's designated resuscitation champion) to identify potential interviewees with roles directly or indirectly related to IHCA and resuscitation. These individuals could potentially include physician leaders (e.g., Chief of Medicine, Chief of Emergency Medicine, Chief of Cardiology, other physician leaders), nurse leaders and bedside nurses, members of the hospital's RRT and Code Blue teams, quality management directors, administrators (e.g., Chief Operating Officer), respiratory therapists, technicians or other individuals. Other individuals that were deemed important by the site liaison for IHCA care at the site even if they represented roles not included above were considered. Once a final list of individuals was prepared, research staff invited them by email or phone to participate in a confidential semi-structured interview. Participation was voluntary.

Study Interviews

We used a consistent approach in interviewing study participants during site visits. In general, two members of the research team -- one clinical expert and one qualitative methods expert -- conducted interviews with the aid of interview guides designed *a priori* based on a clinical framework developed by our multidisciplinary team that included physicians (cardiologist, critical care, hospitalist), nurses, and qualitative

researchers. The semi-structured guide included scripted, open-ended questions across the following domains: prevention of IHCA including the roles and responsibilities of RRT, acute resuscitation care, post-resuscitation care, organizational culture and leadership. After obtaining informed consent, we started the interview by asking each respondent to describe their role in the organization and in resuscitation. We then elicited participants' perspectives about care of patients before, during, and after IHCA. The interview also covered hospital-wide efforts for IHCA prevention including RRTs, and holistic processes such as data collection, best practices, and areas for improvement. For all areas of inquiry, respondents were encouraged to illustrate their experiences with specific stories or vignettes. Specific probes were also included for clarification or requesting additional detail from the participants. Each interview lasted approximately an hour and most involved a single participant. In a few cases, when site or individual schedules required, we conducted group interviews. We did not identify substantive differences in types of comments or concepts between individual and group interviews. A small token incentive ($20 gift card) was offered to study participants for their time and participation in the study.

eReferences

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