Final Progress Report

Title of Project:	Organization of Care and Outcomes in Cardiac Surgery
Principal Investigator:	Elizabeth A. Martinez, MD, MHS
Team Members:	Lisa Iezzoni, MD, MsC
	Peter J. Pronovost, MD, PhD
Organization:	Massachusetts General Hospital
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Federal Project Officer:	Kay Anderson, PhD
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Abstract:

Purpose: To describe the structures and processes of care delivery in a cohort of cardiovascular surgical intensive care units (CVICU) and to assess the impact of these on outcomes.

Scope:
Methods: Prospective, cross-sectional survey study of 250 CVICUs

Results:
Intensivist staffing coverage and participation in multidisciplinary rounds differed among a cohort of CVICUs. Nurse staffing patterns did not seem to occur among CVICUs. Given this variation, the association of these different patterns on outcomes should be explored more.

Key Words: ICU Physician Staffing, Intensivist, Nurse Staffing, Multidisciplinary Rounds, Organization of Care, Cardiac Surgery

Final Report:

Purpose:

The goal of this research project is to identify the characteristics of the postoperative care of cardiac surgical procedures that impact outcomes by identifying variation in the organization of the postoperative ICU care of cardiac surgery patients and identifying those characteristics that correlate with outcomes in cardiac surgery.

Scope: (Background, Context, Settings, Participants, Incidence, Prevalence).

Variation in care delivery models has been shown to be associated with variations in outcomes. This is certainly true of intensive care units, in which variation in physician, nurse, and pharmacy staffing are associated with patient outcomes. There is little known about the impact of intensive care unit staffing patterns among cardiac surgical patients. The goal of this study was to survey a cohort of US cardiac surgical centers to ascertain staffing patterns, use of protocols, and involvement in quality improvement projects and then to evaluate their association with outcomes.

Methods (Study Design, Data Sources/Collection, Interventions, Measures, Limitations).

Methods:
We conducted a cross-sectional survey to understand organizational characteristics of CVICUs.

Survey development:
Through an iterative process that included a literature review, interviews with CVICU staff, site visits to cardiac surgical centers to identify local protocols and practices to include in the survey, and pilot testing, a survey instrument was developed. This survey included questions about physician, nurse, and mid-level provider staffing; utilization of protocols; and participation in quality improvement projects.

Final Survey distribution:
Sampling frame:
The pilot survey was distributed to all cardiovascular centers in Michigan. The national survey was distributed to a cohort of 250 cardiac surgical centers via mail. These centers were identified from a sample of hospitals that report to the Society of Thoracic Surgeons (STS) database. Data managers from each site were responsible for completing the survey with input from the CVICU nurse manager and cardiac surgical chief.

Data analysis:
We evaluated baseline ICU characteristics, ICU characteristics stratified by ICU physician staffing, rounding-team characteristics, and night-time coverage in addition to utilization of protocols and team involvement in quality improvement and morbidity and mortality conferences. Additional data analysis is being performed to link the survey and the Society of Thoracic Surgeons outcomes database.

Results (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications).

Principal Findings and Outcomes:
To date, the principal findings are outlined below. Additional analyses to determine the association between these structural and process-related variations in CVICU care and outcomes are ongoing.

Pilot data results:
Twenty-three of the 32 centers in Michigan returned their surveys (78% response rate). On average, the cardiac surgeons' mean years of experience were 16, and the former and current Chief-Director of cardiac surgery had served in that position for an average of 8 and 7 years, respectively. In that cohort, 18% of CVICUs primarily cared for cardiovascular/thoracic patients, and no ICUs reported caring for both adult and pediatric patients. The average nurse-to-patient ratios in the ICU were 1:1.6 during the weekday, and we found no significant difference in this staffing by day of week or time of day. Furthermore, there was no correlation between the number of staffed beds and the nurse-to-patient ratio. The nurse-to-patient ratio in the step-down units was 1:4.0. Eighty-six percent of the ICUs reported the presence of a nurse practitioner or physician assistant (mid-level provider) in the CVICU, and there was no correlation between the number of staffed beds and the mid-level provider-to-patient ratios. Seventy-two percent of the CVICUs reported that intensivists were part of the primary care structure of care delivery, and 23% identified the surgeon as the primary provider of care in the ICU. Sixty-eight percent of all CVICUs reported having daily rounds with a physician leader most of the time or always, whereas 14% reported never having daily rounds.

National cohort results:
One hundred fifty-eight of the 250 surveys were returned, giving us a 63% response rate.

Respondent Demographic Features and Findings
There was variation in the number of adult ICUs within each center and the number of CVICU beds. Thirteen percent of the surveyed sites reported that they provided care primarily for cardiac surgical patients only. There was little variation in nursing staffing

patterns but important variation in the physician staffing models. We identified variation in the presence or involvement of an intensivist in addition to the multidisciplinary nature of the rounding team. Interestingly, some of the CVICUs reported no daily rounds with a physician. In addition, there was heterogeneity in the utilization of mid-level providers both during the day and at night.

In accompanying work that was part of the grantee's training in ethnographic and survey research techniques for the completion of the proposed specific aim 4, five cardiovascular centers were visited; organizational surveys were administered, and observations of intraoperative care and transitions to the CVICU were completed. During the course of these site visits, many patient safety hazards were identified in cardiovascular operating rooms. Hazards in teamwork and communication, the tasks performed, organizational and safety culture, the tools and technology utilized, and the environment were surfaced. Qualitative analysis of these findings informed the design of a major project for the prioritization and development of interventions in cardiac surgical care (AHRQ 1R18HS019934-01; PI: Peter Pronovost, MD, PhD), on which the grantee has support for 20% effort beginning 3/2011 and is the PI at Massachusetts General Hospital.

Furthermore, during the early phases of the survey development and identification of outcome metrics to track, it became evident that there were little data on how the quality of intensive care unit (ICU) care could be tracked and compared. In response to this observation, the grantee submitted and has been awarded a grant from the Commonwealth Fund (GRANT #20100334) to develop robust metrics that can be used to track and benchmark the quality of ICU care.

Discussion:
Through a national survey, we found that there was variation in current staffing patterns for postoperative cardiac surgical patients. Although the nurse staffing patterns vary little, the daytime coverage by an intensivist, the involvement of a multidisciplinary team, and night-time coverage vary significantly. These differences may be associated with differences in outcomes that will be explored more.

This study has important limitations. First, it utilized a survey tool; despite the robust process of survey development, there may be misclassification of independent variables, because sites were self-reporting. Second, we used a subset of sites that reported to the Society of Thoracic Surgeons database; by chance, these may not be representative of the national cohort. Furthermore, as we perform the analysis of the association between the survey results and the outcomes of the cardiac surgical centers, there may be unmeasured independent variables that contribute to the patient outcomes, such as surgeon experience.

Conclusions/Significance/Implications:
Given that staffing patterns have been shown to be associated with variations in outcomes in studies of general ICU populations, the association of these CVICU staffing patterns with outcomes needs to be explored more. Continued analyses of the data from this project will help to answer this important question. Future research should focus on the optimal staffing patterns in CVICUs. In addition, based on the findings from the observations in cardiac surgery operating rooms, there needs to be additional work done to identify hazards in cardiac surgical ICU care.

List of Publications and Products

New publications are in review or in press that resulted directly from the educational training in cardiovascular surgery safety and performance measurement and from the development of qualitative research skills necessary for the completion of the work funded under this K08.

1. Martinez EA, Thompson R, Errett N, et al. A descriptive analysis of the organization of care in cardiac surgical intensive care units in the US: a multicenter survey. *Crit Care*. In review.

2. Thompson DA, Kass N, Holzmueller C, et al. Variation in Institutional Review Board evaluation of a patient safety study. Jl Healthc Qual. In press.

3. Martinez EA, Thompson DA, Errett NA, et al. Review article: high stakes and high risk: a focused qualitative review of hazards during cardiac surgery. Anesth Analg. May 2011;112(5):1061-1074.

4. Martinez EA, Shore A, Colantuoni E, et al. Cardiac surgery errors: results from the UK National Reporting and Learning System. Int J Qual Health Care. Apr 2011;23(2):151-158.

5. Martinez EA, Marsteller JA, Thompson DA, et al. The Society of Cardiovascular Anesthesiologists' FOCUS initiative: Locating Errors through Networked Surveillance (LENS) project vision paper. Anesth Analg. Feb 2010;110(2):307-311.