

Research BRIEF

Research to Improve the Nation's Health System

2017 . No. 7

STRUCTURAL, NURSING, AND PHYSICIAN CHARACTERISTICS AND 30-DAY MORTALITY FOR PATIENTS UNDERGOING CARDIAC SURGERY IN PENNSYLVANIA

Meghan Lane-Fall, Tara S. Ramaswamy, Sydney E. Brown, Xu He, Jacob T. Gutsche, Lee A. Fleisher, Mark D. Neuman
Critical Care Medicine, June 2017

KEY FINDINGS

Cardiac surgery ICUs vary greatly in structure, care practices, and clinician staffing, but none of these organizational factors is consistently associated with patient mortality in the 30 days following surgery. In this study of 43 Pennsylvania hospitals and nearly 30,000 patients, there was no relationship between mortality and presence of daytime or nighttime intensivists, nurse ICU experience, or presence of interns or residents.

THE QUESTION

Some ICU organizational practices, such as clinician staffing and available specialists, have been associated with patient outcomes. From a fairly limited evidence base, payers and other stakeholders have set standards about how many and what kinds of providers are required to care for critically ill patients. But few studies have been conducted in surgical ICUs; the question of how organizational features affect mortality in surgical ICUs remains an open one.

Cardiac surgery provides an opportunity to investigate the association further, because almost all patients are admitted to an ICU after surgery, their care is protocol-driven, and many of the surgeries are elective. This study describes the variability in how cardiac ICUs are structured and organized, and analyzes whether some features are associated with better patient outcomes in patients undergoing coronary artery bypass grafting (CABG) or valve procedures.

THE FINDINGS

Forty-three of 57 hospitals in Pennsylvania, representing 29,499 cardiac surgical patients, responded to the authors' questionnaires. ICUs differed greatly in their structure and staffing, as shown in the table. After adjusting for patient characteristics, none of these attributes was associated with 30-day mortality in the entire cohort of patients.

SELECTED CHARACTERISTICS OF PENNSYLVANIA CARDIAC SURGERY ICUs

Structural Attributes	Number (Percent)
ICU dedicated to cardiac surgery	16 (37%)
Protocols:	
<i>Low tidal volume ventilation for acute lung injury</i>	18 (43)
<i>Sedation management</i>	33 (77)
<i>Therapeutic hypothermia after cardiac arrest</i>	37 (86)
<i>Liberation from mechanical ventilation</i>	36 (84)
<i>Checklist for central line insertion</i>	41 (98)
Respiratory therapists participate in daily rounds	26 (61)
Pharmacists participate in daily rounds	23 (54)
Presence of nurse practitioners or physician assistants	37 (86)
Telemedicine access	12 (29)
Nursing attributes	
> 2/3 weekday nurses with 2+ years ICU experience	25 (61)
Nurses allowed to work 16-hour shift	29 (69)
> 2/3 weekday nurses with BSN degree	11 (27)
Physician attributes	
Presence of daytime intensivist	21 (54)
Presence of attending at night	25 (60)
Presence of nighttime intensivist	8 (19)
Hospital has teaching affiliation	27 (63)
Presence of interns or residents in ICU	8 (19)
Presence of fellows in ICU	7 (16)

To explore whether patient acuity might influence the relationship between facility characteristics and mortality, the authors separately analyzed patients admitted electively and urgently. Among patients admitted electively, the presence of a nighttime intensivist was associated with decreased mortality, and the presence of a nighttime non-intensivist physician and presence of interns or residents was associated with increased mortality. Among patients who were urgently admitted, less nurse experience was associated with increased mortality.

THE IMPLICATIONS

Hospitals in Pennsylvania have organized their cardiac ICUs in a variety of ways to meet the needs of post-surgical patients. For example, many ICUs have nurse practitioners or physician assistants, but some also utilize residents and fellows. These clinicians have overlapping scopes of practice in many institutions, and further research is needed to understand the roles that they play in a given setting. Furthermore, while these staffing decisions have an unclear effect on patient outcomes, they do have different cost profiles. More research on the cost-effectiveness of staffing models may be useful to inform best choices on staffing and resource use.

Although some data suggest that ICU staffing decisions affect patient outcomes, most studies focus on either medical or mixed medical-surgical ICUs, with an underrepresentation of ICUs focusing on surgical care. This study adds to the growing evidence base that finds no association between ICU staffing and outcomes, suggesting that other factors may

exist alongside staffing that affect ICU patient outcomes. Alternative study designs, such as qualitative or mixed methods approaches, may help explain what these factors may be.

Additionally, further research should follow up on the possibility that organizational practices have a different effect on patients admitted electively than on those admitted emergently. The authors posit that mortality in urgently admitted patients might be driven more by patient acuity than ICU staffing, which would explain the associations they found in electively-admitted patients only. If this finding holds true in further research, it has implications for care networks and efforts to regionalize specialty care.

THE STUDY

The authors conducted a retrospective cohort study of all ICUs in Pennsylvania that care for adult postoperative cardiac patients, and 43 of 57 hospitals responded. From September 2012-May 2013 they surveyed facilities about use of common ICU protocols, access to resources to support ICU care, and staffing characteristics (nurses, advanced practice providers, respiratory therapists, pharmacists, and physicians). They linked facility survey responses to discharge data on patients treated in responding hospitals, information on hospital characteristics from the American Hospital Association, and vital status information from the Pennsylvania Department of Health. The study included 29,499 cardiac surgical patients.

They examined associations between ICU organizational characteristics and mortality in the 30 days after cardiac surgery, adjusting for severity of illness. They measured these effects

among all patients and explored difference in outcomes between emergent and nonemergent procedures.

Lane-Fall, M., Ramaswamy, T.S., Brown, S.E., He, X., Gutsche, J.T., Fleisher, L.A., Neuman, M.D. (2017), Structural, Nursing, and Physician Characteristics and 30-Day Mortality for Patients Undergoing Cardiac Surgery in Pennsylvania. *Critical Care Medicine*. doi: [10.1097/CCM.0000000000002578](https://doi.org/10.1097/CCM.0000000000002578)

ABOUT LDI

Since 1967, the Leonard Davis Institute of Health Economics (LDI) has been the leading university institute dedicated to data-driven, policy-focused research that improves our nation's health and health care. Originally founded to bridge the gap between scholars in business (Wharton) and medicine at the University of Pennsylvania, LDI now connects all of Penn's schools and the Children's Hospital of Philadelphia through its more than 250 Senior Fellows.

LDI Research Briefs are produced by LDI's policy team. For more information please contact Janet Weiner at weinerja@mail.med.upenn.edu.



LEAD AUTHOR

DR. MEGHAN LANE-FALL

[Meghan Lane-Fall, MD, MSHP](#) is an Assistant Professor of Anesthesiology and Critical Care at the University of Pennsylvania. Her current research focuses on the impact of teamwork and communication on health care quality in the perioperative and critical care settings. Dr. Lane-Fall has expertise in the use of mixed methods to answer health services research questions related to surgical care and critical illness. She uses qualitative research techniques to study handoffs and team dynamics and both primary and secondary data sets to model relationships between intensive care unit staffing schemes, clinical predictors, and outcomes in patients receiving critical care. Dr. Lane-Fall received her MD from Yale University School of Medicine in 2006 and an MSHP from the University of Pennsylvania in 2013.