

# Can Residents Be Trained and Safety Maintained?

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**INTRODUCTION:** Teaching hospitals and faculty need to balance the educational mission for training residents with patient safety. There are no data studying the change in trauma patient outcomes before and after implementation of a surgical residency. The objective of this study was to compare trauma center outcomes before and after the advent of a surgical training program. We predicted that patient-centric outcome metrics would not be affected by the integration of surgical residents into trauma patient care.

**METHODS:** A retrospective review was performed using the Crimson Continuum of Care (CCC) dataset and the Trauma Injury Severity Scores (TRISS) for the year before implementation of a surgical residency, compared to the 6 months following initiation of the residency. Severity and risk-adjusted performance measures included mortality, readmissions, complications, and length of stay. Using TRISS, actual, and predicted mortality was compared.

**RESULTS:** There were 1535 trauma admissions to the acute Care Trauma Service the year before starting the residency, and 856 admissions for the 6 months following the implementation of the program. The demographics were similar between the 2 groups. There was no clinically significant difference in observed mortality after the initiation of a surgery residency, based on CCC dataset variables and TRISS datasets. There were also no significant differences in complications and readmission rates.

**CONCLUSIONS:** We found that initiating a surgical training program did not affect mortality rates or complications of trauma patients. Training of general surgery residents in a high-performing trauma center can be effectively implemented without compromising patient safety. (J Surg Ed ■■■■-■■■. Published by Elsevier Inc on behalf of the Association of Program Directors in Surgery)

**KEY WORDS:** general surgery residency program, patient's safety, acute care, trauma, training, outcomes

**COMPETENCIES:** Patient Care, Practice Based Learning, Improvement

## INTRODUCTION

Teaching hospitals and faculty members recognize the need to balance the educational mission for teaching residents with patient safety. Although there is a recognizable need for training the next generation of medical professionals, both patients and attending physicians question the influence of less experienced clinicians on patient care.<sup>1-4</sup> The surgical field is under more pressure for monitoring trainees' influence on outcomes, as immaturity in clinical judgement may be accompanied by inexperience from a technical standpoint.<sup>5,6</sup>

Trauma provides excellent exposure for general surgery residents through variability in the complexity of injuries and the exposure to both critical care and operative cases.<sup>7</sup> General surgery residents are involved in the trauma activation, the decision-making process of operative versus observational management, the critical care in the intensive care unit (ICU), the rehabilitation or surgical floor phase of treatment, and discharge planning. There are multiple levels at which patient outcomes can be affected. Many studies have reviewed the influence of trainees by comparing patient outcomes between teaching and nonteaching hospitals.<sup>4,8</sup> However, there are no data studying the change in trauma patient outcomes before and after implementation of a surgical residency. By comparing the outcomes before and after the start of a residency program at a single busy trauma center, confounding variables such as difference in surgical attending expertise and difference in hospital policy and resources can be reduced.

The primary goal of this review was to compare trauma center mortality before and after the advent of a surgical

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training program. Secondary variables included complications, readmissions, and length of stay. We predicted that patient outcome metrics would not be affected by the integration of surgical residents into trauma patient care.

## MATERIALS AND METHODS

Kendall Regional Medical Center is a Level II Trauma Center in South Miami. In July 2014, the hospital became a teaching center as it welcomed general surgery and internal medicine residents; residents in their postgraduate years 1, 2, and 3 began at once on July 1, 2014. There were no postgraduate years 4 and 5 residents. Before starting the surgical residency, the trauma service consisted of 7 trauma surgeons and 2 advanced practitioners. After starting the program, the same 7 attending physicians and 2 advanced practitioners remained.

Residents were immediately integrated into the services, from their first day of clinical duties. Before this, the residents underwent a week long orientation to the hospital system, with review of expectations and educational objectives for each rotation. In addition, all residents were required to complete the Advanced Trauma Life Support (ATLS) course and pass the certification examination. This course provided the basics necessary to participate in the initial evaluation of trauma patients, as well as simulated hands on practice of common procedures that may be performed in the trauma bay. An introductory packet was provided to each resident introducing the electronic medical record templates that are used, explanation of the discharge process, and included the essential phone numbers of the ancillary staff members involved. The patient handoff process was discussed in orientation and introduced on the first day of clinical duties in both the morning and evening handoff or transition-of-care meetings.

From the first clinical day, residents were involved in every patient's care that was included in the study. Both trauma and ICU rotations had 24 hours a day, 7 days a week morning and night coverage. There were 3 residents on the trauma rotation and 2 residents on the ICU rotation during the day. A night float system consisting of 2 residents, 1 covering trauma, and 1 responsible for the ICU, was developed for night coverage. The general surgery residents are involved in all aspects of trauma patients' care, from their arrival to the emergency department to their discharge. During the study, there were 3 residents on the trauma service and 2 residents in the trauma ICU (TICU). Residents in their first-, second-, and third-years of training rotated on trauma, and those in their first- and second- postgraduate year rotated in the TICU. A first-year resident and a second or third-year resident were present at night.

A retrospective review was performed of the CCC research data for patients admitted from July 1, 2013

through December 31, 2014. We separated the chosen interval into preresidency data, from July 1, 2013 to June 30, 2014, and the data were collected after the start of the general surgery residency, from July 1, 2014 through December 31, 2014.

Crimson continuum of care is a web-based service used to obtain aggregated performance data to provide information about quality outcomes and compare them to other participating trauma centers. Severity and risk-adjusted performance measures included readmissions, complications, length of stay, and mortality rate. The patient population included all patients with traumatic injury 16 years of age and older who were admitted to the Acute Care Surgery Service. Excluded individuals included those under the age of 16 and patients not admitted by a trauma attending. The inclusion criteria follow the guidelines established by the National Trauma Data Standard. The data are collected from the medical chart and entered into the CCC database by administrative staff.

Patients who met study inclusion criteria were dichotomized by their admission date falling into the preresidency and postresidency implementation interval. Using the CCC database, they were compared based on the following (Table 2): patient age, gender, average risk of mortality, average severity level, case mix index, length of stay, percentage of 3-day readmits, percentage of 7-day readmits, percentage of 30-day readmits, mortality rate, percentage of complications of care, mortality observed or expected ratio, and average length of stay. Table 1 provides definitions of the demographic variables.

The Pearson  $\chi^2$  test was used to compare differences in categorical variables. An independent-samples *t*-test was used to compare differences in means for continuous variables. We compared each variable between the interval with no residents present and in the first 6 months where residents were integrated into the hospital system. All results were considered statistically significant at  $p \leq 0.05$ .

## RESULTS

For the 12 months before initiation of the general surgery residency program, ending on June 30, 2014, 1535 trauma patients' records from the trauma registry at Kendall Regional Medical Center were analyzed. Medical records of 856 patients were examined for the study period after the initiation of general surgery residency, from July 1, 2014 to December 31, 2014. Demographic characteristics of patients are shown in Table 2. Average patient age, case mix index, severity of illness, and risk of mortality were similar between the groups (Table 2).

Mortality, the primary outcome variable, was not affected by the integration of surgical residents based on Crimson database (Table 3). The mortality rate with exclusion of

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