A role in trauma care for advanced practice clinicians

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ABSTRACT

Advanced practice clinicians (APCs) are increasingly being utilized to care for patients on trauma services, but the quality of care provided by these alternate delivery models has been questioned. We hypothesized that APCs could safely administer trauma care that had traditionally been provided by surgical residents. Outcomes from an APC trauma-care delivery model were compared with those reported in the National Trauma Data Bank (NTDB). Parameters included in the comparison were mechanism of injury (MOI), length of hospital stay (LOS), injury severity score (ISS), and mortality. When MOI was used as the basis of comparison, the percentage of patients treated at the trauma center and the percentage of patients with information in the NTDB were similar. Despite having more seriously injured patients, the APC-staffed trauma center demonstrated a shorter LOS for all ISS categories; comparisons of patients with ISS >24 did not reach statistical significance. In addition, the APC-staffed trauma center had a statistically lower overall combined mortality rate when categorized by ISS. We conclude that an APC trauma-care delivery model provides outcomes at least as good as those reported by the NTDB.

Advanced practice clinicians (APCs), a term used by the trauma team at LDS Hospital (LDSH) in Salt Lake City, Utah, to include physician assistants (PAs) and nurse practitioners (NPs), are increasingly being utilized to care for patients on trauma services.[1-6] Traditionally, the extensive 24-hours-a day coverage needed to provide quality trauma care has been provided by surgical residents. In 2003, the Accreditation Council for Graduate Medical Education significantly reduced the number of hours that resident physicians are permitted to work in a week.[7] This has forced many trauma programs to develop alternate trauma-care delivery models. The quality of care provided by these alternate-care delivery models has been questioned.[1] With the reduced availability of surgical residents, we hypothesized that APCs could safely provide trauma care that had traditionally been provided by those residents. This paper describes the APC trauma-care delivery model at a level I trauma hospital following the loss of surgical residents and compares patient outcomes from this new model with those in the National Trauma Data Bank (NTDB).

METHODS

LDSH, a 500-bed tertiary-care center, is an American College of Surgeons (ACS)-verified level I trauma center located in metropolitan Salt Lake City, Utah. Along with one other adult level I trauma center and a pediatric level I trauma center, LDSH functions as a regional trauma referral center for 1.2 million people living in Utah and parts of Wyoming, Idaho, and Nevada. The Life Flight Network supports the regional center with multiple fixed wing and helicopter transports. Approximately 1,400 trauma patients are evaluated each year.

The traditional surgical resident-staffed trauma-care model had been used at LDSH for many years. Clinicians on call every night included a chief surgical resident, two junior surgical residents, and an attending trauma surgeon. During the day, eight residents would provide the daily management and surgical care of trauma patients under the direction of the attending trauma surgeons. Residents and attending surgeons would be involved in weekly didactic lectures, quality assurance, and research projects.

With the decrease in their work hours, trauma training for surgical residents was consolidated at the nearby University of Utah Medical Center. Surgical residents were no longer primarily involved with the daily care of the trauma patients at LDSH. The residents still received training in general, colorectal, vascular, endocrine, noncardiac thoracic, and oncologic surgery at both facilities. The only involvement that the surgical residents had with trauma at LDSH during 2006 was when the two chief residents, who rotated an every-third-night call for emergency general surgery patients, would participate in the

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care of operative trauma a couple of times per month. All levels of surgical residents continued to participate in the weekly trauma conference.

The unavailability of surgical residents to the trauma service at LDSH threatened to leave the service inadequately staffed. As a result, the APC trauma-care delivery model evolved from a need to provide care for trauma patients without surgical residents.

The APCs perform almost all the duties previously performed by the residents. APCs provide coverage 24 hours a day, 7 days a week. The team comprises four NPs and four PAs. The seven full-time and one part-time APCs lead the initial and subsequent trauma resuscitations. The trauma team is activated by the emergency department (ED) physician based on the activation criteria developed by the trauma committee at LDSH. While the trauma team assumes overall responsibility for the evaluation and resuscitation of the injured patient, the ED physicians are responsible for initial airway management and stabilization of the head and neck.

In addition to leading the resuscitation, APCs are responsible for trauma patient admissions and inpatient management both on the floor and in the ICU in conjunction with the trauma surgeon and appropriate specialists. The APCs perform procedures previously done by residents, including chest-tube insertion; central-line placement; debridement and suturing of wounds; joint and fracture reduction; and, at the discretion of the emergency medicine or trauma physician, intubation. The APCs maintain an outpatient clinic for follow-up and are involved in weekly didactic lectures, quality assurance, and research projects. However, APCs provide

TABLE 1. Number and percentage of patients admitted by mechanism of injury

Mechanism of injury	LDSH (N=970)	LDSH (%)	NTDB (N=1,055,450)	NTDB (%)	95% CI for LDSH
MVC	362	37.3	447,009	42.4	34.4 - 40.5
Fall	271	27.9	293,804	27.8	25.3 - 30.9
Struck	65	6.7	68,691	6.5	5.3 - 8.4
Firearm	42	4.3	60,377	5.7	3.2 - 5.8
Transport	66	6.8	58,635	5.5	5.4 - 8.5
Cut/Pierce	51	5.3	44,079	4.2	4.0 - 6.8
Cyclist	25	2.6	17,589	1.7	1.7 - 3.7
Machinery	5	0.5	15,900	1.5	0.2 - 1.1
Pedestrian	40	4.1	4,012	0.4	3.0 - 5.5
Other specified/ Unspecified	40	4.1	36,189	3.4	3.0 - 5.5

Key: CI, confidence interval; LDSH, LDS Hospital; MVC, motor vehicle collision; NTDB, National Trauma Data Bank.

TABLE 2. Mean length of hospital stay by injury

Injury	LDSH	NTDB	*P* value	95% CI
MVC	7.5	6.1	.018	6.3 - 8.6
Fall	5.2	5.0	.602	4.4 - 6.0
Struck	6.3	3.6	.011	4.2 - 8.4
Firearm	6.4	6.5	.925	3.6 - 9.1
Transport	4.6	4.9	.633	3.2 - 5.9
Cut/Pierce	3.9	3.2	.406	2.3 - 5.4
Cyclist	3.8	3.2	.569	1.6 - 6.1
Machinery	2.7	4.7	.222	-1.2 - 6.6
Pedestrian	10.0	6.2	.012	7.1 - 12.9
Other	5.8	4.9	.445	3.5 - 8.1

Key: CI, confidence interval; LDSH, LDS Hospital; MVC, motor vehicle collision; NTDB, National Trauma Data Bank.

very little operative assistance, as this is the responsibility of the backup trauma surgeon.

The APC trauma-care delivery model at LDSH has developed gradually over 7 years. At the start of 2006, APCs had been fully integrated into the service for 17 months. To compare a fully established APC-staffed model (ie, one without significant influence from surgical residents) with other staffing models, data from the trauma registry at LDSH were compared with information from the NTDB for the year 2006. The authors of this study and the nurse trauma coordinator collected data from LDSH patients retrospectively through chart review. All patients admitted to the trauma service were included.

The NTDB, developed and maintained by the ACS, is the largest aggregation of trauma registry data ever assembled. It contains more than 2 million records from trauma centers in the United States and Puerto Rico. The NTDB has been used in many areas of study, including epidemiology, injury control, research, education, acute care, and resource allocation.[8]

The NTDB includes data from multiple types of trauma-care delivery models, including APC, traditional surgical resident, and surgeon-only trauma-care models. Trauma centers at all levels of verification are represented. The exact percentage of the various delivery models is unknown.

For the purposes of this study, the mechanism of injury (MOI) defined by cause of injury, length of hospital stay (LOS) in days, and mortality for trauma patients admitted to LDSH were compared with similar information in the NTDB. Further comparison included organizing patients into the four levels of injury severity score (ISS), ie, 1 to 9, 10 to 15, 16 to 24, and >24, for both sets of data. The ISS is an anatomical scoring system that provides an overall score for patients with multiple injuries.[9]

> "Most importantly, in at least one other study besides ours, mortality rate has not changed as APCs have accepted a greater role."

Only categories in the NTDB that were directly comparable with the LDSH data sets were included. For example, burn patients are not treated at LDSH so that category was not included in the NTDB numbers.

Comparisons of count data were done using a chi-square test. If cell counts were small, then the *P* value was computed using simulation rather than the chi-square distribution. Logistic regression was used to compare proportions while adjusting for additional predictor variables. Numerical data were compared using the Student *t* test. When multiple *t* tests were done, the *t* values were squared and summed, then compared with the F distribution to compute the *P* value. A value of $P < .05$ was significant, and data were expressed as a mean +/– standard deviation or as a percentage. Where applicable, the two-sided *P* values were included as well as the 95% confidence interval (CI) on the mean or proportion.

RESULTS

The trauma service at LDSH admitted 967 patients in 2006. For that same year, the NTDB contained information on 1,055,450 patients within the same categories of trauma

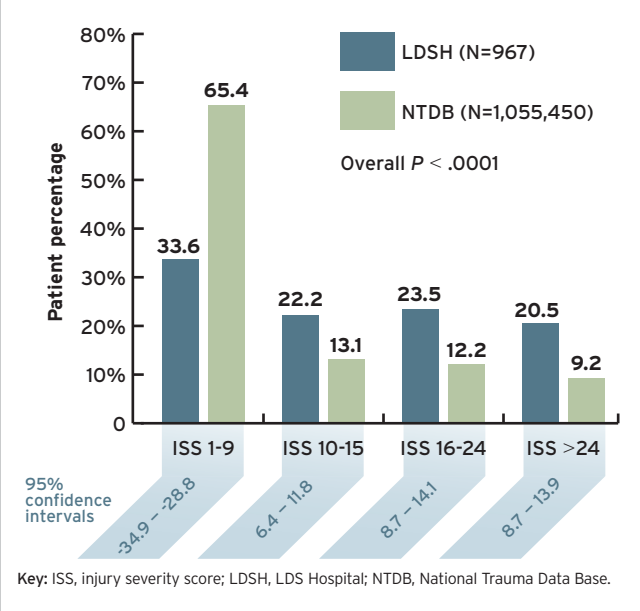

FIGURE 1. Patient percentage by ISS

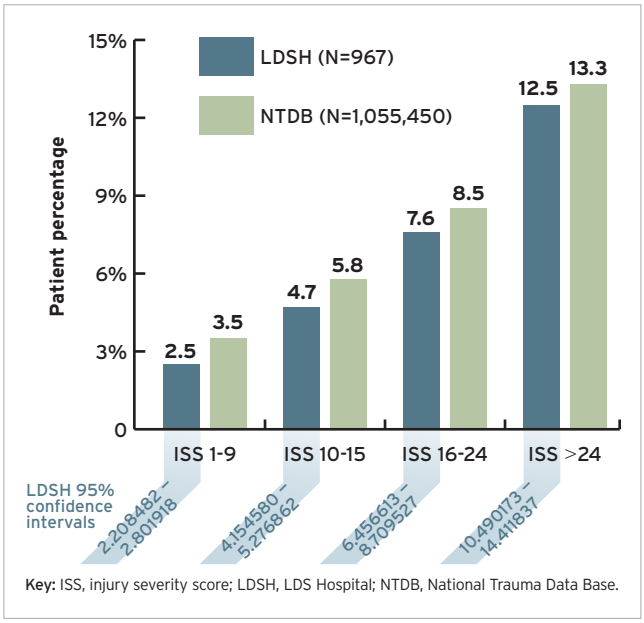

FIGURE 2. Length of stay (in days) by ISS

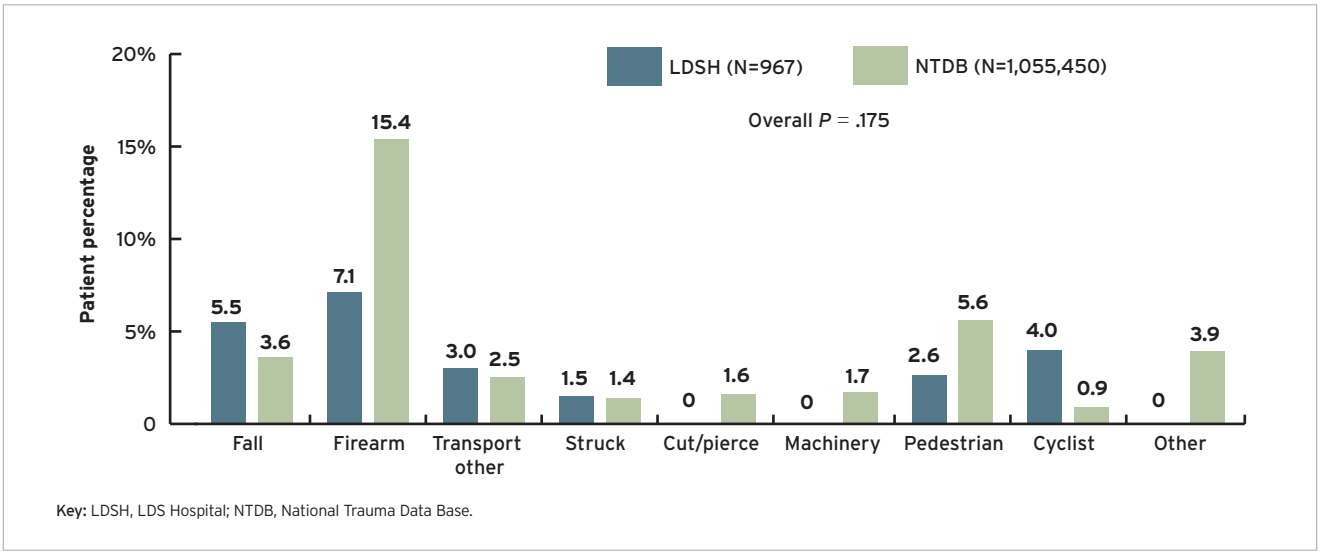

FIGURE 3. Mortality by mechanism of injury

found at LDSH. The highest percentage of injuries, both at LDSH and in the NTDB, resulted from motor vehicle collision (MVC), followed by falls. Table 1 (see page 34) outlines the number of incidents by MOI. When comparing the MOI between LDSH and the NTDB, the combined injury pattern difference is statistically significant using a chi-square test with simulated *P* value ($P < .0001$). The largest contributors to this difference are the categories of MVC, machinery, pedestrian, and cyclist.

The LOS by MOI was not significantly different for the following categories: fall, firearm, transport, cut/pierce, machinery, cyclist, and other. LDSH demonstrated significantly greater LOS for patients injured by MVC, struck, and pedestrian for *P* values and CIs (see Table 2, page 34).

The comparison of percentage of patients categorized by ISS from LDSH and the NTDB is shown in Figure 1 (page 35). For the lowest quartile ISS (1 to 9), the NTDB had nearly double the percentage of patients. LDSH had higher percentages in the remaining three quartiles: 10 to 15, 16 to 24, and >24.

LDSH had a shorter LOS for all categories. However, the difference in LOS for ISS >24 did not reach statistical significance (Figure 2, page 35).

There were no overall statistical differences in mortality data between the LDSH and NTDB data after accounting for the differences in MOI (from a logistic regression comparing a model with location [LDSH versus NTDB], MOI, and the interaction to a model containing only MOI) (see Figure 3).

However, LDSH had a statistically lower overall combined mortality rate when categorized by ISS using a chi-square test of proportions ($P < .0001$). This difference in overall combined mortality rate was mainly driven by the lower mortality rate in the third quartile (ISS 16-24) (see Figure 4).

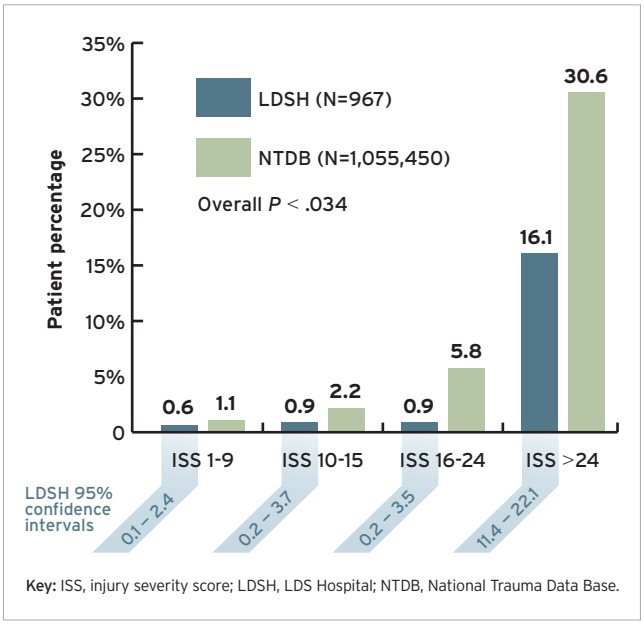

FIGURE 4. Mortality by ISS

DISCUSSION

For the year 2006, the overall mortality rate by ISS for patients at LDSH was lower than for patients from the NTDB despite the higher percentage of more severely injured patients at LDSH. Additionally, data for LDSH patients showed a shorter LOS for all ISS categories when compared with data in the NTDB.

The main limitation of this study is that the NTDB contains data from trauma centers with a variety of care-delivery models. These include models utilizing resident physicians, APCs, attending staff, or a combination of these models.

The exact percentage of NTDB programs that have only resident trauma-care delivery models is unknown. This makes a direct comparison between resident- and APC-staffed models difficult.

Additionally, we were unable to compare our data directly with data from other level I trauma centers. The composition of the trauma centers in the NTDB is unknown and comprises another limitation in our comparison.

Many other trauma centers have documented the benefits of utilizing APCs in the capacity described. Miller and colleagues showed that after incorporating APCs, even with a 19% increase in ISS at their level II trauma center, the LOS decreased, as did the transfer time to the operating room, ICU, and the floor.[2] When resident physicians were replaced with APCs at Wesley Medical Center (a level I trauma center), a subsequent survey of patients, physicians, nurses, and ancillary providers showed that patients were very satisfied with their care and 86% of the staff agreed that APCs were more available to address patient concerns. Eighty percent of the doctors and nurses thought that trauma care was more efficient.[3] When two NPs were incorporated into their trauma system, Christmas and colleagues found statistically significant reductions in floor, ICU, and overall LOS even though resident physician work hours were reduced.[4] Most importantly, in at least one other study besides ours, mortality rate has not changed as APCs have accepted a greater role.[5]

CONCLUSION

An APC trauma-care delivery model seems to provide outcomes at least as good as—and possibly better than—those reported in the NTDB. Integrating APCs into a trauma service is a viable option for trauma services wishing to maintain excellent patient outcomes and improve satisfaction with the loss of surgical resident participation. Allowing for other delivery models could help improve continued access to excellent care for the injured patient. **JAAPA**

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