

Patient Outcomes at Urban and Suburban Level I Versus Level II Trauma Centers



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Study objective: Regionalized systems of trauma care and level verification are promulgated by the American College of Surgeons. Whether patient outcomes differ between the 2 highest verifications, Levels I and II, is unknown. In contrast to Level II centers, Level I centers are required to care for a minimum number of severely injured patients, have immediate availability of subspecialty services and equipment, and demonstrate research, substance abuse screening, and injury prevention. We compare risk-adjusted mortality outcomes at Levels I and II centers.

Methods: This was an analysis of data from the 2012 to 2014 Los Angeles County Trauma and Emergency Medical Information System. The system includes 14 trauma centers: 5 Level I and 9 Level II centers. Patients meeting criteria for transport to a trauma center are routed to the closest center, regardless of verification level. All adult patients (≥ 15 years) treated at any of the trauma centers were included. Outcomes of patients treated at Level I versus Level II centers were compared with 2 validated risk-adjusted models: Trauma Score–Injury Severity Score (TRISS) and the Haider model.

Results: Adult subjects (33,890) were treated at a Level I center; 29,724, at a Level II center. We found lower overall mortality at Level II centers compared with Level I, using TRISS (odds ratio 0.68; 95% confidence interval 0.59 to 0.78) and Haider (odds ratio 0.84; 95% confidence interval 0.73 to 0.97).

Conclusion: In this cohort of patients treated at urban and suburban trauma centers, treatment at a Level II trauma center was associated with overall risk-adjusted reduced mortality relative to that at a Level I center. In the subset of penetrating trauma, no differences in mortality were found. Further study is warranted to determine optimal trauma system configuration and allocation of resources. [Ann Emerg Med. 2017;70:161-168.]

Please see page 162 for the Editor's Capsule Summary of this article.

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0196-0644/\$-see front matter

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<http://dx.doi.org/10.1016/j.annemergmed.2017.01.040>

INTRODUCTION

Background

Trauma is a major public health problem worldwide, and it accounts for approximately 5.8 million, or approximately 10%, of all deaths each year.¹ Regionalized systems of trauma care have consistently been shown to improve outcomes.²⁻⁸ However, there are no clearly established standards or metrics that define the components of an ideal trauma system. The American College of Surgeons recognizes 4 distinct levels of resources and capabilities for trauma care hospitals, which are accordingly verified as Level I (highest), II, III, or IV (lowest).⁹

Level I trauma centers are typically academic teaching hospitals with surgical residency training programs. Level II trauma centers may be academic or community hospitals. Although both are required to provide definitive care for all trauma patients, Level I trauma centers must also (1) meet

minimum volume standards (eg, admission of at least 1,200 trauma patients per year), (2) have a fellowship-trained surgical intensivist and orthopedist in traumatology, (3) demonstrate 24-hour availability of an operating microscope and cardiopulmonary bypass capability, (4) have a dedicated injury prevention coordinator, (5) provide a program for substance abuse screening and intervention, and (6) have faculty engaged in ongoing trauma research (Table 1) (9). In contrast, Level III trauma centers, which have lower capability, may be able to provide only initial care and stabilization and arrange transfer of the victim to a higher level of trauma care. Level IV trauma centers, which have the lowest capability, require only that a midlevel provider or nurse with current advanced trauma life support certification provide immediate, initial resuscitation. Given the increased resource and cost requirements for Level I verification and that nearly all

Editor's Capsule Summary*What is already known on this topic*

Care and resulting outcomes may vary between Level I and Level II trauma centers.

What question this study addressed

Does risk-adjusted hospital mortality differ among patients treated at Level I and Level II trauma centers?

What this study adds to our knowledge

This observational study included patients aged 15 years or older who were treated at Level II (n=29,724) and Level I (n=33,890) trauma centers in Los Angeles. Treatment at Level II centers was associated with lower odds of risk-adjusted hospital mortality for all patients but not for the subgroup with penetrating trauma.

How this is relevant to clinical practice

Level II trauma centers may produce better outcomes, but it is possible that the observed benefit is due to inadequate adjustment for case mix.

Level I trauma centers are university-affiliated teaching hospitals with the ready availability of all subspecialties, one might expect their care to be superior. However, the existing literature comparing patient outcomes at Level I versus Level II verified trauma centers has yielded inconsistent results. Although some literature suggests Level I centers achieve better patient outcomes,¹⁰⁻¹² other studies describe comparable outcomes between Level I and Level II trauma centers.^{13,14} The reasons for the differing results among the previous publications is likely due to variability in reported geographic and urban versus rural study populations, and to the focus of some studies on the outcomes from specific types of injuries, such as aortic dissection or pelvic fractures. Given the previous heterogeneous results and the potential clinical implications for allocation of resources, the importance of understanding whether outcomes differ at Level I versus Level II trauma centers is underscored.

Importance

Meeting established American College of Surgeons criteria for the operation and maintenance of a higher level of trauma center verification is costly; thus, it is important to know whether the additional resources required for a Level I trauma center are associated with improved outcomes.

Goals of This Investigation

The objective of this study was to compare risk-adjusted inhospital mortality outcomes for all adult trauma patients treated at Level I versus Level II trauma centers.

MATERIALS AND METHODS**Study Design and Setting**

The Los Angeles County Emergency Medical Services (EMS) Agency oversees a regional trauma system serving nearly 10 million residents, with 14 designated trauma centers, 5 of which are verified Level I centers, with the remaining 9 being Level II centers. In Los Angeles County, Level I and Level II trauma centers are considered equivalent for the purposes of EMS routing protocols. Each of the 14 trauma centers has an assigned catchment area within the county's 4,751 square miles of predominantly urban and suburban landscape. Trauma victims are transported to the trauma center assigned to the catchment area in which they are located where the incident occurred. Each trauma center is responsible for standardized data collection on all trauma victims, including both EMS-transported and self-presenting patients, meeting prespecified criteria and submission of their data to the EMS agency. The data collectors at each of the trauma facilities are trained to use the standardized data collection form, and the data are regularly reviewed for quality improvement purposes. Data submitted to the EMS agency are maintained in Los Angeles County's Trauma and Emergency Medical Information System. Data received from all trauma centers are verified by an epidemiologist based at the EMS agency for completeness, logical consistency, duplication, and formatting. Identified errors are sent back to the trauma center for correction, and updated information is automatically uploaded to Trauma and Emergency Medical Information System every 24 hours.^{15,16} Quarterly reports are generated and disseminated to the system for use in quality improvement.

This study is a retrospective analysis of patient data contained in the Trauma and Emergency Medical Information System. The study, using deidentified data, was reviewed and determined to be exempt by the institutional review board at the Los Angeles Biomedical Research Institute. Because this was an observational study, we adhered to the Strengthening the Reporting of Observational Studies in Epidemiology standards.

Selection of Participants

The study population included all adult patients treated (those transported by EMS and walk-ins who met

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