Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/burns

Impact of weekend admission on mortality and other outcomes among patients with burn injury: A nationwide analysis

Heather Peluso [a,*], *Marwan S. Abougergi* [b], *Julie Caffrey* [c]

[a] *Department of Surgery, University of South Carolina, Greenville Health System, 701 Grove Road, Greenville, SC 29605, United States*
[b] *Catalyst Medical Consulting, 722 Elmbrook Drive, Simpsonville, SC 29681, United States*
[c] *Department of Plastic and Reconstructive Surgery, Johns Hopkins University Medical Center, Burn Unit, Bayview Campus, 4940 Eastern Ave, Baltimore, MD 21224, United States*

ARTICLE INFO

Article history:
Accepted 8 August 2017
Available online xxx

Keywords:
Burn injury
Weekend
Outcomes
Mortality
Resource utilization

ABSTRACT

Objective: To study the relationship between day of admission and important outcomes among patients with burn injuries.
Methods: The 2014 National Inpatient Sample database was used. Inclusion criterion was a principal diagnosis of burn injury. Exclusion criteria were age <18 years, superficial burn, and non-urgent admission. The primary outcome was in-hospital mortality. Secondary outcomes were morbidity (septic shock and prolonged mechanical ventilation), treatment metrics (time to surgery and parenteral or enteral nutrition (P/E-nutrition)) and resource utilization (length of stay (LOS) and total hospitalization charges and costs). Confounders were adjusted for using multivariate regression analysis.
Results: A total of 21,665 patients were included, 29% of whom were admitted on weekends. Weekend admission was an independent predictor of mortality only among patients >65 years old (adjusted odds ratio (aOR): 2.66 (1.13–4.51), p=0.02). Although rates of septic shock were similar for both groups (aOR): 1.25 (0.74–2.09, p=0.40), weekends were associated with higher odds of prolonged mechanical ventilation (aOR: 1.28 (1.06–1.55), p=0.01). Time to surgery (adjusted mean difference (amDiff): 0.91 (−0.07 to 1.88) days, p=0.07) and time to P/E-nutrition (amDiff: 0.40 (−3.51 to 4.30) days, p=0.80) were similar for both groups. Finally, LOS was longer for weekend admission (amDiff: 1.36 (0.09–2.63) days, p=0.04), but total charges and costs were similar for both groups (amDiff: $16,268 ($-5093–$37,629), p=0.13 and $3275 ($-2337–$8888), p=0.25).
Conclusions: Weekend admission is associated with increased mortality among patients with burn injury >65 years old. Weekend admission is also associated with increased morbidity and prolonged length of stay.

Abbreviations: NIS, Nationwide Inpatient Sample; ICD9-CM, International Classification of Diseases 9th revision Clinical Modification; ORs, unadjusted odds ratios; 95% CI, 95% confidence intervals.

* *Corresponding author at*: 701 Grove Road, Greenville Memorial Hospital, Support Tower 3, Department of Surgery, Greenville, SC 29605, United States. Fax: +1 864 455 1435.
E-mail addresses: hpeluso@ghs.org (H. Peluso), mabougergi@catalystsclinic.com (M.S. Abougergi), jcaffre5@jhmi.edu (J. Caffrey).

http://dx.doi.org/10.1016/j.burns.2017.08.005

1. Introduction

Ever since Bell and Redelmeier [1] published their seminal study showing increased mortality for patients admitted to the hospital on weekends compared to weekdays, the "weekend effect" on treatment outcomes has been intensely scrutinized. A large number of studies across a wide range of surgical and medical conditions and health systems examined this relationship and yielded contradictory results. Glance et al. [2], for instance, found an increase in mortality, length of stay and expenditure after elective and emergent cardiac, vascular or colorectal surgery among patients admitted on weekends-scompared to weekdays. Similarly, Khoshchehreh et al. [3] found that in-hospital mortality for patients with acute coronary syndrome admitted on weekends was higher than that of those admitted on weekdays. On the other hand, Arulkumaran et al. [4] did not find any difference in in-hospital mortality between patients admitted on weekends or weekdays to critical care units in the United Kingdom. Along the same lines, Abougergi et al. [5] found no association between day of admission and in-hospital mortality among patients who present to the hospital with upper gastrointestinal hemorrhage. Similarly, Carmody et al. [6] did not find any difference in in-hospital mortality between patients with trauma admitted to a level I trauma center on weekends or weekdays.

To our knowledge, no study has examined a possible weekend effect on treatment outcomes among patients with burn injury at the national level. Taira et al. [7] used the National Trauma Data Bank, which include patients who presented to selected trauma centers in the United States. The authors found no difference in mortality among patient with burn injury admitted on weekends or off hours (6 P.M.–6 A.M. on weekdays) compared to those admitted on weekdays from 6 A.M. to 6 P.M. Theoretically, outcomes may be worse for patients with burn injury admitted on weekends because operating rooms and intensive care units often have a reduced staff on weekends [1]. This fact can result in more variability in surgical/intensive care unit expertise, delays in surgery, and decreased availability or absence of experienced support staff [1]. In addition, there is evidence that patients presenting to acute care hospitals on weekends might be sicker compared with those presenting on weekdays [8]. Mohammed et al. [8] showed that the mortality difference for emergency medical admissions between weekends or weekdays became null once the authors adjusted for patients' severity of illness [8].

Therefore, the goal of this study was to use a large population-based nationally representative database in the United States to examine the effect of weekend admission on in-hospital all-cause mortality, morbidity, treatment metrics and resource utilization among patients admitted to the hospital with burn injuries.

2. Methods

2.1. Study design and data source

This was a retrospective cohort study of adult patients hospitalized with a burn injury in the United States. Patients were selected from the 2014 Healthcare Utilization Project — Nationwide Inpatient Sample (NIS) database. This database was created and is maintained by the agency for Healthcare Research and Quality. NIS is the largest publicly available all-payer inpatient database in the United States. It is a stratified probability sample of 20% of all admissions in the United States. It is designed to be representative of all non-federal acute care hospitals in the nation. Briefly, hospitals are stratified by ownership/control, bed size, teaching status, urban/rural location, and geographic region. A 20% probability sample of patients from all hospitals within each stratum is then collected. Discharges are weighed to ensure that they are representative of the United States. In 2014, the NIS included 4411 hospitals from 45 states, with a total of 7,071,762 discharges representing 35,358,818 discharges nationwide. The database contains both patient-level and hospital-level information. The principal diagnosis and as many as 29 secondary diagnoses as well as 15 procedures are recorded for each patient using the International Classification of Diseases, 9th revision, Clinical Modification (ICD9-CM) coding system.

2.2. Study patients

The study inclusion criteria were a principal diagnosis of: (1) superficial partial thickness, deep partial thickness, or a third degree burn injury, (2) inhalation injury to the respiratory tract due to fumes and vapors (3) designation of the total body surface area involved with the burn. The ICD-9CM coding system does not have a unified code to identify patients with those types of burn injury. We reviewed the literature to find the ICD-9 CM codes that have been previously used to reliably identify those patients [9–11]. The codes used were: (1) burn depth: 940.0-9, 941.00,01,03-11,13-31,33-41,43-51,53-59, 942.00-05,09,20-25,29-35,39-45,49-55,59, 943.00-06,09,20-26, 29-36,39-46,49-56,59, 944.00-08,20-28,30-38,40-58, 945.00-06,09,20-26,29-36,39-46,49-56,59-65, 946.2-5, and 948.0-9, 949.0,2-5, (2) inhalation injury to the respiratory tract due to fumes and vapors: 506.0,1,2 and 3 (3) total body surface area involved with the burn: 948.0-9. We also used codes for accidental thermal injury, E924.0-2,8-9, E926.1-2, and E890.3; however those did not yield additional patients. Exclusion criteria were age less than 18 years and an elective admission. Patients with superficial burns were not included in our study. Patients were then divided into two groups based on whether the day of admission was a weekday or a weekend. The Greenville Health Institutional Review Board deemed this study exempt from approval due to the fact that it is an analysis of existing de-identified data.

2.3. Study variables

Weekend versus weekday admission, vital status at discharge, length of hospital stay and total hospitalization charges were variables directly provided in the NIS. The HCUP provides hospital-specific cost-to-charge ratios based on all-payer inpatient cost. Cost information is obtained from the hospital accounting reports collected by the Centers for Medicare & Medicaid Services (CMS). Total hospital costs were calculated by multiplying total charges with the appropriate cost-to-charge ratio. The NIS defines a weekday admission as any

Please cite this article in press as: H. Peluso, et al., Impact of weekend admission on mortality and other outcomes among patients with burn injury: A nationwide analysis, Burns (2017), http://dx.doi.org/10.1016/j.burns.2017.08.005