Injury, Int. J. Care Injured 47 (2016) 1393–1403

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Traumatic injury in the United States: In-patient epidemiology 2000–2011

Charles DiMaggio [a,c,*], Patricia Ayoung-Chee [a], Matthew Shinseki [a], Chad Wilson [a], Gary Marshall [a], David C. Lee [b,c], Stephen Wall [b], Shale Maulana [a], H. Leon Pachter [a], Spiros Frangos [a]

[a] Department of Surgery, Division of Acute Care and Trauma Surgery, New York University School of Medicine, New York, NY, United States
[b] Ronald O. Perelman Department of Emergency Medicine, New York University School of Medicine, New York, NY, United States
[c] Department of Population Health, New York University School of Medicine, New York, NY, United States

ARTICLE INFO

Article history:
Accepted 8 April 2016

Keywords:
Injury
Trauma
Epidemiology

ABSTRACT

Background: Trauma is a leading cause of death and disability in the United States (US). This analysis describes trends and annual changes in in-hospital trauma morbidity and mortality; evaluates changes in age and gender specific outcomes, diagnoses, causes of injury, injury severity and surgical procedures performed; and examines the role of teaching hospitals and Level 1 trauma centres in the care of severely injured patients.

Methods: We conducted a retrospective descriptive and analytic epidemiologic study of an inpatient database representing 20,659,684 traumatic injury discharges from US hospitals between 2000 and 2011. The main outcomes and measures were survey-adjusted counts, proportions, means, standard errors, and 95% confidence intervals. We plotted time series of yearly data with overlying loess smoothing, created tables of proportions of common injuries and surgical procedures, and conducted survey-adjusted logistic regression analysis for the effect of year on the odds of in-hospital death with control variables for age, gender, weekday vs. weekend admission, trauma-centre status, teaching-hospital status, injury severity and Charlson index score.

Results: The mean age of a person discharged from a US hospital with a trauma diagnosis increased from 54.08 (s.e. = 0.71) in 2000 to 59.58 (s.e. = 0.79) in 2011. Persons age 45–64 were the only age group to experience increasing rates of hospital discharges for trauma. The proportion of trauma discharges with a Charlson Comorbidity Index score greater than or equal to 3 nearly tripled from 0.048 (s.e. = 0.0015) of all traumatic injury discharges in 2000 to 0.139 (s.e. = 0.005) in 2011. The proportion of patients with traumatic injury classified as severe increased from 22% of all trauma discharges in 2000 (95% CI 21, 24) to 28% in 2011 (95% CI 26, 30). Level 1 trauma centres accounted for approximately 3.3% of hospitals. The proportion of severely injured trauma discharges from Level 1 trauma centres was 39.4% (95% CI 36.8, 42.1). Falls, followed by motor-vehicle crashes, were the most common causes of all injuries. The total cost of trauma-related inpatient care between 2001 and 2011 in the US was $240.7 billion (95% CI 231.0, 250.5). Annual total US inpatient trauma-related hospital costs increased each year between 2001 and 2011, more than doubling from $12.0 billion (95% CI 10.5, 13.4) in 2001 to 29.1 billion (95% CI 25.2, 32.9) in 2011.

Conclusions: Trauma, which has traditionally been viewed as a predicament of the young, is increasingly a disease of the old. The strain of managing the progressively complex and costly care associated with this shift rests with a small number of trauma centres. Optimal care of injured patients requires a reappraisal of the resources required to effectively provide it given a mounting burden.

© 2016 Elsevier Ltd. All rights reserved.

Introduction

Trauma is a leading cause of death and disability in the United States (US). For children and adults younger than age 45, trauma accounts for an estimated 79,000 deaths each year, compared to 49,000 non-communicable disease deaths and 15,000 infectious

Abbreviations: HCUP, Healthcare Cost and Utilization Project; NIS, National Inpatient Sample; AHRQ, Agency for Healthcare Research and Quality; ICD, International Classification of Disease; CI, confidence interval; s.e., standard error.

* Corresponding author at: New York University School of Medicine, Department of Surgery, Division of Trauma and Acute Care Surgery, 550 First Avenue, New York, NY 10016, United States. Tel.: +1 516 308 6426/212 263 3202.
E-mail address: DiMaggio@nyumc.org (C. DiMaggio).

http://dx.doi.org/10.1016/j.injury.2016.04.002
0020–1383/© 2016 Elsevier Ltd. All rights reserved.

disease deaths [1]. In the US, trauma is the single most important cause of potential years of life lost for persons under age 65 [2].

There have been notable advances in our knowledge of the epidemiology of trauma in the US since Donald Trunkey declared "We simply do not know what the incidence of trauma is in this country, or where it occurs" [3]. The advent of national registries coupled with improved hospital record keeping and standardized billing over the past decade has led to the accumulation of a vast amount of information on trauma in the US. Numerous studies in the past five years have utilized databases such as the National Trauma Data Bank (NTDB) and Healthcare Cost and Utilization Project (HCUP) to investigate a wide range of trauma-related injuries and treatments. The nationwide scope of these studies and their findings inform clinicians, researchers, and policy makers alike.

Most studies utilizing large databases have focused on specific injuries such as vascular trauma to the extremities [4], spinal cord injuries [5], and penetrating abdominal injury [6]. Other studies have concentrated on specific populations, such as the elderly [7,8], and adolescents [9]. Still other studies have used these databases to evaluate specific treatment protocols [10] or policy changes [11].

Those studies that have taken a broader view of the epidemiology of trauma in the US have generally concentrated on mortality [12], and have been either largely based on trauma registry data [13], single institutions [14], or have been based on literature review [15]. While informative in their own right, these studies fail to capture the full spectrum of the evolving patterns of trauma morbidity in the US over time.

In this paper, we present a large-data, nationally-representative, population-based study evaluating the descriptive epidemiology and trends of the inpatient incidence of trauma morbidity in the US between 2000 and 2011. We examine changes in the demographic characteristics of inpatient trauma, injury severity, the role of Level 1 trauma centres, the type of trauma (e.g. crush, burn, fracture), the most common causes of trauma, the most common trauma-related surgical procedures performed, and the hospital costs for the care of trauma patients. We believe it presents one of the fullest, most expansive recent pictures of a critically important cause of morbidity and mortality in the US.

Methods

Discharge data

Data were obtained from the US Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Nationwide Inpatient Sample for the years 2000–2011. HCUP is a group of inpatient and outpatient files created by AHRQ. The Nationwide Inpatient Sample (NIS) is a 20% weighted sample of the State Inpatient Database. It is released yearly and appropriate for analysis at the national, regional and census area level. The Nationwide Inpatient Sample (NIS) is a stratified, single-cluster sample design (geographic area, urban/rural, ownership, teaching status, bed size). It is based on a sampling frame of all community hospitals in the US and is designed to be a 20% sample of all community hospitals in the US. Community hospitals are defined as non-Federal general and specialty hospitals including public hospitals and academic medical centres. A complete census of discharges for each sampled hospital is included in the database. Weights must be applied to each entry to get national or regional estimates.

Injury classifications

Raw data were read into a comma-separated file, and national survey adjusted estimates for individual years were verified against estimates obtained from a publicly available HCUP online query system [16]. Trauma discharges were identified using principal or first-listed international classification of diseases 9th edition [17] diagnosis codes for acute injury 800–904.9, 909.4, 909.9, 910–994.9, 995.5–995.59, and 995.80–995.85. As noted in the HCUP documentation "The ICD-9-CM coding guidelines define principal diagnosis as "that condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care."" [18]. Discharges with codes for "late effect" primary diagnoses (ICD 905.0–909.9), insect bites (910.4, 910.5, 9114, 911.5, 912.4, 912.5, 913.4, 913.5, 914.4, 914.5, 915.4, 915.5, 916.4, 916.5, 917.4, 917.5, 919.4, 919.5), poisonings (960.0–964.9, 965.00–965.02, 965.09, 965.1, 965.4, 965.5, 965.61, 965.69, 965.7–969.0, 969.00–969.09, 969.70–969.73, 969.1–969.7, 967.0–967.9, 969.79, 969.8–980.9, 970.81, 970.89, 981, 982.0–985.9, 986, 987.0–989.7, 989.81:989.89, 989.9, 990, 991.0–995.2, 995.20–995.29, 995.3, 995.4), anaphylaxis (995.60–995.69,995.7) and some additional miscellaneous diagnoses (malignant hyperthermia, systemic inflammatory response syndrome, malfunctioning cardiac devices, 995.86–996.00) were removed. The R [19] "icd9" [20] package was used to apply descriptors to the diagnostic ICD9 codes and external cause of injury E-codes.

Primary ICD9 codes were categorized according to the Barell Matrix, an injury diagnosis matrix tool used internationally to standardize the classification of ICD-9 injury codes 800–995 according to 12 nature-of-injury columns and 36 body-location rows [21,22]. Injury severity was quantified using the ICD-derived Injury Severity Score (ICISS) [23]. In this approach, "survival risk ratios (are) calculated as the ratio of the number of times a given ICD-9 code occurs in a surviving patient in a cohort or data set to the total number of occurrences of that code. ICISS calculations were based on all listed diagnoses for all patients during the entire study period. The ICISS is a probability that ranges from 0 to 1, and is defined as the product of all the survival risk ratios for each of an individual patient's injuries (for as many as ten different injuries)" [24]. Patients (discharges) with severe injuries were defined as those with an ICISS below 0.94 [25]. The Charlson Comorbidity Index score was calculated for each discharge using listed ICD-9 codes [20]. The score was then categorized into an indicator variable for patients with a Charlson Comorbidity Index greater than or equal to 3.

Trauma centre classifications and costs

Information on 2040 US trauma centres was obtained from the American Trauma Society (ATS) website [26,27]. The data consisted of both American College of Surgeons verified and state designated trauma centres and included all levels. These data were matched on name and address to 3706 HCUP-sampled US hospitals in the study data set. The matching process returned 1038 hospitals that were present in both the ATS database and the NIS study sample. The hospitals were assigned trauma centre level designations 1–5 as reported by the ATS. Hospitals that did not match were assumed to non-trauma centres. A full description of the matching process and a link to the code is available as supplementary material. Teaching hospitals were identified by an NIS variable. Income quartiles were based on an NIS variable that assigns a quartile classification of the estimated median household income of residents in the patient's ZIP Code. Hospital submitted charges were available for the period 2001–2011. Hospital reported charges were converted to costs with the AHRQ HCUP cost-to-charge ratio files using the group weighted average cost-to-charge ratio variable. Costs were then adjusted for inflation and standardized to 2010 US dollars based on the all-item average yearly consumer price index obtained from the Bureau of Labor Statistics [28]. The HCUP Clinical Classification Software system was used to categorize procedure codes.

Download English Version:

https://daneshyari.com/en/article/6082719

Download Persian Version:

https://daneshyari.com/article/6082719

Daneshyari.com