ELSEVIER

The Spine Journal 13 (2013) 1766–1773

THE SPINE JOURNAL

Clinical Study

# Patient demographics, insurance status, race, and ethnicity as predictors of morbidity and mortality after spine trauma: a study using the National Trauma Data Bank

Andrew J. Schoenfeld, MD[a,*], Philip J. Belmont Jr., MD[a], Aaron A. See, DO[a], Julia O. Bader, PhD[b], Christopher M. Bono, MD[c]

[a]*Department of Orthopaedic Surgery, William Beaumont Army Medical Center, Texas Tech University Health Sciences Center, 5005 N. Piedras St, El Paso, TX 79920, USA*

[b]*Statistical Conulsting Laboratory, University of Texas at El Paso, Bell Hall 131, El Paso TX, 79968, USA*

[c]*Department of Orthopaedic Surgery, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street, Boston, MA 02115, USA*

Received 29 March 2012; revised 1 February 2013; accepted 7 March 2013

**Abstract**

**BACKGROUND CONTEXT:** Predictors of complications and mortality after spine trauma are underexplored. At present, no study exists capable of predicting the impact of demographic factors, injury-specific predictors, race, ethnicity, and insurance status on morbidity and mortality after spine trauma.

**PURPOSE:** This study endeavored to describe the impact of patient demographics, comorbidities, injury-specific factors, race/ethnicity, and insurance status on outcomes after spinal trauma using the National Sample Program (NSP) of the National Trauma Data Bank (NTDB).

**STUDY DESIGN:** The weighted sample of 75,351 incidents of spine trauma in the NTDB was used to develop a predictive model for important factors associated with mortality, postinjury complications, length of hospital stay, intensive care unit (ICU) days, and time on a ventilator.

**PATIENT SAMPLE:** A weighted sample of 75,351 incidents of spine trauma as contained in the NTDB.

**OUTCOME MEASURES:** Mortality, postinjury complications, length of hospital stay, ICU days, and time on a ventilator as reported in the NTDB.

**METHODS:** The 2008 NSP of the NTDB was queried to identify patients sustaining spine trauma. Patient demographics, race/ethnicity, insurance status, comorbidities, injury-specific factors, and outcomes were recorded, and a national estimate model was derived. Unadjusted differences in baseline characteristics between racial/ethnic groups and insurance status were evaluated using the *t* test for continuous variables and Wald chi-square analysis for categorical variables with Bonferroni correction for multiple comparisons. Weighted logistic regression was performed for categorical variables (mortality and risk of one or more complications), and weighted multiple linear regression analysis was used for continuous variables (length of hospital stay, ICU days, and ventilator time). Initial determinations were checked against a sensitivity analysis using imputed data.

FDA device/drug status: Not applicable.

Author disclosures: ***AJS:*** Nothing to disclose. ***PJB:*** Royalties: Slack (Unknown royalties, Paid directly to institution/employer). ***AAS:*** Nothing to disclose. ***JOB:*** Fees for participation in review activities such as data monitoring boards, statistical analysis, end point committees, and the like: William Beaumont Army Medical Center (Contract with the University of Texas at El Paso for statistical support, Paid directly to institution/employer). ***CMB:*** Royalties: Wolterks Kluwer, Informa Healthcare (B); Other: Trial Design Team, HarvardClinical Research Institute (B), Data Safety Monitoring Board, IntrinsicTherapeutics (B).

The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

Investigation performed at William Beaumont Army Medical Center, El Paso, TX, USA.

Disclaimers: Some authors are employees of the US Federal Government and the US Army. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or reflecting the views of William Beaumont Army Medical Center, the Department of Defense, or US government. The National Trauma Data Bank National Sample Program 2008 remains the full and exclusive property of the American College of Surgeons. The American College of Surgeons is not responsible for any claims arising from works based on the original data, text, tables, or figures.

* Corresponding author. Department of Orthopaedic Surgery, William Beaumont Army Medical Center, Texas Tech University Health Sciences Center, 5005 N. Piedras St, El Paso, TX 79920, USA. Tel.: (330) 329-2594.

*E-mail address*: ajschoen@neomed.edu (A.J. Schoenfeld)

1529-9430/$ - see front matter Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.spinee.2013.03.024

**RESULTS:** The weighted sample contained 75,351 incidents of spine trauma. The average age was 45.8 years. Sixty-four percent of the population was male, 9% was black/African American, 38% possessed private/commercial insurance, and 12.5% lacked insurance. The mortality rate was 6% and 16% sustained complications. Increased age, male gender, Injury Severity Score (ISS), and blood pressure at presentation were significant predictors of mortality, whereas age, male gender, other mechanism of injury, ISS, and blood pressure at presentation influenced the risk of one or more complications. Nonwhite and black/African American race increased risk of mortality, and lack of insurance increased mortality and decreased the number of hospital days, ICU days, and ventilator time.

**CONCLUSIONS:** This is the first study to postulate predictors of morbidity and mortality after spinal trauma in a national model. Race/ethnicity and insurance status appear to be associated with greater risk of mortality after spine trauma. Published by Elsevier Inc.

*Keywords:* Spine trauma; Mortality; Complications; Risk factors; Race

## Introduction

Health-care disparities between racial, ethnic, and socioeconomic groups have long been recognized in the United States. Because of a variety of factors, members of subaltern status on the grounds of race, ethnicity, and income have been found to be at an increased risk of inferior outcomes for medical conditions, such as cancer [1,2], coronary artery disease [2], and human immunodeficiency virus [3]. Ostensibly, because of the integrated system and means by which trauma care is delivered in contrast to the other listed conditions, one would anticipate fewer health-care disparities between treatment and outcomes for patients sustaining traumatic conditions [4]. However, numerous investigations continue to document inferior outcomes, and inequalities of care, within and between minority groups treated by trauma centers across the country [4–12].

Inequalities within orthopedic and musculoskeletal health care have only been evaluated within the last two decades and remain incompletely explored, particularly with respect to disparities among patients with spinal conditions and fractures [13,14]. Alosh et al. [15] documented an increased risk of mortality for racial and socioeconomic minorities after anterior cervical procedures. Similarly, in a meta-analysis of the extant literature, Schoenfeld et al. [13] reported an increased risk of unfavorable outcome after spine surgery when comparing groups of white and nonwhite patients.

Several factors have been implicated in influencing, and obfuscating, the roles of race, ethnicity, and income/insurance status on health-care–related outcomes [1–4,11,13]. These include patient-based factors such as age, medical comorbidities, and attitudes toward the use of health care [1,2,7,11,13]. Other supposed mitigating factors are trauma mechanism [4], severity of injury [4,11], hospital quality [1,13,15], and hospital financial payer mix [1,13,15]. Effective study of the impact of patient demographics, race, ethnicity, and insurance status on outcomes within the American health-care system necessitates a large patient sample that cuts across regions and captures patients with sufficient variation to be representative of the population as a whole.

In this study, we used the National Sample Program (NSP) Arrival Year 2008 of the National Trauma Data Bank (NTDB) to investigate the impact of patient age, comorbidities, race, ethnicity, and insurance status on outcomes after spinal trauma. The NSP is a stratified sample of hospitals from the NTDB, which collects robust patient-centered data from Level I and II trauma centers across the United States [16]. The NSP was designed to provide data capable of informing trauma care and clinical outcomes, and the sample has been used in the past in the creation of predictive models for traumatic conditions [17]. To the best of our knowledge, the present investigation is the first to develop a predictive model regarding the impact of demographic factors, injury-specific predictors, race/ethnicity, and insurance status on morbidity and mortality after spine trauma across a broad population representative of the American health-care system.

## Materials and methods

This study received approval from the national program of the NTDB at the American College of Surgeons and an exempt determination from our institutional investigational review board, before commencement. The NSP (arrival year 2008) was obtained through application to the NTDB. The NSP consists of a stratified sample of 100 NTDB participating hospitals based on US census region, trauma care designation (Level I or II trauma center), and NTDB reporting status [16]. The choice of 100 sample sites was determined by the NTDB based on a review that indicated that such a sample would provide sufficient extrapolation to the national level. Sample hospitals were drawn by the NTDB within strata using the probability-proportional-to-size sampling without replacement method of Levy and Lemeshow [16].

The sampling universe for creation of the NSP consisted of the 453 Level I and II trauma centers as identified in the