Healthcare Disparities after Trauma: A Six-Step Plan to Eliminate Them

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Financial Disclosures

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American College of Surgeons C. James Carrico
Fellowship for the study of Trauma and Critical Care
Objectives

1. Describe Trauma Outcome Disparities based on Race and Insurance Status
2. Present a Conceptual Framework to generate hypotheses aimed at understanding the basis for these inequities
3. Discuss our work exploring these hypotheses
4. Suggest a plan for translating research findings into action
# Trauma: Leading Cause of Death Among Young People

## 10 Leading Causes of Death by Age Group, United States – 2003

<table>
<thead>
<tr>
<th>Rank</th>
<th>Age Groups</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65+</th>
<th>Total</th>
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<tbody>
<tr>
<td>1</td>
<td>Congenital Anomalies</td>
<td>5,621</td>
<td>1,717</td>
<td>1,096</td>
<td>1,572</td>
<td>15,272</td>
<td>12,541</td>
<td>16,764</td>
<td>48,843</td>
<td>95,692</td>
<td>583,930</td>
<td>585,089</td>
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<tr>
<td>2</td>
<td>Short Gestation</td>
<td>4,649</td>
<td>2,102</td>
<td>Malignant Neoplasms</td>
<td>515</td>
<td>560</td>
<td>5,348</td>
<td>3,963</td>
<td>15,029</td>
<td>37,732</td>
<td>65,060</td>
<td>368,811</td>
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<td>3</td>
<td>SIDS</td>
<td>2,102</td>
<td>Malignant Neoplasms</td>
<td>302</td>
<td>Congenital Anomalies</td>
<td>180</td>
<td>Suicide</td>
<td>244</td>
<td>Suicide</td>
<td>4,806</td>
<td>Heart Disease</td>
<td>12,606</td>
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<tr>
<td>4</td>
<td>Maternal Pregnancy Comp.</td>
<td>1,719</td>
<td>Homicide</td>
<td>376</td>
<td>Homicide</td>
<td>122</td>
<td>Congenital Anomalies</td>
<td>205</td>
<td>Malignant Neoplasms</td>
<td>1,951</td>
<td>Malignant Neoplasms</td>
<td>3,741</td>
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<tr>
<td>5</td>
<td>Placenta Cord Membranes</td>
<td>1,089</td>
<td>Heart Disease</td>
<td>105</td>
<td>Heart Disease</td>
<td>104</td>
<td>Homicide</td>
<td>200</td>
<td>Heart Disease</td>
<td>1,133</td>
<td>Heart Disease</td>
<td>3,250</td>
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<tr>
<td>6</td>
<td>Unintentional Injury</td>
<td>946</td>
<td>Influenza &amp; Pneumonia</td>
<td>103</td>
<td>Influenza &amp; Pneumonia</td>
<td>175</td>
<td>Heart Disease</td>
<td>100</td>
<td>Congenital Anomalies</td>
<td>110</td>
<td>Influenza &amp; Pneumonia</td>
<td>1,690</td>
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<tr>
<td>7</td>
<td>Respiratory Distress</td>
<td>831</td>
<td>Septicemia</td>
<td>55</td>
<td>Septicemia</td>
<td>39</td>
<td>Chronic Low Respiratory Disease</td>
<td>13</td>
<td>Congenital Anomalies</td>
<td>74</td>
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<tr>
<td>8</td>
<td>Bacterial Sepsis</td>
<td>778</td>
<td>Perinatal Period</td>
<td>29</td>
<td>Benign Neoplasms</td>
<td>38</td>
<td>Influenza &amp; Pneumonia</td>
<td>72</td>
<td>Cerebrovascular</td>
<td>923</td>
<td>Cerebrovascular</td>
<td>2,462</td>
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<tr>
<td>9</td>
<td>Neonatal Hemorrhage</td>
<td>549</td>
<td>Chronic Low Respiratory Disease</td>
<td>56</td>
<td>Chronic Low Respiratory Disease</td>
<td>56</td>
<td>Congenital Anomalies</td>
<td>241</td>
<td>Chronic Low Respiratory Disease</td>
<td>89</td>
<td>Diabetes Mellitus</td>
<td>2,045</td>
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<tr>
<td>10</td>
<td>Circulatory System Disease</td>
<td>581</td>
<td>Benign Neoplasms</td>
<td>51</td>
<td>Cerebrovascular</td>
<td>29</td>
<td>Cerebrovascular</td>
<td>40</td>
<td>HIV</td>
<td>175</td>
<td>Influenza &amp; Pneumonia</td>
<td>573</td>
</tr>
</tbody>
</table>

Source: National Vital Statistics System, National Center for Health Statistics, CDC.
Produced by: Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC.
Years of Potential Life Lost (YPLL) Below the Age of 65, USA 2000

Unintentional injury: 18.0%
Malignant neoplasms: 16.6%
Heart disease: 12.2%
Perinatal period: 8.1%
Suicide: 5.6%
Homicide: 4.9%
Congenital anomalies: 4.4%
Human immunodeficiency virus: 2.8%
Cerebrovascular disease: 2.2%
Liver disease: 2.1%

Clinical Trauma Care is Maturing

Clinical Outcomes have vastly improved over the past 20-30 years:

• ATLS - median time for a Gunshot victim to the OR is about 9 minutes at Hopkins

• Damage control Operations - Have multiple survivors with a pH of less than 7.0

ATLS: Advanced Trauma Life Support
Surgical Outcomes in Trauma

For those who get the best possible or optimal care, outcomes are excellent.

But Does everyone get “Optimal Care”? 
I wanted to take care for patients with fewer means

So – Like most Americans I went to go work in Africa
You don’t have to go to Africa to care for the poor and disenfranchised

“You can do that right here in Baltimore”
Next frontier in improving clinical outcomes in Trauma:

• Ensuring that all patients receive the same excellent trauma care that saves lives by:
  – Measuring Trauma Outcomes
  – Determining those who are risk for receiving sub-optimal care and the reasons for this
  – Create Effective Solutions
2002 Institute of Medicine published

Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare

Disparities among minorities in:

- Access
- Preventive care
- Treatments
Racial Disparities in Trauma?

Trauma Should be immune to this:

– Near universal access to Pre-Hospital Emergency Medical Services
– Emergent Nature of Trauma
– Emergency Departments are “the great equalizers” and are supposedly color blind
Studies suggest inferior care for minority children

After mild Traumatic Brain Injury (TBI):
Black children received less extensive
• Work up
• Observation period

compared to White children

Objective:

To identify disparities in clinical or functional outcomes between children of different races with moderate to severe traumatic brain injury.
Methods

Study Design and Population:

- Review of children aged: 2-16 years
  - National Pediatric Trauma Registry
    - contains Data from 93 Trauma Centers
- April 1996-September 2001
To categorize severity of TBI

used the Relative Head Injury Severity Score*

<table>
<thead>
<tr>
<th>RHISS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No head injury</td>
</tr>
<tr>
<td>1</td>
<td>Mild Head injury</td>
</tr>
<tr>
<td>2</td>
<td>Moderate Head Injury</td>
</tr>
<tr>
<td>3</td>
<td>Severe Head injury</td>
</tr>
</tbody>
</table>

*RHISS is based ICD-9 diagnosis codes
Main Outcome Measures

- Mortality
- Discharge Disposition (Home vs. Rehabilitation Facility)
- Presence or absence of functional impairment at hospital discharge in:
  1. Expression
  2. Locomotion
  3. Feeding

Functional Impairment measured by WeeFIM© score
Statistical Analysis

Multiple logistic regression used to compare differences between:
White children and Individual minorities

Adjusting for:
- Severity of Head Injury - RHISS
- Physical Injury Severity - NISS
- Physiologic Derangement - PTS

RHISS Relative Head injury severity score
NISS = New Injury Severity Score,
PTS Pediatric Trauma Score
Statistics: further adjusted for

- Intent of Injury
- Type of Injury (blunt vs. penetrating)
- Mechanism of Injury (e.g. Car vs Pedestrian)
- Age
- Sex
- Co-morbidities
- Presence of Severe Extremity Injury
41,122 Trauma Patients

7,778 had Moderate to Severe TBI

7041 Children analyzed

737 children: Small sample size minorities

Mean Age 8.2
64% boys

4762 White
1238 Black
1041 Hispanic
Adjusted Odds of Mortality, Discharge Disposition and Functional Deficit of Black and Hispanic vs. White children

<table>
<thead>
<tr>
<th>Category</th>
<th>Black Odds Ratio</th>
<th>Hispanic Odds Ratio</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>1.7</td>
<td>1.3</td>
<td>1.2-1.9</td>
</tr>
<tr>
<td>Discharge to Rehab</td>
<td>1.4</td>
<td>1.3</td>
<td>1.0-1.6</td>
</tr>
<tr>
<td>Expression</td>
<td>1.3</td>
<td>1.3</td>
<td>1.0-1.6</td>
</tr>
<tr>
<td>Locomotion</td>
<td>1.4</td>
<td>1.3</td>
<td>1.0-1.6</td>
</tr>
<tr>
<td>Feeding</td>
<td>1.3</td>
<td>1.3</td>
<td>1.0-1.6</td>
</tr>
</tbody>
</table>
Conclusion

• Black children with traumatic brain injury suffer a race associated disadvantage:
  • Not severe enough to increase mortality
  • Significant enough to affect functional outcomes.
16 year old female
Multiple Gun Shots to Abdomen

- On Arrival  Heart Rate : 140 bpm
  Blood Pressure: 90/60 mmHg

Immediately rushed up to Operating Room
OR / Hospital Course

Trauma Laparotomy -
Briefly goes into Cardiac Arrest on table
Inferior Vena Cava injury repaired
Multiple Bowel Injuries
Damage Control Operation; 37 units of blood

3 Take Backs to OR, Out of ICU on POD 12
Survived - POD 17 on Floor, refusing all care
Patient Suffering from early form of PTSD

- Patient was involved in a hostage situation
- Received Gun Shots during fire fight between her captor and Baltimore Police
  - Night Tremors
  - Insomnia
  - Anhedonia
  - Hallucinations
Black Children Experience Worse Clinical and Functional Outcomes After Traumatic Brain Injury: An Analysis of the National Pediatric Trauma Registry

Adil H. Haider, MD, MPH, David T. Efron, MD, Elliott R. Haut, MD, Stephen M. DiRusso, MD, PhD, Thomas Sullivan, BS, and Edward E. Cornwell III, MD

**Background:** Recent studies suggest racial disparities in the treatment and outcomes of children with traumatic brain injury (TBI). This study aims to identify race-based clinical and functional outcome differences among pediatric TBI patients in a national database.

**Methods:** A total of 41,122 patients (ages 2–16 years) who were included in the National Pediatric Trauma Registry (from 1996–2001) were studied. TBI was categorized by Relative Head Injury Severity Score (RHISS) and patients with moderate to severe TBI were included. Individual race groups were compared with white as the majority group. Differences between races in functional outcomes at discharge in three domains—speech, locomotion, and feeding—were determined using multiple logistic regression. Cases were adjusted for age, sex, severity of head injury (using RHISS), severity of injury (using New Injury Severity Score and Pediatric Trauma Score), premorbidities, mechanism, and injury intent.

**Results:** A total of 7,778 children had moderate or severe TBI with or without associated injuries. All races had similar demographics. Hispanics (n = 1,041) had outcomes comparable to whites (n = 4,762). Black children (n = 1,238) had significantly increased premorbidities, penetrating trauma, and violent intent. They also had higher unadjusted mortality and longer mean intensive care unit and floor stays. After adjustment, there was no difference in the odds of death between black and white children. However, black patients were more likely to be discharged to an inpatient rehabilitation facility and had increased odds of possessing a functional deficit at discharge for all three domains studied.

**Conclusion:** Black children with traumatic brain injury have worse clinical and functional outcomes at discharge when compared with equivalently injured white children.

**Key Words:** Racial disparities, pediatric traumatic brain injury, functional outcomes.
To the Editor:

I find the publication of the article by Haider in this journal to be extremely troublesome; especially, after it was presented at the American Association for the Surgery of Trauma (AAST) without discussion allowed from the floor due to time restraints. Their conclusions could have unintended consequences, and are an insult to those that take care of injured children.

The conclusions could have unintended consequences, and are an insult to those that take care of injured children.
Our Reply: We fully understand the discomfort a study such as this creates. Perhaps no topic in American dialogue generates as much emotion as race. Our own study group is a racially, ethnically, religiously diverse collection of investigators—all of whom have spent their entire careers at urban trauma centers caring for predominantly minority patients. We feel personally challenged by the results of this study—but are no less convinced of its validity.
Are these truly racial disparities?

OR

Are these merely a reflection of differences in insurance status or other measures of socio-economic status (SES)?
Race and Insurance Status as Risk Factors for Trauma Mortality

Adil H. Haider, MD, MPH; David C. Chang, MPH, MBA, PhD; David T. Efron, MD; Elliott R. Haut, MD; Marie Crandall, MD, MPH; Edward E. Cornwell III, MD

Objective: To determine the effect of race and insurance status on trauma mortality.

Methods: Review of patients (aged 18-64 years; Injury Severity Score ≥ 9) included in the National Trauma Data Bank (2001-2005). African American and Hispanic patients were each compared with white patients and insured patients were compared with uninsured patients. Multiple logistic regression analyses determined differences in survival rates after adjusting for demographics, injury severity (Injury Severity Score and revised Trauma Score), severity of head and/or extremity injury, and injury mechanism.

Results: A total of 429,751 patients met inclusion criteria. African American (n = 72,249) and Hispanic (n = 41,770) patients were less likely to be insured and more likely to sustain penetrating trauma than white patients (n = 262,878). African American and Hispanic patients had higher unadjusted mortality rates (white, 5.7%; African American, 8.2%; Hispanic, 9.1%; P = .05 for African American and Hispanic patients) and an increased adjusted odds ratio (OR) of death compared with white patients (African American OR, 1.17; 95% confidence interval [CI], 1.10-1.23; Hispanic OR, 1.47; 95% CI, 1.39-1.57). Insured patients (47%) had lower crude mortality rates than uninsured patients (4.4% vs 8.6%; P = .05). Insured African American and Hispanic patients had increased mortality rates compared with insured white patients. This effect worsened for uninsured patients across groups (insured African American OR, 1.2; 95% CI, 1.08-1.33; insured Hispanic OR, 1.51; 95% CI, 1.36-1.64; uninsured white OR, 1.55; 95% CI, 1.46-1.64; uninsured African American OR, 1.78; 95% CI, 1.65-1.90; uninsured Hispanic OR, 2.30; 95% CI, 2.13-2.49). The reference group was insured white patients.

Conclusion: Race and insurance status each independently predicts outcome disparities after trauma. African American, Hispanic, and uninsured patients have worse outcomes, but insurance status appears to have the stronger association with mortality after trauma.

Arch Surg. 2008;143(10):945-949
Study Population: National Trauma Data Bank (NTDB)

- National database
- Managed by American College of Surgeons
- Voluntary participation
- 1.5 million trauma incidents
- > 700 Trauma Hospitals
Mechanism of Injury Predicts Patient Mortality and Impairment After Blunt Trauma

Adil H. Haider, M.D., M.P.H.,*1 David C. Chang, M.P.H., M.B.A., Ph.D.,* Elliott R. Haut, M.D.,*
Edward E. Cornwell III, M.D.,† and David T. Efron, M.D.∗

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Submitted for publication January 7, 2008

Background. Different mechanisms of injury (MOI), such as motor vehicle crashes, falls, or pedestrians struck by motor vehicle impart varying degrees of force and energy transfer that may impact outcomes. This study analyzed the independent relationship between MOI and mortality and functional outcomes following blunt trauma among adults.

Materials and methods. Retrospective review of blunt trauma patients 15 y and older in the National Trauma Data Bank from 2001 to 2005. Primary outcome measures were mortality and presence of functional deficit in speech, walking, or feeding at discharge. MOI categories, identified by ICD-9 E codes, were motor vehicle crash, pedestrian struck by motor vehicle, motorcycle crash, falls at same level and from any height, and bicycle crash. A multiple regression including MOI, and we propose routine adjustment for injury mechanism in trauma outcomes research. © 2008 Elsevier Inc. All rights reserved.

Key Words: trauma; mechanism of injury; functional outcomes; injury severity; mortality.

INTRODUCTION

Trauma has typically been categorized injury in 2 broad types, blunt or penetrating. Each “type” of trauma has different epidemiology patterns, management paradigms, and outcome assessment methodologies. In penetrating trauma, injury is usually focused on the areas directly affected by the penetrating object. The effect of blunt traumatic injury may be more diffuse, and different
ASSOCIATION FOR ACADEMIC SURGERY

Simplifying Physiologic Injury Severity Measurement for Predicting Trauma Outcomes


*Department of Surgery, Howard University College of Medicine, Washington, D.C.; †Center for Surgical Trials and Outcomes Research / Department of Surgery, Johns Hopkins School of Medicine, Baltimore, Maryland; and ‡Center for Injury Research and Policy / Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland

Submitted for publication January 9, 2009

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**Background.** The Revised Trauma Score (RTS) is commonly used to assess physiologic injury; however, its use is limited by missing data. This study compares different parameters of physiologic injury assessment in their ability to predict mortality after trauma.

**Methods.** Adult patients in the National Trauma Data Bank (NTDB version 7.0) were analyzed, and the following physiologic injury parameters were compared: RTS, systolic blood pressure (SBP), shock (SBP ≤ 90 mm Hg), Glasgow coma scale-total (GCS-T), and GCS-motor (GCS-M). Areas under the receiver-operating characteristic curves (AUROC) were calculated for unadjusted and multivariate regression models to predict mortality after trauma.

**Results.** There were 1,484,648 patients who met inclusion criteria. In unadjusted analyses, RTS had the highest proportion of missing data (21%) and was highly predictive of mortality (AUROC = 0.85). SBP and shock had a much lower AUROC of 0.67 and 0.66, respectively, but had many fewer missing cases. The combination parameters of GCS-M with SBP or GCS-M with shock showed AUROC comparable to RTS (0.85) with approximately 80,000 fewer missing cases.

**Conclusion.** The discriminatory power of RTS is significantly better than SBP, shock, or GCS alone. Given the limitation of missing data associated with RTS, the combination of SBP and GCS-M is a more reliable and equally effective method of assessing physiologic injury severity in studying trauma outcomes. © 2010 Elsevier Inc. All rights reserved.

**Key Words:** injury scoring; physiologic; trauma outcomes

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**INTRODUCTION**

Trauma patients present with varying degrees of injury, from minor to severe life threatening. A variety of scoring systems have been devised to grade and classify the injuries a patient sustains. By providing a snapshot of a patient’s injury severity, injury scoring systems aid in the field triage of injured patients, effectively separating the severely injured from those with lesser degrees of injury. Scoring systems are also instrumental in outcomes research and trauma system development as they provide a means by which patients with different and varying degrees of injury can be compared and their treatments and outcomes evaluated.

There are two basic types of scoring systems, anatomical and physiologic. Anatomical scoring systems attempt to provide an overview of the structural injury a patient has received. The Injury Severity Score (ISS) [1], developed in 1974, has been the most com-
Multiple imputation in trauma disparity research.

Oyetunji TA, Crompton JG, Ehanire ID, Stevens KA, Efron DT, Haut ER, Chang DC, Cornwell EE 3rd, Crandall ML, Haider AH.

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Abstract

BACKGROUND: Missing data has remained a major disparity in trauma outcomes research due to missing race and insurance data. Multiple imputation (M.IMP) has been recommended as a solution to deal with this major drawback.

STUDY DESIGN: Using the National Data Trauma Bank (NTDB) as an example, a complete dataset was developed by deleting cases with missing data across variables of interest. An incomplete dataset was then created from the complete set using random deletion to simulate the original NTDB, followed by five M.IMP rounds to generate a final imputed dataset. Identical multivariate analyses were performed to investigate the effect of race and insurance on mortality in both datasets.

RESULTS: Missing data proportions for known trauma mortality covariates as were follows: age-4%, gender-0.4%, race-8%, insurance-17%, injury severity score-6%, revised trauma score-20%, and trauma type-3%. The M.IMP dataset results were qualitatively similar to the original dataset.

CONCLUSION: M.IMP is a feasible tool in NTDB for handling missing race and insurance data.

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PMD: 21067775 [PubMed - indexed for MEDLINE]
1.46 Million Trauma Patients

429,751 had Moderate-Severe Injuries

376,897 Patients analyzed

52,854 “Other” Minority Patients excluded

69% White (n = 262,878)
19% Black (n = 72,249)
11% Hispanic (n = 41,770)

Mean Age: 36 yrs
70% Men
Adjusted Odds of Death after Trauma

n= 376,897; for patients 18-65 years of age with ISS >8; adjusted for age, sex, ISS, ED Hypotension, GCSm, injury mechanism/type and head injury
These studies together confirm that Trauma Disparities are not just due to Race:

Both insurance and race are independent predictors of trauma outcomes:
In Adults and In Children

So where do we go from here?
Developing the field of Trauma Outcome Disparities

Brought together pioneers in related fields:

- Trauma Outcomes Researchers
- Quality & Safety Specialists
- Disparity Scientists
### Application of a Translational Research Model to Solve Health Care Disparities: Peptic Ulcer Disease Analogy

<table>
<thead>
<tr>
<th>Step A</th>
<th>Step B</th>
<th>Step C</th>
<th>Step D</th>
<th>Step E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Epidemiological Studies of Disease eg. Operations for perforated gastric ulcers common</td>
<td>Develop Understanding of Disease Mechanism Gastric ulcers associated with H. Pylori</td>
<td>Development of Effective Therapies Drug therapy against H. pylori developed</td>
<td>Clinical Trials of Effective Therapy or Drug Combination therapy proven, safe and effective</td>
<td>Widespread Dissemination of Therapy - Combination therapy widely prescribed -Operations for perforated gastric ulcer relic of the past</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Racial Disparities well Documented</th>
<th>Understanding of Mechanism of Disease Processes</th>
<th>Develop intervention</th>
<th>Rigorous testing of intervention</th>
<th>Disseminate intervention widely</th>
</tr>
</thead>
</table>

Knowledge currently here
Hypotheses and questions generated:

1. Are disparities a reflection of poor outcomes at hospitals that treat minorities?
2. Are Certain Subsets of Minorities at increased Risk for Worse Outcomes?
3. Are other socio-economic influences or co-morbidities the real driver of disparity?
4. Does subconscious bias impact treatments that we have?
Hypothesis # 1

Trauma disparities among minorities are due to worse outcomes at hospitals that primarily serve Black and Hispanic patients?
Outcome Measure

• Adjusted In-Hospital Mortality Across the Three Hospital Types

Comparing the Predominantly Majority facilities (reference group) to:

- Mixed (25-50% Black/Hispanic)
- Predominantly Minority (≥ 50% Black/Hispanic)
Crude Mortality Across The Three Hospital Groups

- <25% Minority hospitals, n=256 hospitals, 4.60%
- 25-50% Minority hospitals, n=122 hospitals, 5.70%
- >50% Minority hospitals, n=56 hospitals, 7.40%

Crude Mortality is statistically significantly different across all three groups, p<0.5.
Statistics Employed for Adjusted Analysis

- Multivariate Logistic Regression Adjusting for Patient/Injury Characteristics
- Generalized Linear Models and Cluster-Correlated Robust Estimates of Variance Adjusting for Within-Cluster Correlation
- Multiple Imputation for Missing Data
Adjusted Odds of Death by Hospital Category

Compared to Predominantly White Hospitals, patients at hospitals with more Blacks and Hispanics had a much higher odds of Death.
Question 2) Are Certain Subsets of Minorities at increased Risk for Worse Outcomes?

Clinical Science

Racial disparities in motorcycle-related mortality: an analysis of the National Trauma Data Bank

Joseph G. Crompton, M.D. a,* , Keshia M. Pollack, Ph.D., M.P.H. b , Tolulope Oyetunji, M.D., M.P.H. c , David C. Chang, M.P.H., M.B.Ch.B., Ph.D. a , David T. Efron, M.D. a , Elliott R. Haut, M.D. a , Edward E. Cornwell III, M.D. a , Adil H. Haider, M.D., M.P.H. a

aDepartment of Surgery, Division of Trauma, The Johns Hopkins University, School of Medicine, 600 N. Wolfe St, Blalock 610, Baltimore, MD 21287; bJohns Hopkins Bloomberg School of Public Health, Department of Health, Policy and Management, Center for Injury Research and Policy and Center for Health Disparities Solutions, Baltimore, MD; cDepartment of Surgery, Howard University College of Medicine, Washington, DC, USA
Pedestrians struck by motor vehicles further worsen race- and insurance-based disparities in trauma outcomes: The case for inner-city pedestrian injury prevention programs

Rubie Sue Maybury, MD, MPH,a Oluwaseyi B. Bolorunduro, MD, MPH,b Cassandra Villegas,c Elliott R. Haut, MD,c Kent Stevens, MD, MPH,c Edward E. Cornwell III, MD,b David T. Efron, MD,c and Adil H. Haider, MD, MPH,c Washington, DC, and Baltimore, MD

Background. Pedestrian trauma is the most lethal blunt trauma mechanism, and the rate of mortality in African Americans and Hispanics is twice that compared with whites. Whether insurance status and differential survival contribute to this disparity is unknown.

Methods. This study is a review of vehicle-struck pedestrians in the National Trauma Data Bank, v7.0. Patients <16 years and ≥65 years, as well as patients with Injury Severity Score (ISS) <9, were excluded. Patients were categorized as white, African American, or Hispanic, and as privately insured, government insured, or uninsured. With white and privately insured patients as reference, logistic regression was used to evaluate mortality by race and insurance status after adjusting for patient and injury characteristics.

Results. In all, 26,404 patients met inclusion criteria. On logistic regression, African Americans had 22% greater odds of mortality (odds ratio [OR], 1.22; 95% confidence interval [CI], 1.06–1.41) and Hispanics had 33% greater odds of mortality (OR, 1.33; 95% CI, 1.14–1.54) compared with whites. Uninsured patients had 77% greater odds of mortality (OR, 1.77; 95% CI, 1.52–2.06) compared with privately insured patients.

Conclusion. African American and Hispanic race, as well as uninsured status, increase the risk of mortality after pedestrian crashes. Given the greater incidence of pedestrian crashes in minorities, this compounded burden of injury mandates pedestrian trauma prevention efforts in inner cities to decrease health disparities. (Surgery 2010;148:202-8.)

From the Department of Surgery,a Georgetown University Hospital, Washington, DC; Department of Surgery,b Howard University Hospital, Washington, DC; and Department of Surgery,c Center for Surgery Trials and Outcomes Research, The Johns Hopkins University School of Medicine, Baltimore, MD
3) Are other SES issues or co-morbidities the real driver of the trauma disparities?

• SES not well studied in Trauma
• Co-morbidities known to cause worse outcomes
Objective

• To examine the causal relationships between injury severity, pre-injury health, race, insurance and direct measures of socio-economic status (SES) on one-year functional outcomes after trauma
Structural Equation Modeling

- Structural Equation Modeling (SEM) enables the estimation of the relative effect of different co-variates on an outcome.
- Its Major Strength is that it allows the use of LATENT variables that can combine multiple measurable co-variates.
SEM Depicting Relative Effect of Patient / Injury Factors at 12 months

Effect size > ± 0.1 is significant
# Relative Total Effect on 1 year SF36 Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Injury Health</td>
<td>-0.56*</td>
</tr>
<tr>
<td>Injury Severity</td>
<td></td>
</tr>
<tr>
<td>Head and Neck injury</td>
<td>-0.13*</td>
</tr>
<tr>
<td>Severe Extremity injury</td>
<td>-0.29*</td>
</tr>
<tr>
<td>Private Insurance</td>
<td>+0.22*</td>
</tr>
<tr>
<td>Black race</td>
<td>-0.17*</td>
</tr>
<tr>
<td>SES</td>
<td>+0.16*</td>
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</tbody>
</table>

Hispanic ethnicity did not impact outcomes

Effect sizes range from -1 to +1

*Total effect size, significantly predicts outcomes p < 0.05
4. Are Surgical Care Providers Biased?

Would we treat this patient differently?
Like the general population doctors may possess unconscious biases or preferences. These Unconscious or Implicit Biases may lead us to unknowingly treat patients differently.
Race Implicit Association Test

Computer-based test of social cognition

Measures time it takes to match representatives of social groups with good and bad attributes.

Test-takers with an implicit preference for whites would pair white with pleasure faster than they would with Blacks.

https://implicit.harvard.edu/implicit
Objective

To identify the presence of unconscious/implicit race and class bias among Trauma Care Providers (both nurses and physicians) to determine whether implicit bias affects their clinical decision making.
Methods:
Web based study of RN’s and MD’s

- 400 participants already recruited to take a 25 minute survey including:
  1) IAT: Race
     Social Class
  2) Eight clinical scenario vignettes
  3) Direct questions regarding explicit race and socioeconomic class preferences

Yes we gave them a $25 incentive!
How will all this work to mitigate disparities?

6 Step Translation Process

1. Generate Awareness of the Problem
2. Elucidate their Underlying Mechanism
3. Create Solutions and Interventions
4. Evaluating these Interventions
5. Advocating their Implementation
6. Dynamic monitoring of their effectiveness
The Field of Trauma Disparities is between step 2 and 3 of this

Potential solutions lie in:

• Targeting Minority Hospitals for Quality Improvement
• Tailoring Injury Prevention to needs of Minorities
• Improving patient provider interaction expanding tenets of cultural competency to trauma as well
<table>
<thead>
<tr>
<th>Dr Edward Cornwell III</th>
<th>Dr Tolulope Oyetunji</th>
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<tbody>
<tr>
<td>Dr Ellen MacKenzie</td>
<td>Dr Joseph Crompton</td>
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<tr>
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<td>Ms Sandra Swoboda, RN</td>
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<tr>
<td>Dr Kent Stevens</td>
<td>Ms Valerie Scott</td>
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<tr>
<td>Dr Renan Castillo</td>
<td>Ms Lia Losonczy</td>
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<td>Dr Eric Schneider</td>
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