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# Differences in Pediatric Unintentional Injury Outcomes by Race/Ethnicity

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**Differences in Pediatric Unintentional Injury Outcomes by Race/Ethnicity**

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Unintentional injuries contribute significantly to childhood mortality and morbidity nationally and globally. In the United States, they are the leading cause of death in children over the age of 1, causing more than 9,000 childhood deaths each year. Moreover, for every fatality, there are over 1,000 children seeking medical care for nonfatal unintentional injuries. The staggering rates of both fatal and nonfatal injuries impose a tremendous strain on individual families, the medical system, and the national economy. Sociodemographic risk factors that predict poor outcome in pediatric unintentional injuries have been identified; they include, most notably, lack of insurance and minority race/ethnicity. However, more recent studies conducted in racially diverse settings have not found a similar association between minority race/ethnicity and poor outcome.

This study utilizes trauma data from January 1996 to December 2012 from the University of Texas Medical Branch in Galveston, Texas to compare outcomes of pediatric unintentional injury between patients of White, Black, and Hispanic race/ethnicity. By adjusting for age, sex, insurance status, and severity of injury, we aim to assess whether minority race/ethnicity is a predictor of poor outcomes. The primary outcome is mortality; secondary outcomes are injury severity, the need for emergent surgery, hospital length of stay, and residual morbidity after hospital discharge. After adjustments, Hispanic ethnicity is found not to be associated with increased risk of mortality when compared to White patients. This is in contrast with Black patients, who are found to be at increased risk. Additionally, insurance status patterns differ by race/ethnicity and appear to confer various degrees of protection against mortality.

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# ABBREVIATIONS

| | |
|---|---|
| AIC | AKAIKE INFORMATION SCORE |
| AIS | ABBREVIATED INJURY SCALE |
| ARR | ADJUSTED RELATIVE RISK |
| CDC | CENTERS FOR DISEASE CONTROL AND PREVENTION |
| CI | CONFIDENCE INTERVAL |
| ED | EMERGENCY DEPARTMENT |
| GCS | GLASGOW COMA SCORE |
| ICU | INTENSIVE CARE UNIT |
| IOM | INSTITUTE OF MEDICINE |
| ISS | INJURY SEVERITY SCORE |
| NTDB | NATIONAL TRAUMA DATA BANK |
| OR | ODDS RATIO |
| RR | RELATIVE RISK |
| TBI | TRAUMATIC BRAIN INJURY |
| UTMB | UNIVERSITY OF TEXAS MEDICAL BRANCH |
| YPLL | YEARS OF POTENTIAL LIFE LOST |

# I. INTRODUCTION

## RESEARCH QUESTION

In the pediatric trauma population seen at The University of Texas Medical Branch (UTMB), are there differences in unintentional injury outcomes by race/ethnicity?

## SPECIFIC AIMS

This project will assess race/ethnicity as a risk factor for poor unintentional injury outcomes within the pediatric trauma population at the University of Texas Medical Branch. The primary outcome assessed will be mortality; secondary outcomes include severe injury (as classified by the Injury Severity Score, ISS), the necessity for emergent surgery, morbidity (as defined by discharge to rehabilitation facility vs. home or other locations of origin), and hospital length of stay. Using data from the UTMB trauma registry, the outcomes of interest in pediatric patients will be compared by race/ethnicity, adjusting for age, sex, and insurance status. We hypothesize that Hispanics have poorer outcomes after adjusting for these factors compared to non-Hispanic Whites and Blacks.

Aim 1: To describe the sociodemographic characteristics of the pediatric trauma population seen at UTMB between January 1st, 1996 and December 24th, 2012.

Aim 2: To assess differences in outcomes of the pediatric trauma population by race/ethnicity.

## SIGNIFICANCE

In the United States, unintentional injury is the leading cause of death for individuals between ages 1 and 19 years across all racial and ethnic groups and both

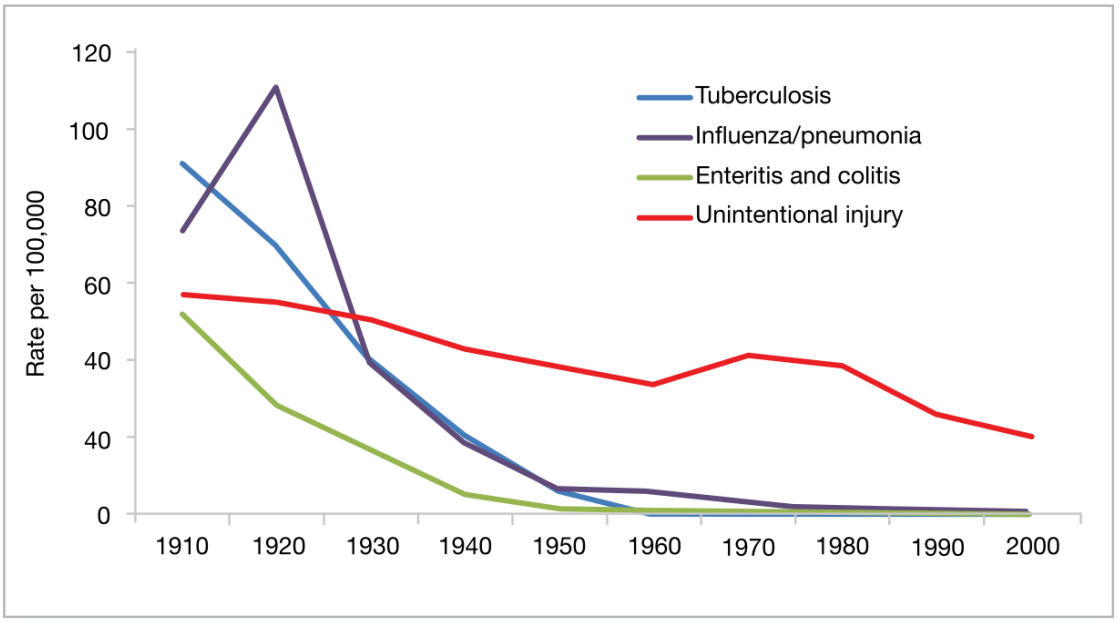
sexes.[1,3,5] Countless campaigns and prevention messages have been implemented, aimed at reducing preventable injuries in children. The impact of these public health campaigns was demonstrated in a 2007 study examining fatal injuries in children ages 0 to 4 from 1981 to 2003.[2] The study showed significant decrease in all-cause injury rates across all racial/ethnic groups. However, this favorable trend was tempered by the seemingly paradoxical finding of widening racial disparities across multiple injury mechanisms. The overall decrease in injury rates was attributed mostly to significant improvements among White children, while Black children experienced only moderate improvements in injury rates. The growing disparity in unintentional injury rates necessitates further examination. Current models of injury prevention may not be equally effective across all racial/ethnic groups

## II. BACKGROUND

In its National Action Plan for Child Injury Prevention, the Centers for Disease Control and Prevention (CDC) defined injury as "the physical damage that results when a human body is suddenly subjected to energy in amounts that exceed the threshold of physiologic tolerance – or else the result of a lack of one or more vital elements, such as oxygen".[3] The report further specified its focus on unintentional injuries, which are "predictable and preventable when proper safety precautions are taken".[3] Thus, injuries inflicted with intention, such as self-inflicted injuries and abuse, are addressed separately and outside the scope of the current discussion.

Unintentional injuries are the leading cause of death for children ages 1 to 19 in the United States and worldwide, accounting for 37% of all deaths in this age group in the United States in 2009.[1,3,4,5] Each year nationally, over 9,000 children die from such injuries.[3,5] While the emotional trauma of such deaths may be incalculable, the societal impact has been described in term of Years of Potential Life Lost (YPLL), an estimate of "the average time a person would have lived had he or she not died prematurely".[6] For children ages 1 to 19, unintentional injuries were responsible for 42% of all YPLL from 2000 to 2009 – five times the YPLL of cancer, 13 times that of heart disease, and 31 times that of pneumonia and influenza.[3] While public health campaigns and medical advances have drastically reduced mortalities resulting from communicable diseases such as influenza and tuberculosis – major causes of childhood fatality in early 20$^{th}$ century – the decrease in childhood unintentional injury mortality has lagged behind.[3]

**Figure 1. Reduction in death rates for persons 1-24 years of age, by cause and year, United States, 1910-2000** [3]




The mortality data only relay a part of the story. For every death from childhood unintentional injury, more than 1,000 children receive medical attention for nonfatal injuries.[5] In 2009, this translated to 8.7 million children and teenagers seen in Emergency Departments across the country; of these, 225,000 patients had injuries severe enough to warrant hospitalization or transfer to higher level of care.[3,5] Along with the physical and emotional needs of an injured child, one must also take into account the increased stress and burden on caretakers and families when considering the total impact of childhood injuries. In all, unintentional childhood injuries cost more than $200 billion annually, after accounting for medical costs, loss of potential incomes by caretakers, and the families' reduced quality of life.[3]

As unintentional injuries are increasingly recognized health problem of epidemic proportions, experts are beginning to approach the issue using a public health, preventative model. The term "accidents" is falling out of favor to emphasize the predictable and preventable nature of the large majority of these deaths and injuries.[3,7] In fact, it has been estimated that 90% of these injuries can be prevented with a multidisclipinary approach.[7]

A review of the literature shows minority race/ethnicity to be a risk factor for poor outcomes in pediatric injuries.[19-21, 23] However, more recent studies in settings with particularly high proportions of Black or Hispanic patients have not shown such a disparity in trauma outcomes.[8,9] The authors attributed these apparent successes in the elimination of racial disparities to a combination of increased insurance coverage, improved cultural awareness, and culturally competent care.

In a state with a highly diverse population but low rate of insurance, this study aims to describe the relationship between race/ethnicity, insurance, and trauma outcome for pediatric patients seen at the University of Texas Medical Branch.

## NATIONAL RECOGNITION OF RACIAL DISPARITIES

As part of Healthy People 2000, Healthy Children 2000 established as one of its three broad goals the reduction of health disparities.[10] The report recognized areas of considerable disparities in maternal, infant, and children's health, and set forth objectives aimed to improve children's health. Despite the collective effort towards combatting these disparities, the problem appeared to remain. In 2002, the Institute of Medicine (IOM) released the report "Unequal Treatment: Confronting Racial and Ethnic

Disparities in Health Care", highlighting the problem of racial and ethnic disparities in healthcare services.[11] In reviewing over 100 studies examining the relationship between race/ethnicity and quality of healthcare, the IOM consistently found that minority patients were less likely to receive necessary clinical services. Even after controlling for potential confounding variables as insurance status, patient income, disease severity, co-morbidities, and location of services, the racial disparities persisted across diagnoses and types of services.

## EARLY NATIONAL PEDIATRIC MORTALITY DISPARITIES RESEARCH

In 1999, Scholer et al. identified sociodemographic factors that increased the risk of injury mortality in infants.[12] They constructed a historical cohort of US infants born between 1985 and 1991 using datasets from the National Center for Health Statistics. The datasets provided linked records of births and deaths that occurred before 1 year of age within the US, including information on maternal and child characteristics. After exclusions, the cohort consisted of 18,768,162 children, or 68% of the total number of births within the study period.

In the risk analysis, the authors stratified groups based on points given by adjusted relatively risk (ARR). For each sociodemographic factor, the highest risk level (ARR = 2.50 to 3.50) was given 3 points while the lowest risk (ARR = 1 to 1.25) given 0 points. For example, in terms of birth weight, those who weighed ≤1,500 g were assigned 3 points while those >2,500 g received 0 points. Each infant was then assigned a risk score, an estimate of total risk, based on the sum of points given.[12]

In bivariate analysis, factors found to be associated with >100% increase in risk of injury mortality were birth weight ≤1,500 g, and being born to mothers <20 years old, with <12 years of education, had ≥3 other children, were African-American, were unmarried, or lived in the South. After adjustments in multivariate analysis, low birth weight, maternal age, maternal education, and number of other children remained associated with a >100% increase in risk. These risk factors extended across injury mechanisms. The lowest risk group of infants had a mortality rate of 7.1 deaths/100,000 child years, while the highest risk group had a rate of 80.4 deaths/100,000 child years.[12] This 11-fold increase in risk of death highlighted the significant disparity in infant injury mortality. Furthermore, the disparity was consistent throughout the study period, indicating no improvement over time.

Of note, the author chose to exclude data from states with <75% complete data, which meant that the three largest states – New York, California, and Texas – along with Washington were excluded from the historical cohort. The authors also conceded that the study did not identify factors that directly place infants at risk for injury mortality, nevertheless the findings helped identify at-risk populations to focus prevention education and strategies.[12]

Using data from about the same time period as Scholer et al. and expanding to include children ages 0 to 4, Pressley et al. examined the trend in mortality rates of young children.[2] They found an overall decrease in mortality rates but an alarming and persistent racial disparity from 1982 to 2003. In fact, the racial disparity between Black and White children widened for certain injury mechanisms, including unintentional suffocation, firearms, and motor vehicle accidents. The increasing disparity was due to

the injury rates decreasing more in White children than minority children. This suggests that preventive measures and education were differentially influencing risk between these populations. Moreover, Black and American Indian children had significantly higher injury mortality rates than children of other races/ethnicities.[2]

## MEASURES TO ADDRESS DISPARITIES – EXPANSION OF MEDICAID AND SCHIP

During the study period of Pressley et al., numerous children's injury prevention programs were initiated to educate and promote the use of protective equipment such as car seats and seat belts. In addition, the Balanced Budget Act of 1997 created the State Children's Health Insurance Program (SCHIP).[13] Depending on the state, SCHIP was established as either an expansion of Medicaid or a separate program to improve healthcare access of uninsured children from low-income families. Since its creation, SCHIP has been expanded to reach more children and, in terms of the number of uninsured children, has been effective in improving access to care. However, research findings remain conflicted regarding its success in addressing racial disparities.

In 2005, Shone et al. examined the experiences of new enrollees in the New York SCHIP.[14] The study comprised of pre- and post-SCHIP telephone interviews with parents of 2,290 children continuously enrolled for at least 3 months in the SCHIP. Information gathered from the interviews and administrative files combined to provide information on 75 measures, giving indicators of sociodemographic characteristics, pre-SCHIP insurance status, healthcare access, continuity of care, and quality of care. Children classified as White, Black, and Hispanic were included – White children being the comparison group – while other races were excluded due to insufficient numbers. The authors found that the

program successfully improved measures across all three racial groups and eliminated racial disparities in terms of overall unmet health need and continuity of care. However, disparities persisted in measures of quality of care and use of preventive care, with parents of Hispanic children reporting the lowest rates in both categories.[14]

The authors noted that adjustments for sociodemographic and health system factors revealed wider disparities. For example, the percentage difference in reported unmet need for care between Black and White children increased from 10.3% to 17.1% after adjustments ($p \leq 0.001$). The change was greater between Hispanic and White children, increasing from 2.0% pre-adjustment to 12.3% post-adjustment ($p \leq 0.05$).[14] This suggests that disparities in these areas were attributable to race/ethnicity itself or to other unmeasured factors.

The Shone et al. study thoroughly captured the children's healthcare experience by collecting 75 measures.[14] The multivariate analysis included about a dozen sociodemographic and health system covariates. The thoroughness to address possible confounding is potentially problematic as it subjected the analysis to collinear effects among the numerous variables. Collinearity is a particular danger in ecologic studies involving a small number of large, heterogeneous groups.[15]

The monetary incentive offered for participation also raised concern for selection bias. The $10 reimbursement would be most attractive to the poorest parents with children having the least access to healthcare who were likely to benefit the most from having new insurance coverage. Thus, the reported positive effect of SCHIP would be exaggerated. In term of racial disparity, however, the incentive selection bias effect

would presumably be homogeneous across racial groups, thereby mitigating the distortion on disparity results.

Other limitations of the study included the parents' self-report bias and limited external validity as the study included only children in one state. The authors also admitted their failure to adjust for immigrant status or language, which may have differentially affected the healthcare experiences of some Hispanic SCHIP enrollees and their families.[14]

As opposed to Shone et al., who focused on the experiences of SCHIP users in New York State alone, Howell et al. utilized national data and focused on child mortality to assess the impact of SCHIP.[16] With data from the National Center for Health Statistics from 1986 to 2003, they found that the expansion of Medicaid and SCHIP was associated with declines in child mortality due to external causes, i.e. traumas. For deaths due natural causes, i.e. those related to diseases, the mortality rate also declined. The improvements in child mortality notwithstanding, the data also showed that the Black-White mortality ratio, an indicator of racial disparity, remained essentially the same for all children. [16]

The most notable limitation of this study was the lack of delineation of Hispanics as a distinct entity. Despite becoming an increasingly significant minority group nationally, Hispanics were included in the "other" category for race in analysis, while White and Black patients were separately categorized. Additionally, the study also excluded infant mortality because of existing extensive literature on infant mortality racial disparities.[16]

## RACIAL DISPARITIES IN TRAUMA CARE AND OUTCOME

Overall, the studies by Shone et al. and Howell et al. demonstrated that provision of insurance coverage is a necessary but insufficient step towards the elimination of racial health disparities.[14,16] This notion underlay the impetus behind SCHIP and Medicaid expansion and the subsequent research into their benefits. At the same time, the role of race/ethnicity as an independent risk factor in pediatric trauma mortality remains less well understood. To explain the relationship between race and trauma mortality, recent studies have examined potential racial disparity in the trauma care provided and in trauma outcomes.[17],[18]

In evaluating the influence on race on trauma care, Shafi et al. conducted a retrospective analysis involving 58,729 pediatric and adult patients with severe trauma brain injury (TBI) from the National Trauma Data Bank (NTDB).[17] They concluded that minority race predicted of decreased odds of rehabilitation placement after discharge. The odds of rehabilitation placement were 15% lower for minority patients compared to White patients. The study adjusted for age, gender, Injury Severity Score (ISS), TBI severity, other associated injuries, and insurance status. Included in the study were patients classified as non-Hispanic White, African-American, and Hispanic, while other minority groups, less severe TBIs, and those with incomplete data were excluded. Insurance status was shown to be an important predictor of rehabilitation placement. For Hispanic patients vs. White patients, the differences in rehab placement rates were statistically significant, even after adjusting for insurance type. For Black patients, however, the difference was not statistically significant after adjustments in multivariate analysis.[17]

Over a series of multivariate analyses, the study design may have suffered from over-adjustment. The odds showed a clear relationship between minority race and decreased odds for rehab placement up through adjustments for head Abbreviated Injury Scale (AIS), Glasgow Coma Score (GCS), and insurance status (adjusted odds: Blacks 0.75 (0.65-0.86) and Hispanics (0.63 (0.54-0.74)). The relationship became diluted after further adjustments for age, ISS, gender, and associated injuries (adjusted odds: Blacks 0.94 (0.88-1.01) and Hispanics (0.73 (0.67-0.80)). However, the authors had previously described these factors as either statistically insignificant (gender and associated abdominal and thoracic injuries) or statistically significant but clinically insignificant (OR=1.015 for age; OR=1.040 for ISS).[17] By making the additional adjustments, the overall analysis model may have gained small degrees of fit at the expense of model simplicity and clinical relevance.

Whereas the Shafi et al. study approached rehabilitation placement as a surrogate measure of equity in healthcare access and trauma care, Haider et al. also in 2007, used it as an outcome measure of injury severity.[17,18] The study found that Black children experienced an increased rate of severe head injury and worse functional outcome than White children, as measured by a higher rate of discharge to inpatient rehabilitation and worse performance on functional assessments. However, there was no statistically significant difference in the odds of death between the two groups. Hispanic children, on the other hand, did not experience a difference in outcomes compared to White children.[18] From the National Pediatric Trauma Registry, the study included 7,041 subjects ages 2 to 16 with moderate to severe head injury (as measured by a Relative Head Injury Severity Scale of 2 or 3, from a scale of 0 to 3). White, African-American, and Hispanic children

were included in the study, while other races were excluded due to small sample sizes. The authors adjusted for multiple indicators for physical injury severity and assessed several outcomes, including mortality, discharge disposition (home, rehabilitation center, or long-term care facility), and state of functional impairment with regards to expression, locomotion, and feeding. Notably, the study did not include indicators of patient socioeconomic status, such as insurance, which had been shown to greatly impact injury outcome.[14,16] Furthermore, the data source only contained data from trauma centers, limiting the generalizability of the findings to more severely injured patients in higher-level healthcare settings.[18]

The work of Shafi et al. and Haider et al. together suggested that race may have influenced rehabilitation status but was not necessarily associated with increased mortality in TBIs.[17,18] Further research described into the effect of race on all-injury pediatric mortality. In 2007, Falcones et al. found that Black infants had higher mortality rate compared to White infants in a review of trauma data over a 10-year period from a single level I pediatric trauma center.[19] In the study population (n = 1,270), race distribution of White and Black patients (69% and 26%, respectively) was similar to the local population breakdown (73% and 23%), so the authors concluded that there was no racial difference infant injury rate. Other races were excluded due to small sample sizes. Additionally, hospital length of stay, ISS, and hospital cost also did not differ by race. Despite these findings, Black infants had an overall higher mortality rate – nearly 3.5 times higher than that of White infants (RR = 3.48; 95% CI = 2.01 – 5.81). Abuse (RR = 3.76; CI = 1.43 – 5.81) and suffocation (RR = 1/83; 95% CI = 1.07 – 9.92) were found as two especially high-risk mechanisms for Black infant mortality compared to White

infants.[19] This overall increased risk of death was evident in both patients with Medicaid and commercial insurance ($p < 0.05$), suggesting that the trend is not exclusive to lower socioeconomic groups. Of note, the database did not provide information on maternal education, marital status, age, prenatal care, and other sociodemographic characteristics – often surrogates for socioeconomic status – previously shown to correlate with increased infant mortality.[12]

Falcones et al. demonstrated that having private commercial insurance did not mitigate the increased risks infant injury mortality for Black patients at their pediatric trauma center.[19] This stood in contrast with a large 2008 case control study, where Rosen et al. examined the relationship between insurance status and pediatric trauma mortality rates and found that uninsured and publicly insured pediatric trauma patients had higher mortality rates than their commercially insured counterparts.[20] With information from the NTDB, 174,921 patients ages 17 and under were classified according to their insurance status: uninsured, publicly insured (Medicaid, SCHIP), and commercially insured. The authors found that uninsured patients had higher odds of death than their commercially insured counterparts (OR = 3.32; 95% CI = 2.95-3.74; $p < 0.001$) after adjusting for confounders (age, sex, race, injury severity score, mechanism of injury – blunt vs. penetrating, and trauma center level). Publicly insured patients also had a higher odds of death compared to the commercially insured, albeit with a less dramatic odds ratio than the uninsured (OR = 1.19; 95% CI = 1.07-1.33; $p < 0.001$).[20]

To assess the presence of racial disparities, Rosen et al. found that relative to non-Hispanic White patients, all other races had higher odds of being uninsured.[20] The racial categories included were non-Hispanic White, Black, Hispanic, and other (including

Asian and/or Pacific Islander). The odds of being uninsured ranged from 1.66 in Black patients (95% CI 1.40-1.97; P<.001) to 2.42 in Hispanic patients (95% CI 1.85-3.18; P<.001).[20] Independent of the association between insurance status and race/ethnicity, the authors also found that Black and Hispanic patients had higher odds of death in reference to White patients. The adjusted OR was 1.34 (95% CI = 1.19-1.52; p < 0.001) for Black patients and 1.20 (95% CI = 1.03-1.41; p = 0.021) for Hispanic patients. These findings indicated that even after adjusting for age, sex, insurance status, injury severity score, and injury mechanism, racial disparity persisted in pediatric trauma mortality rates.[20]

The data source for the study, the NTDB, consisted of voluntary institution participation, and the database "[included] a disproportionate number of larger hospitals with younger and more severely injured patients".[21] Thus, as with the Haider et al. study, the generalizability of the findings may be limited to more severely injured patients in higher level care center.[18]

Similar to the findings of Rosen et al. in 2010, Hakmeh et al. found that in addition to insurance status, African American and Hispanic race/ethnicity were also independent risk factors for higher mortality rate in pediatric blunt and penetrating trauma patients.[22] The study also revealed that when compared to insured patients, uninsured patients were more likely to suffer penetrating injuries and more likely to die from those injuries. The study included 70,781 patients' data from the NTDB. Patients included in the study were 17 years old or younger and were moderately or severely injured, based on an ISS > 8. While both the lack of insurance and minority race were risk factors, insurance status had a stronger association with mortality.[22]

The investigators noted that they chose to include only moderately to severely injured patients because these were the ones at the greatest risk for death. Including patients with relatively minor injuries – typically the majority of patients – however, could potentially dilute the association between race and mortality.

## MOVING FORWARD IN ELIMINATING RACIAL DISPARITIES

The previous cited research provided evidence for the presence of racial and ethnic disparities in pediatric trauma mortality. However, more recent studies have not shown differences in mortality after adjustments.[8,9] Using data from a single independent children's hospital Emergency Department, Howard et al. examined the influence of race on pediatric TBI severity, mortality, and medical disposition (i.e. admission to the hospital and/or ICU).[8] In bivariate analysis, the authors found the mechanisms of injury and insurance status differed by race: minority children were more likely to be pedestrians or cyclists struck by a motor vehicle, while White children were much less likely to be public insured. However, minority children were no more likely to experience severe TBI than White children. Furthermore, in multivariate analysis that included race/ethnicity, ISS, insurance status (public vs. all other), and age as covariates, neither insurance status nor race were found to be statistically significant predictors of severe TBI, mortality, and medical disposition. In a sub-group of less severely injured children with ISS $\leq$ 11, where clinician discretion, rather than established protocols, could play a larger role in treatment decisions, race was still not a significant predictor of hospital and ICU admission. Public insurance, on the other hand, was found to be predictive of hospital admission (OR = 1.54, p = 0.023), though not of ICU admission.[8]

This study demonstrated the elimination of racial disparity in pediatric TBI severity, mortality, and disposition in an institution.[8] However, the generalizability of its conclusions was constrained by the relatively small sample size of 914 patients in the final multivariate analysis. The hospital was also a training site for surgical residents from a historically Black college and had been involved in racial disparities research for several years. These unique characteristics, coupled with a patient population that was predominant of minority race (49% African American, 28% White, 8% Hispanic, and 14% other races), might have facilitated in the delivery of exceptionally culturally competent care.

While the distinctive study setting threatened generalizability, the results of the Howard et al. study were also prone to ecologic fallacy due to the classification methodology.[8] For race, non-White patients were merged into one category for all minorities, while insurance status was simply designated as public vs. all others. These broad categories for key variables failed to take into account the heterogeneity within these groups. As the result, disparity among the different minority races could not be detected, and the effects of private insurance vs. lack of insurance may have nullified one another in the final analysis.

Whereas the Howard et al. study included only TBI patients from a single institution, a 2013 study by Ramirez et al. expanded the scope of investigation to include all pediatric trauma patients within the California Office of Statewide Health Planning and Development (OSHPD) hospital discharge database.[8,9] With 47,000 pediatric patients, the study found no significant racial difference in pediatric injury mortality rates when comparing the in-hospital mortality rates based race/ethnicity while adjusting for

age, sex, admission year, insurance status, injury severity, comorbidities, teaching hospital status, and mechanism of injury.[9]

Similar to the Howard study, Ramirez et al. attributed the apparent lack of racial disparity to a racially/ethnically diverse setting, in this case the state of California, leading to improved provision of culturally competent care.[8,9] Additionally, the authors surmised that California's insurance coverage expansion to children of low- and middle-income families may have also helped to reduce disparities in access to and quality of healthcare for patients.[9]

The main limitation of the study is with the data source.[9] The OSHPD database is an administrative, non-trauma registry that does not use the injury severity score commonly reported in trauma registries. This limited the authors' ability to adjust for injury severity. The database might also have included data errors, though the authors believed that the reporting errors would be non-differential across races.[9]

Just as nearly half of the patients in the Howards study were Black, Hispanic patients constituted 51.4% of this study population, which may be an overrepresentation of the group leading to distortion of the odds ratio towards null.[8,9] Conversely, Black and American Indians were potentially underrepresented in the analyzed data, representing less than 10% of the 47,000 pediatric patients. This may be problematic as the underrepresentation of these minority patients may illustrate the problem of unequal healthcare access and mask racial disparities central to the analysis. The authors failed to address this issue more fully by comparing the portion of Blacks and American Indians in the reference population with that of the database to gauge sampling quality.

Broadening the scope once again to the NTDB, in 2013 Short et al. looked to determine the relationship between race, insurance status, insurance type, and mortality.[23] In an analysis of 68,256 patients 13 years of age and younger from the NTDB, they adjusted for age, gender, injury severity, GCS on arrival, the presence of head injury, and admission systolic blood pressure, and concluded that race did not appear to influence trauma mortality. On the other hand, insurance status and type were found to be independent predictors of mortality.[23]

The authors also noted significant differences in insurance types between the racial/ethnic groups. White and Asian children were most likely to be privately insured, while a high percentage of Hispanic and Black children had Medicaid. The authors also compared the mortality rates within the same race by insurance status and type and found that that the influence of insurance on mortality varied across races. For example, privately insured White children had a lower mortality rate than uninsured White children (0.9% vs. 1.9%, $p < 0.01$), but no such difference existed between privately insured and uninsured Hispanic children (privately insured mortality rate1.7% vs. uninsured 1.4%; $p = 0.67$).[23]

This study was unique in its adjustments for GCS, head injury, and systolic blood pressure on admission as important covariates in trauma outcome. The authors, however, did not explain the rationale for excluding patients ages 14 to 18, while also noting other limitations. The NTDB did not record baseline functional status so co-morbidities, known to heavily predict trauma outcome, were not included in the analyses.[23] The influence of this might have been mitigated by the fact that pediatric patients are generally relatively healthy and do not have many co-morbidities as in adult populations. The study also did

not include other outcomes, such as rehabilitation needs after discharge, or social indicators such as household characteristics. Overall, the findings of this study are of limited utility, especially considering its omission of patients in their late-teens, for whom unintentional injuries and assaults are the two most common causes of death.[1]

## RATIONALE FOR PRESENT STUDY

The conflicting findings within the literature necessitate further inquiry into the presence of racial disparities in pediatric trauma outcomes. This current study seeks to address some of the limitations in these studies by a) including all unintentional pediatric traumas regardless of severity (to increase generalizability of conclusion); b) utilize improved insurance status indicators (information available for patients with concomitant private and public insurance); and c) include secondary outcome indicators (injury severity, hospital; length of stay, discharge to rehabilitation facility, and requirement for emergent surgery).

In Texas, Hispanics make up the largest minority group, with 38.1% of the 26+ million Texans reporting Hispanic or Latino origin.[24] In 2011, this meant approximately 9.5 million self-identified Hispanics lived in Texas.[25] Nationally, Texas ranks number two, after California, in the size of Hispanic population. This population is also relatively young, with a median age of 26 in 2010, compared to 33.6 across the state and 37.3 nationally.[25,26,27] Within Galveston County, the number of Hispanics has increased steadily since 1990. In 2010, 22% of the county residents were Hispanics, compared to 18% in 2000.[28] With a growing, young Hispanic population, recognizing potential racial

health disparities is paramount to identify target areas for intervention, particularly in the pediatric population.

Among Hispanic Texans, 37% are uninsured, which encompasses 26% of native-born Hispanics and 62% foreign-born Hispanics. Among Hispanic Texans ages 17 and younger, 35% live in poverty and 20% are uninsured, while nationally 9.4% of children are uninsured.[29,30] Since insurance status has been identified as an independent risk factor for increased pediatric trauma mortality, improving insurance coverage in this population may be effective to decrease adverse outcomes among Hispanic pediatric patients.[20]

# III. DATA AND METHODS

## STUDY DESIGN

This study was a retrospective analysis conducted through a medical records review of pediatric trauma patient visits seen in the University of Texas Medical Branch Emergency Department between January 1st, 1996 and December 24th, 2012.

## SETTING & POPULATION

The University of Texas Medical Branch (UTMB) is a tertiary care center in Galveston, Texas with a Level I Trauma Center.[31] As a public teaching hospital, UTMB encompasses a medical school and 25 graduate medical residency programs and 33 fellowship programs.[32] UTMB is also affiliated with and adjacent to the Texas Department of Criminal Justice Hospital (TDCJ), which provides care to the inmate population from throughout Texas.[33] Furthermore, UTMB's Blocker Burn Unit and nearby Shriners Hospital for Children are major referral centers for adult and pediatric burn patients.[34] These additional facilities ensure that the UTMB Emergency Department receives a diverse patient population with a wide spectrum of healthcare needs.

## SUBJECT SELECTION

Patients 18 years of age and under at the time of admission with known and documented race and mortality outcome (alive vs. dead) were included in this study. Patients who were not White, Hispanic, or Black were excluded (including American Indian, Asian, and Other) because of the relative small number of subjects. Subjects were also excluded if they met any of the following criteria: age unknown or over 18 years at

time of admission, unknown or undocumented race, unknown or undocumented outcome, or treated for self-inflicted injury.

### VARIABLES FOR ANALYSIS

The main predictor variable in this study was patient race/ethnicity. Within the trauma database, patient race/ethnicity were categorized as White, Black, Hispanic, Asian, other, and unknown. Patients for whom no race information was designated were classified as "unknown" for this study. The database also included 2 patients marked as American Indian, and they were reclassified as "other" due to their rarity and consequent difficulty in drawing generalizable conclusion from their data.

The primary outcome assessed in this study was mortality. Secondary outcomes were included to explain the status of patients alive at the time of discharge from the ED. These secondary outcomes were injury severity score (ISS), whether the patient required emergent surgery from the ED, hospital length of stay, and long-term morbidity as determined by whether the patient was discharged to a rehabilitation facility vs. location of origin (e.g. home, foster care, jail).

In addition to race, other predictor variables that could conceivably act as confounders to mortality rate were included for adjustment. These were age, sex, insurance status (public vs. private vs. self pay vs. other), and severity of injury. Age was examined separately both as a continuous and categorical variable, designated as infant (<1 year old), child (1 to 12 years old), and teenage (>12 to 18 years old). All data were taken directly from the electronic trauma database.

## DATA MANAGEMENT

All available data for the desired variables were extracted from the electronic trauma database and analyzed using Microsoft Excel. A preliminary study database with all patients age 18 and under at the time of admission from January 1st, 1996 to December 24th, 2012 was created. Those with unknown/undocumented race and/or outcome (whether alive or dead) were removed from study database. Subsequently, patients not documented as Black, Hispanic, or White were excluded. Those with self-inflicted injuries were also excluded. A new variable was created to denote the patients' discharge disposition – whether deceased or alive and discharged to home (including foster care, jail, or leaving AMA), rehabilitation facility, psychiatric facility, lower-level regional hospital, or unknown location. Based on payment source documented, insurance status was also reclassified as public, private, uninsured, other (including military, TDCJ, Medicare), unknown (including those specifically documented as "unknown" or with pending public insurance application), or combination (those with multiple payment sources from different categories).

## DATA ANALYSIS

Initial descriptive analysis of the study database was performed to describe sociodemographic characteristics of the study population. Patients missing particular variables to be analyzed were omitted from the analysis. For bivariate analyses, ANOVA was performed for continuous variables while chi-square test was used for categorical variables to compare predictor variables and secondary outcomes – ISS, length of stay, and discharge location – between the three groups. Subsequently, the unadjusted

mortality rate by race/ethnicity and the unadjusted odds ratio for each possible predictor of mortality was obtained. To obtain the odds ratio for each predictor, teenage, female, private insurance, ISS <9, and White were set as reference groups for age group, sex, insurance status, injury severity, and race/ethnicity, respectively. Statistical significance for bivariate analysis was set at $p < 0.05$. All statistical analyses were conducted using SAS v. 9.2.

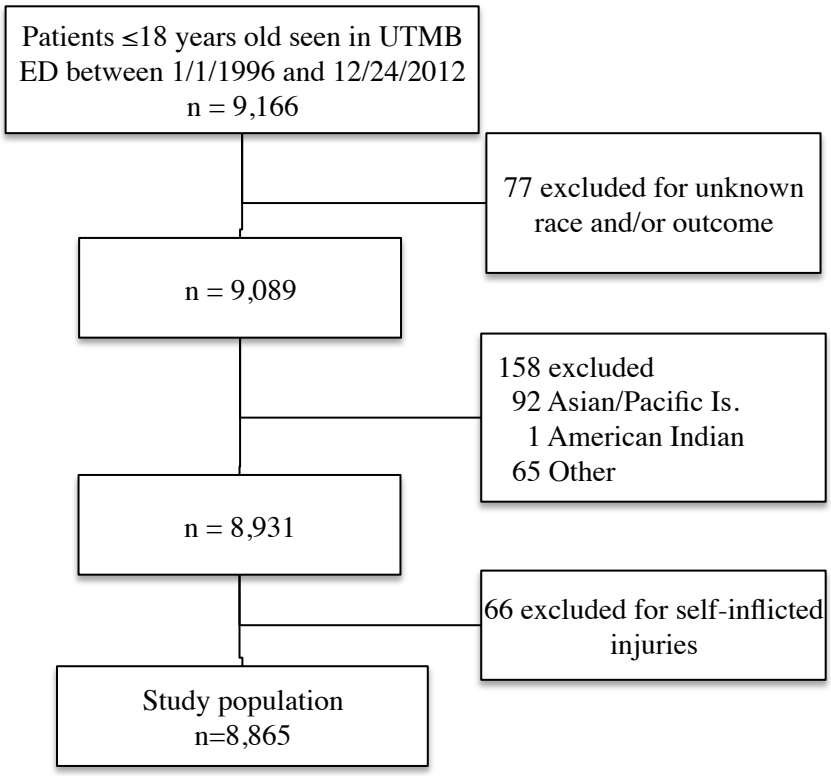
### MODEL DEVELOPMENT & SELECTION

Forward stepwise selection and backward elimination logistic regression techniques were used to determine the most appropriate multivariate regression predictive model. Statistical significance was set at $p < 0.20$ for inclusion. Akaike Information Score (AIC) was used to select the most appropriate final model. At $p < 0.20$, injury severity, insurance status, age (as a categorical variable), and race were included in the final model. Gender was not statistically significant, as was also reflected in the AIC, and thus was not included in the final regression model to obtain the adjusted odds ratios.

## IV. RESULTS

From the initial pool of 9,166 patients 18 years of age or under seen in the UTMB Emergency Department between January 1st, 1996 and December 24th, 2012, 9,089 subjects had known race and outcome (Figure 1). Of those, 8,931 were documented as White, Hispanic, or Black, and were thus included in the study. Of those excluded, 92 were Asian or Pacific Islander, 1 was American Indian, and 65 were designated as "Other". Sixty-six patients treated for self-inflicted injuries were also excluded, resulting in a final study population of 8,865 patients.

**Figure 2. Definition of Study Population**



### DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

White patients constituted 52.5% of the pediatric unintentional trauma patients included in this study. Hispanic patients were second, making up 26.0% of the study population, while Black patients comprised the remaining 21.4% (Table 1).

**Table 1. Demographic characteristics of the study population**

| | **All N (%)** | **White N (%)** | **Hispanic N (%)** | **Black N (%)** |
|---|---|---|---|---|
| **No.** | 8865 | 4657 (52.5) | 2307 (26.0) | 1901 (21.4) |
| **Gender, males** | 5363 (60.5) | 2783 (59.8) | 1403 (60.8) | 1177 (61.9) |
| **Mean Age, years (SD)**[§] | 11.2 ±6.0 | 11.7* ±5.8 | 10.6* ±6.1 | 10.8* ±6.2 |
| Infant (< 1yr) | 401 (4.5) | 189 (4.1) | 109 (4.7) | 103 (5.4) |
| Child (1 – 12yr) | 3811 (43.0) | 1863 (40.0) | 1092 (47.3) | 856 (45.0) |
| Teenage (>12 – 18yr) | 4653 (52.5) | 2605 (55.9) | 1106 (47.9) | 942 (49.6) |
| **Insurance*** | | | | |
| Public | 2243 (25.3) | 746 (16.0) | 668 (29.0) | 829 (43.6) |
| Private | 2075 (23.4) | 1485 (31.9) | 315 (13.7) | 275 (14.5) |
| Uninsured | 3132 (35.3) | 1691 (36.3) | 910 (39.5) | 531 (27.9) |
| Other | 139 (1.6) | 82 (1.8) | 34 (1.5) | 23 (1.2) |
| Unknown | 1244 (14.0) | 637 (13.7) | 373 (16.2) | 234 (12.3) |
| Combination | 32 (0.4) | 16 (0.3) | 7 (0.3) | 9 (0.5) |

* $p < 0.0001$
[§] $p < 0.05$

A statistically significant difference between the groups' mean ages was detected in ANOVA test (Table 1). T-tests comparing the average ages of Black and Hispanic patients separately with that of White patients also showed statically significant differences ($p<0.0001$). Across the three groups, infants formed the smallest category, accounting between 4.06% of the White patients and 5.42% among Black patients (Table 1). This is unsurprising as death from unintentional injuries was the fifth leading cause of death in infants, but the leading cause of death in children ages 1 to 19 years in all

races.[1,3,5] In all three racial/ethnic groups, teenagers ages >12 to 18 years were the largest group.

60.5% of the overall study population was male (Table 1). This slightly increased ratio of males to females (1.53:1) was consistent with the findings of pediatric trauma studies using larger state or national databases. The gender breakdowns did not differ significantly between the racial/ethnic groups ($p = 0.2455$).

Insurance status varied significantly between the groups ($p < 0.0001$). Black patients were much more likely to be publicly insured (43.6%). On the other hand, Hispanic children were more likely to be uninsured or publicly insured (39.4% and 29.0%, respectively), and White children were mostly likely to be either uninsured or privately insured (36.3% and 31.9%, respectively).

**DESCRIPTIVE DATA**

**Table 2. Primary (mortality) and secondary trauma outcome measures**

| | Total N (%) | White N (%) | Hispanic N (%) | Black N (%) |
|---|---|---|---|---|
| **No. (% total)** | 8865 (100%) | 4657 (52.5%) | 2307 (26.0%) | 1901 (21.4%) |
| **Deaths (% mortality)** | 72 (0.8) | 42 (0.9) | 16 (0.7) | 16 (0.8) |
| **Injury Severity Score (SD)** | 4.45 ±6.3 | 4.74* ±6.4 | 4.44* ±6.47 | 3.72* ±5.56 |
| < 9 | 7236 (81.6) | 3742 (80.4) | 1880 (81.5) | 1616 (85.0) |
| 9 - 15 | 908 (10.2) | 519 (11.2) | 229 (9.9) | 160 (8.4) |
| ≥16 | 498 (5.6) | 289 (6.4) | 129 (5.6) | 71 (3.7) |
| Unknown (alive) | 221 (2.5) | 98 (2.1) | 69 (2.99) | 54 (2.8) |
| **Length of stay, Days (SD)** | 1.7 ±5.2 | 1.7§ ±4.9 | 1.8§ ±6.3 | 1.28§ ±3.8 |
| Max LOS | 127 | 84 | 127 | 50 |
| **Requiring emergent surgery** | 1403 (15.9) | 780 (16.8)* | 390 (16.9)* | 233 (12.3)* |
| **Discharge placement (% alive)** | | | | |
| Home | 8419 (95.8) | 4440 (96.2) | 2172 (94.8) | 1807 (95.9) |
| Rehab facility | 25 (0.3) | 15 (0.3) | 7 (0.3) | 3 (0.2) |
| Psych facility | 11 (0.1) | 7 (0.2) | 2 (0.1) | 2 (0.1) |
| Lower-level hospital | 30 (0.3) | 18 (0.4) | 8 (0.4) | 4 (0.2) |
| Unknown (alive) | 306 (3.5) | 135 (2.9) | 102 (4.5) | 69 (3.7) |

* $p < 0.0001$

§ $p < 0.05$

The overall mortality rate was 0.8% (Table 2). White children had the highest mortality rate at 0.9%, followed by Black children at 0.8% and Hispanic at 0.7%. The mortality rates were not statistically significantly different between the racial/ethnic groups (p=0.6664).

The majority of patients, over 80%, had relatively minor injuries, as indicated by an ISS of less than 9, upon presentation at the hospital (Table 2). Black children, in particular, had the highest percentage of minor injury presentations with 85.01%. Comparison of the mean ISS between groups demonstrated statistically significant

differences ($p<0.0001$). Overall, White children were likely to have a higher ISS than Black or Hispanic children, and White children also had the highest proportion of severely injured children (ISS $\geq$ 25) at 2.34%.

Total hospital length of stay (LOS) ranged from 0 to 127 days (Table 2). The large majority of patients, however, were discharged after 0 or 1 day, and the mean LOS was 1.65 $\pm$5.08 days. There were statistically significant differences between the groups' mean LOS ($p<0.05$), with Hispanic patients averaging 1.8 days, White patients 1.7 days, and Black patients 1.3 days.

Overall, 15.9% of the study population was taken for emergency surgery after presenting in the ED (Table 2). This consisted of 12.3% of Black patients, 16.9% of Hispanic patients, and 16.8% of White patients. When comparing the various rates of surgeries, the percentages of patients needing surgery were significantly different by racial/ethnic group ($p <0.05$).

The vast majority – 95.8% – of living patients were discharged home or to other locations of origin after receiving care in the ED. Less than 1% of patients were discharged to rehabilitation facilities, psychiatric care facilities, or lower-level hospitals, while the discharge arrangement of the rest of the living patients were unknown/undocumented. There were no differences by group ($p=0.14$).

By further stratifying mortality rates by race/ethnicity and insurance status, the between group differences in mortality increased (Table 3). Considering privately insured, publicly insured, and uninsured children, the mortality rates ranged from as low as 0.36% in publicly insured Black children to as high as 2.07% in uninsured Black children. Overall, uninsured children had the highest mortality rate at 1.21%, while

publicly insured children had the lowest, at 0.58%. Children with unknown insurance, a combination of private and public insurance, or other forms of insurance (e.g. military or TDCJ) were not included in this comparison due to small sample size.

**Table 3. Unadjusted mortality rate (%) by insurance status and race/ethnicity**

| | **Insurance Status** | | |
|---|---|---|---|
| **Race/Ethnicity** | **Private** | **Public** | **Uninsured** |
| **White** | 0.67 | 0.8 | 1.18 |
| **Hispanic** | 0.63 | 0.6 | 0.77 |
| **Black** | 0.73 | 0.36 | 2.07 |
| **Total study population** | 0.67 | 0.58 | 1.21 |

## MAIN RESULTS

Logistic regression analysis yielded the unadjusted odds ratios of factors thought to influence mortality rate (Table 4). Of the factors included, age in years and gender did not predict mortality (p=0.82 and p=0.96, respectively) in a statistically significant manner. However, age groups (infant, <1year old; child, 1 to 12 years old; and teenager, >12 to 18 years old) did appear to have some predictive value.

**Table 4. Unadjusted odds ratios of predictors of mortality**

| Variable | Unadjusted OR | 95% CI | P value |
|---|---|---|---|
| **Race** | | | |
| White | Reference | | |
| Black | 0.76 | 0.43 - 1.33 | 0.329 |
| Hispanic | 0.62 | 0.35 - 1.09 | 0.098 |
| **Age** | | | |
| Infant (<1 year old) | 1.75 | 0.74 – 4.16 | 0.204 |
| Child (1 – 12 yrs) | 0.85 | 0.53 – 1.39 | 0.521 |
| Teenage (>12 – 18 yrs) | Reference | | |
| **Gender** | | | |
| Female | Reference | | |
| Male | 1.013 | 0.63 - 1.62 | 0.959 |
| **Insurance** | | | |
| Private | Reference | | |
| Uninsured | 1.81 | 0.98 - 3.35 | 0.059 |
| Public | 0.86 | 0.40 - 1.83 | 0.692 |
| **ISS** | | | |
| < 9 | Reference | | |
| 9 - 15 | 15.97 | 1.45 - 176.36 | 0.024 |
| ≥16 | >999 | 166.74 – 999 | <0.0001 |

** Insufficient number of subjects for comparison

**Table 5. Adjusted odds ratios of predictors of mortality**

| Variable | Adjusted OR* | 95% CI | p value |
|---|---|---|---|
| **Race** | | | |
| White | Reference | | |
| Black | 2.01 | 1.02 – 3.94 | 0.043 |
| Hispanic | 0.92 | 0.49 – 1.71 | 0.785 |
| **Sex** | | | |
| Female | Reference | | |
| Male | 0.72 | 0.42 – 1.21 | 0.211 |
| **Age** | | | |
| Infant | 1.35 | 0.49 – 3.68 | 0.560 |
| Child | 0.95 | 0.56 – 1.62 | 0.846 |
| Teenage | Reference | | |
| **Insurance** | | | |
| Private | Reference | | |
| Uninsured | 1.57 | 0.80 – 3.08 | 0.191 |
| Public | 0.67 | 0.29 – 1.58 | 0.361 |
| **ISS** | | | |
| < 9 | Reference | | |
| 9 – 15 | 17.70 | 1.60 – 195.88 | 0.019 |
| ≥16 | >999 | 182.09 – 999 | <0.0001 |

* Adjusted for race, sex, age group, insurance status, and ISS.

Characteristics that were statistically significant ($p<0.05$) in predicting mortality were Black race and severe injury (ISS ≥ 9). Being uninsured was also correlated with increased mortality; however, it failed to reach statistical significance. Hispanic ethnicity, male sex, and public insurance did not appear to predict mortality. Of note, having public insurance was found to be associated with decreased risk of death, albeit at a level above statistical significance.

# V. DISCUSSION

## KEY RESULTS

This study demonstrated that among pediatric unintentional trauma patients seen at UTMB ED, Hispanic ethnicity was not a risk factor for mortality. In fact, Hispanic patients had the lowest mortality rate overall at 0.7% despite having the highest percentage of uninsured patients (39.5%). Among uninsured patients, Hispanics patients also had the lowest mortality rate at 0.8%, compared to the highest – 2.1% – in Black patients. As with previous literature cited, these results may be related to the diverse population, specifically the high proportion of Hispanics living in Texas and the hospital staff's increased sensitivity to possible cultural and language barriers.[8,9] 26.02% of the study population were Hispanic. Compared to the 23.2% of Galveston County residents self-reported as Hispanic, this appeared to be representative of the local population.[35]

Conversely, Black patients were found to have twice the risk of death compared to White patients after adjusting for age group, insurance, and injury severity (AOR = 2.01; p = 0.043). Previous investigations in the literature have also found similar evidence of racial disparity between Black and White patients. Black patients also constituted 21.4% of the study population, despite only 14% of Galveston County residents self-reporting as Black.[35] This overrepresentation in the patient population might be explained by increased pediatric injury rate in the community, different cultural ED care seeking patterns, or a combination of both. Further research is necessary to explain the finding.

The breakdown of mortality rates by race and insurance status indicated that having insurance differentially impacted the groups. In particular, Black children

appeared to benefit the most, as the mortality rate decreased dramatically from 2.07% in the uninsured to 0.36% in those with public insurance. Although the protective effect of public insurance was less striking in Hispanic and White children (mortality decreasing from 0.77% to 0.6% and 1.18% to 0.8%, respectively, from uninsured to publicly insured), the value of public insurance in improving healthcare access should not be discounted as Texas continues to have the highest percentage of uninsured population.[36]

### STRENGTHS & LIMITATIONS

The size and composition of the study population is the primary strength of this study with over 9,000 pediatric visits in the 17-year study period. Formerly known for providing a substantial proportion of charity care in Texas, UTMB attracted a large portion of uninsured and underinsured patients. This was reflected by the 35.33% of uninsured patients in the study population, compared to 24.6% statewide. This focus on a single institution with a population that is generally un- or underinsured, however, compromises external generalizability. Moreover, the trauma database documents each visit individually, thus patients with multiple visits would be accounted for more heavily.

In addition, two significant changes may have reshaped the patient population of UTMB. First, recent changes in state legislative policy decreased the provision of charity care at UTMB. In September of 2008, Hurricane Ike caused considerable damage to Galveston Island and the hospital in 2008; current population estimate of nearly 48,000 in Galveston City has yet to recover to the pre-hurricane level of 53,000 permanent residents.[37,38] Furthermore, the study did not adjust for admission year, which may reflect changing hospital policies and capabilities as UTMB continued to evolve.

The inability to assess for patient's insurance quality is yet another limitation of the study. While private insurance has often been a surrogate marker for higher socioeconomic status and better healthcare access, in reality, being underinsured is a common characteristic among the privately insured. Thus, patients designated as have private insurance may have had less healthcare access than a publicly insured patient in reality. This phenomenon of underinsurance might have had the greatest effect on White patients, as they were most likely to be privately insured or uninsured.

## IMPLICATIONS

Given the limitations of this study, its findings may be carefully applied to other large, public teaching medical institution EDs in racially diverse settings with a large proportion of Hispanics. For UTMB, the study also reveals strengths and potential areas for improvement in providing culturally competent trauma care in the ED. Comparable outcome measures between White and Hispanic patients suggest that Hispanic children and their families received culturally competent care institutionally. In the larger community, Hispanic race may also confer some protective effect against the previously cited adverse outcomes minority patients experience. If identified with further supportive investigation, this protective mechanism may be harnessed to improve healthcare quality and access for minority patients across various settings. Black patients, in contrast, had the highest adjusted odds of death despite having the best secondary outcome measures (i.e. lowest average ISS, lowest average length of hospital stay, lowest percentage requiring emergent surgery, and largest percentage discharged home). This troubling finding encourages further consideration into explanations and possible interventions.

This study, along with the bulk of existent pediatric racial disparity research, focuses on Hispanic and Black pediatric patients. Asian, Pacific Islander, American Indian, and multi-racial patients have been noticeably neglected in the discussion of racial disparity. As the understanding of and progress in the elimination of racial disparity in pediatric trauma care continue, it is evident that we are only at the beginning of unraveling the nuanced and complicated entanglement of culture, socioeconomics, and healthcare.

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# CURRICULUM VITAE

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## EDUCATION

*2009 – Present* **The University of Texas Medical Branch** – Galveston, TX
Doctor of Medicine Candidate, anticipated June 2014
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*2005 – 2009* **The University of Texas at Austin** – Austin, TX
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## HONORS & AWARDS

*2012* International Field Epidemiology Scholarship

*2010* Global Health Scholars Scholarship

*2006 – 2009* Alpha Phi Sigma Pre-Medical Honor Society

## RESEARCH EXPERIENCE

*May 2013 – Present* **MPH Capstone Project**
"Hispanic Race as Risk Factor for Poor Outcome in Pediatric Unintentional Injuries"

- Advisor: Melanie de Boer, PhD, Assistant Professor, Department of Preventive Medicine and Community Health, UTMB Galveston, TX
- Perform univariate and multivariate regression analysis using UTMB pediatric trauma data with software SAS v.9.2

*May 2013 – Present* **MPH Fieldwork**
"Exploring Donation Practices at the Facility Level"

- Advisor: Catherine Cooksley, DrPH, Senior Biostatistician, Sealy Center on Aging; Assistant Professor, Department of Internal Medicine, UTMB Galveston, TX
- Gather data and personal accounts to investigate causes for decreasing trend in institutional organ donation rate
- Generate and assist in delivery of intervention to improve organ donation rate

*2012 – Present* **Co-Investigator**
"Effectiveness of a Community Health Worker in Reducing Nonattendance at a Free Clinic"

- St. Vincent's Student Clinic, Galveston, TX
- Oversee running of IRB-approved randomized clinical trial
- Assist in developing research protocol and data collection tools

## PRESENTATION

*January 2013* **Society of Student-Run Free Clinics Annual Conference** – San Antonio, TX
"Effectiveness of a Community Health Worker in Reducing Nonattendance at a Free Clinic"

## EXTRACURRICULAR ACTIVITIES

*2012 – 2013* **Global Health Inter-professional Core Course**
*Small Group Facilitator*
- Facilitated student discussions on global health topics

*2009 – 2011* **Christian Medical Association**
*Co-President (2010 – 2011)*
- Coordinated and led weekly Bible studies and monthly speaker luncheons

*2009 – 2011* **Forssmann Osler Student Society**
*Co-Vice President (2010 – 2011)*
- Coordinated gala that raised $1680 for Galveston non-profit organizations

## VOLUNTEER ACTIVITIES

*2011 – Present* **C.D. Doyle Student Clinic** – Austin, TX
*Student Director*
- Free, student-run community clinic for the homeless population
- Establish community partnerships and seek funding to maintain and expand clinic operation
- Supervise undergraduate students in patient intake and triage

*2010 – Present* **St. Vincent's Student Clinic** – Galveston, TX
*Volunteer*
- Free, student-run community clinic providing primary and select specialty care to indigent populations
- Guide lower-level medical and nursing students in interview and physical exam techniques, patient counseling, medical management, and clinic resource referrals

*2010 - 2011* **Frontera de Salud** – Galveston, TX
*Volunteer* in health fair, gynecology clinics

*2010* **National Youth Leadership Forum** – Galveston, TX
*Mentor*
- Facilitated problem-based learning session for high school students

- Served on medical student panel discussion

*2010* **Hands and Feet Medical Missions Trip** – Laredo, TX
*Volunteer*

## GLOBAL HEALTH & INTERNATIONAL EXPERIENCE

*2012* **Universidad Peruana Cayetano Heredia** – Lima, Peru
- International Field Epidemiology Course in Tumbes, Peru
- Conducted mock-outbreak field investigation in low-resource setting
- Participated in didactics and Infectious Diseases rounds with UPCH medical students and residents

*2010* **House of Hope Orphanage and Clinic** – Nairobi, Kenya
- Created patient intake form and medical filing system for new community clinic
- Assisted clinical officer in patient interviews and physical exams
- Instructed 1st through 8th grade students at the orphanage and local public school on hygiene, health, and basic science

*2007* **Université Jean Moulin Lyon 3** – Lyon, France
- Participated in language and culture immersion program through daily classes and residing with local family

## PROFESSIONAL ORGANIZATIONS

*2009 – Present* American Medical Association

*2009 – Present* Texas Medical Association

## LANGUAGES

Mandarin Chinese – native-speaker fluency
French – conversational fluency

## PERSONAL INTERESTS

Travel, gastronomy, swing dance, photography, live music