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Insurance status and pediatric mortality in nonaccidental trauma



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ABSTRACT

Background: Nonaccidental trauma (NAT) is a leading cause of injury and death in early childhood. We sought to understand the association between insurance status and mortality in a national sample of pediatric NAT patients.

Materials and methods: We performed a retrospective cohort study using the 2012–2014 National Trauma Databank. We included children ≤ 18 y hospitalized with NAT (The International Classification of Diseases, Ninth Revision codes: E967–968). The primary exposure was insurance status (categorized as public, private, and uninsured). The primary outcome was emergency department or inpatient mortality from NAT.

Results: We identified 6389 children with NAT. Mean age was 1.6 y (standard deviation 3.7), with 41% female and 42% of an ethnic or racial minority. Most were publicly insured (77%), with 17% privately insured and 6% uninsured. Mean injury severity score (ISS) was 13.9 (standard deviation 10.3). Overall, 516 (8%) patients died following NAT. Compared to patients who survived, those who died were more likely to be younger (mean age 1.0 y versus 1.6 y; $P < 0.001$), uninsured (13% versus 6%; $P < 0.001$), transferred to a higher-care facility (57% versus 49%; $P < 0.001$), and more severely injured (mean ISS 25.9 versus 12.8; $P < 0.001$). After adjusting for age, race, transfer status, and ISS, uninsured patients had 3.3-fold (95% CI = 2.4–4.6) greater odds of death compared to those with public insurance. For every 1 point increase in ISS, children had 12% (95% CI = 11%–13%) increased adjusted odds of death.

Conclusions: Pediatric patients without insurance had significantly greater odds of death following NAT, compared to children with public insurance. Knowledge that uninsured children comprise an especially vulnerable population is important for targeting potential interventions.

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Introduction

Nonaccidental trauma (NAT) is a leading cause of injury and death in early childhood. In 2015, an estimated 683,000 children were victims of abuse and neglect, with 1670 deaths related to NAT.¹ Between 2011 and 2015, there was a 9% increase in child abuse and neglect cases reported to child protective services.¹ With an estimated 7.5% of all pediatric admissions at major pediatric trauma centers now associated with NAT,² NAT is a public health crisis with devastating consequences.

For the overall population of trauma patients, it has been well demonstrated that demographic disparities exist in health-care outcomes, with the highest risk populations including ethnic and racial minorities and uninsured patients.³⁻⁵ For NAT, previous studies have shown that mortality cannot fully be explained by injury severity⁶; however, there have been varied results from small cohorts on the association between mortality from NAT and insurance status, socioeconomic status, and race.^{7,8} Of these candidate risk factors, we chose to focus on insurance status because it may represent an important proxy for a vulnerable population. Despite subsidized plans available through the Children's Health Insurance Program, Medicaid, and the Affordable Care Act, 3.8 million children were uninsured in 2016.⁹ The aim of this study was to describe the contemporary NAT patient population in a large national database and explore the association between insurance status and mortality following NAT.

Material and methods

Study design and data source

We conducted a retrospective cohort study utilizing the 2012-2014 National Trauma Data Bank (NTDB). The NTDB is managed by the American College of Surgeons Committee on Trauma and is the largest aggregation of US inpatient trauma data, with approximately 150 million recorded pediatric admissions a year from over 800 facilities (both pediatric and nonpediatric hospitals), including presentation to the emergency department.^{10,11} The database includes information on patient demographics, socioeconomic status, admission diagnosis, injury severity, and additional clinical variables. To ensure uniformity of variables, the NTDB has specific standards for each submission to the registry.¹²

Study population and classification of outcomes

We included all children ≤ 18 y of age who were hospitalized with NAT, defined by external cause of injury code consistent with NAT (E967-978). We excluded children with missing age, gender, race/ethnicity, or insurance status. The primary outcome was in-hospital (i.e., emergency department or inpatient) mortality.

Patient characteristics

We abstracted demographic and socioeconomic information including age, gender, race/ethnicity, and insurance status (our primary exposure) for all children. Using the primary payer reported in NTDB, we categorized insurance status into public (Medicaid, Medicare, other governmental insurance), private (Blue Cross/Blue Shield, worker's compensation, no fault automobile), and uninsured. We identified key clinical characteristics known to affect mortality after NAT, including whether the child had signs of life (SOL) upon arrival to the emergency department, injury severity score (ISS), traumatic brain injury (*versus* other), intensive care unit (ICU) admission, ventilator requirement, and transfer status (whether the patient was transferred to a higher level facility).^{2,13-16} We also included whether the child was treated at a facility designated by the state as a pediatric trauma center.

Statistical analysis

First, we calculated descriptive statistics for the overall cohort. Next, we performed unadjusted analyses to assess the impact of each demographic, socioeconomic, and clinical characteristic on mortality, comparing children who survived to those who died. Similarly, we compared these characteristics within each of the three insurance category strata. We used chi-square or exact tests to compare categorical variables between groups, as appropriate. Finally, we performed multivariable logistic regression analysis to assess the association between insurance status and mortality, conditioned on age (continuous), gender, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), insurance status (public, private, and uninsured), transfer status, ISS (continuous), and traumatic brain injury, as previously described. To account for the potentially confounding effect of patient ability to actually reach care on the relationship between insurance status and mortality, we performed an additional sensitivity analysis that excluded those children with no SOL upon arrival. We performed another multivariable logistic regression analysis with the same variables as previously mentioned, in addition to whether the facility was designated as a pediatric trauma center, to assess whether pediatric trauma center designation modified the association between insurance status and mortality. Interaction between pediatric trauma center (*versus* nonpediatric trauma center) and insurance status was evaluated on the multiplicative scale using regression coefficients and on the additive scale using the relative excess risk of interaction (RERI). Significance was defined by $P < 0.05$. All analyses were completed in SAS 9.4 (SAS Institute, Inc, Cary, NC). This study was deemed exempt from requiring IRB approval by the University of Texas Southwestern Medical Center Institutional Review Board.

Results

We identified 7987 children who presented with NAT over the study period. Children with missing age ($n = 948$), insurance ($n = 648$), or gender ($n = 2$) were excluded. Our final cohort

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