

## ORIGINAL RESEARCH

# Pediatric head and neck trauma in the United States: Trends, risk factors and outcomes using the National Trauma Data Bank

Ashwini Sarathy BS<sup>1</sup>  | Jamie Benson BS<sup>1</sup> | Kenny Nguyen BS<sup>1</sup>  |  
Stas Amato MD<sup>2</sup> | Mirabelle Sajjisevi MD<sup>3</sup>  | Erin T. Ostby MD<sup>3</sup>

<sup>1</sup>University of Vermont, Larner College of Medicine, Burlington, Vermont, USA

<sup>2</sup>Department of Surgery, University of Vermont Medical Center, Burlington, Vermont, USA

<sup>3</sup>Department of Otolaryngology, University of Vermont Medical Center, Burlington, Vermont, USA

## Correspondence

Ashwini Sarathy, University of Vermont, Larner College of Medicine, 111 Colchester Ave, Burlington, VT 05401, USA.  
Email: [ashwini.sarathy@med.uvm.edu](mailto:ashwini.sarathy@med.uvm.edu)

## Abstract

**Introduction:** Pediatric head and neck (HN) trauma is an important contributor to pediatric morbidity, resulting in significant downstream consequences. Few studies provide epidemiological predictors of pediatric HN trauma on a national scale. The present study aims to identify risk factors of HN injury and mortality in the pediatric population.

**Methods:** A retrospective cohort study was conducted for patients (age <18 years) using the US National Trauma Data Bank (NTDB 2007–2019). Demographic, injury, and physiologic outcome data were analyzed. HN injury was defined as a head or neck Abbreviated Injury Scale (AIS) >0. Logistic regression identified independent predictors of mortality following HN trauma.

**Results:** Of the 1.42 million pediatric patients analyzed, 44.05% had HN injury. In patients aged 0–4, the most common mechanism was falls (47.67% in this age group) while in ages 14–17, motor vehicle/transport accidents (MVTs) were the most common mechanism (56.06%). Controlling for demographics, comorbidities, and injury severity, HN injury was associated with increased odds of mortality (OR 2.404, 95% CI 1.530–3.778). HN injury mortality was strongly predicted by firearm exposure (OR 11.28, 95% CI 6.074–20.95), age <4 (OR 1.179, 95% CI 1.071–1.299), and self-insured status (OR 1.977, 95% CI 1.811–2.157).

**Conclusion:** NTDB data demonstrate that the percentage of pediatric patients with HN trauma has decreased over the past 12 years although is associated with increased odds of mortality. Age and insurance status predicted mortality from HN trauma, with falls and MVTs being the most common mechanisms of injury. These data have implications for future public health efforts in this patient population.

**Level of Evidence:** 3.

## KEYWORDS

falls, head and neck trauma, mortality, motor vehicle trauma, pediatric

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## 1 | INTRODUCTION

Pediatric head and neck trauma (HN) have devastating consequences for the health and well-being of children across the country. Head and neck trauma in the pediatric population can be defined as injury occurring because of falls, firearms, motor vehicle accidents (MVA), and other miscellaneous causes including abuse, machinery-related, and environmental injuries. Based on the National Trauma Data Bank (NTDB), the term head and neck trauma encompasses all injuries to the brain, neck and face including traumatic brain injuries, penetrating neck trauma, blunt trauma to the head and neck, abusive head trauma, and facial lacerations.<sup>1,2</sup>

Compared to the general population, head trauma is more common in children.<sup>3</sup> The consequences of pediatric head and neck injury from even minor trauma can include cognitive and behavioral deficits from post-concussion or post-traumatic stress disorders.<sup>4,5</sup> Despite representing approximately 12% of the total body surface area, head and neck injuries contribute greatly to the overall burden of trauma.<sup>6,7</sup>

In the United States, pediatric traumatic brain injury alone results in over 500,000 emergency department visits and 60,000 hospitalizations annually.<sup>8</sup> The incidence of abusive head trauma in the first year of life is about 35 per 100,000 infants. The downstream consequences of abusive trauma are drastic, resulting in long-term neurological disabilities in 65% of victims.<sup>9</sup> Firearms are the leading cause of death among youth in the United States and the consequences of firearm-related injuries are economically significant—accounting for over \$1 billion annually in healthcare spending.<sup>10</sup> Firearm injuries affecting vulnerable anatomic regions such as the head and neck can require prolonged recovery and may result in permanent disability.<sup>10</sup>

The present study aims to outline key trends, risk factors and independent predictors of head and neck trauma in the pediatric population. Prior studies are limited by their focus on a specific mechanism of injury, leading to a gap in the literature in quantifying national trends for all causes of pediatric head and neck trauma. We hypothesize that there exist statistically significant differences in pediatric head and neck trauma based on demographic variables such as age, sex, and insurance status. These findings may help guide the development of targeted interventions to reduce the overall rates of morbidity and mortality due to pediatric head and neck trauma.

## 2 | METHODS

### 2.1 | Study design

This is a retrospective cohort study of hospitalized injured patients in the United States National Trauma Data Bank (NTDB) from 2007 to 2019. The NTDB is a nationally sourced trauma registry owned and operated by the American College of Surgeons, which captures reported traumatic injuries that presented to participating hospitals based on a patient inclusion criteria algorithm.<sup>11</sup> This dataset included records from 1153 unique hospitals, 628 of which are ACS verified at

Level I, II, III, or IV. Participant use file (PUF) request for the study's objectives was approved by the American College of Surgeons Trauma Quality Improvement Program (TQIP) and data were obtained from their online PUFs. Additionally, a file with facility keys for each patient was purchased from TQIP, allowing for facility-level treatment effects to be controlled for. This study was approved by the University of Vermont Institutional Review Board (Study ID: 17-0467).

### 2.2 | Inclusion and exclusion

We included all pediatric patients (17 years old and younger) with head and neck injuries in the NTDB from 2007 to 2019. Patients with Abbreviated Injury Scale (AIS) score values greater than zero in the head, face, or neck were considered to have HN trauma. Head and neck injuries were defined as trauma caused by blunt, penetrating, burn-related head and neck injury as well as traumatic brain injury. ICD10 codes utilized include: S00-T88 (injury, poisoning, and certain other consequences of external causes), S00-S09 (injuries to the head), S09.90 (unspecified injury of head), and S10-S19 (injuries to the neck). Patients aged 18 years and older or those with ages not reported were excluded.

### 2.3 | Data collection and variables

Upon data collection, variables were matched and merged into a single data file for analysis. Boolean variables were created from long format PUF datasets and were then merged into a main wide format combined dataset. Independent variables included presence of HN injury, mortality, hospital length of stay, and severe injury (ISS >14). Severe injury is defined as per the standardized Abbreviated Injury Scale, which accounts for body region of injury, type of anatomic structure, specific anatomic structure, and level.<sup>12</sup> The MGAP scale (mechanism, GCS, age, and penetrating injury) was also used to control for mortality probability, as it has been found to significantly outperform other injury classification scores.<sup>13</sup> Dependent variables included mechanism of injury, patient demographics, injury patterns, and severity. Mechanisms of injury included falls, MVA, firearms, struck by an object, and others. The category “others” refers to head and neck injury due to cuts, drowning, machinery, bites and stings, overexertion, pedal cyclist, pedestrian, poisoning, and suffocation. Hospital complications evaluated were wide-ranging, and included bleeding, coagulopathy, infection (sepsis, deep and superficial surgical site, central line, osteomyelitis, pneumonia and urinary tract infections), myocardial infarction, cerebrovascular accident, kidney injury, venous thromboembolism, compartment syndrome, return to OR, unplanned ICU, and others collected in the TQIP NTDB database.

### 2.4 | Statistical analysis

Patient characteristics, injury patterns, length of hospital stay, and trauma mortality outcomes were analyzed. Univariate statistics,

including counts, percentages, means with SDs, medians with IQRs, *t*-tests, Wilcoxon rank-sum tests, and Pearson  $\chi^2$  tests as appropriate, were used to identify pediatric injury characteristics for patients with head and neck trauma.

Multivariable logistic regression with stepwise backwards elimination was utilized to identify independent risk factors for head and neck trauma, prolonged hospitalization (length of stay greater than 14 days), and mortality. Logistic regression models controlled for age, sex, physiology, and injury severity (ISS), with standard errors clustered at the hospital level. Statistical significance was defined as  $p < .01$ , given the large size of the dataset. In very large datasets such as NTDB, arbitrary correlations will appear highly “statistically significant” due to random chance, a  $p$  of .01 along with an appropriate confidence interval and clinically relevant effect size was used to indicate significance in multivariate models.<sup>14</sup>

All statistical analyses were performed using Stata V.17 (StataCorp. 2019. Stata Statistical Software: Release 17. College Station, Texas: StataCorp).

### 3 | RESULTS

#### 3.1 | Patient flow and characteristics

Of the 10.8 million pediatric trauma cases in the NTDB from 2007 to 2019, 1.42 million cases met inclusion criteria (Figure 1). In total, 627,928 patients (44.0%) had documented head and neck injury, whereas 797,451 patients (56.0%) did not. The proportion of head and neck injury has decreased by 4.37% over the past 12 years: 46.3% in 2007 down to 41.9% in 2019, with a spike in the death rate in 2015 in non-head and neck injury (Figure 2).

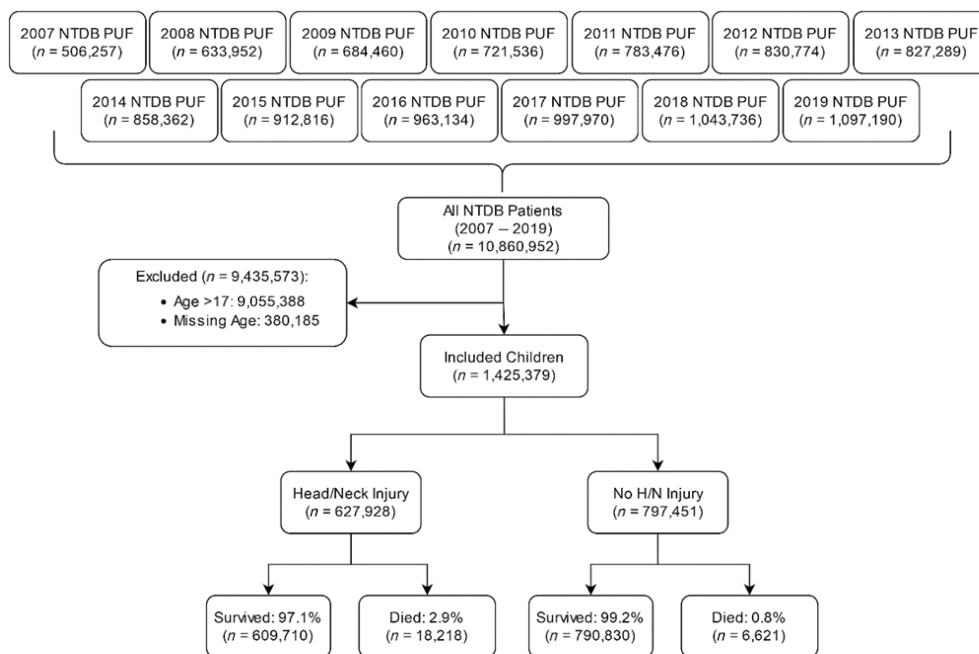
#### 3.2 | Trends in pediatric head and neck trauma

Pediatric head and neck injury significantly decreased over time, per the Cochran–Armitage test ( $p < .001$ ). Head and neck mortality and non-head and neck injury mortality steadily decreased between 2007 and 2019.

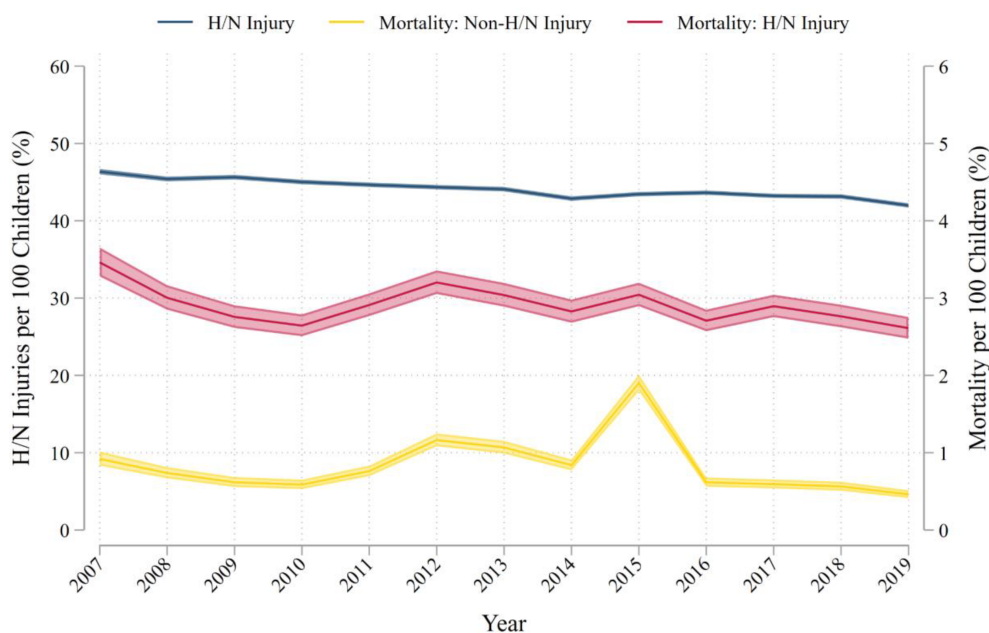
#### 3.3 | Risk factors for head and neck trauma

Patient characteristics were analyzed to determine percentages, age distributions, and injury scores correlating with exposure to head and neck trauma. In younger patients (ages 0–4) the most common mechanism of injury was falls (47.67%) while in the older patients (ages 14–17), it was MVA (56.06%). There was no statistically significant difference in demographic composition, including age, race, and payment method, in the rate of head and neck versus non-head and neck injury between the two age groups.

In patients with head and neck injury present, 26.5% had a mechanism of injury due to falls. Among patients without head and neck injury, 43.1% of these injuries were due to falls (Table 1). Patients with head and neck injury had a higher rate of injury via MVA (41.4% vs. 18.4%) compared with those without head and neck injury (Table 1). Patients with head and neck injury had an increased injury severity score (9.1 vs. 5.6), greater hospital complications (9.9% vs. 7.5%), and higher overall mortality (2.9% vs. 0.8%) compared with those without head and neck injury (Table 1). The head and neck injury group demonstrated a statistically significant lower association with other mechanisms of injury including cuts, drowning, machinery, bites, stings, overexertion, pedalist, pedestrian, poisoning and suffocation-related injuries compared with patients without head and neck injury.



**FIGURE 1** Patient flow diagram detailing database searches, inclusion and exclusion criteria, and total survival percentages.



**FIGURE 2** Proportion of pediatric head and neck injuries treated at US Trauma Centers, as well as base mortality for head and neck and non-head and neck injuries.

### 3.4 | Independent predictors of head and neck injury, mortality, prolonged hospitalization, and severe injury

Using multivariable logistic regression models, we were able to predict pediatric head and neck trauma, mortality, prolonged hospitalization, and severe injury based on sex, age, race, mechanism of injury, insurance status, comorbidity index, systolic blood pressure, and injury severity score (Table 2). Five separate models labeled (1–5) were performed to identify key predictors of these outcomes (HN injury, mortality, mortality with HN injury, prolonged hospitalization, and severe injury) (Table 2).

When analyzing independent predictors of pediatric head and neck injury, age 0–4 was associated with higher odds of head and neck injury (OR 1.231 CI 1.169–1.295) (Table 2, Model 1). Other predictors include MVA (OR 3.756 CI 3.483–4.050), being struck by or against an object or entity (OR 2.342 CI 2.232–2.456) and self-insurance status (OR 1.077 CI 1.038–1.117) (Table 2, Model 1).

When analyzing independent predictors of in-hospital mortality, increased overall odds of mortality was associated with male sex (OR 1.299 CI 1.209–1.396), ages 0–4 (OR 1.179 CI 1.071–1.299), and firearm-related injury (OR 11.28 CI 6.074–20.95) (Table 2, Model 2). Firearm exposure was strongly predictive of mortality when involving head and neck injury (OR 32.47 CI 26.77–39.39) (Table 2, Model 3).

Increased odds of prolonged hospitalization was associated with MVA (OR 3.858 CI 3.579–4.158), Medicaid insurance status (OR 1.260 CI 1.190–1.334), a greater Charlson comorbidity index (OR 1.440 CI 1.360–1.525) as well as a greater systolic blood pressure (OR 1.011 CI 1.010–1.012) (Table 2, Model 4).

Greater severity of injury due to head or neck trauma was associated with male sex (OR 1.314 CI 1.281–1.349), trauma by MVA (OR 2.517 CI 2.346–2.700), and firearm exposure (OR 3.937 CI 3.520–4.402) (Table 2, Model 5).

## 4 | DISCUSSION

Identifying key risk factors, trends, and independent predictors of head and neck trauma in the pediatric population is crucial to better characterize outcomes of these injuries. Although there are studies examining specific causes of pediatric trauma, there is a paucity of research on all mechanisms of injury of head and neck trauma on a national scale.<sup>15</sup> Understanding predictors of head and neck injury can help healthcare providers develop targeted interventions to improve mortality rates and trauma outcomes in these patients.

The present study found that the number of pediatric patients presenting to NTDB affiliated hospitals with head and neck injury decreased by 4.37% over the past 12 years. The observed overall decrease in the rate of head and neck injury could be attributable to increased car safety, legislative efforts, and public health initiatives.<sup>16–18</sup> There has been a decline in child fatalities due to MVA globally, accredited to improvements in car seat education, legislature requiring the use of child car restraints, and improved car seat quality.<sup>16</sup> From a legislative perspective, the US Congress authorized federal agencies such as the Centers for Disease Control and Prevention (CDC) to engage in activities to decrease the severity and incidence of traumatic brain injuries.<sup>17</sup> In the past decade, the CDC has launched numerous public health campaigns targeted at prevention of pediatric head and neck injury such as the “HEADS UP campaign.”<sup>18</sup> The cumulative impact of these efforts has likely resulted in the stated decrease in pediatric head and neck trauma cases in the United States.

Our data suggests that the most common mechanism of HN injury in young children ages 0–4 years old is due to falls, which accounted for 47.67% of HN cases presenting to NTDB-affiliated hospitals between 2007 and 2019. Prior epidemiologic studies have indicated MVA as the predominant mechanism of injury across all pediatric age groups, including in young children.<sup>19,20</sup> These studies

**TABLE 1** Patient characteristics by exposure to trauma.

	Head/neck trauma present		Head/neck trauma absent	
Age (years) (mean, [SD])	10.0	(5.5)	9.4	(5.1)
Race (% , n)				
Non-White	37.0%	231,228	37.8%	299,543
White	63.0%	393,598	62.2%	493,661
Payment method (% , n)				
Medicaid	36.5%	212,443	38.8%	288,200
Not billed (for any reason)	0.3%	1556	0.2%	1483
Self-pay <sup>a</sup>	8.1%	47,171	7.3%	54,230
Private/commercial insurance	47.9%	278,845	47.4%	352,438
Medicare	0.3%	1934	0.3%	2590
Other government	3.1%	18,000	2.9%	21,228
Other	3.7%	21,640	3.0%	22,648
Injury mechanism (% , n)				
Fall	26.5%	166,480	43.1%	343,357
MVT injury	41.4%	259,891	18.4%	146,467
Struck by, against	13.2%	83,183	9.4%	74,792
Firearm	1.8%	11,413	4.4%	35,475
Other (cuts, drowning, machinery, bites and stings, overexertion, pedal cyclist, pedestrian, poisoning and suffocation)	17.0%	106,961	24.7%	197,360
Length of stay (days) (mean, [SD])	3.3	(6.7)	2.6	(4.6)
Total GCS (mean, [SD])	13.7	(3.3)	14.8	(1.3)
ISS (mean, [(SD)])	9.1	(9.4)	5.6	(5.1)
MGAP (mean, [SD])	22.7	(3.7)	23.9	(2.3)
Hospital complications (% , n)				
None	90.1%	565,760	92.5%	737,722
Complications	9.9%	62,168	7.5%	59,729
Mortality (% , n)				
Lived	97.1%	609,710	99.2%	790,830
Died	2.9%	18,218	0.8%	6621

Note: Patient characteristics by exposure to trauma reported in percentages, age, days, and scores as relevant. All differences significant between groups at  $p < .01$ .

<sup>a</sup>Self-pay refers to patients without insurance.

also suggest that the primary modality of injury varies with age: motor vehicle injuries represent a larger proportion of HN injuries with increasing age, whereas falls serve as a major contributor of injury in younger children, primarily ages 0–4 years. The variance in our data compared to prior studies is likely attributable to differences in the examined pediatric populations. The aforementioned studies primarily examined patterns and outcomes in a specific subset of pediatric HN cases, such as in hospitalized patients and in regard to facial fracture injuries.<sup>19,20</sup> Our study includes all cases of pediatric HN trauma, including traumatic brain injury, facial fractures, and penetrating neck injuries.

Falls are thought to be a significant mechanism of injury in young children due to the effects of anatomic proportions, motor control, and environmental factors, which lessen as children age and develop.<sup>21</sup> Infants' heads at birth account for one-fourth of total body

length, compared with an adult at one-seventh head-to-body ratio. Therefore, the center of gravity in younger children is displaced due to the disproportionately larger body mass located above the torso.<sup>21</sup> Mobility increases as children age, which is consistent with a primary incidence of multi-level falls in younger children compared with falls of low height (<1 m) in older children. Younger children are more likely to be dropped from a caregiver's arms or be inappropriately placed on household surfaces, whereas older children most often fall from running, tripping, or stumbling.<sup>22</sup>

MVA remain a major contributor of pediatric HN trauma across all age groups, particularly in older children and teens. Several factors have been attributed to increased MVA-related injuries in teens compared with older adults, including lower rates of seatbelt use, increased presence of passengers and socializing while driving, and

**TABLE 2** Logistic regression models predicting pediatric head and neck trauma, mortality, length of hospital stay, and severe injury.

Model	(1) HN Injury	(2) Mortality	(3) Mortality w/ HN Injury	(4) Prolonged Hospitalization	(5) Severe Injury
Sex: male	0.984 [0.961,1.008]	1.299*** [1.209,1.396]	1.366*** [1.260,1.482]	0.897*** [0.853,0.944]	1.314*** [1.281,1.349]
Age category					
0–4	1.231*** [1.169,1.295]	1.179*** [1.071,1.299]	1.385*** [1.230,1.559]	1.171** [1.060,1.295]	0.857*** [0.797,0.921]
5–9	0.645*** [0.618,0.672]	0.952 [0.787,1.151]	0.894 [0.788,1.014]	0.798*** [0.730,0.872]	0.679*** [0.637,0.724]
10–14	0.793*** [0.767,0.820]	0.977 [0.855,1.117]	0.899 [0.802,1.007]	0.830*** [0.773,0.890]	0.859*** [0.816,0.905]
15–18 (Ref.)	1 [1]	1 [1]	1 [1]	1 [1]	1 [1]
Interaction: sex × age					
Males aged 0–4	1.048** [1.017,1.080]	0.750*** [0.679,0.829]	0.717*** [0.637,0.807]	1.126** [1.037,1.222]	0.778*** [0.749,0.809]
Males aged 5–9	1.247*** [1.206,1.289]	0.787*** [0.697,0.888]	0.726*** [0.633,0.832]	1.101* [1.008,1.203]	0.801*** [0.770,0.833]
Males aged 10–14	1.009 [0.980,1.038]	0.871* [0.761,0.996]	0.830** [0.724,0.952]	0.951 [0.881,1.027]	0.822*** [0.796,0.850]
Race: White, Non-Hispanic	0.989 [0.946,1.035]	1.041 [0.922,1.177]	0.981 [0.905,1.064]	0.880*** [0.833,0.929]	0.826*** [0.741,0.921]
Mechanism of injury					
Fall (Ref.)	1 [1]	1 [1]	1 [1]	1 [1]	1 [1]
MVT Injury	3.756*** [3.483,4.050]	1.541 [0.999,2.376]	2.365*** [2.078,2.692]	3.858*** [3.579,4.158]	2.517*** [2.346,2.700]
Struck by, against	2.342*** [2.232,2.456]	1.177 [0.962,1.440]	1.633*** [1.447,1.844]	1.364*** [1.239,1.501]	1.043 [0.991,1.096]
Firearm	0.639*** [0.584,0.700]	11.28*** [6.074,20.95]	32.47*** [26.77,39.39]	7.156*** [6.507,7.871]	3.937*** [3.520,4.402]
Other	1.088 [0.990,1.197]	2.487*** [1.479,4.183]	4.283*** [3.635,5.046]	4.545*** [4.050,5.100]	1.268*** [1.181,1.362]
Insurer: medicaid	1.003 [0.968,1.040]	1.042 [0.955,1.137]	1.024 [0.943,1.113]	1.260*** [1.190,1.334]	0.847*** [0.790,0.908]
Insurer: self	1.077*** [1.038,1.117]	1.977*** [1.811,2.157]	1.936*** [1.760,2.130]	0.553*** [0.471,0.648]	0.852*** [0.793,0.916]
Head/neck injury		2.404*** [1.530,3.778]		0.980 [0.922,1.043]	2.628*** [2.409,2.868]
Charlson Comorbidity Index		0.754*** [0.655,0.868]	0.825** [0.732,0.930]	1.440*** [1.360,1.525]	1.078* [1.017,1.143]
SBP (mmHg)		0.965*** [0.962,0.967]	0.966*** [0.964,0.967]	1.011*** [1.010,1.012]	0.988*** [0.987,0.989]
ISS		1.110*** [1.104,1.116]	1.120*** [1.114,1.125]	1.104*** [1.101,1.107]	
Observations	1,422,903	1,265,630	574,455	1,149,395	1,305,279
Pseudo R <sup>2</sup>	0.066	0.451	0.477	0.226	0.091
AIC	1822864.9	117826.2	76020.7	225761.1	969546.9



TABLE 2 (Continued)

Model	(1) HN Injury	(2) Mortality	(3) Mortality w/ HN Injury	(4) Prolonged Hospitalization	(5) Severe Injury
BIC	1823047.4	118055.2	76223.4	225988.3	969764.4
Log lik.	-911417.4	-58894.1	-37992.4	-112861.6	-484755.5

Note: Logistic regression models reporting odds ratios for (1) head and neck trauma, (2) mortality, (3) mortality associated with head and neck trauma, (4) prolonged hospitalization, and (5) severe injury. 95% confidence intervals reported in brackets. Cases where  $p < .05$  are marked with a single asterisk (\*), cases with  $p < .01$  are marked with two asterisks (\*\*), and cases where  $p < .001$  are marked with three asterisks (\*\*\*). Falls were used as a reference value [1] to determine odds ratios for mechanisms of injury.

driving under the influence.<sup>23,24</sup> Notably, teens drive under the influence of alcohol less frequently than adults, but place themselves at increased risk when they do as they are often less experienced drivers compared with adults.<sup>25</sup>

Previous studies in India and the United States have found the head to be the most frequently injured anatomic region in MVAs, at rates of around 70%–80%.<sup>26,27</sup> Injuries to the head and face are decreased significantly in frontal and lateral crashes if seatbelts and airbags are utilized.<sup>28</sup> Head injuries are particularly common as the head is one of the only body parts not protected behind bulky components of the car. Additionally, the high velocity and acceleration-deceleration mechanism of energy transfer to the neck implicated in MVAs renders involved individuals particularly susceptible to whiplash injuries.<sup>29</sup> Despite overall increasing presentations of HN-related injuries to the emergency department in recent years, the proportion of severe MVA-related HN injuries has been decreasing.<sup>30</sup> This may be attributable to continuous implementation of federal and state regulations regarding traffic laws, promoting seat belt usage, child safety seats, and motorcycle helmets.<sup>31,32</sup>

Firearms are significantly associated with increased odds of mortality and greater injury severity in pediatric patients with head and neck trauma. Firearm-related injury is the devastating product of increased access to firearms, national gun legislation, and unsafe storage practices.<sup>33,34</sup> In the United States, firearms are the leading cause of death in children and youth ages 0–24.<sup>35</sup> The high mortality associated with firearm injury may be attributable to the high rate of gun ownership in the United States. A recent study found that cases of firearm-related injury were more likely to occur in households that did not engage in safe gun storage practices.<sup>36</sup> Four key practices that are associated with protective effects against firearm-related injury include keeping the gun locked, unloaded, storing ammunition locked and in a separate location.<sup>36</sup>

The downstream consequences of increased exposure, ownership and access to guns are tremendous. As evidenced by the present study, mere exposure to firearms is associated with a significant increase in odds of mortality and injury severity. Even among non-powder firearm head and neck injuries, the presence of lacerations, contusions and abrasions is associated with an increased overall odds of mortality and higher in-hospital mortality.<sup>35–37</sup> It is critical that healthcare providers advocate for tighter gun control regulations and safer storage campaigns to limit the burden of pediatric head and neck injury caused by firearms.

When considering limitations of the present study, there are population, generalizability, and methodological considerations. A major

limitation of this study is that it only evaluates injured patients that present to hospitals and does not capture head and neck injuries that result in prehospital death or that do not present to NTDB participating hospitals. The CDC reports that 82% of mild traumatic brain injuries do not actually present to the hospital, rather they visit primary care and urgent care clinics. These healthcare settings are not captured by the NTDB, and thus the current study likely underestimates the actual incidence of pediatric head and neck trauma.<sup>38</sup>

Another limitation to this study is that there exists variability in the literature regarding ICD-9 codes for head trauma. Accordingly, some NTDB hospitals may not adequately capture the extent of presenting head and neck injury patients. In the 2001 National Hospital Discharge Summary dataset, ICD external cause codes were only included in approximately 68% of injury-related hospitalization records.<sup>39</sup> Furthermore, the present study does not examine each mechanism of injury; therefore conclusions regarding injury-specific outcomes are limited.

## 5 | CONCLUSION

Over the past 12 years, analysis of pediatric head and neck injury from the NTDB demonstrates that the rate of trauma has decreased by 4.37%. Despite this, head and neck trauma in the pediatric population is associated with increased odds of mortality. Demographic features such as age and insurance status predict mortality from head and neck trauma with falls and MVTs being the most common mechanisms of injury.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## ORCID

Ashwini Sarathy  <https://orcid.org/0000-0002-8769-5364>

Kenny Nguyen  <https://orcid.org/0000-0003-2858-1225>

Mirabelle Sajisevi  <https://orcid.org/0000-0003-3126-7739>

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