3-17-2023

# A Nationwide Analysis of Gunshot Wounds of the Head and Neck: Morbidity, Mortality, and Cost

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# A Nationwide Analysis of Gunshot Wounds of the Head and Neck: Morbidity, Mortality, and Cost

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**Background:** Gun violence in the United States rose continuously from 2010 to 2022, spiking during the pandemic, and peaking in 2021 at 48,830 deaths (14.8 per 100,000). Previous reports investigated health and financial burden associated with gunshot wounds (GSWs) during 2004 to 2013; however estimates related specifically to head and neck (H&N) injuries have been lacking. This population-based study aims to examine incidence, morbidity, mortality, and health resource utilization of H&N injuries utilizing the Nationwide Inpatient Sample database.

**Methods:** A population-based study was undertaken using the National (Nationwide) Inpatient Sample (NIS) database (2015Q4–2017Q4). The International Classification of Diseases, Tenth Revision (ICD-10) codes were used to create a composite variable (inclusive of brain, eye, facial nerve, and facial fractures) resulting from GSW to the H&N. Incidence per 100,000 hospitalizations and case fatality rates were calculated to determine the health burden of H&N injuries. Length of hospital stay, and inflation- adjusted hospital charges were compared among H&N and non-H&N injuries. $X^2$ (classical and bootstrapped) and Mann-Whitney tests were used to compare groups.

**Results:** Of 101,300 injuries caused by firearms, 16,140 injuries (15.9%) involved H&N region. The average incidence of H&N injuries was 20.1 cases per 100,000 hospitalizations, with intentional injuries having the highest case fatality rates of 32.4%. Patients with H&N injuries had extreme loss of function (33.4% versus 18.3%, $P<0.001$) and extreme likelihood of mortality (27.0% versus 11.3%, $P<0.001$) than non-H&N injuries. Statistically significant differences in the median length of stay (4.8 d versus 3.7 d; $P<0.001$) and median inflation-adjusted hospital charges ($80,743 versus $58,946, $P<0.001$) were found among H&N and non-H&N injuries.

**Conclusions:** Injuries due to GSW remain an inordinate health care and financial burden, with trauma to the H&N carrying an especially high cost in dollars, morbidity, and mortality.

**Key Words:** Facial fractures, gun violence, gunshot, head, incidence, inpatients, morbidity

(*J Craniofac Surg* 2023;00: 000–000)

Reading the latest headlines, one quickly learns that the United States is suffering from an epidemic of gun violence. In 2020 there was a total of 45,222 firearm-related deaths (13.6 per 100,000 people), representing a 14% increase from the year before, a 25% increase from 2015 when there were 36,252 deaths. This was topped again in 2021 with 48,830 deaths (14.8 per 100,000). Gun deaths in the United States have been rising for several years, with smaller, steadier increases between 2014 and 2019 before the larger surges in the last 2 years. Although this high total number of gun deaths for the United States is remarkable, this statistic does not consider the nation's growing population nor the nation's long history of violence. The current rate is merely the highest since the mid-1990s, but still well below the peak of 16.3 gun deaths per 100,000 people in 1974.[1] Mass shooting deaths, while increasing over the last 2 decades from a low of 7 deaths in 2000, to a high of 59 as of October 18, 2022, represent less than 0.1% of all firearm-related deaths.[2]

Still, the reality is that the United States remains the front-runner, among developed countries with high income, for both homicide and firearm-related homicide which is 19.5 times higher than comparable nations.[3] The higher burden of firearm associated morbidity and mortality translates to an exorbitant financial burden.[2,3] A report from between 2006 and 2010 showed that the shared cost to the American Health Care system in treating gunshot wounds (GSWs) equated to $88.6 billion.[4,5] Previous reports studied socio-economic correlates and the ever-increasing health care burden of GSWs utilizing the 2004 to 2013 National (Nationwide) Inpatient Sample database developed for the Healthcare Cost and Utilization Project (HCUP).

Although these general trends characterize the magnitude of the problem, they do not address specific areas of anatomic interest to health care providers such as the head and neck (H&N), which warrants further exploration of variations in the presentations of GSWs. Many patients arrive at the hospital with over three wounds, with the injuries localized to 3 or more

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Received April 12, 2022.

Accepted for publication November 28, 2022.

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The study has been approved and monitored by an Institutional Review Board of the University of Nevada Las Vegas School of Medicine. Project # 1685630-1

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The authors report no conflicts of interest.

**Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website, www.jcraniofacialsurgery.com.**



ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000009268

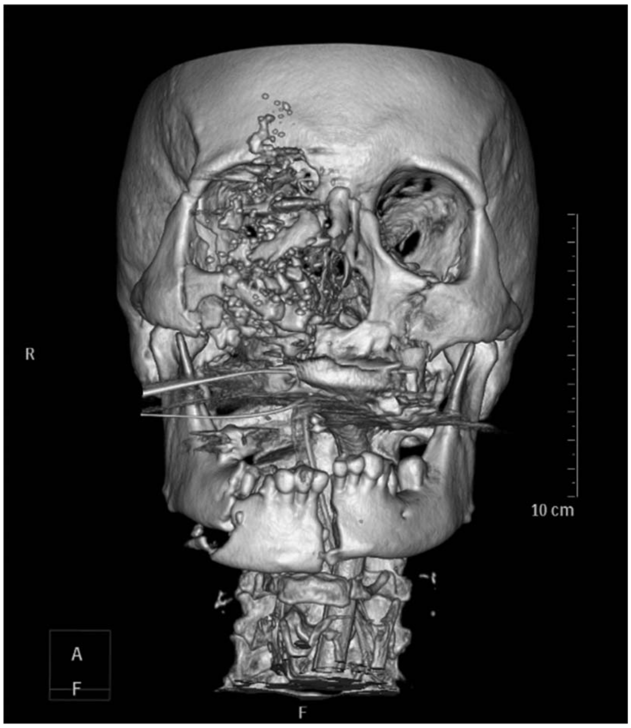


**FIGURE 1.** Three-dimensional CT of gunshot wounds (GSW) to head. A self-inflicted GSW to the face demonstrating the number of regions injured by a single bullet. Entry wound under the chin and an exit through the supraorbital rim without any brain injury. The right eye required enucleation. The patient required 14 separate procedures, including microsurgical free fibula mandible reconstruction, over 2.5 years. Surgical specialists included trauma surgery, otolaryngology, plastic surgery, and oral and maxillofacial surgery. CT indicates computed tomography.

different body regions.[6] Injury to areas of complex anatomy, such as the H&N, which is dense with critical anatomic elements, should equate to increased costs associated with both their immediate and subsequent care (Fig. 1). They are also likely associated with greater morbidity and mortality than injuries to other areas of the body. Therefore, this study aims to investigate the health and financial burden associated with GSW.

## METHODS

### Data Source and Study Population

We conducted a population-based study using the National (Nationwide) Inpatient Sample (NIS) database from the fourth quarter of 2015 [when International Classification of Diseases, Tenth Revision (ICD-10) codes are first used by this database] to the end 2017. The NIS is the largest all-payer hospital inpatient database sponsored by the Agency of Healthcare Research and Quality (AHRQ) HCUP, created through a Federal-State-Industry partnership.[7] The NIS contains the discharge records from 20% of the community hospitals of the United States and uses complex weighting procedures to generate nationally representative samples. It includes clinical and non-clinical variables corresponding to each hospital stay, which can be utilized to assess trends, quality of care, health care utilization and hospital charges associated with the outcome of interest. We used the ICD-10 external cause of injury codes to identify GSWs.[7] A total of 837 codes were selected for the query (Supplemental Table 7, Supplemental Digital Content 7, http://links.lww.com/SCS/E862). We then dichotomized the gunshot injuries into H&N and non-head injuries. The major anatomic regions of the H&N evaluated include the brain, facial skeleton, eye, facial nerve, and cervical spine. As the data were deidentified, this study [UNLV IRB Protocol #1685630-1] was exempt from review by the University of Nevada, Las Vegas Institutional Review Board.

### Data Analysis

A composite variable of H&N injuries was created to include brain, eye, facial nerve, and facial fractures. Distribution of H&N injuries by different mechanisms of injuries, such as intentional, assault, legal intervention, accidental, and undetermined was also assessed. A comparison group was defined as all other gunshot injuries involving non-H&N areas of the body. Hospital utilization and inflation-adjusted health care cost was also computed. For health care costs, total hospital charges (adjusted for inflation to 2021 U.S. dollars) were determined using the medical care component of the Consumer Price Index [Health Resources and Services Administration (HRSA), 2019]. Total charges reflecting the total facility fee reported for each discharge record (not including professional fees) were calculated. The unit of analysis was inpatient hospitalization. Incidence rates of overall gunshot injuries and H&N gunshot injuries were calculated per 100,000 inpatient hospitalizations. In addition, the case fatality rate of isolated H&N injuries by mechanism of injury was calculated by dividing the number of deaths in each category with the number of cases. A $\chi^2$ was conducted to compare categorical variables. Bootstrapped significance testing for the $\chi^2$ test was conducted to examine replicability and consistency. Frequencies/percentages and mean with standard deviations were used to report categorical and continuous variables respectively. Mann-Whitney U test was conducted to compare median scores of continuous variables across 2 groups. Missing data were handled with multiple imputation techniques. The significance level was set at 0.05 using 2-sided, unpaired testing. All analyses were conducted using SPSS version 26 and SAS 9.4. We followed the Checklist for statistical Assessment of Medical Papers (CHAMP) statement for reporting the results of statistical analyses used in this study.[8]

## RESULTS

During the study period, a total of 101,165 patients (average of 44,962 per year) were admitted to the hospital with a diagnosis

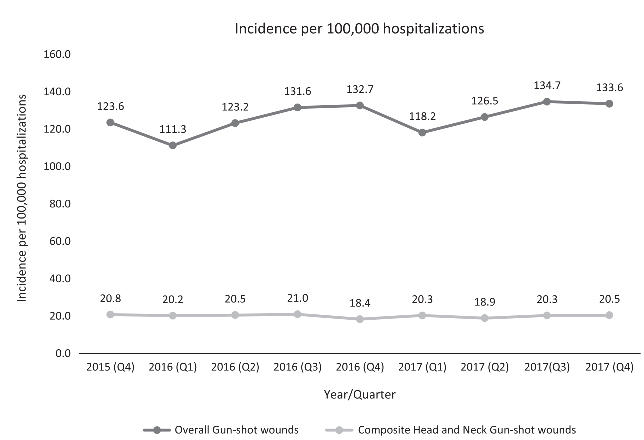


**FIGURE 2.** Incidence per 100,000 hospitalizations. Comparing the incidence of overall gunshot injuries with head/neck gunshot injuries (2015 Q4–2017 Q4).

 

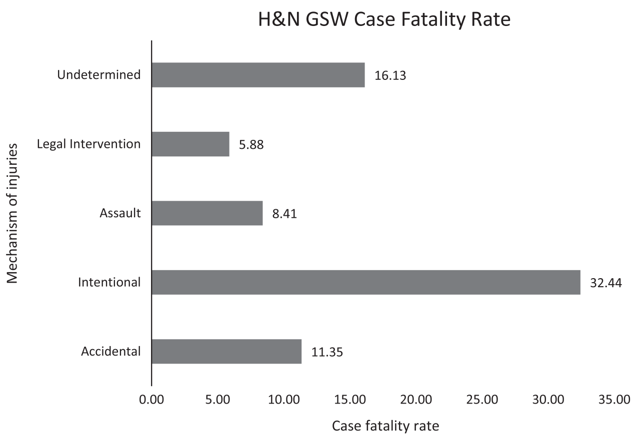


**FIGURE 3.** Case fatality rate. Case fatality rate of head/neck injuries by mechanisms.

of a GSW. The average incidence of overall firearm injuries was 126 cases per 100,000 hospitalizations. There were 85,025 (84%) patients with non-H&N injuries who were admitted to the hospital or 106 per 100,000 hospitalizations.

There were a total 16,140 patients (15.9%) or roughly 7000 per year. Of these, 12,335 patients were entered into the database has having single, or isolated injuries in the H&N region whereas 3805 had multiple injuries. Adding together the isolated and multiple injuries subtotals it was found that there were 20,120 total injuries distributed between the 16,140 patients. This was an incidence of 20 cases per 100,000 hospitalizations associated with H&N gunshot injuries (Fig. 2). The injuries were distributed by anatomic region as follows: 3095 brain injuries (19.2%), 2325 eye injuries (14.4%), 11,230 facial fractures (69.6%), 3010 C-spine injuries (18.6%), and 460 cranial nerve 7 injuries (2.9%). The differences in the incidence rate between quarters in the study period were insignificant ($P = 0.2$); however, additional data would be needed to confirm the trajectory of the trends. Among H&N gunshot injuries, intentional injuries (suicide attempt) had the highest case fatality rate of 48.9% (Fig. 3).

Comparing H&N firearm injuries to non-H&N injuries by mechanism: 37.4% versus 46.2% were related to assaults, 29.3% versus 42.4% were accidental, 26.9% versus 4.7% were intentional ($P < 0.001$ for all mechanisms except legal intervention and undetermined). Pertaining to the in-hospital mortality, 25.7% died compared with 2.7% of non-H&N GSW ($P < 0.001$, Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E863). As indicated in Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E863, whereas the high male preponderance (86.2%) persisted, the proportion of H&N firearm injuries compared with non-H&N injuries were higher among females, those aged over 50 years, and white race. Central county location remained highest at close to 40% but was slightly less among isolated H&N injuries (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E863). With regards to the clinical characteristics, patients with H&N firearm injuries were significantly more likely to have extreme loss of function (38.3% versus 18.3%, $P < 0.001$; Fig. 4) and had an extreme likelihood of mortality (36.8% versus 11.3%, $P < 0.001$; Fig. 5) as opposed to those who have had non-H&N firearm injuries.

Supplemental Table 2, Supplemental Digital Content 2, http://links.lww.com/SCS/E864 indicates the payer and hospital characteristics of firearm injuries. As opposed to patients with non-H&N GSWs, H&N gunshot victims were less likely to be admitted to private for-profit hospitals (8.1% versus 10.4%, $P < 0.001$), were more likely to be admitted to a hospital with a large number of beds (70.0% versus 65%, $P < 0.001$). Many categories had similar distributions for both types of GSW with Medicaid dominating as a source of payment for more than 40%. The South Atlantic and South Central were well represented as regions and urban teaching hospitals accounting for nearly 90% of the admissions.

In addition to the higher morbidity and mortality, H&N firearm injuries are associated with greater length of hospitalization and inflation-adjusted hospital charges. Our results indicate statistically significant differences in the median length of stay (4.8 d versus 3.7 d; $P < 0.001$) and median inflation-adjusted hospital charges ($80,743 versus $58,946, $P < 0.001$, Supplemental Table 3, Supplemental Digital Content 3, http://links.lww.com/SCS/E865) among H&N gunshot and non-H&N gunshot injuries (Supplemental Table 3, Supplemental Digital Content 3, http://links.lww.com/SCS/E865).

## Burden and Characteristics of Un-pooled Head/face Gunshot Injuries

A total of 16,140 (15.9%) gunshot injuries were identified as isolated to specific regions including brain, eye, facial nerve, C-spine, and head/face fractures. For better inferencing, injuries with more than one type of location involved were classified as multiple injuries as indicated in Supplemental Table 4, Supplemental Digital Content 4, http://links.lww.com/SCS/E866. Much of the data available had and single diagnostic code for each area of anatomic concern. There were also subsets with multiple injuries coded into NIS-HCUP. By looking at isolated injuries (Supplemental Table 4, Supplemental Digital Content 4, http://links.lww.com/SCS/E866), risk categories could be assessed by area. Over 50% of brain injuries were intentional with only 22% related to assault. Eye injuries were caused by assault 35.8% of the time and were accidental 50% of the time. The majority of the facial nerve, head/face fractures and multiple injuries resulted from assault. Nearly 47% of C-spine injuries were accidental. Isolated brain injuries had the 100% fatality rate followed by 61.1% percent of fatality associated with multiple injuries. Facial fractures had a 12% fatality rate. C-spine injuries were divided between assault and accidental at 43.9% and 46.7% respectively. Although most injuries were coded as isolated injuries, a significant number of each region fell under patients with multiple injuries. Supplemental

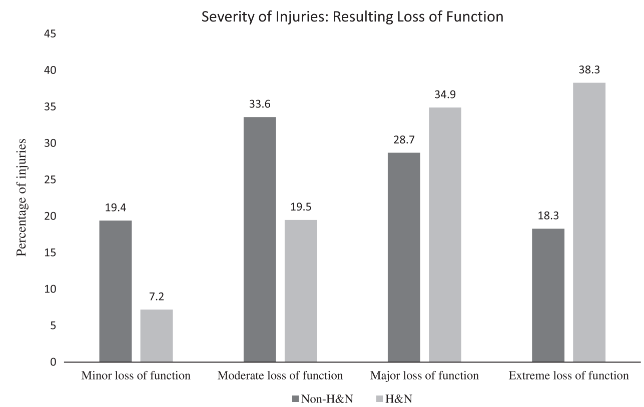


**FIGURE 4.** Severity of injuries: resulting loss of function. Percentage distribution by Loss of Function. All results were statistically significant with $P < 0.001$.

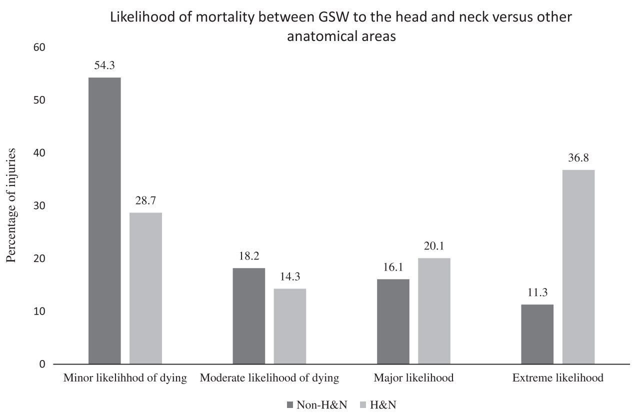


**FIGURE 5.** Likelihood of dying. Percentage distribution by likelihood of mortality. All results were statistically significant with $P < 0.001$.

Tables 5, Supplemental Digital Content 5, http://links.lww.com/SCS/E867 & 6, Supplemental Digital Content 6, http://links.lww.com/SCS/E868 provide additional detail on these subgroupings of anatomic regions for morality and loss of function, respectively. The most severe of these having combinations of brain injury, eye injury and facial fractures.

## DISCUSSION

Gun violence is but a subset of violence in general. In the United States, violent crime (homicide, rape, robbery, and aggravated assault) was low in the middle of the 20th century compared with the present. In 1960 there were 160 violent crimes per 100,000 people. This figure steadily increased, until peaking in the early 1990's at 690 per 100,000. There were periods of rapid rise, 83% from 1973 to 1991, which were followed by a decline of 33.6% from 1991 to 2001.[9] This period of decline is most highly correlated with increases in the numbers of police and a significant increase in incarceration rather than an improving economic situation or an increase in gun control laws. . More recently, in 2019, there were an estimated 367 violent crimes per 100,000. This 2019 estimate of violent crime total was 0.4% above the 2015 level but 3.8% below the 2010 level. In 2021 this rose to 398.5 per 100,000. In 2019 aggravated assaults accounted for 68.2% of violent crimes reported to law enforcement, robbery 22.3%; rape accounted for 8.2%; and murder accounted for 1.4%. Information collected regarding types of weapons used in violent crimes showed that firearms were used in 73.7% of the nation's murders, 36.4% of robberies, and 27.6% of aggravated assaults. (Weapons data are not collected for rape.) These figures are based on statistics from the FBI Uniform Crime Report.[10]

Looking at homicide alone, the per capita rate 100 years ago was around 5 deaths per 100,000. It remained relatively steady at about 4 to 5 per 100,000 population from 1950 through the mid-1960s, at which point they started rising to a peak of 10.2 per 100,000 population in 1980. From 1980 to 1991, the homicide rate fluctuated between 8 and 10 per 100,000 population. After that, the homicide trend began a large, steady decline. Between 1991 and 2000, homicide rates per capita fell from 9.8 to 5.5 per 100,000.[9,11]

Arriving at the present, the overall firearm homicide rate increased 34.6%, from 4.6 to 6.1 per 100,000 people from 2019 to 2020.[12]

During the pandemic, homicides and gun assaults trended upward whereas most property crimes receded. In the first half of 2022, crime patterns partially reversed: in particular, homicides and gun assaults declined whereas property crimes rose. The number of homicides declined by 2% in the first half of 2022 compared with the first half of 2021 (a decrease of 54 homicides). Although this reduction is heartening, the homicide rate is still 39% higher than it was during the first half of 2019, before the COVID-19 pandemic. The number of gun assaults also dropped—by 6% in the first half of 2022. For 2022 up to October total gun deaths are 38,826 with 13,380 homicides (36%) and 22,926 suicides (61%).[13] Although the surge in gun deaths in 2020 was primarily driven by an increase in gun homicides, other data suggest that increases in gun violence in 2021 were driven by increases in both gun homicides and gun suicides. Provisional data shows roughly 1500 more gun homicides in 2021 over 2020 and ~2000 more gun suicides.[14]

Gun ownership per capita remains high in the United States According to The Small Arms Survey 2018, a Swiss-based leading research project, the US ratio of 120.5 firearms per 100 residents was up from 88 per 100 in 2011. There was a spike in new gun ownership during the pandemic with 7.5 million U.S. adults, just under 3% of the population, buying a gun for the first time.[15] Yet even these remarkable numbers are not historically high rates for the United States where the average citizen values owning a gun. The percentage of households in the United States owning one or more firearms peaked in 1978 at 50%. From 1972 to 2021, ownership ranged between 37% and 50% of households and was 42% in 2021.[16]

Although the statistics on firearm-related mortality stand out, injuries are far more prevalent. Everytown Research reported that twice the number of individuals are injured as compared with those killed at the hands of gun violence. This rough estimate was confirmed by a cross-sectional study using data from 2009 to 2017 obtained from the CDC death certificate data and national data on emergency department visits where there was a mean of 85,000 nonfatal visits for injury per year compared with ~ 35,000 deaths per year—a total of 120,000 people per year who are either injured or killed due to firearms. Roughly 90% of self-harm GSW injuries ended in death, the majority recorded outside the hospital. About 25% of those injured in assaults or in legal intervention, such as police-involved shootings, died. About 1% of those injured in accidents died.[17] Although the number of deaths is significant one cannot ignore the morbidity of associated injuries in GSW survivors. According to Kaufman et al, suicide accounted for 61% of the deaths but only 3% of the nonfatal injuries. Assaults accounted for 35% of the deaths and 41% of the injuries whereas unintentional GSWs accounted for 2% of the deaths and 51% of the nonfatal injuries.[17] In our study, mechanism of injury influences results in a predictable manner. Assault and accidental GSW was ~10% more likely to result in a non-H&N injury, just as intentional was 5 times more likely to result in a H&N injury and a significantly higher risk of death. GSW to the H&N was also more than twice as likely to result in an extreme loss of function.

The last comparable review looking at hospitalizations utilized the National (Nationwide) Inpatient Sample (NIS) from 2004 to 2013. It looked at mortality after admission, associations of race sex, injury severity, and trends in-hospital charges. Hospitalizations were stable at 30,000 admissions per year or 80 per 100,000 admissions. This represents less than half of those seen in emergency departments for nonfatal injuries. Hospital mortality was 2500 per year (8%). Of those dying, 32% were caused by suicide. Hospital charges had an annual increase of 20% from \$30,000 to \$56,000 per patient each visit.[5] We report 101,165 hospitalizations (roughly 45,000 per year) over 9 consecutive quarters from the end of 2015 through 2017. We compare this cohort with the specific subset of patients who had injuries to the H&N with an overall mortality rate of 25.7% the highest among intentional (suicide) GSW with 48.9% dying in the hospital. With regard to suicide, the Center for Disease Control and Prevention (CDC), saw an increase of 33% in suicide rate in the general population between years of 1999 and 2017.[18] Men lead the statistic in the adjusted suicide rates with a concerning 26% increase, and yet, an alarming 53% increase has also been seen in women. In 2018 alone, 48,344 Americans have successfully committed suicide of the 1.4 million attempts with 50.57% of those cases secondary to firearm use.[19]

## Brain Injury

Traumatic brain injury (TBI) encompasses a broad array of etiologies. Among all types of presentation post resuscitative GCS scores remains one of the best prediction modalities. Almost half of all patients with a brain injury will present with a GCS of 3-5 with only 8% surviving. Higher GCS improves survival with a GCS of 6 to 8 having a survival rate of 35% whereas a GCS of 9 to 15 has a 90% survival rate.[20] Presentations including hypotension, hypoxia, airway compromise, coagulopathy and oral maxillofacial trauma are common. Among these additional factors low blood pressure was also a consistent predictor of post TBI mortality.[21] Epidemiologically TBI related mortality remains the highest in teenagers, young adults, men above 75 years of age, and African American race.

In the United States, gun-related violence over the past 20 years has correlated with a rising number of penetrating brain injuries annually.[22,23] It is estimated that these gunshot related brain injuries account for between 32,000 and 35,000 civilian deaths per year.[24–26] Penetrating brain injuries are estimated to count for 12% of all traumatic brain injuries.[22] The annual cost for an economic lifetime from traumatic brain injury in the United States is estimated to be $76.5 billion with ninety percent of the cost originating from traumatic brain injuries hospitalizations and fatal outcomes which includes direct and indirect costs.[23,27,28] Firearms have been linked to account for nearly 35% of traumatic brain injury related deaths, with over half cases due to attempted suicide, followed by motor vehicle trauma and falls.[23,27,29] Only ten percent survive long enough to reach the hospital, and up to half who survive long enough to reach the hospital die during resuscitation attempts.[23,25,30,31] This is of course what accounts for the higher likelihood of dying from GSW to the H&N found in our study with nearly 20% having a brain injury.

## Cervical Spine Injury

C-spine injuries are always a concern when a patient has head trauma. For facial trauma, c-spine injury has been previously reported in 6.7% of facial fractures, 7.0% of head injuries, and 7.8% of patients with a combined facial fracture and head injury.[32] The dataset for penetrating injuries related to gunshot causing cervical spine injuries is less complete with only rare reports and no broad incidence available. We report a more than double the rate of C-spine injury (18.6%) for those admitted to the hospital for GSW compared with facial fractures in general.

## Facial Nerve Injury

The facial nerve can be injured by a gunshot either in the temporal bone or extracranially in the face. If the temporal bone is involved the injury rate is as high as 75%.[33] For gunshot as a source of injury the incidence of facial nerve injury seems, however, to be low at 12.9% for our cohort.

## Eye Injury

According to the US Eye Injury Registry Database GSWs account for only 7.4% of all penetrating injuries to the eye.[34] Ocular injuries occur in almost 30% of GSWs to the H&N and half result in permanent visual deficit.[35] This is higher than our report of eye injury reported here as 14.4%, which of course only includes inpatient hospital admissions.

## Facial Fractures

An evaluation of emergency department admissions spanning 6 years from 2008 to 2013 found 15,469 patients with facial fractures secondary to firearms injuries.[36] This works out to ~2500 per year. Of the 80,000 or so nonfatal firearms injuries per year, this works out to ~3% of all injuries. For those admitted to the hospital with GSW to the H&N the rate is of course much higher. We report a total of 11,230 facial fractures (~5,000 per year) in about 70% of H&N GSW and 11% of all GSW admitted to the hospital. Because of the nature of the NIS-HCUP database's entry of isolated versus combined injuries, it is not possible to assess the relative protection against mortality that the facial skeleton as a shock absorber may afford.

## The Financial Burden

That firearm-related injuries are financially burdensome to society is not a surprise. According to the prior NIS-HCUP study, (2006–2014), the initial hospitalization for injuries stemming from gun violence costs about $734.6 million annually.[37] Costs for GSW in general remain high but are significantly higher for patients with H&N injuries at nearly $81,000 per admission compared with non-head-and-neck injuries at about $59,000. Both are higher than the prior NIS-HCUP study which showed yearly rising cost peaking at $56,000 per patient admission. That H&N injuries cost more is expected, as these patients often require extended care in the intensive care unit, may require tracheostomy and gastrostomy as well as multiple reconstructive procedures to reestablish the form and function of the many specialized structures of the H&N.

## Strengths and Limitations

To our knowledge, this study is the first one to provide latest estimates of health and financial burden associated with H&N GSWs. However, this study is not without limitations. Misclassification bias may have occurred due to coding errors. Given the high level of energy delivered by a GSW to the relatively small area of the H&N, dense with critical anatomic elements, there is likely some error of under-coding when entering an injury into the database for so-called "isolated injuries". For instance, it is unlikely that an eye injury occurred without a facial fracture. The possibility that coding entry may not always be complete should be considered as a source of error in our results. Although the NIS database provides comprehensive information about billing, detailed clinical information still lacks in such administrative databases. Another limitation is that our study only reports hospital charges (instead of actual costs) associated with the H&N injuries. The hospital charges correspond to the amount set for hospital services before negotiating any discounts with payers. In addition, this did not capture actual financial load associated with emergency room visits, as this database records only inpatient hospitalizations. As the unit of analyses was in-patient hospitalization, it is possible to count one patient multiple times in the absence of appropriate linkage key. This also prevented longitudinal analyses of the data, including readmissions and cost associated with the readmissions. Because of cross-sectional design of the study, causality could not be inferred. Finally, we expect some residual confounding as some variables related to history of comorbid conditions were not available in the database, which could be used as potential covariate to perform predictive modeling.

## CONCLUSIONS

Gun-related injuries remain a major public health issue, with many beginning to view this as a national health crisis. To summarize, there are 120,000 injuries resulting in over 40,000 deaths each year. Over 7,000 patients per year are admitted to the hospital with GSW of the H&N. These are associated with significantly higher mortality, higher morbidity, and higher cost of care than non-head-and-neck GSW.

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