HHS Public Access

Author manuscript

*Inj Prev*. Author manuscript; available in PMC 2024 July 03.

Published in final edited form as:

*Inj Prev*. ; 30(3): 188–193. doi:10.1136/ip-2023-045107.

# Assault-related anoxia and neck injuries in US emergency departments

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## Abstract

**Background:** Early identification of non-fatal strangulation in the context of intimate partner violence (IPV) is crucial due to its severe physical and psychological consequences for the individual experiencing it. This study investigates the underreported and underestimated burden of IPV-related non-fatal strangulation by analyzing assault-related injuries leading to anoxia and neck injuries.

**Methods:** An IRB-exempt, retrospective review of prospectively collected data was performed using the National Electronic Injury Surveillance System All Injury Program data from 2005

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Contribution Statement:
The author confirms sole responsibility for the following:
study conception and design (BK and RL), data collection (RL), analysis (RL) and interpretation of results (BK and RL), and manuscript preparation (BK, JP, ALC, KR, WG, RL).

Competing Interests: None

Ethics approval statement: The Indiana University School of Medicine termed this was an exempt study and no IRB approval was needed. The data is in the public domain and can be freely downloaded from the NEISS websites.

through 2019 for all assaults resulting in anoxia and neck injuries. The type and mechanism of assault injuries resulting in anoxia (excluding drowning, poisoning, and aspiration), anatomical location of assault-related neck injuries, and neck injury diagnosis by morphology, were analyzed using statistical methods accounting for the weighted stratified nature of the data.

**Results:** Out of a total of 24,493,518 assault-related injuries, 11.6% (N=2,842,862) resulted from IPV (defined as perpetrators being spouses/partners). Among 22,764 cases of assault-related anoxia, IPV accounted for 40.4%. Inhalation and suffocation were the dominant mechanisms (60.8%) of anoxia, with IPV contributing to 41.9% of such cases. Neck injuries represented only 3.0% of all assault-related injuries, with IPV accounting for 21% of all neck injuries and 31.9% of neck contusions.

**Conclusions:** The study reveals a significant burden of IPV-related anoxia and neck injuries, highlighting the importance of recognizing IPV-related strangulation. Comprehensive screening for IPV should be conducted in patients with unexplained neck injuries, and all IPV patients should be screened for strangulation events.

### Keywords

Assault; Strangulation; Intimate Partner Violence; Domestic Violence; Neck Injuries

## Introduction:

Intimate partner violence (IPV) refers to patterns of coercion, abuse, and/or aggression that are perpetrated by a current or former intimate partner. The emergency department (ED) is typically the first clinical touchpoint among IPV patients with acute injuries. Approximately 14% to 54% of female patients in ED are treated for IPV-related injuries.[1-3] Strangulation is defined as “the external compression of a person’s neck and/or upper torso in a manner that inhibits that person’s airway or the flow of blood into or out of the head.”[4] Although accurate estimates are yet to be calculated, studies have found that the prevalence of strangulation among females seeking care after experiencing IPV is as high as 38% to 80%.[5-10]

From a clinical perspective, only 50% of survivors of non-fatal strangulation present with any obvious visual findings on neck exam, which complicates the identification of this violence.[5,11-13] However, clinical findings of non-fatal strangulation can include petechiae, vocal changes, and neck pain. Additionally, assault and IPV victims may have whiplash injury patterns via non-fatal strangulation due to violent grabbing and shaking of the neck.[14] The pathophysiological mechanisms of strangulation-induced morbidity/mortality typically occur through vascular compromise.[15] One adverse consequence of non-fatal strangulation is anoxia or hypoxia due to blockage of the airway, blockage of major blood vessels, abrupt blood pressure changes (cardiac arrest, stroke, aneurysm), and/or damage to neck structures (thyroid cartilage, trachea, hyoid bone).[16] Another complication of strangulation is traumatic brain injuries, which manifest as alterations in brain physiology caused by external forces resulting in cognitive disruptions, physical symptoms, emotional and mood-related issues, as well as sleep disruptions.[17] Recent studies have also shown that between 1.3%[18] to 2.1%[19] of IPV victims who have

experienced strangulation suffer an arterial dissection. Strangulation is also associated with depression, anxiety, post-traumatic stress disorder, and seizures.[5, 20, 21]

In addition to treatment of acute injuries from non-fatal strangulation, prompt identification of occurrence of strangulation is crucial for victims of IPV. Women with a history of strangulation perpetrated by an intimate partner have 6.7 higher odds of experiencing attempted and 7.5 times higher odds of experiencing completed intimate partner homicide when compared to women without a strangulation history.[22] However, these identification efforts are complicated by the extent of under-reporting by victims. Only 5% to 29% of victims seek medical attention after an IPV-related non-fatal strangulation attack.[10, 12,23] Furthermore, there is a concerning trend of minimizing non-fatal intimate partner strangulation by health care providers and policymakers with an undue focus on the loss of consciousness as the sole marker of hypoxia. Consequently, non-fatal strangulation may be mentioned in medical notes but is frequently omitted from the final diagnosis or clinical impression. Adding to these challenges, the majority of previous studies have considered head, neck, and facial injuries as an aggregated group offering limited insights into the distinctive nature of neck injuries. This hinders understanding of the connection between neck injuries and potential non-fatal strangulation in IPV.[14, 24-29, 30]

As a result of under-reporting by patients and under-identification by healthcare providers, the true burden of IPV-related strangulation is likely underestimated and needs further investigation.[26, 31] To our knowledge, few studies have utilized national datasets to explore IPV and neck injuries. We wished to further study this question using a national dataset of ED visits, explicitly investigating the estimated (1) events of assault-related anoxia, and assault-related neck injuries, in assault patients and those who experienced IPV, and (2) the presence of IPV in patients presenting with assault-related anoxia and assault-related neck injuries.

## Materials and Methods

### 2.1) Data source

Data from the National Electronic Injury Surveillance System (NEISS) All Injury Program (AIP) were used for this study. NEISS is a probability sample of all hospitals with ED in the United States (US) and has statistical properties to adjust for the nonparticipation from other hospitals to provide national estimates for the number of injuries. This weighted dataset, managed by the U. S. Consumer Product Safety Commission (USCPSC) collects injury data from roughly 100 hospitals with an ED in the US. The NEISS AIP data is in the public domain and housed by the Inter-University Consortium for Political and Social Research (ICPSR). Use of this publicly available, de-identified data, was considered exempt by our local Institutional Review Board. It was not possible to involve patient or public in the design or conduct of our research.

The database includes many variables, such as typical demographics, details of the injuries (anatomic location, cause, incident locale), type and reason of assault, and hospital size based on the number of ED visits per year. Further details regarding this dataset can be obtained at its website.[32]

The NEISS-AIP data for the years 2005 through 2019 was used. Data before 2005 was excluded since it was coded differently for many variables, creating significant problems when trying to combine the years before 2005 with those afterwards. Although the data for 2020 exists, it was excluded as differences in injury patterns and demographics for assault and IPV occurred during this period of the COVID pandemic.[33] Injuries due to assaults were identified with the intent code INTENT =1 (assault). The NEISS defines an assault as “any injury from an act of violence where physical force by one or more persons is used with the intent of causing harm, injury, or death to another person, or an intentional poisoning by another person.”[32] This category includes perpetrators as well as intended and unintended victims of violent acts (e.g., innocent bystanders); it excludes unintentional shooting victims (other than those occurring during an act of violence), unintentional drug overdoses, and children or teenagers "horsing" around. The type of assault [32] is identified by the code REASON, and classified by NEISS as altercation, robbery/burglary, drug-related, sexual assault, gang-related, other specified, and unknown/not specified. Altercation was defined as a heated argument or dispute over traffic, children, gambling, money, property, sex jealousy, politics, ethnicity, race or sexual preference. Sexual assault is defined as the use of physical force to compel another person to engage in a sexual act against his or her will with attempted or completed sex act and abusive sexual contact.”[32] When there is inadequate information in the narrative to describe the assault type, it is classified as unknown. IPV cases were identified as those with the codes of INTENT = 1 and PERP (perpetrator of the assault) = 1 (spouse/partner). Of particular interest in this study was those with a diagnosis code of 65 (anoxia). NEISS defines “anoxia” as when a patient could not obtain sufficient oxygen either due to hampered breathing or lack of oxygen itself due to causes other than poisoning, aspiration, or drowning. This code includes strangulation, suffocation, or asphyxia, in addition to anoxia due to inhaling products of combustion, carbon monoxide, methane, propane or natural gas.[32] To specifically analyze neck injuries, the NEISS body part code of 89 was used.

### 2.2 Statistical analysis

The national estimates of ED visits were obtained using SUDAAN 11.0.01™ software (RTI International, Research Triangle Park, North Carolina, 2013) which accounts for the weighted, stratified nature of the data. The estimated number (N) of injuries/ED visits is calculated, along with 95% confidence intervals [CIs] of the estimate. When the actual number of patients (n) is < 20, the estimated number (N) becomes unstable and should be interpreted with caution; thus, we report both the n and N.

## Results

### Assault-related anoxia:

There were an estimated 24,493,518 (95% CI [23,288,437, 25,725,542] assault-related injuries seen in US EDs between 2005 to 2019; IPV accounted for 11.6% (2,842,862; 95% CI [2,593,864, 3,110,677]). The vast majority of injuries resulting in anoxia (89.7%; 889,691/ 992,025) were unintentional or due to unknown causes. Anoxia was reported in only 0.1% of all assault-related injuries (22,764; 95% CI [16,067, 32,134]) (Table 1, Supplemental File 1) and only 2.3% (22,764/992,025) of injuries resulting in anoxia were

due to assault. There were an estimated 15,672 (68%) women and 7,092 men (31.2%) with an average age of 30.5 years (95% CI [28.1, 32.9]) and race distribution of 54.9% White, 29.5% Black, 15.6% Other. Out of the 2,842,862 IPV-related injuries, 9,184 cases (95% CI [6,362, 12,980]) were associated with anoxia, or 0.3% of the total (Table 2, Supplemental File 1). In contrast, the occurrence of anoxia in other assault types ranged from 0% to 0.2% (average 0.06% (13,580/21,650,656)). Of the 22,764 cases of anoxia due to assault, IPV accounted for 40.4% (9,184/ 22,764) and was the most common cause after excluding those where the mechanism of injury was unknown.

Among assault-related anoxia, 60.5% (13,766/ 22,764) of the injuries were due to inhalation or suffocation, and 30% (6,907/ 22,764) were due to being struck by or against something. The mechanism of assault demonstrated that inhalation and suffocation was the most common mechanism in IPV, accounting for 62.8% (5,765/ 9,185) of injuries, followed by being struck by or against something (34.3%; 3,151/ 9,185). IPV accounted for 41.9% (5,765/13,764) of all assaults resulting in anoxia due to inhalation and suffocation and 45.6% (3,151/ 6,906) due to being struck by or against something (Figure 1).

### Assault-related neck injuries:

Except for sexual assault, the head and neck region was the most common location of injury for all assaults, comprising 57.5% of all assault-related injuries (14,087,953 (95% CI [13,723,058, 14,447,464]). There were an estimated 5,073,933 (36%) women and 9,013,270 men (64%) with an average age of 30.8 years (95% CI [30.3, 31.4]) and race distribution of 48.7% White, 32.2% Black, 17.9% Hispanic, and 1.2% Asian.). IPV accounted for 12% (1,645,356; 95% CI [1,508,707,1,792,709]) of all head and neck assault-related injuries, and 57.9% (1,645,356/2,842,863) of all IPV-related injuries involved the head and neck. While the neck represented only 3% (732,758; 95% CI [673,572, 796, 039]) of all assault-related injuries, 21.4% (156,960; 95% CI [139,869, 175,973]) of all neck injuries were in the IPV group. After excluding drug or gang-related neck injuries, 122,761 of all 697,415 neck injuries (21.9%) were due to IPV (Figure 2). While the neck remains an infrequent site of injury among assault injuries in general, it was the third most common location in IPV assaults (5.5%) after the face (24.9%) and head (22.6%).

Within neck injuries due to assault, a strain or sprain was the most common diagnosis (51.3%; 357,513/ 697,414). Contusions and abrasions were the second most frequent assault-related neck injuries due to IPV (38.5%; 58,845/152,761) after strain/sprain (49.2%; 75,101/152,761) (Table 3, Supplemental File 2). Although cervical spine fractures were reported in only 1% of IPV patients, 9% of all assault-related cervical spine fractures were due to IPV. IPV accounted for 31.9% of all neck contusions, second after unknown mechanism. (Table 4).

## Discussion

To our knowledge, this study is the first to use more than a decade of national ED visit data examining the estimated events of anoxia, and neck injuries among victims of assault and IPV. We found that 11.6% of the perpetrators in assault-related injuries were intimate partners and 40.4% of all assault-related anoxic injuries were due to IPV. Furthermore,

IPV represented 45.6% of all assaults resulting in anoxia due to being struck by or against something, second after an unknown perpetrator. Given the barriers to self-disclosure of IPV and the well-known IPV under-reporting in clinical settings,[24, 29, 33-38] many patients coded for “unknown” perpetrator may also have experienced non-disclosed IPV. The likely presence of unreported IPV within our population suggests even stronger relationships than we were able to identify. Nevertheless, our study demonstrates several important findings that can improve clinical IPV identification and intervention to decrease risk of future mortality.

An intimate partner was the assailant in 40.4% of the assault-related injuries resulting in anoxia, supporting prior literature demonstrating the high burden of asphyxia homicides perpetrated by intimate partners.[39] Strangulation, in particular, has been repeatedly identified as one of the most common forms of IPV perpetration and refers to the pathological external compression of the neck that can prevent blood flow and/or breathing, leading to anoxia and/or asphyxia.[14, 24, 26] We similarly noted a high occurrence of non-fatal strangulation events among this NEISSAIP group of IPV patients. These results likely stem from a combination of factors including 1) the violent nature of IPV, 2) the desire of the perpetrator to exert power and control over the victim, and 3) the accessibility of the neck as a target.[9] Non-fatal strangulation has been suggested to occur later in the course of a violent relationship and is associated not only with more aggressive forms of abuse but also with > 7 times higher odds of mortality.[13, 35]

This study identified several neck injuries that were most common among IPV patients who had experienced likely strangulation. Though the neck was affected in only 3.0% of all assaults and was only the third most common site of IPV-related injuries, over 21% of all neck injuries and 30% of all neck contusions were due to IPV. Similar to prior studies, we found that neck strains/sprains occurred most frequently, though these tend to be fairly non-specific.[24-28, 34] Neck contusions were the second most frequent finding and have also been identified in pre-existing literature as markers of non-fatal strangulation. Contusions typically result from blunt forces or compression that lead to bleeding from blood vessels and cause discoloration in the skin.[24] Patterned bruises can be caused by the perpetrator’s fingers, fingernails, bitemarks, or the pattern of the object used to strangle the victim.[11, 16, 17] Internal injuries to the neck were also noted, which may be the result of blunt force applied to the neck and resulting edema that can damage underlying neck structures (e.g., larynx, oropharynx, major vessels, hyoid, cricoid/thyroid cartilage, etc.). These internal injuries can serve as red flag symptoms acutely in addition to increasing morbidity/mortality over time.[40] Finally, we found that neck fractures were the least common neck injury reported by IPV patients, which aligns with the relative rarity of cervical spine fractures due to blunt assault and manual strangulation. Kulvatunyou et al. reported that only 0.7% of patients admitted with a blunt assault diagnosis in a Level I trauma center had a cervical spine fracture or dislocation.[39] In our study, fractures represented only 2.3% of all assault-related neck injuries, although 9% of all neck fractures were due to IPV. Our results suggest that although neck fractures are less likely to occur due to strangulation in general, forced hyperflexion-extension or whiplash injuries of the spine can occur with attempted IPV-related strangulation because of violent pulling, pushing, shoving, and shaking of the neck by the perpetrator.[14]

Our findings can be applied clinically to improve clinical screening and detection of IPV. First and foremost, the neck should be thoroughly examined for evidence of injury in all patients, especially those with IPV risk factors. Even when a negative Computerized Tomography (CT) scan of the cervical spine is obtained, healthcare providers should not overlook the importance of inspecting the neck as our research has revealed that one-third of assault-related neck contusions stem from IPV. Furthermore, existing evidence indicates that females who have experienced a concussion (i.e., a potential marker of IPV) are at higher odds of comorbid neck injuries.[40] By proactively examining the neck for visible injuries in patients suspected of IPV, we can utilize neck injuries as specific indicators and raise concerns about potential IPV, given their high occurrence within the context of under-reported cases of IPV. Notably, these injuries may also serve as red flags for strangulation and subsequent anoxia. Therefore, we recommend screening all IPV patients for potential strangulation. A recent study by Messing et al. demonstrated that, a large proportion of the interviewed subjects reported surviving multiple strangulation events, and survivors were found to be more likely to seek medical care as the severity and number of strangulation attacks increased.[5] To ensure comprehensive care for IPV patients, it is vital that all individuals at risk of experiencing IPV be screened for potential strangulation. The providers should consider non-fatal strangulation not only in the current presentation of injuries but also in pre-existing histories among patients at risk of experiencing IPV.[5] Non-fatal strangulation is associated with a host of physical, emotional, and neurobehavioral needs that must all be addressed in patients' clinical management and coordination of care. Providers can mitigate and address the adverse repercussions of IPV-related non-fatal strangulation by intentionally and proactively developing clinical policies and procedures that optimize the care, interventions, and coordinated services needed for these patients.

### Limitations:

Despite the strengths of our study, we acknowledge several limitations. One such limitation is the historical constraint of the NEISS, which, until recently, only permitted a single diagnosis. This restriction hinders our understanding of the various risk factors and their association with injury patterns. The NEISS database lacks specific information regarding strangulation incidents and the correlation between anoxia and neck injuries. Nevertheless, considering the substantial occurrence of anoxia and neck injuries among individuals experiencing IPV, it strongly indicates the heightened prevalence of strangulation cases. The internal organ injuries reported in the database include injuries to brain, thoracic and abdominal organs only, and not deep organs in the neck. We are also unable to consider the details of individual injury types (e.g., locations of neck fractures). Our dataset only includes injuries reported in ED settings and does not include injuries treated in other healthcare settings. The NEISS study population tabulates injuries documented by healthcare providers, which is universally limited by patient under-reporting, provider under-detection, and inconsistent diagnostic codes. Finally, the NEISS definition of anoxia captures hypoxia due to the inclusion of insufficient and not complete lack of oxygen without any information on circulatory or respiratory compromise.

## Conclusions

Our findings underscore the alarming occurrence of intimate partner violence (IPV) as the cause of 40.4% of assault-related injuries resulting in anoxia, with non-fatal strangulation emerging as a significant contributor through inhalation/suffocation and forceful impact against objects as dominant mechanisms. With one-third of neck contusions attributable to IPV, we strongly recommend implementing comprehensive screening of all patients presenting with unexplained neck injuries for IPV. Furthermore, it is crucial to systematically screen all patients experiencing IPV or a history of IPV for the presence of non-fatal strangulation. Healthcare providers must acknowledge the gravity of strangulation, considering its immediate medical consequences, heightened fatality risk, profound psychological impact on survivors and legal implications. The aftermath of non-fatal strangulation and neck injuries can present with a complex mixture of physical, emotional, and neurobehavioral manifestations, requiring careful evaluation, assessment, safety planning, and multidisciplinary follow-up. By adopting these proactive screening protocols, healthcare providers can identify cases of IPV and strangulation at an early stage, allowing for timely intervention and support.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Source of Support:

Bharti Khurana receives support from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) and the Office of the Director, National Institutes of Health (1R01eb032384-01a1) and the National Academy of Medicine Scholar in Diagnostic Excellence Program.

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**Key messages:**

**What is already known on this topic:**

Intimate Partner Violence (IPV) could involve non-fatal strangulation, which is challenging to identify and often under-reported.

**What this study adds:**

By demonstrating a high occurrence of IPV-related injuries leading to anoxia and neck injuries, the study suggests a substantial burden of non-fatal strangulation among IPV patients presenting to the Emergency Departments.

**How this study might affect research, practice or policy:**

Patients with unexplained neck injuries should undergo thorough screening for IPV, and all IPV patients must be evaluated for incidents of strangulation.

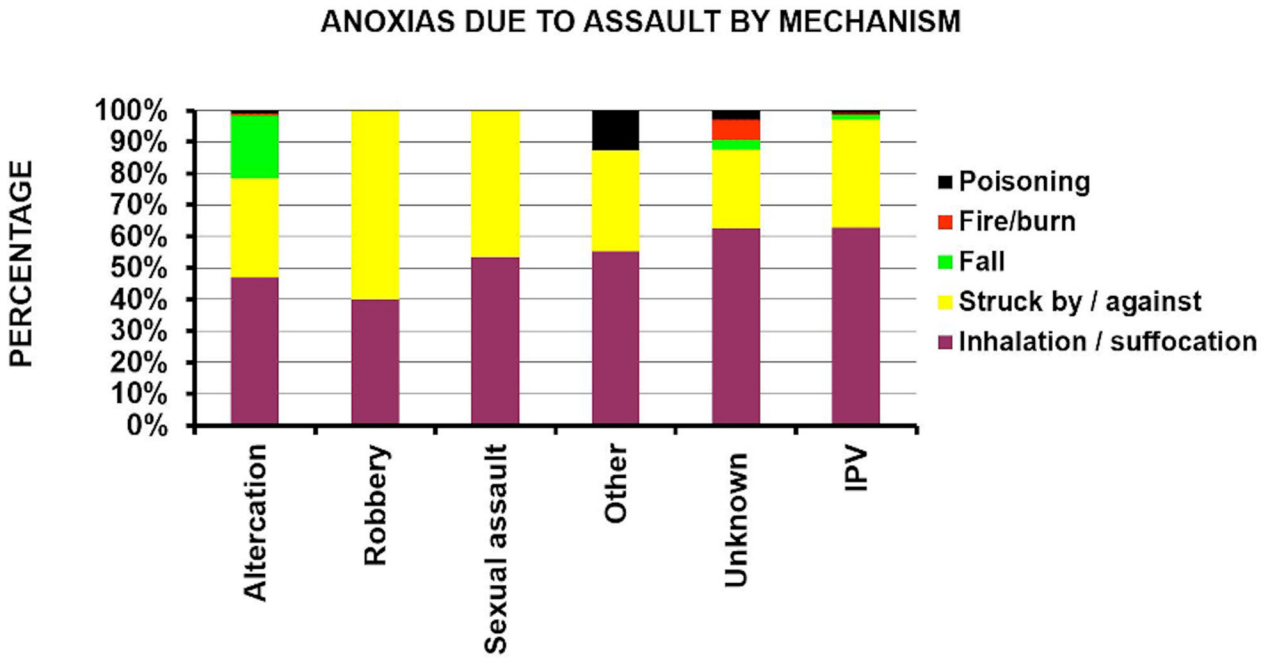


**Figure 1:**

Percentage incidence of different mechanisms contributing to 22,764 assault-related anoxia cases reported in the NEISS AIP database from 2005 to 2019 based on the type of assault.

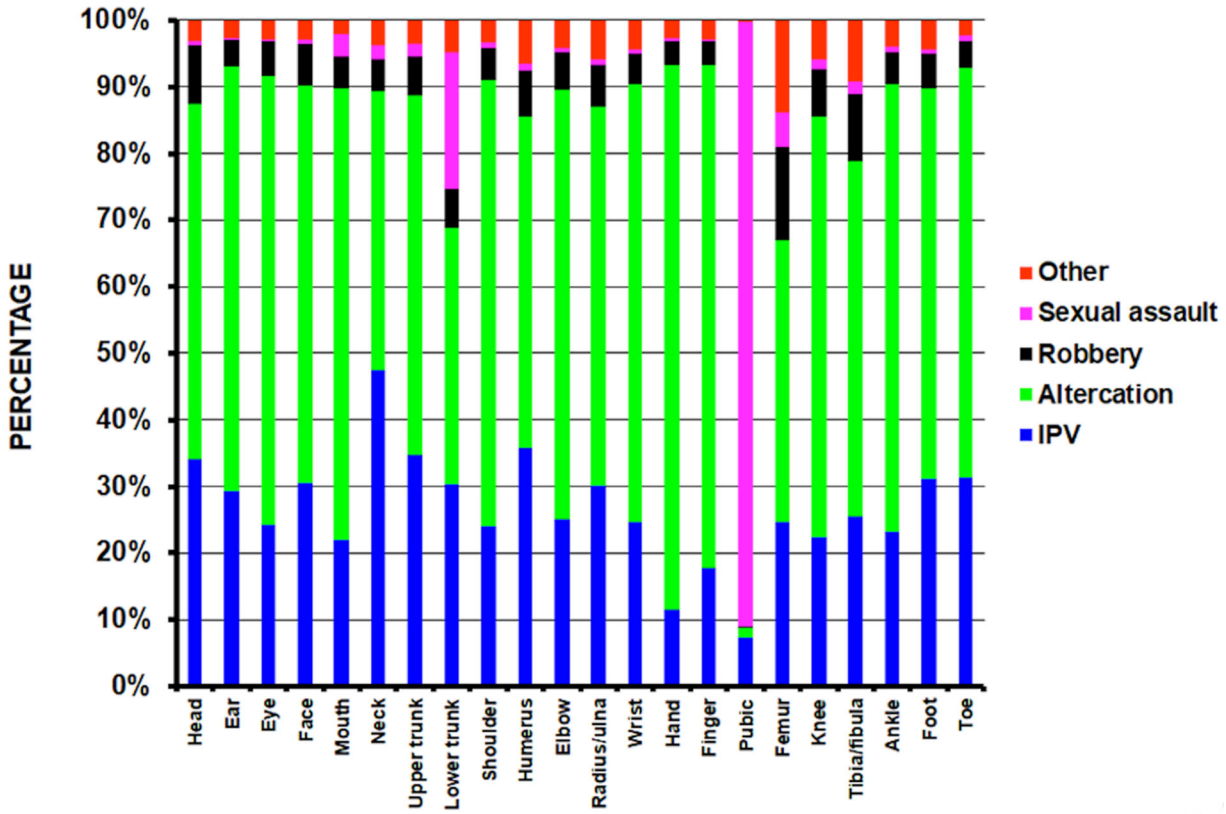


**Figure 2:**

Percentage anatomic distribution of injuries based on the etiology of 24,493,518 injuries from assaults (after excluding “unknown”) reported in the NEISS AIP database from 2005 to 2019.

**Table 1:**

Type of injuries based on 24,493,518 assault-related injuries reported in the NEISS AIP database from 2005 to 2019.

| Diagnosis | n[a] | N[b] | L95% | U95% | % |
|---|---|---|---|---|---|
| Contusions/abrasions | 124,299 | 6,956,437 | 6,373,213 | 7,570,946 | 28.4 |
| Fracture | 59,202 | 3,203,661 | 2,919,627 | 3,509,921 | 13.1 |
| Laceration | 90,128 | 4,724,133 | 4,166,347 | 5,337,138 | 19.3 |
| Strain/sprain | 23,788 | 1,378,423 | 1,143,847 | 1,658,211 | 5.6 |
| Internal organ | 61,649 | 3,287,040 | 2,860,843 | 3,764,654 | 13.4 |
| Concussion | 11,938 | 606,946 | 458,029 | 800,938 | 2.5 |
| Unknown | 64,558 | 2,668,093 | 2,260,752 | 3,137,620 | 10.9 |
| Poisoning | 1,778 | 105,577 | 83,278 | 132,265 | 0.4 |
| Anoxia | 433 | 22,764 | 17,145 | 31,842 | 0.1 |
| Other | 33,250 | 1,560,465 | 1,320,201 | 1,792,926 | 6.4 |

[a]"n" = actual number of patients

[b]"N" =estimated number of patients

L95% = lower 95% confidence interval of N

U95% = upper 95% confidence interval of N

**Table 2**

Type of injuries based on etiology of 24,493,518 assault-related injuries reported in the NEISS AIP database from 2005 to 2019.

| Diagnosis | Altercation | Robbery | Sexual Assault | Other | Unknown | IPV |
|---|---|---|---|---|---|---|
| Contusions / Abrasions | 1,651,764 (28.5%) | 132,989 (22.2%) | 55,139 (4.9%) | 123,859 (34.5%) | 3,896,487 (28.3%) | 1,096,199 (38.6%) |
| Fractures | 929,895 (16.01%) | 92,057 (15.4%) | 3,788 (0.3%) | 39,086 (10.9%) | 1,886,299 (13.7%) | 252,536 (8.94%) |
| Lacerations | 1,297,728 (22.4%) | 134,575 (22.5%) | 12,054 (1.1%) | 38,595 (10.7%) | 2,773,945 (20.1%) | 467,235 (16.4%) |
| Strains / Sprains | 516,086 (8.9%) | 26,672 (4.5%) | 3,964 (0.4%) | 32,408 (9.0%) | 587,400 (4.3%) | 211,894 (7.5%) |
| Internal Organ | 552,916 (9.5%) | 101,204 (16.9%) | 9,324 (0.8%) | 36,366 (10.1%) | 2,195,466 (15.9%) | 391,764 (13.8%) |
| Concussions | 114,136 (2.0%) | 14,227 (2.4%) | 589 (0.1%) | 5,735 (1.6%) | 410,153 (3.0%) | 62,106 (2.2%) |
| Unknown | 357,410 (6.2%) | 48,883 (8.2%) | 1,000,148 (89.8%) | 46,579 (13.0%) | 1,019,974 (7.4%) | 195,098 (6.9%) |
| Poisoning | 18,274 (0.3%) | 2,129 (0.4%) | 13,189 (1.2%) | 1,795 (0.5%) | 57,179 (0.4%) | 13,012 (0.5%) |
| Anoxia | 1,797 (0.0%) | 412 (0.1%) | 407 (0.0%) | 637 (0.2%) | 10,305 (0.1%) | 9,184 (0.3%) |
| Other | 362,067 (6.2%) | 46,060 (7.7%) | 11,921 (1.4%) | 33,400 (9.5%) | 938,952 (6.8%) | 143,834 (5.1%) |

^The 95% confidence intervals are shown in Supplemental file 1.

**Table 3:**

Diagnosis of injury by type of assault in those with only neck injuries.[^]

| | Altercation | | Robbery | | Sexual Assault | | Other | | Unknown | | IPV | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | p value |
| **Contusion/abrasion** | 28,522 | 21.6 | 3,863 | 26.7 | 3,023 | 44.4 | 3,214 | 27.9 | 86,888 | 22.9 | 58,845 | 38.5 | $< 10^{-4}$ |
| **Fracture** | 2,127 | 1.6 | 889 | 6.1 | 46 | 0.7 | 453 | 3.9 | 11,304 | 3.0 | 1,467 | 1.0 | |
| **Lacereation** | 16,063 | 12.2 | 2,466 | 17.0 | 95 | 1.4 | 551 | 4.8 | 55,143 | 14.5 | 8,566 | 5.6 | |
| **Strain/sprain** | 76,331 | 57.9 | 5,822 | 40.2 | 1,496 | 22.0 | 6,271 | 54.5 | 192,492 | 50.6 | 75,101 | 49.2 | |
| **Internal organ injury** | 252 | 0.2 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 603 | 0.2 | 24 | 0.0 | |
| **Unknown** | 8,452 | 6.4 | 1,450 | 10.0 | 2,142 | 31.5 | 1,022 | 8.9 | 33,673 | 8.9 | 8,758 | 5.7 | |

The percentages are column percentages.

[^]The 95% confidence intervals are shown in Supplemental file 2.

**Table 4:**

**Percentage injury patterns based on 732,758 assault-related neck injuries reported in the NEISS AIP database from 2005 to 2019.**

The values are column percentages.

| | Contusions / Abrasions | Fractures | Lacerations | Strains / Sprains | Internal Organ | Unknown |
|---|---|---|---|---|---|---|
| **Altercation** | 15.5 | 13.1 | 19.4 | 21.4 | 28.7 | 15.2 |
| **Robbery** | 2.1 | 5.5 | 3.0 | 1.6 | 0.0 | 2.6 |
| **Sexual assault** | 1.6 | 0.3 | 0.1 | 0.4 | 0.0 | 3.9 |
| **Other** | 1.7 | 2.8 | 0.7 | 1.8 | 0.0 | 1.8 |
| **Unknown** | 47.1 | 69.4 | 66.5 | 53.8 | 68.6 | 60.7 |
| **IPV** | 31.9 | 9.0 | 10.3 | 21.0 | 2.7 | 15.8 |