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Injury Patterns and Demographics in Older Adult Abuse and Falls: A Comparative Study in Emergency Department Settings

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Abstract

Background: Falls and interpersonal violence pose significant threats to older adults, leading to injuries, hospitalizations, and emergency department (ED) visits. This study investigates the demographics and injury patterns in older adults (aged 60 and above) who sought ED care due to assaults, comparing them with those who experienced falls to gain a deeper understanding of older adult abuse patterns.

Method: This study utilizes data from the National Electronic Injury Surveillance System (NEISS) All Injury Program (2005–2019) to examine injuries among older adults aged 60 years and above. Participants were categorized into two groups: older adult abuse and injuries due to falls. The differences between the groups by demographics, injury locations, patterns, and temporal trends were analyzed using statistical methods accounting for the weighted stratified nature of the data. Cosinor analysis and Joinpoint regression were used for temporal analysis.

Results: Over 15 years, there were an estimated 307,237 ED visits for older adult abuse and 39,477,217 for falls. Older adults experiencing abuse were younger and had lower hospital admission rates compared to fall patients. Injuries associated with abuse included contusions/abrasions, penetrating injuries, and fractures to the head/neck, fingers, toes, ribs, and lower extremities. In contrast, fall patients had higher admission rates, with more fractures, including

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cervical spine and hip fractures. Temporal patterns showed a higher rate of assaults during the summer, while abuse demonstrated bimodal peaks in the summer and fall.

Conclusions: Injuries associated with abuse such as facial, upper trunk, and upper extremity fractures should raise suspicion even in the absence of severe symptoms. These findings emphasize the importance of early identification to connect older adults with support resources, as patients experiencing abuse often get discharged from the ED.

Keywords

Abuse; Older Adult abuse; Interpersonal violence; Assault; Falls

INTRODUCTION

Falls are frequently seen in older adults, with over 33% experiencing them each year,[1,2] leading to 10% of emergency room visits and 6% of acute hospitalizations.[3,4] The resulting injuries often include fractures, soft tissue injuries, and head injuries.[2–4] Aside from falls, another concerning issue is interpersonal violence. Each year, over 10% of older adults experience abuse,[5] which leads to 0.013% of emergency department (ED) visits[6] and increases risk for hospitalizations.[7] Injuries in this category usually include: fractures, contusions, abrasions, and lacerations, especially to the head/neck, trunk, and upper extremities.[8]

Older adult abuse is a growing public health concern in the United States (US),[9–12] where violence rates are notably higher than in other industrialized nations.[13–16] Patients confront fear around reporting abuse. This adds complexity to the already challenging dynamics in the ED characterized by a chaotic environment; unclear communication; cognitive, auditory, and visual impairments, emotions, and varying levels of health literacy.[17] Furthermore, identifying abuse in cognitively impaired older adults in the ED is particularly challenging due to overlapping of symptoms with other comorbidities and a lack of specialized training and standardized identification protocols.[17] Despite these challenges, ED providers should interview others, including family members, the primary care physician, or neighbors, apart from the patient to compare all accounts.[18] Healthcare professionals' age-related biases around interpersonal violence limit the screening of older adults; up to 60% of physicians have never asked their older adult patients about abuse.[19] Even when older adult abuse may be suspected in the ED setting, providers may hesitate to act on it due to inadequate training, unawareness of reporting resources, and a focus on identifying critical injuries and not underlying conditions.[6] In most US states, physicians are mandated to report older adult abuse across all settings. However, studies have revealed a significant gap between screening guidelines and their implementation by physicians. For instance, a study focused on Adult Protective Services cases indicated that physicians reported merely 2% of suspected cases.[20]

Nevertheless, according to self-reported data gathered from the National Intimate Partner and Sexual Violence Survey (NISVS) in a non-ED setting, 14% of individuals aged 70 years or older reported abuse in the previous year. Within this group, 1.7% reported physical abuse, with 27.4% of physical abuse incidents attributed to intimate partner violence.[20] Furthermore, 7% of older adults in the ED (with no cognitive deficits and who live in the

community) report some form of abuse.[20] Findings from the National Elder Mistreatment Study indicate that older adults subjected to emotional abuse from spouses during their lifetime have an increased incidence of physical abuse after the age of 60.[21] Middle-aged and older women who have been exposed to physical violence face a greater risk of mortality compared to women who have not reported any abuse.[22–23]

The high prevalence of falls in older adults often complicates the task of distinguishing between injuries resulting from accidental falls and those arising from abuse. Therefore, this study aims to analyze older adults (aged 60 and above) who seek emergency care, with the objective of identifying distinct injury patterns and demographics that are indicative of older adult abuse as opposed to unintentional falls. Our research addresses the Geriatric Emergency Care Applied Research priority of identifying and differentiating abuse from falls, with the potential of developing a standardized approach to targeted screening for older adult abuse and identifying etiology for falls.[24]

METHODS

Study design

Our study utilized the National Electronic Injury Surveillance System (NEISS) All Injury Program (AIP) data, a database operated by the US Consumer Product Safey Commission in collaboration with the Centers for Disease Control and Prevention. NEISS injury data are gathered from the EDs of approximately 100 hospitals selected as a probability sample of all US hospitals with EDs.[25–27] The NEISS data collection process begins when a patient is admitted to the ED of a NEISS hospital with an injury. An ED provider elicits critical information about how the injury occurred and enters that information into the patient's medical record. Then, a trained NEISS hospital coordinator reviews all ED records, selecting those that meet the criteria for inclusion in NEISS, abstracting and coding the key variables onto a coding sheet, following the NEISS Coding Manual guidelines.[28] This study was considered exempt by our local Institutional Review Board due to its publicly available, deidentified nature. Details of this database can be accessed at the website,[28] as well as several earlier publications from our group on injury and temporal patterns related to intimate partner violence.[25–27]

Selection of participants

The database includes many typical demographic variables, as well as types of assault, types and locations of injuries, and hospital size. Race was classified as White, Black, Hispanic, Asian, Native American, and Other using the NEISS codes for RACETH_C. For the current study, data from 2005 – 2019 was used. While 2020 data was available at the time this study began, it was excluded as many different injury patterns emerged during the COVID pandemic.[29–32]

Measurements

Injuries due to assaults were identified using the code INTENT = 1 (assault). Two groups of older adults were created. The first group was those assaulted (NEISS code INTENT = 1) by individuals known to the patient (NEISS PERP codes 1 through 5 – spouse/partner,

parent, other relative, unrelated caregiver, and friend/acquaintance), indicating a likely older adult abuse group – physical injury sustained during an assault by someone known to the individual. The second group was those who sustained a fall (NEISS codes INTENT = 0 [unintentional/accidental] and ICAUSE_C = 6 [fall]). We denote these as injuries related to older adult abuse group (OAA) and fall group.

Analysis

The national estimates of ED visits were obtained from this weighted, stratified data set using SUDAAN 11.0.01™ software (RTI International, Research Triangle Park, North Carolina, 2013). The estimated number (N) of injuries is calculated, along with 95% confidence intervals [C.I.s] of the estimate. Analyses between groups of continuous data were performed with the t-test (2 groups) or ANOVA (3 or more groups). Differences between groups of categorical data were analyzed by the $\chi 2$ test.

Cosinor analysis[30] was used to analyze for rhythmic variation by weekday or month. Cosinor analysis is a best fit of the data to a cosine curve. This curve is defined by the equation $F(t) = M + A\cos(\omega t + \varphi)$, where M = the mean level (termed mesor), A = the amplitude of the cosine curve, φ = acrophase (phase angle of the maximum value), ω = the frequency (which for week day analysis is 360°/7 = 51.4° and monthly analysis is 360°/12 = 30°), and t = time (which in this study is each day or month). Joinpoint regression analysis (Joinpoint Regression Program, Version 4.8.0.1, April 2020; Statistical Research and Applications Branch, National Cancer Institute [https://surveillance.cancer.gov/joinpoint/]) was analyzed for percentage changes over time. An $\alpha < 0.05$ was considered statistically significant. We followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting standards for this study.

RESULTS

Over this 15-year period, there were an estimated 307,237 patients seen in the ED in OAA and 39,477,217 in the fall group.

Characteristics of study subjects (Table 1 & Supplementary Table 1)

There were significant differences in the average age between the two groups (OAA– 68.5 years, fall – 77.1 years). The fall group was older due to the largest percentage of patients ≥ 85 years old ($p<0.001$) (Figure 1). The percentage of injuries decreased across age for both OAA and the fall group, with nearly half of injuries seen between 60 and 64 years of age (OAA – 43.9%, fall – 52%). There was a higher percentage of females in the fall group (66.2%), compared to OAA (53.1%). While the majority of patients in both groups were White, there was a higher representation of Black patients in OAA (22.8%) compared to the fall group (7.5%; $p<0.0001$). There was a slightly higher representation of Hispanics in OAA (6.4%) compared to the fall (4.0%) group. The most common incident locale was the home in both.

Anatomic location of injury (Figure 1)

The head/neck was the most commonly injured area in both groups: OAA (53.7%) and fall (35.4%; p<0.0001). The lower extremity was the second most common location of injury in the fall group (16.5%), while it represented the least common site of injury for OAA (5.5%). The upper extremity represented the second most common site of injury after the head/neck for OAA (19.2%). The lower trunk was more commonly injured in the fall group (19.8%), compared to OAA (7.9%).

Injury Patterns and Severity

There were significant differences between major diagnoses, with contusion/abrasion being the most common diagnosis in OAA (38.4%) and fracture the most common diagnosis in the fall group (35.7%; p<0.001). OAA group had more internal organ injuries (16.9% and 21%, respectively) and lacerations (14.3% and 18.4%, respectively) than fractures (13.4% and 16.2%, respectively). However, lacerations represented only 10.7% of all injuries in the fall group. While most of the patients were released from the ED, there were more hospital admissions in the fall group (27.2%) compared to OAA (11.7%; p<0.0001).

Fracture locations (Table 2 & Supplementary Table 2)

The face was the most common site of fracture for OAA (32.3%), while only 4.6% of patients in the fall group had facial injuries. The lower trunk was the most common fracture site among the fall group (34.1%), but it represented only 10.9% for OAA. The upper trunk (e.g., rib, thoracic spine) was the second most common location of fracture for OAA (17.5%), and the third most common site for the fall group (10.0%).

There were also significant differences between the groups for the detailed fracture locations (Figures 1 and 2). Neck fractures were much higher in the fall group (23%), compared to the OAA (3.1% p<0.001). Within upper extremity fractures, the percentage incidence of finger fractures was higher in OAA (20.3%), compared to the fall group (4.6%, p<0.001). Tibial/fibular fractures were the most common lower extremity fractures in OAA (28.3%), while they represented only 18.7% of all lower extremity fractures in the fall group. There was a higher representation of toe fractures in OAA (11.7%), compared to the fall group (3.3%; p<0.001).

Perpetrators

Within the OAA abuse group, the perpetrator was reported as a friend/acquaintance in 47.6%, another relative in 31.1%, and a spouse/partner in 20.5%. Of the 15 cases reported to be perpetrated by a parent, 14 patients were between 60 and 70 years. Thus, it is possible that a child in their early 60s being cared for by a parent in their 80s could be abused; this would be especially so if the child/abused patient had underlying developmental or cognitive issues, likely due to the complicated nature of this relationship and related health stressors.[33]

Temporal patterns (Supplementary Table 3)

Joinpoint regression analysis demonstrated that there was a gradual increase in the number of patients seen over time for both groups. The average annual percentage increase for the OAA group was 8.06% and for the fall group 4.24% ($p<0.05$).

The fall group had a relatively similar distribution across all months with a slightly higher prevalence in December and January but was not statistically significant (cosinor analysis, $p = 0.10$). Although injuries seemed slightly more common on weekends for abuse cases, they were relatively stable throughout the week for the fall group; none were statistically significant with cosinor analysis[34] ($p=0.34$).

DISCUSSION

This study examined injury trends among older adults who experienced interpersonal violence compared to those who experienced a fall. We identified an inverse relationship between age and abuse, whereas fall patients were the oldest compared to all other groups. The majority of patients experiencing abuse and those who had suffered a fall were women. OAA had lower hospital admission rates and experienced contusions/abrasions, penetrating injuries, and fractures to the head/neck, fingers, toes, ribs, and/or lower extremities. Alternatively, those who experienced falls had higher hospital admission rates, having sustained the highest percentage of fractures, including cervical spine and hip fractures (Figure 1).

Consistent with previous studies, we noted a lower representation of older patients within OAA, which emphasizes the importance of education and awareness efforts for healthcare workers encountering such populations at commonly accessed touchpoints (i.e., the ED). Although an educational intervention designed for Emergency Medicine residents exists, providing comprehensive knowledge on older adult abuse,[22] there is an absence of a standardized care protocol for responding to older adult abuse in the ED. The absence of rigorously evaluated interventions can be attributed to factors such as limited funding for research and a related scarcity of investigators dedicated to studying acute care for older adults.[35] Additionally, the low rates of older adult abuse identification may contribute to the misconception that a greater focus on older adult abuse is not imperative.[35]

To address these issues, The National Collaboratory to Address Elder Mistreatment has crafted a free toolkit designed for use by hospitals focusing on screening and referral procedures in the ED, integrated with community support networks for post-discharge and is partnered with Geriatric Emergency Department Collaborative (www.gedcollaborative.com). Finally, geriatric EDs have been evolving, acknowledging that the current ED model is inadequate for older adult care.[36] A hospital that has received the American College of Emergency Physician's Emergency Department Accreditation is fitted with interdisciplinary staff who are geriatric-trained and has standardized approaches to common geriatric health problems.[37]

Ageism in medicine may only be coupled with additional biases about a patient's identity. Our observation of a reduced representation of Black individuals seeking acute care for

falls implies the existence of health disparities with limited access to healthcare services.[37] Alternatively, this could be explained by data that shows older Black adults have a lower risk of fracture due to increased bone density and slower osteoporotic decline with aging.[38] Nevertheless, we share the vision of the *Journal of the American Geriatrics Society*, which underscores the substantial evidence highlighting the intersection between structural racism and ageism in the field of medicine.

Additionally, we found that certain injury locations (i.e., face, hand, finger, ribs) and patterns (i.e., contusions, abrasions) were more frequent among patients experiencing abuse and should therefore serve to increase clinical suspicion of older adult abuse in acute care settings. Previous studies also underline "superficial injuries," such as contusions, being associated with older adult abuse. In fact, one study showed a rate of contusions in older adult abuse populations to be nearly three times higher than that of the general ED population.[6] Facial, upper trunk, and upper extremity fractures may reflect defensive injuries[9] that exposed patients' upper trunk or back to injury.[39] Lower leg fractures may be caused by blunt force trauma or falls[8] or by curling up to protect the central body from a perpetrator. Our findings can be applied by providers in ED settings to better screen and intervene on interpersonal violence experienced by older adults.

Among the fall group, fractures were the most common injury type and were typically associated with injuries to the cervical spine, as well as the lower trunk. Of the head/neck injuries, cervical spine fractures were rare in OAA and more common in the fall group (Figure 1), which aligns with previous guidance that older adults with a history of acute falls be evaluated for a cervical spine fracture to be ruled out.[40] Lower trunk (e.g., pelvis, hip) fractures were also more common in the fall group.[41] Patients in the fall group who presented with these injuries were more likely to be admitted to the hospital, while patients in OAA presenting with interpersonal violence-related injuries (e.g., upper extremity fractures, facial fractures, contusions/abrasions) were more likely to be discharged from the ED. Retrospective studies have shown similar trends with shorter average lengths of stay for interpersonal violence-related injuries−−3 days for facial injuries[42] and no admission for upper extremity fractures.[43] Alternatively, fall-related injuries involve more inpatient care, with most hip fractures requiring hospital admission [44] and concomitant upper extremity fractures lengthening hospital stays.[45] Our findings that patients experiencing abuse were more likely discharged after receiving acute care in the ED stresses the importance of ED-based efforts to identify such patients and connect them to appropriate resources for follow up and additional care regarding social issues. Early discharges leave patients experiencing abuse with less access to inpatient counseling/support and may even place them back into a potentially dangerous situation with their abuser. Our findings that patients experiencing abuse were more likely discharged after receiving acute care in the ED stresses the importance of ED-based efforts to identify such patients and connect them to appropriate resources for more comprehensive care.

Findings on perpetrator demographics in this study are markedly different than 2010 NISVS data, which states that nearly 50% of interpersonal violence and sexual abuse perpetrators are a current or former intimate partner.[46–47] This is compared to only 20.5% of perpetrators being identified as spouse/partner in our dataset, suggesting significant underreporting of

abuse. Stigma around reporting violence, especially that caused by a partner, may play a role in the low rates of spousal abuse documented in this group.[48] Interestingly, nearly 50% of perpetrators in this study were friends/acquaintances, which may further indicate underreporting of familial interpersonal violence due to fear of caretaker status and living situation; nevertheless, there were several documented cases of older adult abuse where the parent was the perpetrator. It is possible that this relationship may represent a parent of a disabled older adult in a caretaker role. The older adult parent relationship with children is often complex and influenced by codependency as well as potential health problems that accompany aging.[49] Furthermore, underreporting of older adult abuse may be partially caused by recurrent episodes of trauma that impact cognition.[50] Additionally, cultural barriers, language barriers, and stigma may impact older adults' trust in self-reporting sensitive issues like interpersonal violence.[51] Although the dynamics between patients and perpetrators of interpersonal violence are considered more extensively by the multidisciplinary longitudinal care team, they can be important for ED providers to keep in mind during the screening and assessment process. Patients experiencing abuse are less likely to self-disclose violence in the company of their perpetrator, so understanding most common perpetrator profiles can inform ED providers' judgment around speaking to the patient alone, asking for security, and/or passing off information to the longitudinal care team.[52]

Recognizing the challenges within EDs is crucial, particularly in the context of physician burnout, high attrition rates, and overcrowding. These factors contribute to problems that affect the hospital and its patients: increased waiting times, medical errors, and financial losses.[53] The imperative to provide timely care, coupled with reimbursement structures based on volume, makes the thorough assessment of older adult abuse increasingly challenging. The integration of artificial intelligence and machine learning in electronic medical records might offer a promising solution.[54] By analyzing large datasets to detect injury patterns and frequent ED visits, it can facilitate the abuse detection and reporting process, enabling quicker and more effective interventions.

Study Limitations

In addition to its significant size, the NEISS data collection protocols maintain a high level of accuracy ranging from 89% to 98%.[55] Nevertheless, it is crucial to acknowledge that the participants in this study are solely derived from the reports by ED providers and is dependent on the completeness of data capture and coding by the NEISS hospital coordinator. This national database lacks detailed, granular information (such as specific data on nursing home facilities, forensic nurse examination, imaging reports, underlying medical conditions of the injured patient) due to its broader scope and focus on nationwide trends and statistics. Our study does not include patients who sought assistance in other settings nor those who experienced interpersonal violence but did not report it to the ED providers. The dataset also does not include details around prior interpersonal violence counseling, associated injuries, injuries due to neglect, whether injuries resulted from victimization or perpetration, and whether injuries were isolated versus recurrent incidents. Furthermore, the NEISS AIP excludes data from fatal injuries. Thus, homicidal interpersonal violence trends are not represented in this analysis. Also, it is important to note that while

this study does report the relation of the perpetrator to the patient, no data was collected about the patient's main caregiver, which may indicate a helpful direction for future research to better understand the complexity of the relationship between perpetrators and patients.

In conclusion, this study provides valuable insights into ED visit trends for assault injuries among older adults, aiding healthcare providers in recognizing patterns of interpersonal violence. Given the lower hospital admission rates for patients who were abused, awareness of specific injury patterns, like hand, finger, and facial fractures and contusions/abrasions, is vital in suspecting abuse. Improved screening protocols are essential to address this growing concern, particularly in the context of an aging population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- Older adults who experienced abuse are less likely to be admitted to hospitals, indicating the need for proactive identification and support in the Emergency Departments.
- Specific injury locations and types associated with abuse, such as fractures to the head/neck, fingers, toes, ribs, and lower extremities, can aid healthcare providers in recognizing potential abuse cases.
- The inverse relationship observed between age and the reporting of abuse among older adults emphasizes the complex challenges faced by older adults in disclosing interpersonal violence.

Why Does this Paper Matter?

The study's use of a large, nationally representative dataset spanning 15 years provides a comprehensive analysis of injury patterns and demographics among older adults (aged 60 and above) who sought emergency care due to abuse and falls.

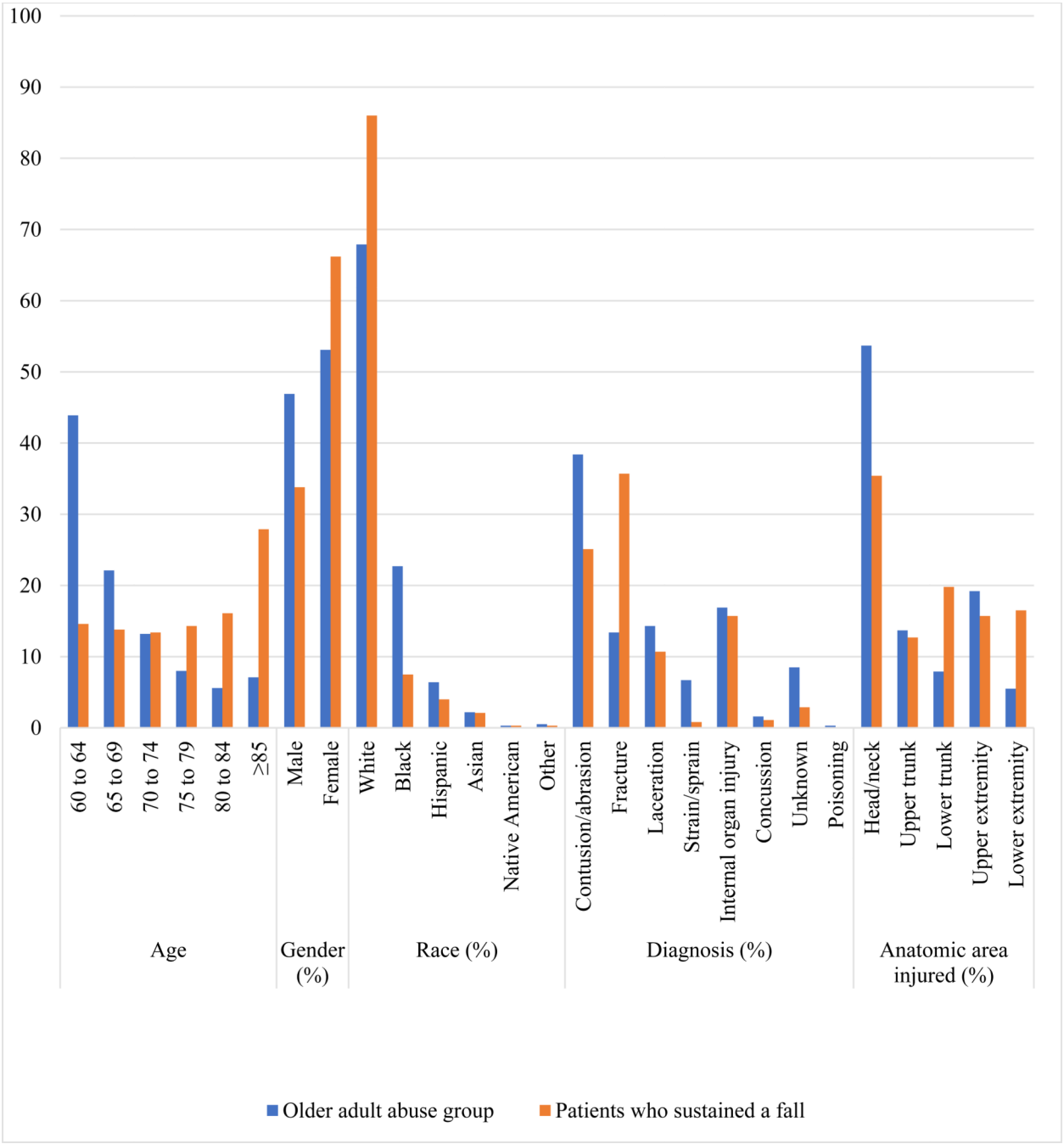

Figure 1:

Differences in demographics of the patient population, showing an overall younger population for the abuse group and a higher proportion of White individuals in both groups. Injury pattern characteristics are also included, with a higher incidence of contusions in cases of abuse and fractures in the fall group. The head and neck region represents the most commonly affected anatomical region of injury across both groups.

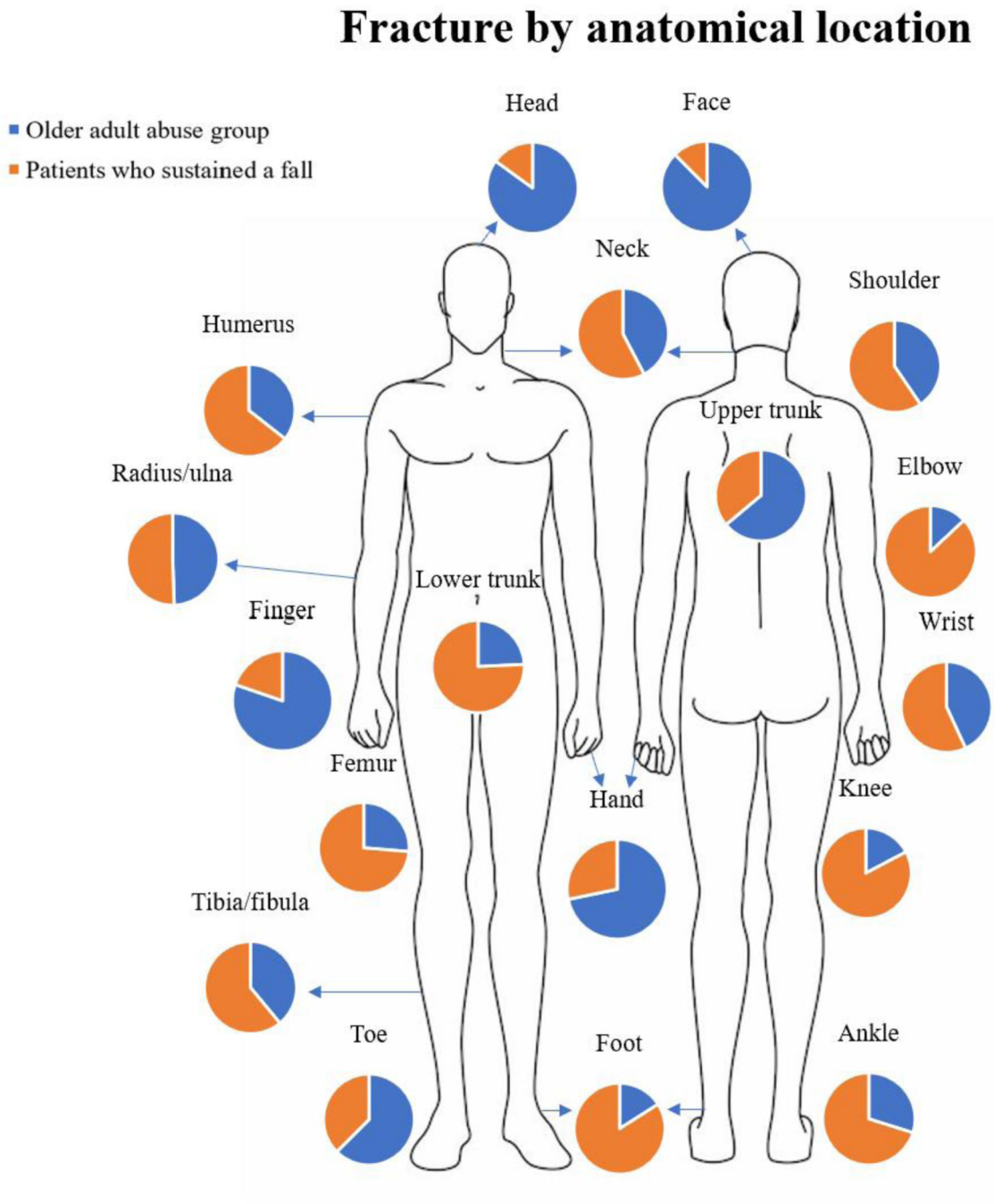

Figure 2:
Exploring trends in fracture location between groups, demonstrating the highest rates of face fractures in the abuse group, while the highest percentage of the fall group had lower extremity fractures.

Table 1:

Differences in demographics of injuries sustained by both groups of adults ≥ 60 years old.

	Older adult abuse group (OAA)		Patients who sustained a fall		P-value
Variable	**N**	**%**	**N**	**%**	
All	307,237		39,477,217		
Age group					
60 to 64	134,804	43.9	5,749,184	14.6	0.0001
65 to 69	67,882	22.1	5,432,235	13.8	
70 to 74	40,426	13.2	5,290,232	13.4	
75 to 79	24,701	8.0	5,629,967	14.3	
80 to 84	17,190	5.6	6,350,008	16.1	
≥85	21,665	7.1	11,024,696	27.9	
Sex					
Male	144,010	46.9	13,325,410	33.8	0.0001
Female	163,203	53.1	26,149,716	66.2	
Race					
White	156,390	68.3	24,411,081	86.2	0.0001
Black	52,351	22.8	2,120,513	7.5	
Hispanic	14.652	6.4	1,124,864	4.0	
Asian	5,032	2.2	587,488	2.1	
Native American	702	0.3	81,828	0.3	
Other	1,206	0.5	87,279	0.3	
Disposition from the ED					
Release	266,429	88.3	28,612,831	72.8	0.0001
Admit	35,419	11.7	10,669,043	27.2	
Anatomic area injured					
Head/neck	161,931	53.7	13,884,678	35.4	0.0001
Upper trunk	41,137	13.7	4,971,058	12.7	
Lower trunk	23,754	7.9	7,769,741	19.8	
Upper extremity	57,781	19.2	6,158,246	15.7	
Lower extremity	16,686	5.5	6,456,663	16.5	
Diagnosis					
Contusion/abrasion	110,629	38.4	9,474,704	25.1	0.0001
Fracture	38,524	13.4	13,484,745	35.7	
Laceration	41,271	14.3	4,030,007	10.7	
Strain/sprain	19,396	6.7	320,518	0.8	
Internal organ injury	48,763	16.9	5,940,589	15.7	
Concussion	4,536	1.6	422,373	1.1	
Unknown	24,456	8.5	1,112,670	2.9	
Poisoning	765	0.3	56,149	0.1	

N = estimated number of ED visits

Table 2:

Fracture patterns sustained by both groups of adults ≥ 60 years old.

	Older adult abuse group (OAA)		Patients who sustained a fall		P-value
	N	%	N	%	
Fracture location					
General area					
Trunk	11,049	28.7	5,945,290	44.1	
Upper extremity	10,788	28.0	4,105,936	30.5	
Lower extremity	3,170	8.2	2,572,326	19.1	
Head/neck	13,518	35.1	860,098	6.4	
By detailed location					
Head	649	1.7	46,803	0.3	0.0001
Face	12,447	32.3	615,736	4.6	
Neck	421	1.1	197,560	1.5	
Upper trunk	6,833	17.7	1,351,876	10.0	
Lower trunk	4,215	10.9	4,593,414	34.1	
Shoulder	1,240	3.2	638,885	4.7	
Humerus	1,625	4.2	1,029,656	7.6	
Elbow	132	0.3	275,382	2.0	
Radius/ulna	1,821	4.7	647,343	4.8	
Wrist	2,526	6.6	1,170,650	8.7	
Hand	1,257	3.3	171,511	1.3	
Finger	2,187	5.7	190,510	1.4	
Pubic	0	0.0	13,955	0.1	
Femur	777	2.0	755,771	5.6	
Knee	199	0.5	321,596	2.4	
Tibia/fibula	897	2.3	481,802	3.6	
Ankle	755	2.0	627,046	4.7	
Foot	170	0.4	286,436	2.1	
Toe	372	1.0	85,721	0.6	

N = estimated number of ED visits