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Hand and Upper Extremity Trauma in the Undocumented Immigrant Population in the United States

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Background: Undocumented immigrants in the United States are at risk for upper extremity trauma due to occupational exposure, and decreased access to healthcare can worsen outcomes. The purpose of this study was to compare documented versus undocumented patients in a large cohort of patients in New York City's most diverse neighborhood in order to characterize upper extremity trauma in this population.

Methods: The Elmhurst Hospital trauma database was examined for patients admitted with upper extremity trauma from April 2016 to December 2019. Charts were examined for demographic information, documentation status, injury mechanism, and outcomes.

Results: Of the 1041 patients included, 865 (83.1%) were documented and 176 (16.9%) were undocumented. Undocumented immigrants were younger (40.5 versus 62.4 years, $P < 0.0001$) and predominantly men (83.5% versus 57.1%, $P < 0.0001$) with fewer comorbidities (42.6% versus 64.6%, $P < 0.0001$). Occupational injury was three times as likely in undocumented immigrants (13.6% versus 4.6%, $P < 0.0001$) and these patients were nearly twice as likely to be harmed from violence (19.9% versus 10.2%, $P = 0.0003$). Increased rates of injury during bicycle/motorcycle accidents (8.0% versus 3.0%, $P = 0.0017$) or being struck as a pedestrian (21.6% versus 14.3%, $P = 0.0149$) were found in the undocumented cohort, with falls (39.8% versus 59.3%, $P < 0.0001$) or vehicle collisions (0.6% versus 3.5%, $P = 0.0402$).

Conclusions: Undocumented patients with upper extremity trauma represent a younger/healthier cohort, but are more likely to be injured at work or by violence. Documentation status plays a role in injury characteristics. *(Plast Reconstr Surg Glob Open 2022;10:e4117; doi: 10.1097/GOX.0000000000004117; Published online 17 February 2022.)*

INTRODUCTION

An undocumented immigrant (UI) is a foreign national who lacks proper authorization to reside in the United States, whether by entering the United States without immigration inspection, or staying in the US beyond the expiration of a temporary visa.[1] UIs face a variety of challenges that predispose them to poor health outcomes. Despite trends of improving access to trauma care, epidemiologic studies have documented healthcare disparities in underrepresented minorities and patients of low socioeconomic status.[2–4] UIs are particularly vulnerable to experiencing these disparities, as they face language barriers, limited access to health insurance, fewer safety precautions at work, and more dangerous living conditions.[5,6]

The upper extremity commonly suffers traumatic injuries, and such damages can have devastating consequences on health and socioeconomic status.[6–9] Because 74% of the UI population in the United States work in the labor force, often holding jobs that require manual labor, the ability to utilize an uninjured upper extremity is vital for economic independence in this population.[4,5,10]

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More than one-third of the New York City (NYC) foreign-born population lives in Queens, a quarter of whom are undocumented.[11,12] Neighborhoods of Northwest Queens (including Elmhurst and Jackson Heights), two of NYC's three neighborhoods with the largest populations of immigrants, are served by Elmhurst Hospital Center (EHC).[13] EHC is a level-one trauma center and NYC's second largest public hospital in the public healthcare system (NYC Health + Hospitals), serving what is considered to be the most ethnically diverse neighborhood in NYC and possibly the world.[12,14,15] Examining this population provides a large-scale glimpse of healthcare disparity and outcome data in a very distinct group of UIs.

Although health features pertaining to UIs have been studied in the past, there are no reported studies examining upper extremity trauma specifically in this population. The purpose of this study was two-fold. First, we sought to compare clinical features of upper extremity trauma injuries in documented versus undocumented patients at EHC during a 45-month period. Secondly, we sought to identify disparities in health-related variables and thereby provide a more thorough understanding and ability to optimally provide care for this population.

Takeaways

Question: Are there differences in mechanism and types of injuries in the undocumented immigrant population in NYC compared with the general population?

Findings: This was a retrospective chart review of all trauma admissions with upper extremity injuries within a 45-month period, examining the differences in injuries among undocumented immigrants. Authors found that the undocumented population consisted of a younger, healthier and predominantly male cohort of patients that were more likely to be injured at work, as a result of violence, or being struck as a pedestrian.

Meaning: There are significant differences in the mechanisms of injury in the undocumented immigrant population presenting with upper extremity trauma. Awareness of these differences and how they illustrate the impact of the current state of social determinants of health on these individuals are essential for providing optimal care for these patients.

METHODS

The Elmhurst trauma registry was queried for all patients over age 18 admitted with upper extremity trauma from April 2016 to December 2019. This start date was chosen because this was the time that EHC implemented Epic electronic medical record (Epic systems, Madison, Wis.) use in the hospital. IRB approval was obtained from the Mount Sinai Hospital/EHC Institutional Review Board Committee.

The trauma registry and patient charts were examined for demographic information, presence of a social security number, and mention of the following words: "documented/undocumented," "citizen," "domiciled/undomiciled," "immigrant," "green card," "visa," and "illegal" to clarify documentation status. Any patients with unclear documentation status based on the medical record were excluded from the examined cohort. Specifically, this refers to patients with no documented social security number but also no mention of immigration status in the medical record. Likewise, patients who had a social security number but were noted to be "undocumented" in the chart were excluded from the study. Additionally, any patients aged younger than 19 years were also excluded from the study, as documentation status was usually not discussed in pediatric patients' records.

Patients included in the study were categorized as either documented or undocumented, and clinical variables were compared among the two groups. Demographic variables, presence of comorbidities, injury severity score, presence of injuries to multiple organ systems, type of injury, and mechanism of injury were evaluated. Patient records were examined for information regarding occupational exposure and incidence of injury due to being struck as a pedestrian or related to violence. Any injury via the following mechanisms was considered to be a violence-related injury: gunshot wound, stabbing, or assault. Demographic and clinical variables among the cohorts were compared using a Welch's test (for continuous variables) and chi-square (for categorical variables) analysis.

RESULTS

Between April 2016 and December 2019, a total of 1219 patients with upper extremity trauma required hospital admission. An estimated 114 were excluded for being younger than 19 years of age, and 62 were excluded for incomplete information regarding documentation status.

Of the remaining 1041 patients in the registry, 865 (83.1%) were found to be documented and 176 (16.9%) were UIs. The undocumented patient cohort was significantly younger on average (40.5 years versus 62.4 years, $P < 0.0001$) and had a significantly greater proportion of men (83.5% versus 57.1%, $P < 0.0001$). Additionally, undocumented patients had significantly fewer pre-trauma comorbidities than the documented cohort (42.6% versus 64.6%, $P < 0.0001$). These results are displayed in Table 1.

There were no significant differences in rates of multisystem trauma (59.7% undocumented versus 61.9% documented, $P = 0.5847$) between the two cohorts. However, documented patients did have significantly higher injury severity scores (8.28 versus 6.91, $P = 0.0205$) and

Table 1. Demographic and Hospital-stay Information among Documented versus Undocumented Upper Extremity Trauma Patients

Variable	Documented	Undocumented	*P*
N	865 (83.1%)	176 (16.9%)	
Age	62.4	40.5	**$P < 0.0001$**
Men	494 (57.1%)	147 (83.5%)	**$P < 0.0001$**
Women	371 (42.9%)	29 (16.5%)	**$P < 0.0001$**
Length of Stay	9.1	6.26	**$P = 0.0040$**
ISS	8.28	6.91	**$P = 0.0205$**
Comorbidities	559 (64.6%)	75 (42.6%)	**$P < 0.0001$**
Other systems	536 (61.9%)	105 (59.7%)	$P = 0.5847$

Bolded *P*-values indicate statistical significance.

significantly longer length of hospital stay (9.1 days versus 6.26 days, $P = 0.0040$) than undocumented patients. There was no significant difference in mortality rate between the two populations (3.4% documented versus 4.0% undocumented, $P = 0.6932$).

Undocumented patients were more likely to be injured by the following mechanisms: bike/motorcycle accident (8.0% versus 3.0%, $P = 0.0017$), struck as a pedestrian (21.6% versus 14.3%, $P = 0.0149$), assault (9.1% versus 4.6%, $P = 0.0157$), and machinery (5.7% versus 2.4%, $P = 0.0186$), while less likely to be injured as a result of a fall (39.8% versus 59.3%, $P < 0.0001$). There were no significant differences in rates of injury secondary to the following mechanisms: gunshot wound, stabbing, animal attack, accident not otherwise specified, and self-harm. These results are displayed in Table 2 and graphically in Figure 1.

Undocumented patients were over three times as likely to be injured at work (13.6% versus 4.6%, $P < 0.0001$) and nearly twice as likely to be injured as a result of violence (19.9% versus 10.2%, $P = 0.0003$). This is displayed in Figure 2. Undocumented patients were equally as likely to be discharged against medical advice as documented patients were in this cohort (2.3% versus 2.3%, $P = 1.000$).

Table 2. Mechanisms of Upper Extremity Injuries in Documented versus Undocumented Trauma Patients

Mechanism	Documented	Undocumented	*P*
Fall	513 (59.3%)	70 (39.8%)	**$P < 0.0001$**
GSW	14 (1.6%)	3 (1.7%)	$P = 0.9237$
MVC	30 (3.5%)	1 (0.6%)	**$P = 0.0402$**
Bike/moto	26 (3.0%)	14 (8.0%)	**$P = 0.0017$**
Pedestrian struck	124 (14.3%)	38 (21.6%)	**$P = 0.0149$**
Stab	37 (4.3%)	13 (7.4%)	$P = 0.0803$
Animal	10(1.2%)	1 (0.6%)	$P = 0.4866$
Assault	40 (4.6%)	16 (9.1%)	**$P = 0.0157$**
Machine	21 (2.4%)	10 (5.7%)	**$P = 0.0186$**
Accident	20 (2.3%)	6 (3.4%)	$P = 0.3931$
Self-harm	25 (2.9%)	4 (2.3%)	$P = 0.6601$

Bolded *P*-values indicate statistical significance.

UIs were significantly more likely to experience phalangeal fractures (9.1% versus 4.4%, $P = 0.0105$), carpal dislocations (1.7% versus 0.2%, $P = 0.0070$), tendon lacerations (2.3% versus 0.6%, $P = 0.0284$), and upper extremity lacerations (29.5% versus 20.1%, $P = 0.0058$). They were less likely than documented patients to present with humerus fractures (10.8% versus 23.1%, $P = 0.0003$). These results are displayed in Table 2. Mechanisms of injury for these specific injuries in the UI cohort are shown in Figures 3–5.

DISCUSSION

In our large urban trauma center, undocumented patients presenting with upper extremity trauma are typically younger and healthier than documented patients, but are significantly more likely to have been injured at work, as a result of violence, or being struck as a pedestrian or motorcycle/bike passenger. These findings are reflective of the underlying social determinants of health that UIs face in the United States. As noted in our study, the undocumented population in the United States is largely composed of younger individuals, many of whom are men.[11] As younger patients are less likely to have comorbidities and previous hospitalizations, they usually are not at an increased risk for in-hospital mortality,[16] which is reflected in our results. Additionally, the fact that this is often a younger and healthier cohort provides a likely explanation for the shorter hospital lengths of stay. However, it should be emphasized that these patients are often less likely to present to the emergency department or seek preventive care due to fear of discovery and lack of coverage, further placing them at risk for poor health outcomes.[16,17] In fact, it has been demonstrated that the health status, illustrated by cholesterol values, obesity rates, smoking/alcohol status, mental illness, dietary health, and suicide rates, of migrant workers in the United States declines with the amount of time that they have spent in the United States, in part due to a lack of access to appropriate care.[18]

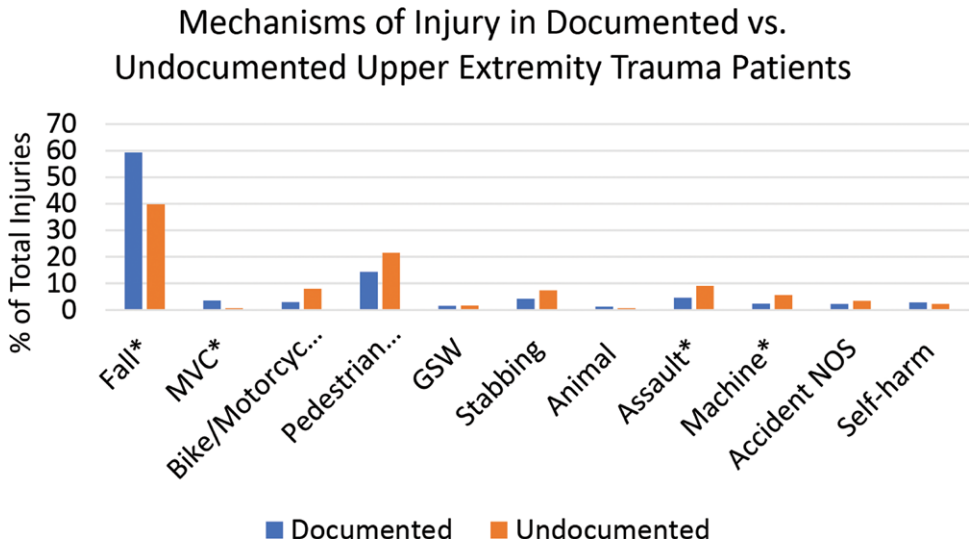

Fig. 1. Mechanisms of injury in documented vs. undocumented upper extremity trauma patients.

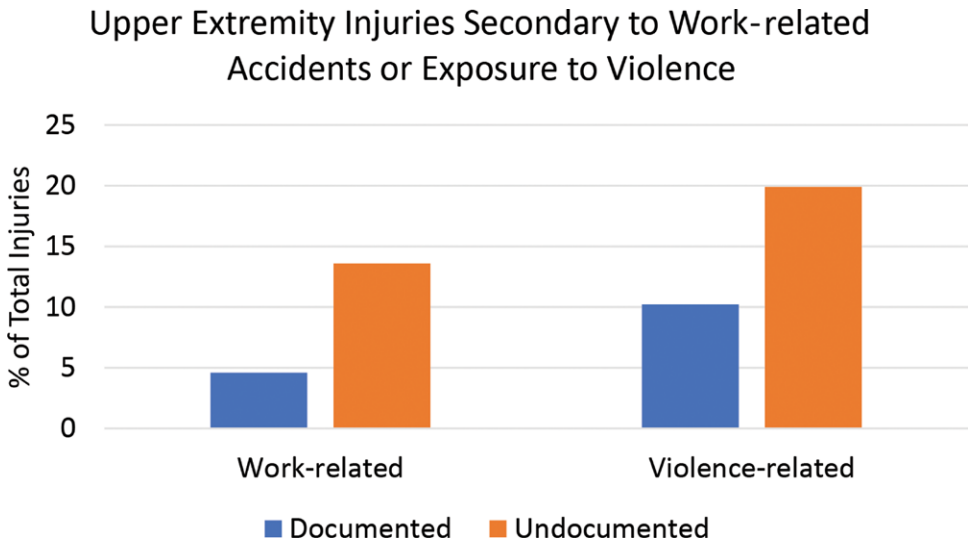

Fig. 2. Upper extremity injuries secondary to work-related accidents or exposure to violence.

Our findings that undocumented patients with upper extremity trauma were three times more likely to have been injured at work further emphasizes the public health challenges experienced by UIs. Occupational risk factors exist, including language barriers, lack of training/education, lack of resources, lack of stable employment, and higher risk manual labor jobs.[19–24] Additionally, employees are discouraged from reporting unsafe work conditions or negotiating fair wages/health benefits through the development of "subcontracting" by employers and fears of deportation.[19,25–27] Oftentimes they are expected to work without breaks or sick leave, further placing them at higher risk for injury on the job.[25] Following occupational injury, surveyed individuals have related concern for the repercussions of reporting any injuries and are often discouraged from applying for workers compensation, further limiting their access to appropriate care.[27]

These results have been replicated in other studies examining the effects of healthcare disparities on the health of the UI population. Forst et al examined work-related trauma and consults in Chicago, and found that Hispanic patients were more likely to report that their injuries occurred at work.[20] These types of injuries are often reported during construction jobs or work involving

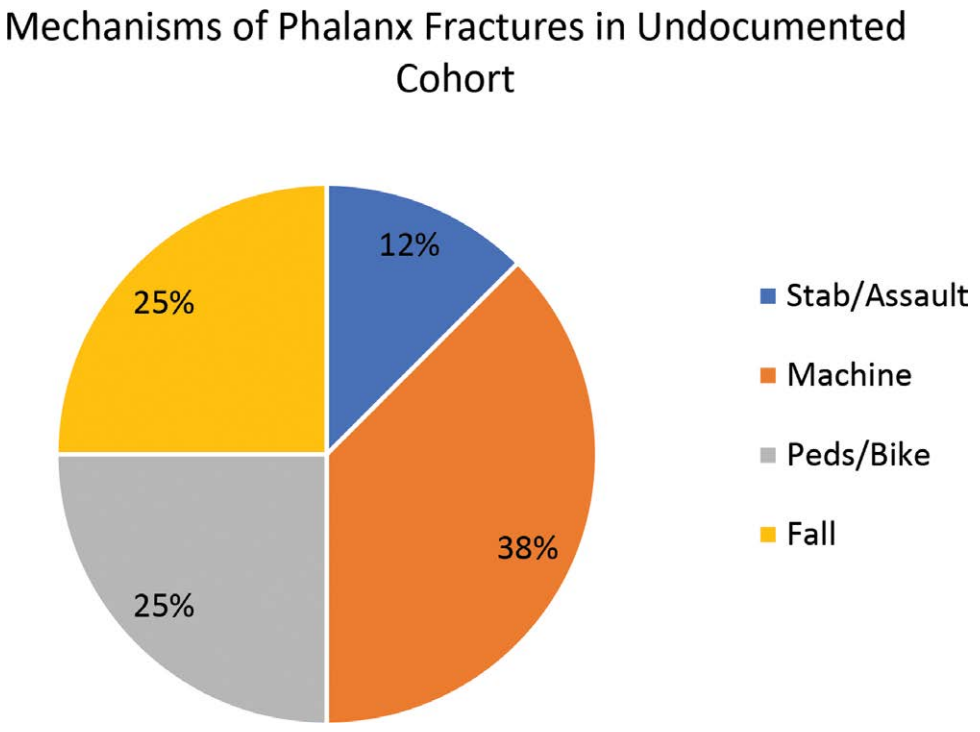

Fig. 3. Mechanisms of phalanx fractures in undocumented cohort.

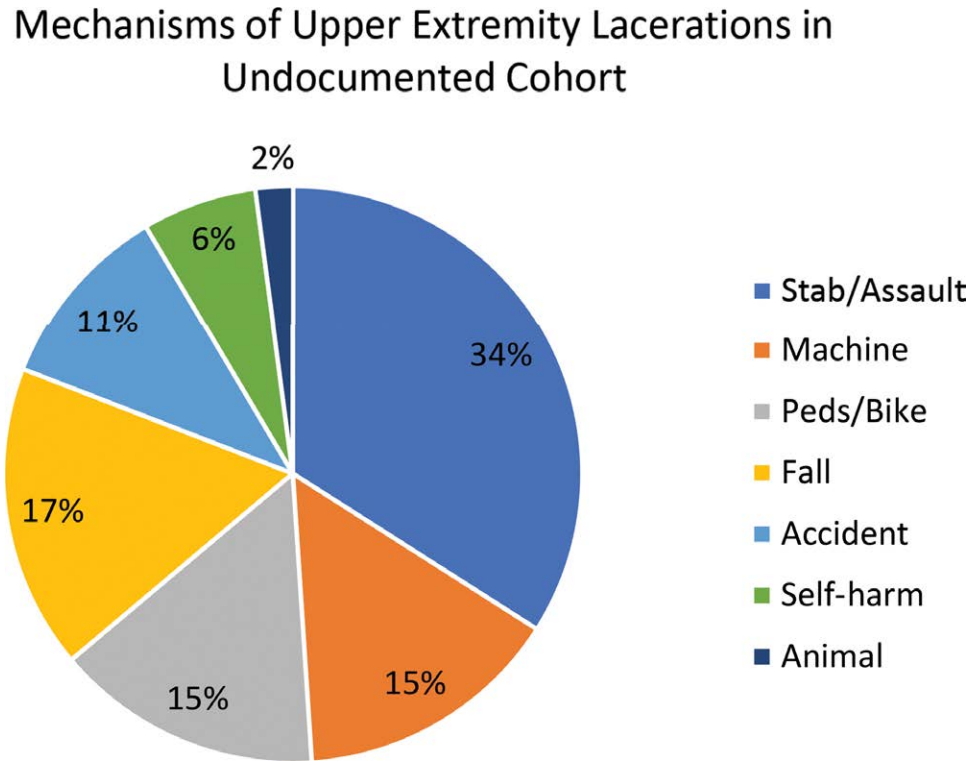

Fig. 4. Mechanisms of upper extremity lacerations in undocumented cohort.

industrial machinery, particularly in more rural areas of the country including the Southeastern and Southwestern United States.[20,27,28] Additionally, Reister et al studied work-related injuries in the Minneapolis-Saint Paul area and found that undocumented Hispanic workers were twice as likely to be injured at work and 1.86 times more likely to experience upper extremity injuries than patients in the documented population.[22] Increased rates of upper extremity injuries in this cohort are thought to be a result of higher rates of manual labor jobs during which the upper extremities/hands are exposed to higher risk conditions.

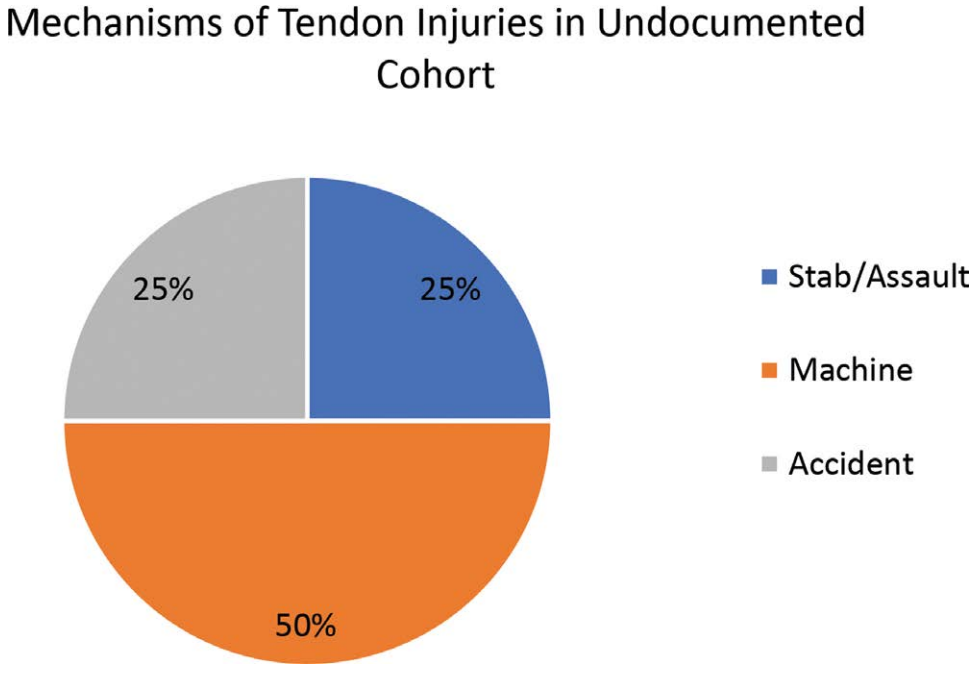

Fig. 5. Mechanisms of tendon injuries in undocumented cohort.

Our findings that UIs are more likely to experience violence-related injuries to the upper extremity are also reflected in the literature. Ram et al demonstrated that undocumented patients with traumatic brain injuries are twice as likely to be assault victims.[14] This is thought to be the result of the social disadvantages this urban population suffers, such as segregation to lower socioeconomic neighborhoods with increased exposure to violence and crime.[29] Strict enforcement of immigration laws has been thought to lead to financial insecurity and residential segregation of this population, and high pressures in these conditions have been suggested to increase chances for violence and substance abuse.[30,31] Additionally, when discussing this vulnerable population, it should be mentioned that providers in the acute care and trauma setting should always be cognizant to look for signs of potential human trafficking, as undocumented individuals are particularly vulnerable to trafficking.[32]

Differences in rates of automobile versus pedestrian accidents or bike/motorcycle-related injuries are likely also reflective of the social disparities faced by UIs. As undocumented patients are more likely to report lower incomes,[16] it is reasonable that these patients are less likely to be passengers in an automobile and more likely to utilize public transportation or commute via walking or bike/motorcycle.

Our results indicate that UIs are more likely to experience phalangeal fractures, carpal dislocations, tendon lacerations, and more superficial lacerations. We propose that this reflects the mechanisms of injury themselves, considering that a large proportion of these injuries occurred as a result of work/machinery-related injuries, assault, or pedestrian/biking accidents. These mechanisms are shown graphically in Figures 3–5.

Implications of our results are mainly limited by the nature of this single institution study representing one area of a large metropolis. However, we posit that the population studied in Queens, New York provides an inclusive understanding of the public health struggles of the undocumented population in urban areas of the United States at large, and the clinical implications for patients presenting with upper extremity trauma throughout the country. Our outcome variables were limited to length-of-stay and mortality, as recorded in our trauma database, and no in-hospital disparities were noted in these outcomes. Due to the study being based on a registry of data, we were unable to examine functional and patient-reported outcomes.

CONCLUSIONS

There are significant differences in the injury patterns and mechanisms of injury in the UI population presenting with upper extremity trauma. Awareness of these differences and how they illustrate the impact of the current state of social determinants of health on these individuals is essential for providing optimal care for these patients. While this study reflects those variables in one very diverse community, we assert that these same challenges are being faced by UIs across the country and are therefore imperative for hand/upper extremity surgeons to understand and appreciate. In this way, the hand surgeon will have a more holistic understanding of both preinjury and post-discharge outcome factors that can affect the patient's long-term return to function.

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