Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of Emergency Medicine 55 (2022) 20–26

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Trends in upper extremity injuries presenting to emergency departments during the COVID-19 pandemic

J. Alex Albright, BS *, Edward J. Testa, MD, John Hanna, MD, Michael Shipp, MD, Christopher Lama, MS, Michel Arcand, MD

Brown University Warren Alpert Medical School, Department of Orthopaedic Surgery, Providence, RI 02912, United States of America

ARTICLE INFO

Article history:
Received 3 December 2021
Received in revised form 11 February 2022
Accepted 14 February 2022

Keywords:
Upper extremity
Musculoskeletal
Epidemiology
Emergency department
COVID-19

ABSTRACT

Introduction: During the emergence of the SARS-CoV-2 (COVID-19) pandemic, there were substantial changes in United States (U.S.) emergency department (ED) volumes and acuity of patient presentation compared to more recent years. Thus, the purpose of this study was to characterize the incidence of specific upper extremity (UE) injuries presenting to U.S. EDs during the COVID-19 pandemic and analyze trends across age groups and rates of hospital admission compared to years prior.

Methods: The National Electronic Injury Surveillance System (NEISS) database was queried to identify patients who presented to U.S. EDs for an UE orthopaedic injury between 2016 and 2020. Chi-square analysis and logistic regression were used to assess for differences in ED presentation volume and hospital admissions between pre-pandemic (2016 through 2019) and during-pandemic (2020) times.

Results: These queries returned 285,583 cases, representing a total estimate of 10,452,166 injuries presenting to EDs across the U.S. The mean incidence of UE orthopaedic injuries was 640.2 (95% CI, 638.2–642.3) injuries per 100,000 person-years, with the greatest year to year decrease in incidence occurring between 2019 and 2020 (20.1%). The largest number of estimated admissions occurred in 2020, with a total 135,018 admissions (95% CI, 131,518–138,517), a 41.6% increase from the average number of admissions between 2016 and 2019.

Conclusion: There was a 20.1% decrease in the incidence of UE orthopaedic injuries presenting to EDs after the start of the COVID-19 pandemic with a concomitant 41.2% increase in the number of hospital admissions from the ED in 2020 compared to recent pre-pandemic years. We speculate that at least some elective, semi-elective or urgent ambulatory surgeries were canceled or delayed due to the pandemic and were subsequently directed to the ED for admission. Regardless of the cause of increased UE orthopaedic admissions, policy planners and administrators should be aware of the additional stresses placed on already burdened ED and inpatient services.

Level of evidence: Level III – Retrospective Cohort Study.

1. Introduction

On March 13, 2020, the United States (U.S.) declared a national emergency to combat coronavirus disease 2019 (COVID-19) – a lethal respiratory illness caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). With its unbiased infectivity and rapid rate of spread, COVID-19 quickly placed significant strain on the U.S. and other national healthcare systems, prompting strategic resource reallocation and reorganization of healthcare services [1,2]. Hospital staff and medical resources were redeployed to handle the abrupt surge in critically ill patients, which led to a near complete cessation of elective services and large drop in patients seeking emergent medical care for fear of COVID-19 transmission [1,3]. As national quarantine orders came into effect and the fear of COVID-19 permeated throughout the country, the number of patients presenting to emergency departments (EDs) decreased precipitously by as much as 42% in the early phases of the pandemic [1,4]. With this, concerns arose from the medical community about patients delaying or foregoing emergency medical care altogether. While there is considerably more understanding of the epidemiology, physiology, and treatment of COVID-19, less is understood about how COVID-19 has impacted other facets of patient care in the setting of the current pandemic.

Prior to the pandemic, musculoskeletal (MSK) conditions accounted for 602.3 million medical consultations, 2.2 billion prescriptions, and 21.5 million hospital discharges annually in the U.S. [5,6]. Among all MSK regions, hand and upper extremity (UE) injuries have historically accounted for 12% of all traumatic injuries in the U.S. that present to EDs [7]. This equated to 34 million ED visits for hand injuries from 2009 to 2012. However, fear of contagion and the implementation of national quarantines to curb the spread of COVID-19 have deterred

* Corresponding author at: 222 Richmond Street, Providence, RI 02903, United States of America.
E-mail address: James_Albright@brown.edu (J.A. Albright).

https://doi.org/10.1016/j.ajem.2022.02.033
0735-6757/

some patients with significant UE injuries from seeking emergent medical attention [2,8].

Higher acuity UE fractures, nerve injuries, and dysvascular limbs can often result in considerable disability if there are delays in treatment [9]. Management often requires access to level-1 trauma centers with readily available operating rooms and microsurgical equipment – many of which have been limited with the reallocation of resources due to the COVID-19 pandemic [2]. In addition, lower-acuity UE injuries that are more tolerable are at risk of neglect if patients avoid emergency care, pushing a subset of patients outside the window of predictably favorable outcomes. Thus, it is critical that we better characterize the influence of COVID-19 on UE emergency care to better allocate resources and maximize outcomes during this unique public health crisis.

The purpose of this study was to assess the impact of the COVID-19 pandemic on the epidemiology of UE MSK injuries and care in the U.S. We compared trends in UE injury presentation and admission from four years prior to the pandemic to the first year during the pandemic. Given national stay-at-home mandates and social distancing restrictions, we hypothesized that there would be a decrease in the incidence of both ED presentations and hospital admissions across all UE injury types during the pandemic compared to years prior.

2. Methods

This is a retrospective, cross-sectional epidemiological study using the Consumer Product Safety Commission's (CPSC's) National Electronic Injury Surveillance System (NEISS) database, a public database containing deidentified data not requiring institutional review board (IRB) approval [10]. The NEISS database includes consumer product-related injuries and is generated via a complex probability model of all-injury data from ED visits at a stratified sample of 100 hospitals with EDs around the U.S. and its territories. Each injury is assigned a weighted value based on the inverse probability of being selected to create a national estimate of injuries presenting to U.S. EDs. Each year the CPSC generates a new 100 hospital sample, selected from both children's and adult hospitals, rural and urban, to ensure accuracy. A full description of the database, including design and utilization, is publicly available on the CPSC electronic webpage [10]. The NEISS database serves as a public resource for epidemiological studies and has been used as such in many studies [11-16]. The NEISS database has also been used recently to examine changes during the COVID-19 pandemic [17-19].

Using the NEISS database, we performed annual queries from 2016 to 2020 to extract all information regarding UE MSK injuries during the four years prior to the COVID-19 pandemic (2016–2019) and the first year of the pandemic (2020). Data from the four years prior to the pandemic provided the statistical strength to determine if there were any changes in ED presentation of UE injuries. According to the NEISS Coding Manual, the Body_Part_2 and Diagnosis_2 numeric fields were added in 2018. These fields were utilized to augment the data extraction for 2018 through 2020. These queries extracted all patients with at least one identified UE injury; this includes isolated UE injuries and those that present in addition to other diagnoses. Information regarding the UE area injured was extracted using the following codes within the Body_Part and Body_Part_2 numeric fields: Elbow (code 32), Finger (code 92), Hand (code 82), Lower Arm (code 33), Shoulder (code 30), Upper Arm (code 80), and Wrist (code 34). Information regarding the primary diagnosis was extracted using the following diagnosis codes within the Diagnosis and Diagnosis_2 numeric fields: Contusion or Abrasion (code 53), Crushing (code 54), Dislocation (code 55), Fracture (code 57), Strain or Sprain (code 64), and Nerve Injury (code 61). These queries returned 285,583 cases that fit the above criteria, representing a total estimate of 10,452,166 injuries presenting to U.S. EDs.

To determine incidence rates, both the national estimates from the NEISS query and U.S. census data from 2016 to 2020 were used. This population data was used to assess the incidence of UE injuries in the U.S. presenting to EDs per 100,000 person-years. Ages were divided into five age groups for further comparison: 0–20 years, 21–40 years, 41–60 years, 61–80 years, and 81 years and older. Analyses of these incidence rates and the distribution of injuries and patient disposition

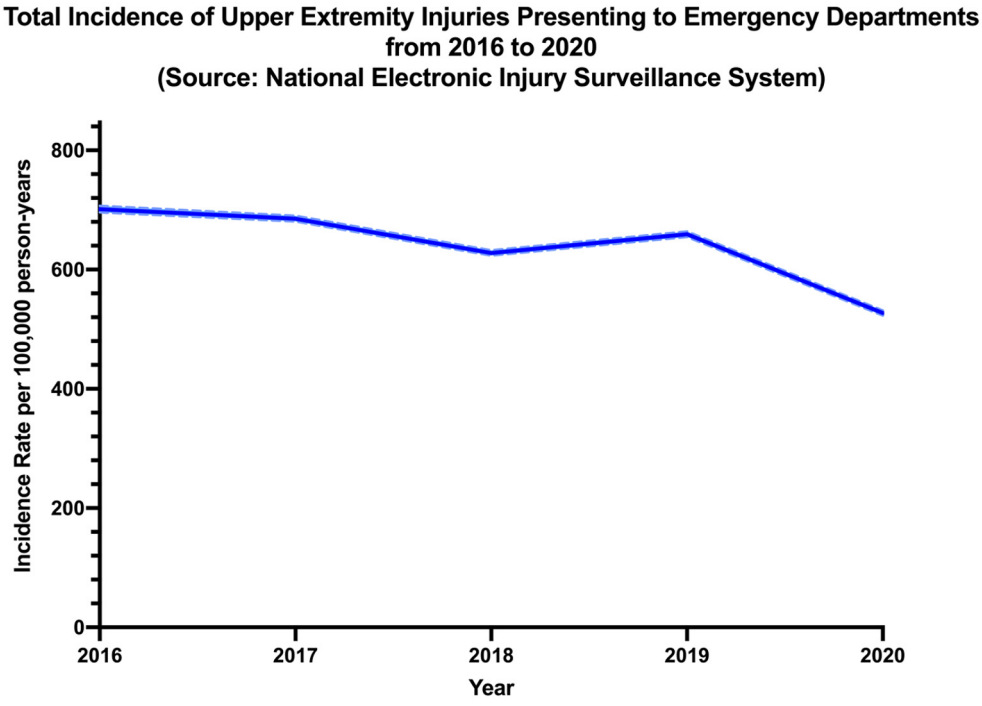

Fig. 1. Trends in the incidence of UE MSK injuries presenting to U.S. emergency departments between 2016 and 2020. The fig. provides a trend line of the incidence of UE MSK injuries for each respective year within the study period. The upper and lower 95% confidence intervals are depicted as dashed blue lines with light blue color fill presenting the 95% confidence interval of the incidence of UE MSK injuries between 2016 and 2020. These values were calcuated using the national estimates provided by the National Electronic Injury Surveillance System (NEISS). (For interpretation of the references to color in this fig. legend, the reader is referred to the web version of this article.)

Table 1
Average annual incidence of injuries to each respective body part that presented to U.S. emergency departments between 2016 and 2020.

Average annual incidence rate of injuries to each respective body part over the 5-year study period		
Body Part	Average Annual Incidence	95% Confidence Interval
Elbow	66.3	65.6–67.0
Finger	117.2	116.3–118.1
Hand	85.6	84.9–86.3
Lower Arm	75.7	74.9–76.4
Shoulder	136.2	135.3–137.1
Upper Arm	46.0	45.4–46.5
Wrist	113.3	112.4–114.1

following an injury across age groups and before and after the COVID-19 pandemic were done using chi-square analysis. *Z*-test column proportion post-hoc analysis with Bonferroni adjustments was used to analyze differences between proportions of injuries and disposition across age groups and time. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs). To account for the weighted sampling methodology underlying NEISS, the Weight numeric field was specified as an importance weight prior to statistical analysis. A cut-off of $P < 0.05$ was considered statistically significant. The statistical significance of incidence rates and ORs was reported using 95% CIs. Analysis was performed using Microsoft Excel (Microsoft Corporation, Redmond, WA), SPSS (Version 28, SPSS Inc., Chicago, IL), and Stata (Version 15.1, StataCorp, Durham, NC, USA).

3. Results

An estimated total of 10,452,166 UE MSK injuries presented to U.S. EDs from January 1st, 2016, to December 31st, 2020. The mean incidence of UE MSK injuries was 640.2 injuries per 100,000 person-years (95% CI, 638.2–642.3). The year with the greatest incidence of injuries was 2016 with 701.5 injuries per 100,000 person-years, while 2020 had the lowest incidence with 527.0 injuries per 100,000 person-years (Fig. 1). There was a total decrease in incidence over the five-year period of 24.9%, with the greatest percent decrease occurring between 2019 and 2020 (20.1%).

Overall, the top three most injured areas presenting to U.S. EDs from 2016 to 2020 were: shoulder, finger, and wrist. The average annual incidence of injuries to each respective body part can be seen in Table 1. A similar pattern was observed for each year individually; 2020 had the lowest overall incidence for all body parts except for the upper arm (Fig. 2).

Regarding the patient's disposition at discharge from the ED, the largest estimated number of hospital admissions from U.S. EDs occurred in 2020 at 135,018 admissions (95% CI, 131,518–138,517) (Fig. 3). Fig. 4 demonstrates the trend in the proportion of the estimated number of UE injuries presenting to EDs that resulted in hospital admission each year during the study period. The proportion of patients admitted with UE MSK injuries after presenting to the ED was 5.8% in 2019 and 7.8% in 2020, which is a 31.7% year-to-year increase. The OR and respective 95% CI regarding the likelihood of a patient being admitted to the hospital by injury type and within each 20-year age group is available in Supplemental Table 1. Overall, there was a significant increase in the likelihood of being admitted to the hospital for an UE MSK injury following the start of the COVID-19 pandemic (OR = 1.81, 95% CI, 1.815–1.820). For each age cohort, there were increased odds of being admitted to the hospital during the pandemic compared to the four years prior. In the 0–20 age group, there was a 51% increase in the likelihood of being admitted to the hospital during 2020 compared to the previous 4 years (OR = 1.51). Similarly, the 21–40 (100% increase), 41–60 (70% increase), 61–80 (58% increase), and 81 and older (48% increase) age groups all experienced significantly increased likelihood of hospital admission following the initial presentation to the ED in 2020 compared to the previous 4 years. Injuries to the hand yielded the greatest increased odds of being hospitalized in the 0–20, 21–40, 41–60, and 61–80 age groups. In the 81 and older age group, injuries to the finger had the highest odds of leading to hospital admission. The only body parts that had decreased odds of being admitted during the pandemic were elbow injuries in the 0–20 age group (OR = 0.936). The data used to calculate the ORs in Supplemental Table 1 are located in Supplemental Table 2.

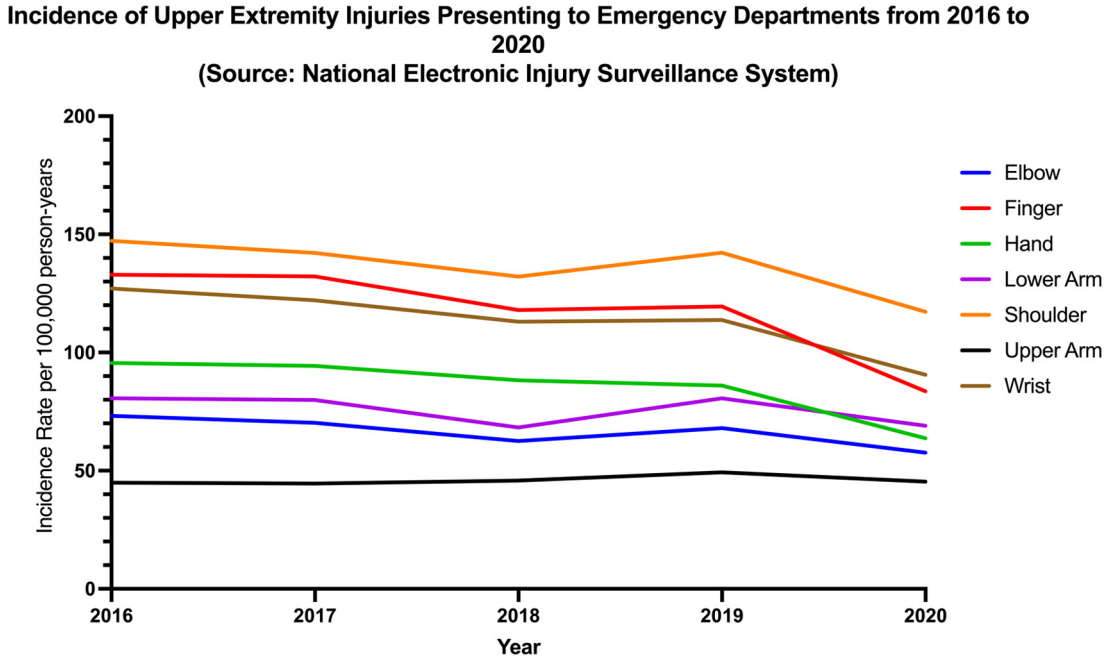

Fig. 2. Trends in the incidence of specific UE MSK injuries presenting to U.S. emergency departments between 2016 and 2020. Each specific body part (elbow, finger, hand, lower arm, shoulder, upper arm, and wrist) is depicted as a different colored line representing the incidence of a MSK injury to that respective body part between 2016 and 2020. These values were calcuated using the national estimates provided by the National Electronic Injury Surveillance System (NEISS).

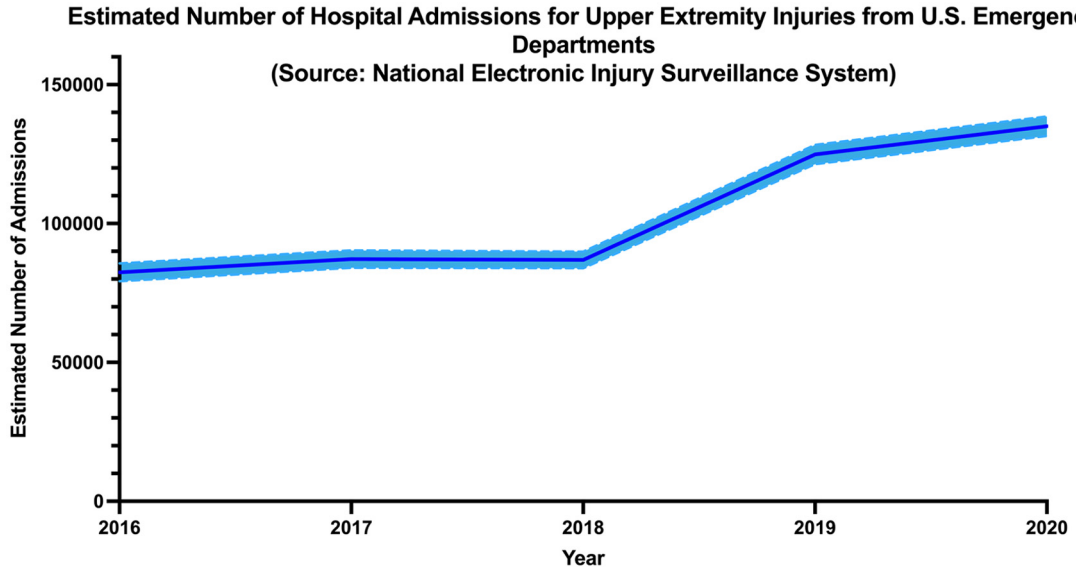

Fig. 3. Trends in the (estimated) number of UE MSK injuries resulting in hospital admissions between 2016 and 2020. The fig. provides a trend line of the number of UE MSK injuries resulting in hospital admissions for each respective year within the study period. The upper and lower 95% confidence intervals are depicted as dashed blue lines with light blue color fill presenting the 95% confidence interval of the total (estimated) number of UE MSK injuries leading to hospital admissions between 2016 and 2020. (For interpretation of the references to color in this fig. legend, the reader is referred to the web version of this article.)

Analysis of specific types of injuries (i.e. contusion, dislocation, fracture) is presented in Table 2. There was a significant difference between the proportion of specific UE injuries admitted to the hospital prior to and during the pandemic. Rates of admission following the pandemic varied across all contusions, crushing injuries, dislocations, fractures, and sprains.

4. Discussion

The COVID-19 pandemic has placed a tremendous strain on the U.S. healthcare system, necessitating fundamental changes in practice across all specialties including orthopaedic surgery and emergency medicine [20-24]. The impact of the pandemic on MSK injury presentation, particularly UE injuries, has not been fully elucidated. UE injuries are one of the most common types of injuries treated in EDs [25]. They also benefit from timely identification and management in order to maximize outcomes and improve long-term function [26-28]. Therefore, it is important to recognize the impact of COVID-19 on UE injury care. In this study, we utilized a national database to compare trends in UE injury presentation during the pandemic to pre-pandemic levels. As strict lockdown procedures and social distancing took effect, we hypothesized that there would be a decrease in the incidence of UE injuries presenting to EDs resulting in a decrease in hospital admissions during the first year of the pandemic compared to prior years.

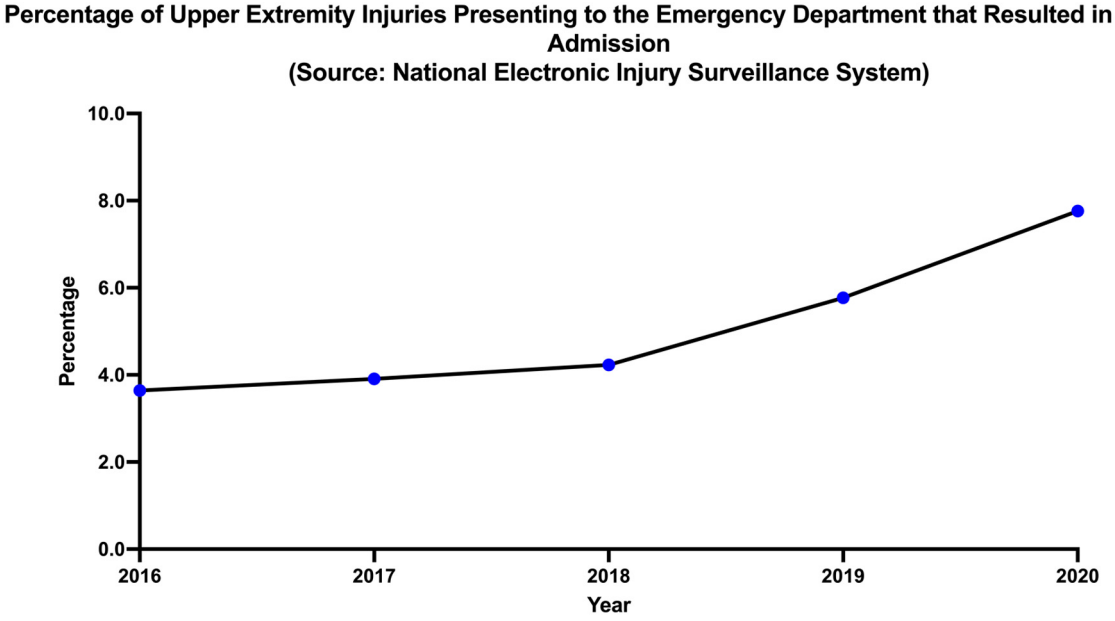

Fig. 4. Changes in the proportion of UE MSK injuries that resulted in hospital admission between 2016 and 2020. The fig. provides a trend line of the proportion of UE MSK injuries resulting in hospital admissions for each respective year within the study period. The upper and lower 95% confidence intervals are too small to be seen on the graph.

Table 2
Change in the proportion of patients presenting with specific injuries being admitted to the hospital from before the start of the COVID-19 pandemic and during the pandemic

Percent of Injuries and Diagnoses Admitted to Hospital Before the COVID-19 Pandemic (2016 to 2019) Compared to During the COVID-19 Pandemic (2020)						
Body Part	Diagnosis	Pre COVID-19, n (%)	COVID-19, n (%)	Odds Ratio	95% Confidence Interval	*p*-value
Elbow						
	Contusion	11,014 (3.2)	5463 (6.8)	2.258	(2.183, 2.335)	< 0.001
	Crush	0 (0)	0 (0)	N/A	N/A	N/A
	Dislocation	2755 (1.9)	599 (2.0)	1.054	(0.964, 1.154)	0.244
	Fracture	35,313 (12.3)	10,262 (15.9)	1.341	(1.310, 1.374)	< 0.001
	Sprain	124 (0.1)	56 (0.4)	3.193	(2.285, 4.415)	< 0.001
Finger						
	Amputation	12,987 (13.9)	2873 (12.5)	0.888	(0.850, 0.927)	< 0.001
	Contusion	784 (0.2)	634 (1.3)	5.236	(4.707, 5.825)	< 0.001
	Crush	349 (0.5)	35 (0.3)	0.519	(0.358, 0.733)	< 0.001
	Dislocation	1644 (1.3)	436 (1.9)	1.436	(1.289, 1.599)	< 0.001
	Fracture	10,366 (1.5)	4534 (3.5)	2.373	(2.290, 2.459)	< 0.001
	Sprain	282 (0.1)	307 (0.8)	9.916	(8.407, 11.696)	< 0.001
Hand						
	Amputation	336 (59.4)	316 (76.8)	2.280	(1.701, 3.064)	< 0.001
	Contusion	8469 (1.4)	2231 (2.2)	1.583	(1.510, 1.660)	< 0.001
	Crush	176 (0.9)	165 (4.3)	5.037	(4.037, 6.281)	< 0.001
	Dislocation	130 (3.4)	167 (9.3)	2.933	(2.301, 3.743)	< 0.001
	Fracture	7392 (1.6)	4327 (5.0)	3.141	(3.022, 3.264)	< 0.001
	Sprain	211 (0.2)	113 (0.8)	3.672	(2.891, 4.645)	< 0.001
Lower Arm						
	Contusion	10,096 (4.0)	6168 (10.4)	2.787	(2.696, 2.882)	< 0.001
	Crush	101 (5.9)	56 (9.5)	1.649	(1.151, 2.343)	0.004
	Dislocation	0 (0)	5 (1.0)	N/A	N/A	N/A
	Fracture	52,732 (7.5)	15,959 (10.0)	1.372	(1.347, 1.398)	< 0.001
	Sprain	131 (0.3)	190 (2.7)	9.417	(7.486, 11.872)	< 0.001
Shoulder						
	Contusion	13,877 (3.5)	5088 (6.1)	1.797	(1.738, 1.858)	< 0.001
	Crush	22 (3.9)	132 (35.8)	13.294	(8.219, 22.207)	< 0.001
	Dislocation	10,665 (3.6)	3239 (4.7)	1.334	(1.281, 1.390)	< 0.001
	Fracture	48,295 (10.1)	19, 502 (15.7)	1.661	(1.631, 1.691)	< 0.001
	Sprain	3156 (0.5)	908 (0.8)	1.733	(1.608, 1.868)	< 0.001
Upper Arm						
	Amputation	55 (100.0)	17 (100.0)	N/A	N/A	N/A
	Contusion	3271 (5.2)	928 (6.0)	1.176	(1.090, 1.268)	< 0.001
	Dislocation	63 (5.2)	78 (46.5)	15.208	(10.06, 22.944)	< 0.001
	Fracture	101,106 (21.4)	32,280 (26.2)	1.305	(1.286, 1.324)	< 0.001
	Sprain	325 (0.5)	192 (1.8)	3.508	(2.919, 4.215)	< 0.001
Wrist						
	Amputation	32 (36.6)	89 (100)	N/A	N/A	N/A
	Contusion	1047 (0.7)	853 (3.2)	4.500	(4.099, 4.932)	< 0.001
	Crush	0 (0)	0 (0)	N/A	N/A	N/A
	Dislocation	681 (14.4)	95 (12.9)	0.881	(0.693, 1.113)	0.283
	Fracture	42,082 (5.2)	16,514 (9.0)	1.796	(1.762, 1.830)	< 0.001
	Sprain	1151 (0.2)	205 (0.2)	1.210	(1.040, 1.408)	0.012

There were significantly fewer UE injuries presenting to U.S. EDs in 2020 compared to prior years. There are several potential explanations for this finding, the most likely of which relate to hospital avoidance at the height of the pandemic and a large-scale decrease in activities leading to UE injuries. We speculate that patients with chronic or less acute UE injuries either delayed their presentation or avoided the ED altogether during pandemic times. Similar findings have been demonstrated in previous studies which noted decreased hand and UE injury volume seen in EDs during the pandemic [3,29]. Other factors potentially contributing to the overall reduction in ED visits include travel restrictions and lock-down measures that encouraged patients to remain at home and the closing of nonessential businesses employing manual laborers. This has also led to a marked change in the workforce and workplace-related injuries, which would change the patient population able to use worker's compensation insurance [30]. These mandates may have not only deterred people from leaving their homes to seek care but could have also had a protective effect by discouraging risky behaviors that may lead to traumatic injuries.

Despite the reduced number of UE ED visits in 2020, there were significantly greater odds of being admitted to the hospital when presenting with an UE injury. Other studies have noted similar trends in orthopaedic injury volume related to an increased prevalence of high-risk activities as the pandemic progressed and patients spent more time social distancing [3,31]. Jeffrey et al. analyzed the trends of ED visits and hospital admissions within health care systems in five states during the first four months of the COVID-19 pandemic and found this same trend. They reported up to a 63.5% decrease in ED visits, with a concomitant 22.0% to 149.0% increase in admission rates [24]. Other potential contributing factors include a lack of available outpatient resources as well as self-injurious behavior related to the pandemic's impact on mental health [31]. These findings are important in anticipating UE surgical needs during a pandemic and better inform conversations about the associated care and resource requirements.

The results of the current study provide a broad framework to characterize UE injury care during the COVID-19 pandemic. However, on an individual level, the pandemic was associated with social, economic, psychological, and physical hardships, some of which likely contributed to delays in UE injury presentation. Prompt diagnosis and treatment of UE injuries is essential for long-term function and recovery [25-28]. Therefore, any form of delay in the management of UE injuries during the pandemic could ultimately lead to poor patient outcomes [31]. Furthermore, decreased inpatient ancillary service availability, such as physical and occupational therapy, may adversely affect long-term outcomes for patients with UE injuries who presented in 2020 [32,33]. The

increased rates of admissions also exposed patients to the hospital setting where the highest rates of COVID-19 transmission were observed, putting patients with UE injuries at an increased risk of disease transmission [34,35]. Importantly, increased rates of admissions for UE complaints contributed to the increased hospital utilization in 2020, further stressing a hospital system already suffering from bed shortages in many areas of the country.

As a result of the healthcare burden placed upon society during the early stages of the COVID-19 pandemic, many institutions resorted to the cancellation of outpatient procedures as bed availability reached critically low levels and operating room ventilators were being redistributed to treat COVID-19 patients [36]. This not only affected orthopaedic providers who rely heavily on short post-operative hospital stays for therapy optimization and pain control but placed a greater burden on the greater emergency medicine community. Lockdown procedures also mandated the closure of ambulatory surgical facilities in most areas of the U.S. in 2020, a setting in which the majority of UE injuries can be surgically managed [37]. The cancellation of ambulatory surgical services may have contributed to the increase in hospital admissions in 2020. A potential explanation is that elective, semi-elective, or urgent surgeries that otherwise would have been performed in outpatient surgery centers or had a hospital admission scheduled in advance were instead directed to the ED for admission. This also resulted in a large backlog of patients requiring elective or outpatient orthopaedic procedures who were unable to receive their surgical care during the first year of the pandemic [21,38]. The lack of available resources to surgically manage this patient population likely led to inappropriate or otherwise avoidable ED utilization, which places additional burden on an already stressed staff and system trying to manage the early stages of the COVID-19 pandemic [24].

As patients begin to feel more comfortable seeking standard medical care as the pandemic state improves, orthopaedic providers and emergency medicine services could be faced with an increase in undiagnosed or under-treated UE injuries from during the COVID-19 pandemic. This delayed presentation could not only impact patient treatment plans and outcomes but could also place further strain on the U.S. hospital system, emergency medical services, and orthopaedic providers as they attempt to recover from the pandemic. As the COVID-19 pandemic continues late into 2021, many orthopaedic providers continue to struggle with a large backlog of patients requiring operative intervention [38-40]. This may result in a shift to increased utilization of ambulatory surgical centers for injury patterns previously managed in the inpatient setting in an effort to decrease the backlog of patients waiting for operative intervention. These results suggest that treatment strategies to prevent and care for UE injuries should be incorporated into planning for future pandemics when allocating resources in times of crisis. An upfront investment of resources, as well as a well-designed plan to better prepare health care systems to manage those patients who require surgical services, may provide long term decompression of the system and prevent inappropriate or otherwise avoidable ED utilization.

This retrospective database study has limitations. The NEISS database is generated via a complex probability model creating a national estimate of injuries presenting to U.S. EDs which may fail to capture the true number of UE injuries presenting to EDs from 2016 to 2020. Broad categories of UE injury patterns were chosen to capture the true incidence of injuries over the time frame studied. This categorization system lacks detail about the specific types of injuries which presented to EDs in 2020 and relies on ED classification of injuries which may have been misidentified or later changed following diagnostic testing. The chosen categories may not cover the full spectrum of orthopaedic UE complaints, thus underestimating the true incidence of UE injuries during this 5-year period. As this study focuses on the changing trends caused by the COVID-19 pandemic, only the 4 years prior to the pandemic (2016 through 2019) and the first year of the pandemic (2020) were analyzed. This did not allow for the analysis of trends in ED utilization and subsequent hospital admission for UE injuries in the years leading up to the pandemic. While the presented fig.s may potentially demonstrate both a decrease in ED utilization and an increase in subsequent hospital admission prior to the start of the pandemic, this may be due to the limited number of observational years in the study. However, in a report to the U.S. Department of Health & Human Services in 2021, the Office of the Secretary for Planning and Evaluation demonstrate a normal fluctuation of ED utilization with the most recent peak occurring in 2016, followed by a small decrease in 2017 and 2018 [41]. After Medicaid expansion in 2014, there was a decrease in the rate of hospital admission from EDs until 2016. After 2016, the rate subsequently increased in 2017 and 2018. As the present study only includes years after 2015, the normal fluctuation of ED utilization and fluctuation following Medicaid Expansion may explain the changes seen leading up to 2020 and the COVID-19 pandemic. Another limitation includes the inability of the database to capture tele-health and virtual consultations which increased drastically in 2020. Furthermore, the database fails to identify pertinent specifics about patient care, such as surgically versus nonsurgically managed patients, specific injury patterns, or those with an UE complaint not related to their admission. Finally, the study does not evaluate outcome measures which may be a future area of interest in orthopaedic and emergency medicine research.

5. Conclusion

Our study demonstrated that when compared to pre-pandemic levels, fewer patients presented to the ED with UE injuries in 2020 but the estimated number of hospital admissions related to UE conditions increased from prior years, regardless of age or body part affected. The decreased incidence of UE injuries observed may be a result of hospital avoidance in fear of COVID-19 transmission and decreased risky behaviors during lockdown conditions. We speculate that the increased rates of hospital admissions for UE complaints may be explained by delays in care and lack of available outpatient resources resulting in both higher acuity and complexity of ED visits and potential inappropriate use of ED services in the setting of strains on resource utilization and the cancellation of ambulatory surgical services in the early months of the pandemic. Upfront resource allocation to treat UE injuries may be an important way to decrease strain on the healthcare system in future pandemics.

CRediT authorship contribution statement

J. Alex Albright: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – review & editing, Writing – original draft. **Edward J. Testa:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization. **John Hanna:** Writing – original draft, Writing – review & editing. **Michael Shipp:** Writing – review & editing, Writing – original draft. **Christopher Lama:** Writing – original draft, Writing – review & editing. **Michel Arcand:** Writing – review & editing, Project administration.

Declaration of Competing Interest

There are no relevant conflicts of interest for any authors or involved parties.

There were no sources of financial assistance for this work.

This work has not been submitted or presented for publication elsewhere.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2022.02.033.

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