

The COVID-19 Pandemic: Effects on Pediatric Fracture Patterns in the Emergency Department and Subspecialty Follow-up Care

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Purpose: The COVID-19 pandemic affected pediatric fracture injury patterns and volume. There is a paucity of research evaluating this trend throughout the pandemic and also follow-up to orthopaedic subspecialty care after emergency fracture management.

Methods: This retrospective cohort study reviewed patients 2 to 18 years of age presenting for fracture care to an urban pediatric emergency department. We assessed patient demographics, clinical care, and follow-up to surgical subspecialist. Time periods investigated included March 30 to September 4, 2020 (pandemic), March 30 to September 4, 2019, and March 30 to September 4, 2018 (prepandemic). Subanalysis within the pandemic was during the “stay-at-home order” versus the phased reopening of the state. Descriptive statistical analysis, Pearson’s χ^2 or Fisher exact tests, and Mann-Whitney U tests were performed.

Results: In this population, fractures overall declined by 40% ($n = 211$) during the pandemic compared with 2019 ($n = 349$) and 28% compared with 2018 ($n = 292$). Lower extremity fractures accounted for a greater percentage of injuries during the pan-

dem compared with prepandemic. Time to surgical subspecialty follow-up was shortest during the 2020 pandemic peak at 9 days and was significantly longer during phased reopening (phase 1: 18 d, $P = 0.001$; phase 2: 14 d, $P = 0.005$). These patterns were also consistent for days to repeat imaging.

Conclusions: We found differences in fracture prevalence, mechanisms, and follow-up care during the pandemic. Time to subspecialty follow-up care was longer during pandemic phased reopening despite overall fewer fractures. Plans to absorb postponed visits and efficiently engage redeployed staff may be necessary to address difficulties in follow-up orthopaedic management during public health crises.

Level of Evidence: Level II.

Key Words: fracture, clinic care, emergency care, pandemic

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BACKGROUND

The COVID-19 global pandemic greatly impacted the spectrum of pediatric medical emergencies. Although there was a concern that adult resources may become overwhelmed, pediatric emergency visits and hospitalizations initially decreased.^{1,2} Types of pediatric illnesses³ and injuries⁴ requiring care were also affected, likely from both the government response and personal behavior influencing how children spent time. Initial research demonstrated that ingestions⁵ and non-accidental trauma (NAT)⁶ rose during the beginning of the pandemic, while other authors have reported no difference in trauma from inter-personal violence, including NAT, as the duration of pandemic progressed.⁷ Although the volume and the epidemiology of emergency department visits changed, there was a concomitant concern about routine follow-up and preventative care. There were 2.5 million fewer routine pediatric immunizations ordered in the United States,⁸ suggesting a decline in wellness exams. As clinics shifted to telemedicine⁹ and physicians were redeployed to COVID-19 units, compounded by the possibility of families avoiding healthcare facilities due to fear of infectious exposures, the question further emerged about patient access to timely follow-up care for injuries.

Fractures are a common childhood injury and account for a large proportion of trauma treated in the pediatric emergency department (PED). One out every 1000

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children will sustain a fracture, with 9.47 children for every 1000 requiring fracture treatment yearly. The most common is forearm fractures, representing 17.8% of fractures.¹⁰ Although most fractures can be managed as an outpatient, prevention is important owing to the financial burden and psychological stress to children.¹¹ Despite new preventative measures, fracture incidence continued to increase over the years before the pandemic¹² and follow-up is important to prevent complications. One prior study highlighted that fracture incidence decreased during the first month of the pandemic,⁴ but it is unknown whether such trends persisted throughout the evolving health crisis and how patients fared during follow-up after PED management.

Our objectives were to determine the pediatric fracture injury pattern and PED care during the height of the COVID-19 pandemic. To address the paucity of research assessing PED follow-up care during a global health crisis, we further examined surgical subspecialty clinic care and imaging for fractures following emergency visits.

METHODS

Study Design

This is a retrospective cohort study of pediatric patients treated for fracture injuries at an urban PED. The hospital's Institutional Review Board approved this study.

Study Setting

The study was conducted in PED patients evaluated for fracture at a large urban tertiary care pediatric center. It is the state's only level 1 pediatric trauma center and there are ~34,000 visits per year before the global pandemic. The PED serves patients from 0 days to 21 years of age; the overall patient population is 60% African American, 20% Caucasian, and the majority (60%) are publicly insured. There were ~10,000 fewer overall visits to our PED in 2020 compared with 2018 and 2019. Pediatric orthopaedic surgery has 24-hour coverage for the PED

and has outpatient clinics on site at the hospital, and community satellite clinics.

Patient Population

Inclusion criteria were patients aged 2 to 18 years, fractures of axial or long bones (Fig. 1), and presentation to the PED from March 30 to September 5 in the years 2020, 2019, and 2018. Exclusion criteria were fractures of hands, fingers, feet, or toes. These dates were selected to reflect the state timeline of pandemic-related restrictions. Similar to all states with pandemic mitigation strategies, the state government enacted a "stay-at-home" order, followed by various stages of reopening. The "stay-at-home" order limited travel outside the home and closed all non-essential businesses, effective from March 30, 2020 to May 15, 2020. Phase 1, which allowed some nonessential businesses to reopen and expanded the limit of gathering size, was from May 15, 2020 to June 6, 2020. Further reopening occurred from June 6, 2020 to September 4, 2020, at which time Phase 3 began. The "pandemic" will refer to data from the year 2020 and "prepandemic" time periods will indicate 2019 and 2018.

Data Collection

The electronic medical record (EMR) utilized by this study site was EPIC. This EMR queried ICD-10 diagnostic codes for all fractures to identify eligible patients (Supplemental appendix Fig. 1, Supplemental Digital Content 1, <http://links.lww.com/BPO/A527>). Demographic data including medical record number, arrival date, acuity level, PED disposition, and means of arrival were reported directly from aggregated department metrics. Emergency department and subspecialty consult notes, procedure notes, radiographic imaging, and clinic documentation were reviewed to determine type of fracture, mechanism of injury, location of injury, PED presentation (transfer vs. primary presentation to the study site), PED management (need for subspecialty consultation, and procedural sedation for closed reduction), and postPED management (subspecialty follow-up visit and follow-up radiographic

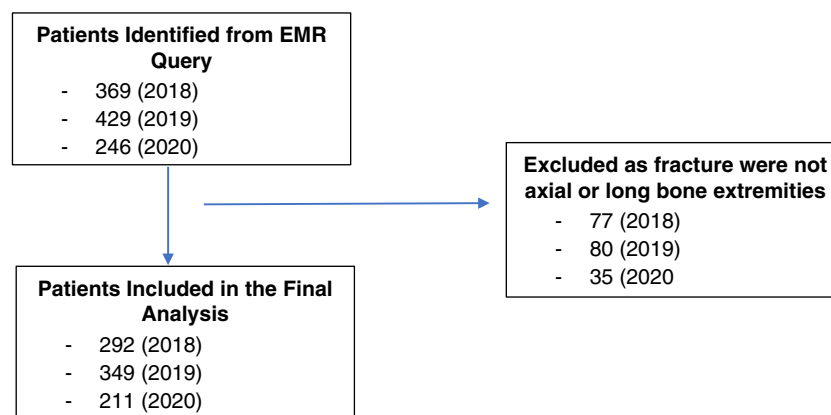


FIGURE 1. Schematic of patients meeting inclusion and exclusion criteria for data analysis Electronic Appendix: ICD1- codes used to query charts for patient analysis Electronic Appendix: Time to surgical subspecialist follow-up and imaging after PED evaluation during various phases of the pandemic and prior equivalent years. full color online

imaging). If a mechanism or location of injury was not listed in the chart, or there were disagreements among different provider notes, the variable was listed as “unknown”. The record was reviewed to determine if a patient sought care in the PED before first clinic visit. Such visits were characterized as “unexpected return to care”.

Medical record review included both the hospital-based EMR and also the state-wide EMR system (Chesapeake Regional Information System for our Patients [CRISP, <https://www.crisphealth.org>]) to determine if a patient had unexpected return to care, clinic follow-up, or imaging at an outside facility.

“Primary encounter” was defined as a patient presenting to the PED for first evaluation, or as referral from an urgent care or outpatient clinic. “Transfer encounter” was defined as initial care received at another PED which required transfer to our hospital for a higher level of care.

One researcher collected data for all included subjects. A second researcher reviewed 40% of the included patients, representing 30% of each year’s data. There was an initial 97% agreement for all data collected, with a kappa of >0.9 for each variable. Data was then reconciled by consensus to 100% agreement for statistical analysis.

Statistical Analysis

Descriptive analyses characterized the patient sample including type of fracture, and location and mechanism of injury. To examine differences in frequencies for eleven categorical variables (sex, means of arrival, presentation, acuity level, surgical consultation, sedation, operative repair, disposition, unexpected return to the PED, follow-up to subspecialist, and repeat radiography) between the groups of interest (ie, patients presenting to the PED during the pandemic vs. prepandemic), χ^2 or Fisher exact tests were used. The 3 continuous variables (age and time to surgical follow-up and repeat radiography) were reported as median and interquartile ranges (IQR) and group differences were examined with Mann-Whitney *U* tests. Statistical significance was assumed when $P < 0.05$.

RESULTS

Overall Patient Population

There were 1044 patients identified that presented for fracture care. Of these, 852 were included in the final sample (Fig. 1).

Fracture Demographics

Overall, there was a decrease in the number of patients presenting to the PED with fractures during the pandemic (Table 1). In 2020, there were 211 total PED patients with fractures compared with 349 and 292 in 2019 and 2018. This represented a 40% decrease compared with 2019 and a 28% decrease from 2018. In the prepandemic years, the three most common sites of injury were public/private playground, street, and home/yard (Table 2). In 2020, although home/yard and street remained as the most common locations, playground injuries and sports field injuries were less common.

The top five most common mechanisms of injuries were similar during the prepandemic and pandemic time periods (Table 3). However, playground and sports falls were far less common in 2020, whereas self-propelled toys with wheels accounted for more injuries during the pandemic.

The differences in locations and mechanisms of injuries also led to different patterns in types of fractures (Table 4). The most common fractures prepandemic and during the pandemic were forearm, supracondylar, and lower leg fractures. Overall, lower extremity fractures accounted for a greater proportion of injuries in 2020 at 28.4% compared with 20.9% in 2019 and 20.2% in 2018. Femur fractures were more common during the pandemic compared with prior years, being the fourth most common fracture presenting for care in 2020.

Ages and sex of patients presenting for fractures were similar across all years (Table 5), with 63% of fractures occurring in males during the pandemic, and 61.6% in 2019 ($P=0.79$) and 59.6% in 2018 ($P=0.46$). The median age of patients was 8 (IQR 5-12) years old in 2020, 7 (IQR 5-11) years old in 2019 ($P=0.8$) and 7.5 (IQR 6-12, 95% confidence interval -1 to 1) years old in 2018 ($P=0.94$, 95% confidence interval -1 to 1).

Pre-Emergency Department Care

Presentation to the PED for care was similar during prepandemic and pandemic years (Table 5). Means of arrival was consistent, with 25.6% of patients presenting via ground or air ambulance in 2020, and 22.9% in 2019 ($P=0.23$) and 20.5% in 2018 ($P=0.35$). There was no statistical difference in patients presenting for initial care in our PED compared with an outside-hospital facility. In all, 41.7% of patients were transferred to our facility for fracture management in 2020, 38.4% in 2019 ($P=0.48$), and 45.5% in 2018 ($P=0.41$).

Emergency Department Care

The severity of fractures in 2020 compared with 2018 and 2019 was similar based on acuity triage level (Table 5), with 80.1% acuity level 3 in 2020, 80.8% in 2019 ($P=0.67$), and 83.6% in 2018 ($P=0.62$). Fractures requiring subspecialty consultation, most commonly orthopaedics, were similar during the pandemic and prepandemic. In 2020, 92.4% of patients had a surgical subspecialist consultation in the PED, with 88.8% in 2019 ($P=0.46$) and 92.1% in 2018 ($P=0.97$). There was no statistical difference in the proportion of fractures requiring closed reduction under sedation (29.9% in

TABLE 1. Types of Fractures Presenting During the Pandemic and Prepandemic

Type of Fracture	2020	2019	2018
	(n = 211) % (n)	(n = 349) % (n)	(n = 292) % (n)
Axial skeleton	10.9 (23)	10.0 (35)	9.9 (29)
Upper extremity	60.7 (128)	67.6 (236)	69.9 (204)
Lower extremity	28.4 (60)	20.9 (73)	20.2 (59)
More than one location	0 (0)	1.4 (5)	0 (0)

TABLE 2. Locations of Fracture Injuries During Pandemic and Prepandemic

Location of Injury	2020	2019	2018
	(n = 211) % (n)	(n = 349) % (n)	(n = 292) % (n)
Home/yard	35.1 (74)	18.1 (63)	18.5 (54)
Street	30.3 (64)	16.3 (57)	20.9 (61)
Playground (public or private)	8.5 (18)	24.4 (85)	22.6 (66)
Gym/rink	0.9 (2)	1.7 (6)	4.1 (12)
School/camp/daycare	0.5 (1)	6.9 (24)	5.1 (15)
Community	2.8 (6)	5.2 (18)	5.1 (15)
Sports field	7.1 (15)	13.2 (46)	14.7 (43)
Natural or artificial water	3.3 (7)	0.6 (2)	2.4 (7)
Unknown	11.4 (24)	13.8 (48)	6.5 (19)

Bold reflects 3 most common locations of injury.

2020; 32.4% in 2019, $P=0.57$; and 29.1% in 2018, and $P=0.92$) or operative repair on initial presentation to the PED (32.7% in 2020; 26.9% in 2019, $P=0.15$; and 28.1% in 2018, $P=0.28$). During the pandemic 23.7% of patients were admitted to inpatient care for further management, similar to 16.9% in 2019 ($P=0.14$) and 21.2% in 2018 ($P=0.54$).

Subspecialty Follow-up

During the entirety of the pandemic time period evaluated, 76.3% of patients successfully obtained follow-up fracture care after PED management (Supplemental appendix Table 1, Supplemental Digital Content 2, <http://links.lww.com/BPO/A528>), which was comparable to 80.2% in 2019 ($P=0.29$) and 75.3% in 2018 ($P=0.83$).

TABLE 3. Mechanism of Fracture Injuries During Pandemic and Prepandemic

Mechanism of Injury	2020	2019	2018
	(n = 211) % (n)	(n = 349) % (n)	(n = 292) % (n)
Fall from standing	10.4 (22)	19.8 (69)	15.1 (44)
Fall from furniture	15.2 (32)	6.3 (22)	7.5 (22)
Sports injury	9.5 (20)	15.5 (54)	17.1 (50)
Fall from playground equipment	8.5 (18)	22.3 (78)	23.3 (68)
Motor vehicle crash	4.7 (10)	2.3 (8)	1.4 (4)
Pedestrian struck	4.3 (9)	2.0 (7)	4.5 (13)
Assault	0.9 (2)	2.3 (8)	1.7 (5)
Fall from building (window or ceiling)	0.9 (2)	1.1 (4)	1.0 (3)
Trampoline injury	7.1 (15)	4.0 (14)	2.4 (7)
Water activity	1.4 (3)	0.6 (2)	2.1 (6)
Self-propelled toy with wheels (bike, rollerblades, skateboard, hoverboard)	18.5 (39)	11.2 (39)	12.0 (35)
Scooter	4.7 (10)	4.6 (16)	4.1 (12)
Go-kart/four-wheeler	3.8 (8)	1.4 (5)	1.0 (3)
Fall on staircase	4.3 (9)	2.6 (9)	1.4 (4)
Fall from height (tree, wall, horse)	2.4 (5)	2.0 (7)	4.5 (13)
Fall from sled	0.5 (1)	0 (0)	0 (0)
Unknown and medically complex	2.8 (6)	2.0 (7)	1.0 (3)

Bold reflects the 3 most common mechanisms of injury.

TABLE 4. Bone Fractures Presenting During Pandemic and Prepandemic

Type of Fracture	2020	2019	2018
	(n = 211) % (n)	(n = 349) % (n)	(n = 292) % (n)
Skull and face	8.5 (18)	8.3 (29)	8.2 (24)
Spine	2.4 (5)	1.4 (5)	1.7 (5)
Rib/sternum	0 (0)	0.3 (1)	0 (0)
Clavicle	5.2 (11)	1.7 (6)	4.8 (14)
Scapula	0.5 (1)	0 (0)	0 (0)
Humerus (proximal or midshaft)	3.8 (8)	3.2 (11)	3.8 (11)
Supracondylar	19.4 (41)	20.9 (73)	21.9 (64)
Epicondyle (medial or lateral)	1.9 (4)	3.4 (12)	2.7 (8)
Forearm (radius, ulna, both bone forearm)	28.9 (61)	38.1 (133)	36.0 (105)
Pelvis	1.9 (4)	0.6 (2)	1.4 (4)
Femur	11.8 (25)	7.7 (27)	6.8 (20)
Lower leg (tibia, fibula, tibia-fibula)	14.7 (31)	11.7 (41)	12 (35)
Patella	0 (0)	0.9 (3)	0 (0)
Multiple upper extremity	0.9 (2)	0 (0)	0 (0)
Multiple lower extremity	0 (0)	0 (0)	0.7 (2)
Multiple sites	0 (0)	1.7 (6)	0 (0)

Bold reflects the 3 most common fracture bones.

The median time to first clinic appointment overall was similar at 13 (IQR 8-27) days in 2020 compared with 12 (IQR 7-23) days in 2019 ($P=0.06$) and 11 (IQR 8-23) days in 2018 ($P=0.11$).

The shortest time to clinic follow-up in all the pandemic and prepandemic time periods was the peak of the pandemic during the “stay-at-home” order (Supplemental appendix Table 2, Supplemental Digital Content 3, <http://links.lww.com/BPO/A529>) in 2020 (March 30, 2020-May 15, 2020), or pandemic peak, with a median time of 9 (IQR 7-13.5) days. This was not statistically significantly different than prepandemic equivalent dates.

When examining the various stages within the 2020 pandemic, there was a significantly longer time to follow-up during the phased reopening compared with the “stay-at-home” order. Compared with the peak of the pandemic, Phase 1 of 2020 reopening had a median time to subspecialty follow-up of 18 (IQR 11-41.75) days ($P=0.001$, 95% CI [-22, -3]) and 14 (8-27.75) days in Phase 2 ($P=0.005$, 95% CI [-7, -1]) (Supplemental appendix figure 2, Supplemental Digital Content 4, <http://links.lww.com/BPO/A530>).

Imaging Follow-up

Similar proportions of patients were able to obtain follow-up imaging after diagnosis of fracture (Supplemental appendix Table 1, Supplemental Digital Content 2, <http://links.lww.com/BPO/A528>) during the pandemic (75.0%) as in 2019 (74%, $P=0.77$) and 2018 (71%, $P=0.31$). Overall, in the pandemic there was a similar time to imaging at 13 (IQR 8-29) days compared with a median of 13 (IQR 7-25) days in 2019 ($P=0.39$, 95% confidence interval -2 to 1 d) and 12 (IQR 8-12) days in 2018 ($P=0.26$, 95% CI [-3, 1]).

TABLE 5. PED Presentation and Clinical Care

	2020 (n = 211)	2019 (n = 349)	P	2018 (n = 292)	P
Sex	% (n)	% (n)		% (n)	
Female	37 (78)	38.4 (134)	—	40.4 (118)	—
Male	63 (133)	61.6 (215)	—	59.6 (174)	—
			0.79		0.46
Age (y)	Median (IQR) 8 (5-12)	Median (IQR) 7 (5-11)	—	Median (IQR) 7.5 (6-12)	—
			0.83		0.91
			95% CI [-1, 1]		95% CI [-1, 1]
Means of arrival	% (n)	% (n)		% (n)	
Air ambulance	0.5 (1)	0 (0)	—	0 (0)	—
Ground ambulance	25.1 (53)	22.9 (80)	—	20.5 (60)	—
Public/private transportation	45.0 (95)	51.9 (181)	—	46.2 (135)	—
Hospital transport	29.4 (62)	25.2 (88)	—	33.2 (97)	—
			0.23		P=0.35
Primary vs transfer presentation	% (n)	% (n)		% (n)	
Primary	58.3 (123)	61.6 (215)	—	54.5 (159)	—
Hospital-hospital transfer	41.7 (88)	38.4 (134)	—	45.5 (133)	—
			0.48		0.41
Acuity level	% (n)	% (n)		% (n)	
1	0 (0)	0.3 (1)	—	0 (0)	—
2	14.7 (31)	12.0 (42)	—	12.3 (36)	—
3	80.1 (169)	80.8 (282)	—	83.6 (244)	—
4	5.2 (11)	6.9 (24)	—	4.1 (12)	—
			0.67		0.62
Surgical subspecialty consultation	% (n)	% (n)		% (n)	
Yes	92.4 (195)	88.8 (310)	—	92.1 (269)	—
No	7.6 (16)	11.2 (39)	—	7.9 (23)	—
			0.46		0.97
Sedation	% (n)	% (n)		% (n)	
Yes	29.9 (63)	32.4 (113)	—	29.1 (85)	—
No	70.1 (148)	67.6 (236)	—	70.9 (207)	—
			0.57		0.92
Operative repair	% (n)	% (n)		% (n)	
Yes	32.7 (69)	26.9 (94)	—	28.1 (82)	—
No	67.3 (142)	73.1 (255)	—	71.9 (210)	—
			0.15		0.28
Disposition	% (n)	% (n)		% (n)	
Discharge	62.1 (131)	68.5 (239)	—	66.8 (195)	—
Admit	23.7 (50)	16.9 (59)	—	21.2 (62)	—
Operating room	14.2 (30)	14.6 (51)	—	12.0 (35)	—
			0.14		0.54
Unexpected return to PED	% (n)	% (n)		% (n)	
Yes	4.3 (9)	5.7 (20)	—	4.5 (13)	—
No	95.7 (202)	94.3 (329)	—	95.5 (279)	—
			0.56		1.00

CI indicates confidence interval; IQR, interquartile range; PED, pediatric emergency department.

Within the pandemic, follow-up imaging was longer after the peak of the pandemic (Supplemental appendix Table 2, Supplemental Digital Content 3, <http://links.lww.com/BPO/A529>). Phase 1 of 2020 had a median time for first imaging at 18 (IQR 11-40) days ($P < 0.001$, 95% CI [-22, -4]) and 14 (IQR 9-29) days in Phase 2 ($P = 0.002$, 95% CI [-9, -2]).

Unexpected Return to Emergency Care

Similar number of patients returned to the PED for care before first subspecialty follow-up appointment in the pandemic and prepandemic (Table 5) with 4.3% in 2020, 5.7% in 2019 ($P = 0.56$), and 4.5% in 2018 ($P = 1.00$).

There was no more unexpected return to care in the PED when clinic and imaging were delayed, as there were 0 patients fitting this 2020 criteria in Phase 1 of reopening ($P = 1.00$) and only 6% in Phase 2 ($P = 0.45$) compared with the peak of the pandemic (stay-home-order), which had the most expedited clinic appointments.

DISCUSSION

Although other studies have explored the impact of the pandemic on injury epidemiology, including relating to fractures,² this study is unique because we assessed only long bones of the arms and legs and axial skeleton, which are generally fractures that require subspecialty follow-up.

Fracture care was also analyzed during a longer period of the pandemic and included multiple phases of government reopening that would affect how and where children play. To our knowledge, this is also the first pediatric study to assess surgical subspecialty clinic follow-up after PED care during the pandemic.

According to our data, the number of long bone and axial fractures presenting to the PED decreased during the pandemic, but injury severity was unchanged given PED presentation and management were unaffected. This study site and surrounding community had a smaller decrease in the number of fractures, compared with the 2.5-fold decrease in March 2020 to April 2020 at a children's hospital in Philadelphia.⁴ This may reflect the exclusion of long bone fractures of the digits in this analysis. Other reasons may include: variations in exposure to injury (i.e. different behavior response to similar government mandates compared with other cities and riskier motor vehicle and pedestrian street practices), variation in threshold and/or setting to seek care for injury (higher utilization of the emergency department), and longer time duration in our study.

In contrast to other studies, we also found that there was no significant difference in the proportion of fractures that underwent operative repair on initial presentation.⁴ In addition, the method of transportation to the PED, transfers to tertiary care facility, subspecialty consultation, and closed reduction with sedation in the PED showed no significant difference during the pandemic and pre-pandemic periods. Overall, PED care for fractures presenting in 2020 and pre-pandemic was similar.

The types of fractures and mechanism of injury during the pandemic compared with pre-pandemic time periods highlight the inherent dangers in the home which should be addressed to reduce preventable injuries, regardless of on-going public health concerns. In addition to the need for increased supervision, many injuries occurred from falls off furniture and down the stairs, which may be mitigated through practices such as child-safety gates and bolting furniture. Despite public playgrounds being closed during the pandemic, injuries still occurred at private playgrounds. It is important for the general and emergency medicine pediatrician to discuss appropriate playground safety, child-proofing, and age-appropriate play.

There was high proportion of fractures occurring during the pandemic from the use of self-propelled wheeled toys, such as bicycles, skateboards, hoverboards, and rollerblades, demonstrating the need for safety equipment to prevent such injuries, and re-evaluation of the overall safety of these toys for different age groups. Continued road safety teaching for children is also indicated; it is additionally important for drivers to have increased awareness during pandemics as more children are using the streets as a play area when sports fields and playgrounds are no longer accessible.

The different stages of the pandemic government-mandated "stay-at-home" order and phased re-opening affected patients' time to subspecialty follow-up clinic care and imaging. During the pandemic "stay-at-home" order, time to follow-up was expedited. This is from a combination

of factors, but most likely the postponement of other previously scheduled non-urgent routine clinic appointments. Employed adult working from home may facilitate bringing children to clinics during the work-day. Remote learning and canceled after-school activities may have further contributed to ease of clinic presentation.

Conversely, once the state entered phases 1 and 2 of re-opening, the ability to follow-up in subspecialty clinic was significantly delayed; the longest time to first clinic appointment and follow-up imaging date in all time periods assessed was during this time. It is most surprising that this follow-up was prolonged compared with pre-pandemic visits, as the total number of fractures requiring care was fewer.

It is unlikely that a fear of presenting to healthcare contributed as the percentage of patients who were lost to follow-up was unchanged. This is also in contrast to expedited care during the pandemic "stay-at-home" order, when non-emergent medical care visits were most discouraged. Changes in follow-up cannot be attributed to different fracture severity presenting throughout the pandemic, as presentation to the PED, PED care, and disposition were similar. The most likely causative factor was an accumulation of postponed routine appointments during the pandemic peak that made urgent follow-up visits more difficult to schedule.

These patterns are important to learn so that clinic care can be improved during future national and state emergency responses that will affect overall access to healthcare. Surgical subspecialties should be prepared for an accumulation of patients needing both routine and urgent care following the acute phase of any public health crisis or pediatric illness surge. Procedures to ensure patients can obtain fracture follow-up after emergency care is necessary. Options include reserving more than typical urgent appointment visits per day, even though the overall number of injuries are likely to decrease during this time. The emergency medicine physician can also contribute to follow-up navigation during these times by scheduling first follow-up clinic appointment before PED discharge.

Surgical subspecialists also participated in re-deployment to departments with overwhelmed resources during the pandemic. Even though planned surgeries and clinics may be cancelled during a government "shut-down" or redistribution of resources during increased emergency department volumes, it is important to efficiently re-engage physicians and other available staff back to their primary specialty during re-opening so that urgent patients can still receive expedited care.

Our study is limited by the retrospective nature and single-site design. Limitations also include relying on physician notes to evaluate several analyzed variables. In addition, patients may have followed up outside of clinics that report to the state-wide EMR system—CRISP.

The pandemic changed the fracture landscape and mechanisms of injury compared with prior time periods, but not the severity of injuries. Although follow-up care was expedited during the pandemic peak, patients had delayed first clinic and imaging appointments during the phased re-opening. Future research is needed to determine

if such patterns persist in nonurban environments and at what point clinic follow-up returned to prepandemic timing. Continued clinic data analysis will also help determine the exact cause of delayed cared during the phases of pandemic re-opening.

REFERENCES

1. Adejemia J, Hartnett KP, Kite-Powell A, et al. Update: COVID-19 pandemic-associated changes in emergency department visits- United States, Dec 2020-Jan 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70:552–556.
2. Harnett KP, Kite-Powell A, Devies J, et al. Impact of the COVID 19 pandemic on emergency department visits- United States, Jan 1 2019-May 30, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69:699–704.
3. Pelletier JH, Rakkar J, Au A, et al. Trends in United States Pediatric Hospital Admissions in 2020 compared with the decade before COVID-19 pandemic. *JAMA Netw Open.* 2021;4:E2037227.
4. Bram JT, Johnson MA, Magee LC, et al. Where have all the fractures gone? the epidemiology of pediatric fractures during the COVID-19 pandemic. *J Pediatr Orthop.* 2020;40:373–379.
5. Radwan CM. COVID-19: Poison control centers report surge in accidental poisonings from cleaning products. *Contemp Pediatr.* 2020;1. Available at: <https://www.contemporarypediatrics.com/view/covid-19-poison-control-centers-report-surge-accidental-poisonings-cleaning-products>.
6. Kovler ML, Ziegfeld S, Ryan LM, et al. Increased proportion of physical child abuse injuries at a level I pediatric trauma center during the Covid-19 pandemic. *Child Abuse Negl.* 2021;116 (Pt 2):104756.
7. Sanford EL, Zagory J, Blackwell JM, et al. Changes in pediatric trauma during COVID-19 stay-at-home epoch at a tertiary pediatric hospital. *J Pediatr Surg.* 2021;56:918–922.
8. Santoli JM, Lindley MC, DeSilva MB, et al. Effects of the COVID-19 pandemic on routine pediatric vaccine ordering and administration — United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69:591–593.
9. Wahezi SE, Duarte RA, Yerra S, et al. Telemedicine during COVID-19 and beyond: a practical guide and best practices multi-disciplinary approach for the orthopedic and neurologic pain physical examination. *Pain Physician.* 2020;23:S205–S238.
10. Naranje SM, Erali RA, Warner WC Jr, et al. Epidemiology of pediatric fractures presenting to emergency departments in the United States. *J Pediatr Orthop.* 2016;36:e45–e48.
11. Stancin T, Kaugars AS, Thompson GH, et al. Child and family functioning 6 and 12 months after a serious pediatric fracture. *J Trauma.* 2001;51:69–76.
12. Mathison DJ, Agrawal D. An update on the epidemiology of pediatric fractures. *Pediatr Emerg Care.* 2010;26:594–603.