



Trends in Pediatric Emergency Department Utilization after Institution of Coronavirus Disease-19 Mandatory Social Distancing

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We conducted a descriptive time-series study of pediatric emergency healthcare use during the onset of severe acute respiratory syndrome coronavirus 2 pandemic after a state-wide stay-at-home order. Our study demonstrated decreased volume, increased acuity, and generally consistent chief complaints compared with the prior 3 years (2017 through 2019). Ingestions became a significantly more common chief complaint in 2020. (*J Pediatr* 2020;226:274-7).

In an effort to contain the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), there have been widespread changes in daily activities and healthcare delivery to decrease viral spread.^{1,2} In addition to the intended impacts on healthcare use, changes in daily activities could also lead to changes in emergency healthcare use for complaints unrelated to SARS-CoV-2 syndromic illness (coronavirus disease 2019 [COVID-19]). Early data have shown changes in emergency care use including decreased frequency of visits and disease specific changes.³⁻⁷

Changing patterns of healthcare use could be driven by a decreased need for emergency medical care, decreased use of emergency medical care despite need, or shifted use within the medical system to alternative sources of urgent medical care, such as telemedicine. For example, decreased travel and mobility may lead to fewer related injuries and a decreased need for emergency medical care related to motor vehicle accidents.³ Related data from California show fewer motor vehicle crashes and injuries during the COVID-19 shelter-in-place period compared with data from the previous year.⁸ There have been multiple reports of decreased care for acute myocardial infarction in adults with concern that delayed or missed presentation may result in long-term morbidity.^{4,6} Data from pediatric providers have demonstrated that approximately 1 in 3 presentations for emergency medical care was perceived to be delayed.⁹ Finally, telemedicine care has been brought to the forefront during the global pandemic response.¹⁰

Children have a lower likelihood of direct infection with SARS-CoV-2, and thus less need for related emergency medical care, compared with adults.¹¹ Changes in other healthcare interactions, including routine pediatric care has been as demonstrated by decreased immunization rates per the US Centers for Disease Control and Prevention.¹² An analysis from a Chinese outpatient pediatric care also revealed decreased overall outpatient healthcare with notable

decreases in multiple infectious complaints.¹³ Alternatively, social isolation measures may expose children to different risks. For example, available data have shown a large increase in national calls to poison control centers, including a persistent percentage of child exposures, and a 3-fold increase in dog bites at 1 large pediatric hospital.^{14,15}

Understanding patient or caregiver stated concerns at the point of emergency medical care access can be a useful reflection of community sense of health emergencies beyond provider determined diagnoses. Data support discordance between chief complaint and diagnosis codes.^{16,17} Additionally, triaged acuity at presentation to ED can give insight to use of emergency medical care for high-vs low-acuity issues. In prepandemic times, a substantial volume of pediatric ED use was related to low-acuity needs.¹⁸ Drivers of low-acuity ED use include perceived and real barriers in access to other sources of medical care, parental health literacy, and perceptions in quality of care differences.¹⁸⁻²¹ Overall shifts in acuity trends at presentation may give additional insight to community sense of health emergencies, as well as outline areas of focus for assessment of delayed emergent medical care that may result in morbidity and mortality.

We sought to characterize the early impact of social distancing measures by describing the volume, acuity, and distribution of presenting complaints in a high-volume urban, tertiary pediatric emergency department.

Methods

Study Design

A descriptive, cross-sectional study of emergency department (ED) visits to a tertiary urban children's hospital comparing

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|------------|---|
| COVID-19 | Coronavirus disease 2019 |
| ED | Emergency department |
| ESI | Emergency Service Index |
| SARS-CoV-2 | Severe acute respiratory syndrome coronavirus 2 |

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2020 (the study time period) to the same date range during 3 prior years (2017 through 2019, the baseline time period).

Participant Selection

Visits were excluded if patients left without being seen, were transferred to another institution, left against medical advice, or were older than 21 years ($n = 446$). We included data per visit and did not restrict to unique patients served during the study period.

Data Source

We abstracted data from the institution's electronic medical record, including demographic variables, chief complaint, triage acuity at presentation, and disposition from ED. Demographic variables included age, sex, race, ethnicity, and insurance carrier. Insurance carrier was classified as private or public including Medicaid or local state providers. Chief complaint and acuity are recorded during triage by a standardized process. Chief complaint is categorized according to an institutional standard.²² Acuity is determined per the Emergency Service Index (ESI) triage levels on scale of 1 (critical) to 5 (nonurgent) based on anticipated resource use and patient factors such as medical history, age, and vital signs.²³ We reviewed the complete list of chief complaints ($n = 231$) in the dataset. We collapsed rare presenting chief complaints into clinically synonymous common categories by author consensus, for example, combining ingestions and poisonings (Table 1; available at www.jpeds.com). We included the top 20 complaints for each time period which resulted in 21 total complaints.

Outcomes

We assessed visit count by week during the first 16 weeks of the calendar year during 4 consecutive years (2017-2020) to evaluate the impact of social distancing and official stay-at-home orders on ED volume. We then reviewed additional elements of visits within 30 days after a statewide stay-at-home order was issued (March 23, 2020, through April 21, 2020) compared with the same date range during the 3 prior years (2017-2019).

Data Analyses

We described demographic characteristics associated with ED visits. We assessed acuity at presentation overall between the 2 time periods as well as by chief complaint. We described disposition from the ED as admission or discharge. Admission to the intensive care unit was defined as admission from the ED directly to any intensive care unit including general, neonatal, and cardiac.

We compared data from 2017 through 2019 with that from 2020 using standard parametric and nonparametric descriptive tests. We set level for statistical significance at 0.0016 per Bonferroni correction for family-wise error. This study was determined to not represent human subjects research by the Institutional Review Board at the Children's Hospital of Philadelphia.

Results

We observed similar weekly numbers of ED visits for all 4 years through week 10 of 2020, when there was a rapid decrease in ED visits concurrent with local documentation of SARS-CoV-2 (Figure; available at www.jpeds.com).

In the 30-day window after the stay at home order in 2020 and the same time period in 2017-2019, there were 29 496 ED visits (Table II). Of these, 2948 were in 2020 and 26 548 were in 2017-2019. The mean number of daily visits was lower in 2020 (95 ± 16 vs 286 ± 42 ; $P < .001$). The distribution of patient race was significantly different ($P < .001$), including a smaller proportion of African American patients (53.9% vs 58.7%) in 2020 compared with the baseline study period (Table II). The distribution of insurance categories also changed ($P < .001$) with a decrease in public insurance (52.3% vs 56.4%).

The proportion of patients categorized as high acuity (ESI triage level 1, 2, or 3) was higher in 2020 (59.4% vs 49.6%; $P < .001$).²³ Similarly, the proportions of patients admitted both overall (22.4% vs 18.5%; $P < .001$) and to the intensive care unit (2.8% vs 1.7%; $P < .001$; Table II) were higher in 2020. By chief complaint, trauma, fever, and abdominal

Table II. Demographic and clinical characteristics of ED visits in baseline period and 2020*

| Characteristics | Baseline (n = 26 548) | 2020 (n = 2948) | P value [†] |
|-------------------------------------|--------------------------|--------------------|-----------------------------|
| Visit year | | | NA |
| 2017 | 8798 (33) | 0 (0) | |
| 2018 | 8094 (31) | 0 (0) | |
| 2019 | 9656 (36) | 0 (0) | |
| 2020 | 0 (0) | 2948 (100) | |
| Daily visits | 286 ± 42 | 95 ± 16 | <.001[‡] |
| Age, years | | | .55 [‡] |
| <1 | 3838 (14) | 531 (18) | |
| 1-4 | 9089 (34) | 908 (31) | |
| 5-12 | 8828 (33) | 832 (28) | |
| 13-18 | 4175 (16) | 544 (19) | |
| 18-21 | 607 (2) | 131 (4) | |
| Female | 12 612 (48) | 1406 (48) | #§ |
| Race | | | <.001[§] |
| African American | 15 578 (60) | 1590 (54) | |
| White | 6640 (25) | 904 (31) | |
| Asian or Pacific Islander | 1107 (4) | 94 (3) | |
| American Indian or Alaskan Native | 32 (1) | 3 (0) | |
| Other | 3142 (12) | 341 (12) | |
| Hispanic or Latino | 2735 (10) | 341 (12) | <.001[§] |
| Public insurance | 14 968 (56) | 1543 (52) | <.001[§] |
| High acuity (ESI triage 1, 2, or 3) | 13 174 (50) | 1543 (52) | <.001[§] |
| ED disposition | | | |
| Admission | 4902 (19) | 661 (22) | <.001[§] |
| Intensive care admission | 456 (2) | 82 (3) | <.001[§] |

NA, not applicable.

Values are mean \pm SD or number (%).

*Limited to March 23 to April 21 for included years; baseline included 2017 through 2019.

[†]P value for comparison of baseline period to 2020. Bolded values statistically significant per Bonferroni family-wise error correction ($P < .0016$).

[‡]t test, unequal variance.

[§] χ^2 test of proportions.

#Due to rounding the percentages are equivalent, by statistical testing there is a statistically significant difference in the proportions (likely driven in part by sample size), however this is not a clinically meaningful difference.

Table III. Count and acuity by chief complaint of pediatric ED use during the first 30 days of the COVID-19 stay-at-home order

| Chief complaints | Baseline | | 2020 | | P value* |
|-----------------------|--------------------------|------------------|------------|------------------|-----------------|
| | Visits per year (n ± SD) | High acuity (%)† | Visits (n) | High acuity (%)† | |
| Trauma | 1274 ± 102 | 34.7 | 449 | 44.3 | <.001 |
| Respiratory | 1538 ± 139 | 64.9 | 433 | 59.8 | .36 |
| Fever | 1229 ± 233 | 30.2 | 394 | 51.8 | <.001 |
| Abdominal pain | 1100 ± 192 | 54.4 | 336 | 69.7 | <.001 |
| Rash | 368 ± 50 | 14.2 | 85 | 28.2 | .003 |
| Seizure | 131 ± 19 | 90.0 | 83 | 97.6 | .282 |
| Sore throat | 176 ± 32 | 15.9 | 72 | 15.3 | 0.526 |
| Psychiatric emergency | 204 ± 33 | 99.4 | 58 | 96.6 | .088 |
| Foreign body | 88 ± 3 | 38.9 | 55 | 30.9 | .288 |
| Chest pain | 119 ± 6 | 46.3 | 50 | 40.0 | .45 |
| Eye emergency | 231 ± 40 | 25.7 | 48 | 47.9 | .002 |
| Dental problem | 53 ± 9 | 50.9 | 45 | 51.1 | 0.559 |
| Male GU | 58 ± 13 | 80.6 | 41 | 78.0 | .671 |
| Headache | 174 ± 35 | 72.0 | 38 | 73.7 | 0.494 |
| Abscess | 61 ± 3 | 85.3 | 38 | 100.0 | .006 |
| Ear pain | 230 ± 5 | 7.4 | 36 | 8.3 | .745 |
| Edema/swelling | 78 ± 3 | 69.8 | 33 | 84.9 | .098 |
| Sickle cell disease | 87 ± 7 | 100.0 | 32 | 100.0 | NA |
| Urination problem | 76 ± 6 | 48.9 | 31 | 61.3 | .251 |
| Ingestion | 25 ± 5 | 76 | 31 | 87.1 | .293 |
| Allergic reaction | 60 ± 4 | 69.3 | 29 | 86.2 | .075 |
| Other or missing | 1490 ± 57 | 61.4 | 531 | 69.1 | .001 |

GU, genitourinary.

*Bolted values statistically significant per Bonferroni family-wise error correction ($P < .0016$).

†Percent of visits categorized as high acuity (ESI triage 1, 2, or 3).

pain had higher proportions of high-acuity presentations in 2020 (Table III).

The most common chief complaints were similar in 2020 compared with the baseline period and the top 20 complaints included more than 80% of visits in both periods (82.0% in 2020 and 83.1% in the baseline time period). Consistent with the decreased volume overall, counts of patient visits for most chief complaints in 2020 were decreased compared with the average counts per year during the baseline period. Notably, ingestion was a top 20 complaint only for 2020 and the number of ingestions in 2020 was higher than the average number of ingestions per year in the comparison period (31 vs 25 ± 6 ; Table III).

Discussion

Visits to a tertiary care pediatric ED decreased dramatically in line with local impact of the COVID-19 pandemic and subsequent to a statewide stay-at-home order. In the 30 days after a statewide stay-at-home order, the mean number of daily visits to a tertiary urban care ED was significantly lower compared with the same time period in the previous 3 years. An initial decrease in visit volume started just before the state-wide stay-at-home order, which may represent voluntary self-isolation before the mandatory order. The proportion of high-acuity patients increased in 2020 as measured by ESI triage level, hospital

admission rate, and intensive care admission rate. The most common chief complaint categories were consistent between the time periods with notable exception of ingestion, which entered the top 20 list for 2020.

The prominence of ingestions is notable as a potential preventable harm experienced by children during the COVID-19 pandemic. This result is consistent with data from the US Centers for Disease Control and Prevention about poison control call volumes, although we are unable to clarify ingestion category or intent within our data.¹⁴ Additionally, although absolute numbers decreased, other potentially preventable chief complaints—namely, trauma and foreign body—increased in relative frequency in 2020. These data, in addition to a report in the literature of increased rate of dog bites, support the hypothesis that children's shifted environments after the stay-at-home orders present different threats to child health, may place children at new, modifiable risk, and identifies an important area of public health education and intervention.¹⁵

A primary source of decreased ED visit volume was fewer low-acuity visits. It is likely that low-acuity visits were influenced by hesitancy to seek medical care in the context of a pandemic. For low-acuity use of emergency medical services, this approach may be appropriate. We are unable to clarify high-volume pediatric equivalents to adult myocardial infarction that would have similar morbidity impact of delayed emergency healthcare.^{4,6}

Our study has several limitations. First, chief complaint scripts are less widely standardized across hospitals, which limits generalizability.²⁴ Second, our study does not capture data beyond the first 30 days of the pandemic. Initial patterns may not be reflective of persistent risks.

Overall, these results suggest that children may be exposed to preventable harm during enforced social distancing and that overall use of emergency medical care was significantly reduced. Continued evaluation of trends in healthcare use has implications for healthcare service delivery planning, and individual clinicians, particularly around the future trajectory of the SARS-CoV-2 pandemic. Finally, healthcare providers need to partner with community and public health organizations to ensure that families receive timely safety and anticipatory education during times of decreased contact with the healthcare system. Specifically, public health education reiterating child-proofing against ingestions and trauma prevention is warranted to address modifiable risks facing children in shifted care environments. ■

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Table I. Chief complaint categorization

| Chief complaints | Included list of chief complaints |
|-----------------------|--|
| Respiratory | Asthma flare, breathing difficulty, cold symptoms, congestion, cough, croup, respiratory distress, wheezing |
| Fever | Fever-CVC (nononcologic), fever-neonate, fever-SCD, fever-transplant, ILI-fever, ILI-fever-SCD, ILI-fever-oncologic, infection, |
| Trauma | Animal bite, arm injury, bruise, burn/wound recheck, cast concern, cast damage, damaged cast, fall, finger injury, fingernail injury, fracture, gun-shot wound, hematoma, laceration, motor vehicle accident, mouth injury, ortho cast wet/damage, suture removal, trauma, trauma-activation, trauma-extremity, trauma-face/head/neck, trauma-finger, trauma-foot, trauma-genital, trauma-head, trauma-mouth, trauma-torso |
| Abdominal pain | Constipation, diarrhea, feeding intolerance, vomiting, vomiting with diarrhea |
| Rash | Derm problem, diaper rash, sores, warts |
| Eye emergency | Blurred vision, eye pain, eye swelling, vision change |
| Psychiatric emergency | Aggression, anxiety, behavioral problem, health and behavior problem, psychology evaluation, self-injury |
| Ear pain | Ear congestion, ear problem, ear pierced problems |
| Headache | Headache-migraine |
| Seizures | Seizure with fever |
| Dental problem | Dental emergency |
| Sickle cell disease | Sickle cell anemia/thalassemia |
| Urination | Decreased urine output, urinary frequency, urinary pain, urinary problem |
| Edema/swelling | Edema, face swelling, joint swelling, lip swelling, swelling |
| Abscess | Abscess |
| Male GU | Penile/scrotal complaint, penis/scrotum problem, swollen scrotum, testicle problem |
| Allergic reaction | Allergic/adverse reaction, anaphylaxis |
| Ingestion | Poisoning |

CVC, Central venous catheter, GU, genitourinary; ILI, Influenza-like-illness, SCD, Sickle cell disease.

Three of top 20 complaints (sore throat, chest pain, foreign body) were isolated chief complaint categories.

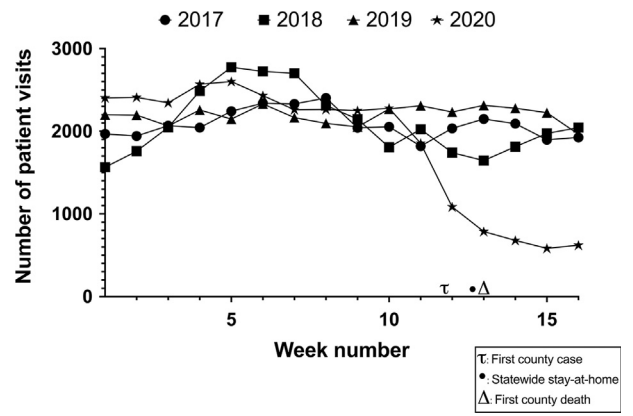


Figure. Weekly visit count to pediatric emergency department from 2017 through 2020.