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Pediatric Firearm Injury Emergency Department Visits from 2017–2022: A Multicenter Study

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Contributors' Statement

Dr. Hoffmann provided substantial contributions to conception and design, analysis and interpretation of data, and drafted the article. Ms. Carter, Mr. Olsen, Dr. Cook, and Dr. Alpern provided substantial contributions to conception and design, analysis and interpretation of data, and revised the article critically for important intellectual content. Drs. Chaudhari, Chaudhary, Duffy, Glomb, Goyal, Grupp-Phelan, Haasz, Ketabchi, Kravitz-Wirtz, Lerner, Shihabuddin, and Wendt provided substantial contributions to analysis and interpretation of data and revised the article critically for important intellectual content. All authors provided final approval of the version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Abstract

Background and Objective: Pediatric firearm injuries increased during the COVID-19 pandemic, but recent trends in firearm injury emergency department (ED) visits are not well described. We aimed to assess how pediatric firearm injury ED visits during the pandemic differed from expected pre-pandemic trends.

Methods: We conducted a retrospective study of firearm injury ED visits for children <18 years old at nine U.S. hospitals participating in the Pediatric Emergency Care Applied Research Network Registry before (January 2017-February 2020) and during (March 2020-November 2022) the pandemic. We constructed multivariable Poisson regression models to estimate expected visit rates from pre-pandemic data. We calculated rate ratios (RR) of observed to expected visits per 30 days, overall and by sociodemographic characteristics.

Results: We identified 1904 firearm injury ED visits (52.3% 15–17 years old, 80.0% male, 63.5% non-Hispanic Black), with 694 pre-pandemic visits and 1210 visits during the pandemic. Death in the ED/hospital increased from 3.1% pre-pandemic to 6.1% during the pandemic (P=0.007). Firearm injury visits per 30 days increased from 18.0 pre-pandemic to 36.1 during the pandemic (observed to expected RR 2.09, 95% CI 1.63–2.91). Increases beyond expected rates were seen for 10–14-year-olds (RR 2.61, 95% CI 1.69–5.71), females (RR 2.46, 95% CI 1.55–6.00), males (RR 2.00, 95% CI 1.53–2.86), Hispanic children (RR 2.30, 95% CI 1.30–9.91), and Black non-Hispanic children (RR 1.88, 95% CI 1.34–3.10).

Conclusions: Firearm injury ED visits for children increased beyond expected pre-pandemic trends, with greater increases among certain population subgroups. These findings may inform firearm injury prevention efforts.

In 2020, firearms became the leading cause of death for U.S. children and adolescents;[1,2] and, for every child who dies from a firearm, an estimated 4 children survive their injuries.[3] During the COVID-19 pandemic, an unprecedented increase in firearm purchasing occurred, as communities grappled with alterations to daily life and economic stressors.[4] In this context, pediatric firearm deaths and nonfatal injuries increased substantially compared to prior years.[5,6] However, not all children were equally affected. Non-Hispanic Black children and publicly insured youth accounted for a greater proportion of firearm injuries,[6] further widening disparities that existed even before pandemic onset.[7,8]

The primary setting for immediate treatment of firearm injures in children is the emergency department (ED), but recent trends in pediatric firearm injury ED visits have not been well described. Existing literature focuses on the first months of the pandemic or provides data through 2021,[9–12] with few studies extending into 2022.[13,14] As societal effects of the pandemic stabilize, it is imperative to understand recent and emerging trends in

sociodemographic and clinical characteristics of pediatric firearm ED visits. Specifically, recent studies have not examined injury severity or death rates across multiple sites, and they have not fully characterized inequities in injury risk across groups of children.[13,14] These data can help guide tailored prevention strategies, efforts to mitigate the physical and emotional sequalae of firearm injuries, and attempts to reduce reinjury.[15] The Pediatric Emergency Care Applied Research Network (PECARN) Registry provides a multicenter repository of electronic health record data from geographically dispersed children's hospitals, with regular deposition of data enabling meaningful time-sensitive analyses.

Thus, we used data from 9 EDs participating in the PECARN Registry to assess how pediatric firearm injury ED visits per 30 days during the COVID-19 pandemic differed from expected rates based on pre-pandemic trends, overall and by sociodemographic characteristics.

METHODS

Study Design and Data Sources

We conducted a retrospective cross-sectional study using data from 9 children's hospital EDs participating in the PECARN Registry from January 2017 to November 2022. The PECARN Registry comprises electronic health record data from every pediatric ED encounter at participating institutions, harmonized into a deidentified, central repository.[16] Variables include demographics, laboratory and radiology results, *International Classification of Diseases, 10th Revision, Clinical Modification* (ICD-10-CM) diagnoses, and disposition. The date range included all available data in the PECARN Registry at the time the analysis was conducted. U.S. Census regions of participating hospitals were: 5 Midwest, 2 West, 1 Northeast, and 1 South. This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.[17] The study was approved by the institutional review boards of all study sites and the University of Utah Emergency Medical Services for Children Data Center.

Encounter Identification

We identified ED visits by children <18 years old with any ICD-10-CM diagnosis code for a firearm injury, excluding non-powder firearm injuries,[18] and excluding codes for subsequent visits (Supplemental Table).

Study Measures

Demographic characteristics included patient age, sex, insurance type (private, public, other/self-pay), composite race and ethnicity, and zip-code level Child Opportunity Index (COI) 2.0. The COI 2.0 is a composite measure of neighborhood-based opportunities for children including education, health and environment, and social and economic factors.[19,20] We analyzed COI in quintiles (very low, low, moderate, high, or very high neighborhood opportunity), as provided in the COI dataset.[21,22] Race and ethnicity were categorized by ethnicity (Hispanic or non-Hispanic) and then by race within the non-Hispanic group. Due to limited sample sizes, non-Hispanic racial categories were analyzed as Black, White, and other non-Hispanic (including American Indian or Alaska Native, Asian, Native Hawaiian

or Other Pacific Islander, Multiple Races, and other). Race and ethnicity were examined as social constructs and included in analyses due to differential COVID-19 pandemic experiences and previously described differences in pediatric firearm injury rates.[3,23,24]

Clinical characteristics included: triage acuity defined by emergency severity index,[25] the injury severity score (0–8, 9–15, ≥16),[26,27] body region (head or neck, chest, abdominal or pelvic content, extremities or pelvic girdle, face, external),[28] intent of injury based on diagnosis codes, ED disposition (admitted/observation/ transferred, discharged, died, other), hospital length of stay (in days) among the subgroup admitted to the hospital, and death (in the ED or after admission to the hospital). If a visit had codes for multiple intents, we assigned each ED visit to one intent as follows: we classified ED visits with undetermined and assault codes as assaults, undetermined and accidental codes as accidental, undetermined and self-inflicted codes as self-inflicted, and all other combinations as "multiple" intents.

The exposure of interest was time period, defined as before the pandemic (January 1, 2017–February 29, 2020) and during the pandemic (March 1, 2020–November 30, 2022). The outcome was firearm injury ED visits per 30 days for each of the time periods.

Statistical Analysis

We described sociodemographic and clinical characteristics of the firearm injury visits during each time period using counts and percentages, analyzing differences using chi-square tests.

We calculated observed 30-day firearm injury visit rates for each time period. To estimate expected 30-day visit rates during the pandemic time period, we fit multivariable Poisson regression models to visit data from the pre-pandemic time period. A Pearson scale parameter was used to account for overdispersion. Poisson models were chosen in favor of negative binomial models due to better model fit estimated by log likelihood statistics. Models included the number of months since January 2017 to account for temporal trends. A more complex temporal effect, such as an autoregressive trend, was not considered due to an insufficient number of pre-pandemic observations. Covariates additionally included month and site to account for seasonal and geographic trends. The dependent variable was the rate of firearm injury visits per 30 days. We estimated 95% confidence intervals (CI) for the 30-day firearm injury visit rates during the pandemic time period. Rate ratios and 95% CIs of observed to expected visits were calculated by treating the number of observed visits as a fixed parameter and calculating the ratio between observed visits and the estimated visit rate and 95% confidence limits.

Individual models were constructed for each of the following sociodemographic characteristics: age, sex, race and ethnicity, insurance type, and COI quintile. Models for each characteristic included the same covariates as the overall model, with the addition of the characteristic of interest and an interaction with the number of months since 2017. The interaction term allowed modeling of temporal trends for each level of the characteristic, resulting in better fitting models. Rate ratios and 95% CIs of observed to expected visits during the post-pandemic period were calculated for each level of the characteristic.

Visits missing information about a particular characteristic (missing race and ethnicity, for example) were excluded from related models but included in other subgroup models when possible. One hospital had data quality issues for race and ethnicity, insurance type, and COI, so visits from that hospital were excluded from models using those characteristics.

Estimated visit rates and 95% CIs were plotted alongside observed visit rates for each calendar month for all firearm injury visits and by age group, sex, race and ethnicity, and COI quintile.

We used a significance level of 0.05, with no adjustments made for multiple comparisons. We performed all analyses using SAS/STAT software version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Study Population Characteristics

There were 1904 firearm injury ED visits by children during the study period (52.3% by adolescents 15–17 years old, 80.0% by males, 63.5% by non-Hispanic Black children) (Table 1). Of firearm injury ED visits, 81.1% were by children with public insurance and 63.8% were by children from very low COI areas. There were 694 (36.4%) firearm injury ED visits before the COVID-19 pandemic (January 2017-February 2020) and 1210 (63.6%) firearm injury ED visits during the pandemic (March 2020-November 2022).

There were no statistically significant differences before versus during the pandemic for insurance payer distribution, COI distribution, intent of injury, injury severity score, body region, ED disposition, or hospital length of stay. Emergency severity index level 1 visits (representing the highest triage acuity) increased from 38.5% pre-pandemic to 46.4% during the pandemic (P=0.027). Deaths increased from 3.1% of pre-pandemic visits to 6.1% of visits during the pandemic (P=0.007).

Observed versus Expected Firearm Injury ED Visits by Pandemic Time Period

Before pandemic onset, 18.0 pediatric firearm injury ED visits occurred per 30 days. During the pandemic, firearm injury ED visits increased to 36.1 per 30 days, which was twice the expected rate based on extrapolated pre-pandemic trends, with an observed to expected rate ratio of 2.09 (95% CI 1.63, 2.91) (Table 2, Figure 1).

Observed versus Expected Firearm Injury ED Visits by Sociodemographic Characteristics

During the pandemic, firearm injury ED visits per 30 days were higher than expected among children 10–14 years old (observed to expected rate ratio [RR] 2.61, 95% CI 1.69, 5.71) and 15–17 years old (RR 2.09, 95% CI 1.51, 3.38) (Figure 2). During the pandemic, firearm injury ED visits per 30 days were higher than expected for both female (RR 2.46, 95% CI 1.55, 6.00) and male patients (RR 2.00, 95% CI 1.53, 2.86). Firearm injury ED visits per 30 days were 2.30 times higher (95% CI 1.30, 9.91) than expected for Hispanic children, 1.88 times higher (95% CI 1.34, 3.10) than expected for Black, non-Hispanic children, and 2.21 times higher (95% CI 1.65, 3.35) than expected for publicly insured children. Firearm injury ED visits were higher than expected by children from COI areas classified as very low (RR

2.30, 95% CI 1.64, 3.86), low (RR 2.52, 95% CI 1.38, 14.21) and high (RR 4.59, 95% CI 2.02, infinity) (Figure 3).

DISCUSSION

Within a multicenter pediatric ED data registry, rates of firearm injury ED visits by children doubled during the COVID-19 pandemic, compared with expected levels based on pre-pandemic trends. Firearm injury ED visits increased relative to expected levels among specific demographic groups: children older than 10 years old, both males and females, and Hispanic and Black non-Hispanic children. Firearm injury visits by children from very low, low, and high COI areas increased compared with expected levels based on pre-pandemic trends.

Our results are consistent with other studies demonstrating a substantial increase in pediatric firearm injuries during the pandemic, while also contributing more recent data from 2022. During the first 6 months of the pandemic, pediatric firearm injuries at 9 Midwest trauma centers increased 87% above expected rates.[29] During the same time frame, Gun Violence Archive data indicated a 1.90 fold increase in firearm injuries among young children <12 years old.[30] During the first 21 months of the COVID-19 pandemic (through 2021), pediatric firearm injury presentations to U.S. children's hospitals increased 52% compared to prior years.[6] The most recent Centers for Disease Control and Prevention data from 2022 found that firearm injury ED visits increased among children age 0–14 years, with a visit ratio of 1.49 for females and 1.44 for males, compared with 2019.[14] Our data suggest this increase was driven primarily by children older than 10 years, as we did not find significantly greater than expected increases among younger age groups. In addition to changes in injury epidemiology, it is also possible that Emergency Medical Services transport patterns may have changed during the pandemic, with differential transport of older adolescents to pediatric rather than adult trauma centers.

Reasons for rising pediatric firearm injuries during the pandemic are multifactorial, often varying by intent. In 2020, U.S. gun and ammunition sales surged,[30,31] in part due to worries about potential violence and lawlessness, with many first-time owners purchasing guns and existing owners switching to less secure manners of storage in response to the pandemic.[32,33] Additionally, among households that already owned guns prior to the pandemic, those storing firearms unsafely (i.e., loaded and unlocked) were more likely to purchase additional firearms during the pandemic than households utilizing safe storage practices.[33] Access to guns stored unsafely in the home may have contributed to increases in self-inflicted and unintentional firearm injuries.[30,31] Simultaneously, psychosocial stressors and financial strains related to the pandemic may have led to increases in assault and self-inflicted firearm injuries.[7,34–36] While we collected intent data and found no significant difference in intent by study period, we are cautious about interpreting this data due to the extent of miscoding of intent of firearm injuries in administrative datasets.[37,38] Emerging methodologies, such as natural language processing, may improve accuracy in identification of intent from electronic health record data.[37] An improved understanding of injury patterns by intent may inform specific opportunities for prevention.[39]

We found that more than half of all firearm injury visits were incurred by Black children, both before and during the pandemic. During the pandemic, Hispanic and Black non-Hispanic children experienced disproportionate increases in firearm injuries with significant increases above expected levels. Some studies did not identify any change to the racial and ethnic breakdown of pediatric firearm injures during the pandemic,[9,10] while others found post-pandemic increases in the proportion of firearm injuries by Black children only.[6,13] When specifically focusing on firearm assaults, racial and ethnic disparities widened substantially during the pandemic in 4 major U.S. cities. In particular, the Black-White disparity in firearm assaults grew from a relative risk of 27.5 before the pandemic to 100.7 during the pandemic, while the Hispanic-White disparity grew from a relative risk of 8.6 to 25.8.[7] These data suggest that firearm injury prevention efforts should center the most affected communities, while targeting structural racism as a driver. Examples of such efforts may include neighborhood environmental interventions associated with violence reduction, such as cleaning and greening of vacant spaces,[40,41] and community investments that address social determinants of health, such as increased access to affordable housing and educational and employment opportunities.[39,42]

We found that 4 in 5 firearm injury ED visits were by publicly insured children, and nearly two-thirds were by children from very low COI areas, illustrating the high risk of firearm injury for children living in areas of concentrated disadvantage. During the pandemic, firearm injury visits increased across all payer types and COI quartiles, with significant increases beyond expected rates among publicly insured children and children living in very low, low, and high COI areas. However, the overall distribution of firearm injury ED visits by both payer and COI did not significantly differ before versus during the pandemic. This is consistent with a study of firearm-related encounters at U.S. children's hospitals from March-August 2020, which also found no change in the distribution of COI quartiles among firearm-injured children before versus during the pandemic.[10] Similarly, a study conducted at 9 Midwest trauma centers during the first 6 months of the pandemic found no difference in the Social Vulnerability Index (SVI) among firearm-injured children before versus during the pandemic.[29] The SVI is a census tract-level composite index that incorporates socioeconomic status, household composition and disability, minority status and language, and housing and transportation.[43] Increases in firearm injuries across socioeconomic groups indicate that no child in the U.S. is immune to the growing risks of firearm violence.

We found increases in death rates for pediatric firearm injury visits during versus before the pandemic. In contrast, during the first 6 months of the pandemic, death rates did not change for pediatric firearm injuries at 9 Midwest trauma centers.[29] However, a single-center study contributing data through March 2022 also found that pediatric firearm deaths increased 29% during the pandemic, in tandem with increased admissions to the operating room and intensive care unit.[13] The pandemic placed strains on the capacity of Emergency Medical Services and prolonged response times,[44] resulting in delays that might have contributed to increased death rates. While we did not identify changes in injury intent during the pandemic in our data, self-inflicted firearm injuries are known to have high case-fatality rates,[45] and other studies have identified increases in suicide attempt-related ED visits during the pandemic, particularly among adolescent girls.[46] Thus, strategies to reduce

pediatric firearm fatalities must encompass suicide prevention efforts, such as increasing access to mental health services.[47]

A comprehensive approach to prevent pediatric firearm injuries must be rooted in public health principles.[48] At the level of the individual clinician, counseling on safe storage and distribution of gun locks may modestly improve safe firearm storage practices.[49] At the health system level, hospital-based violence intervention programs are increasingly available to assist youth at risk of violence by providing linkages to community-based services and long-term case management.[50–52] Societal-level efforts must address social and structural determinants of health by bolstering community-based and economic supports.[53] Additionally, a substantial investment in firearm injury prevention research is needed,[54,55] given that firearm injury research has historically been funded at only 3.3% of predicted levels based on mortality burden.[56] Research is also needed to understand the long-term behavioral and physical health consequences of firearm injuries on children, and to design effective intervention to mitigate those impacts.[57] Finally, policy solutions may also play a role in reducing pediatric firearm injuries.[58,59] Specific types of firearm legislation, such as universal background checks and child access prevention laws, have been associated with reduced pediatric firearm mortality.[60,61] During the first year of the pandemic, states with stronger gun laws saw decreased child-involved shooting incidents, while states with weaker gun laws experienced increased rates of pediatric firearm violence.[12] Investments at all levels are needed to mitigate the substantial morbidity and mortality associated with increasing pediatric firearm injuries.

LIMITATIONS

There are several limitations to be considered with our work, including miscoding of intent of firearm injuries[37,38] and potential misclassification of race and ethnicity in electronic health record data. The data do not capture children who died at the scene and were not transported to the ED. Additionally, due to large sample sizes, some statistically significant differences may not be clinically significant. As we were unable to clearly define the populations living in the catchment areas of the participating hospitals, we were unable to calculate population-based rates of firearm-related ED visits, overall or for specific demographic subgroups. Data were collected from children's hospitals, potentially limiting generalizability of results to non-pediatric trauma centers, where most firearm-injured children in the U.S. receive their emergency care.[62] We were unable to determine to what extent the increase in ED visit rates reflected an increase in firearm injuries occurring in communities, versus increased transport of firearm-injured children to children's hospitals relative to non-children's hospitals during the pandemic.

CONCLUSION

Firearm injury ED visit rates by children during the COVID-19 pandemic exceeded twice the rates predicted by pre-pandemic trends. Visit rates were higher than expected for Black and Hispanic children, widening injury disparities that preceded the pandemic. While children from low opportunity neighborhoods remain at highest risk for firearm injuries, increases in injuries spanned multiple levels of neighborhood opportunity. Our results

have relevance to the development of targeted injury prevention interventions and policy considerations. A comprehensive public health approach is needed to stem the rising tide of firearm injuries in children.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations:

ED	Emergency Department
PECARN	Pediatric Emergency Care Applied Research Network
ICD-10-CM	International Classification of Diseases, 10th Revision, Clinical Modification
COI	Child Opportunity Index
CI	Confidence Interval
SVI	Social Vulnerability Index

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Article Summary

We compared pediatric firearm injury ED visits at nine U.S. hospitals before and during the COVID-19 pandemic, through November 2022, exploring differences from expected rates.

What's Known on This Subject

Pediatric firearm injuries increased during the COVID-19 pandemic, but evolving and recent trends in firearm injury emergency department (ED) visits have not been well described.

What This Study Adds

Pediatric firearm injury ED visits per 30 days doubled during the pandemic, and mortality rates increased. Visit rates increased beyond expected rates for children older than 10 years old, for males and females, and for Hispanic and non-Hispanic Black children.

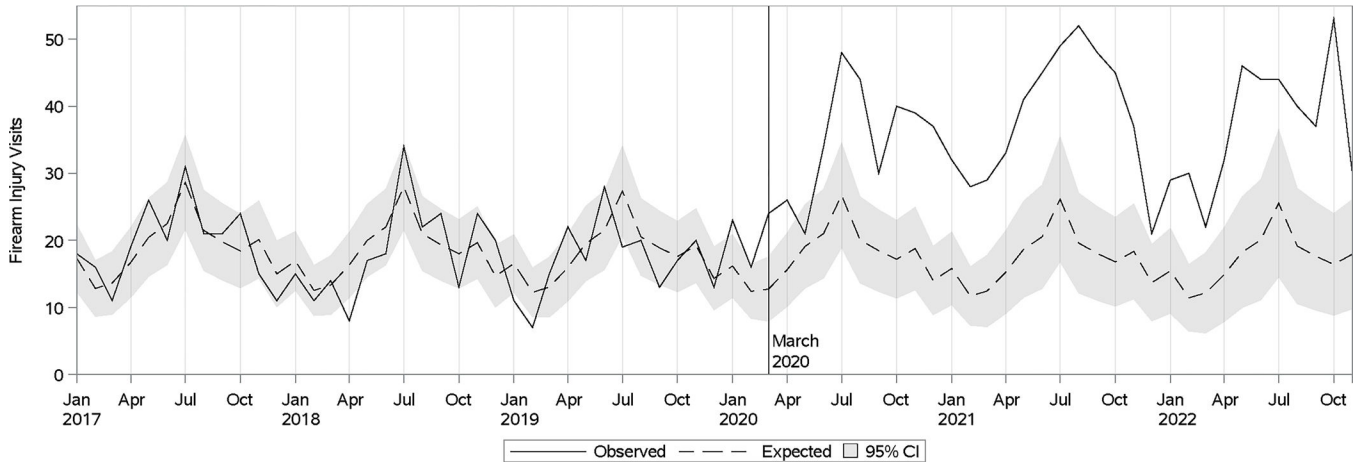

Figure 1. Observed versus Expected Pediatric Firearm Injury Emergency Department Visits, January 2017-November 2022

Expected emergency department (ED) visits generated by the model during the pre-pandemic period are displayed to demonstrate model fit. During the pandemic period, firearm injury ED visits per 30 days increased significantly above expected visit rates from July 2020 through November 2022.

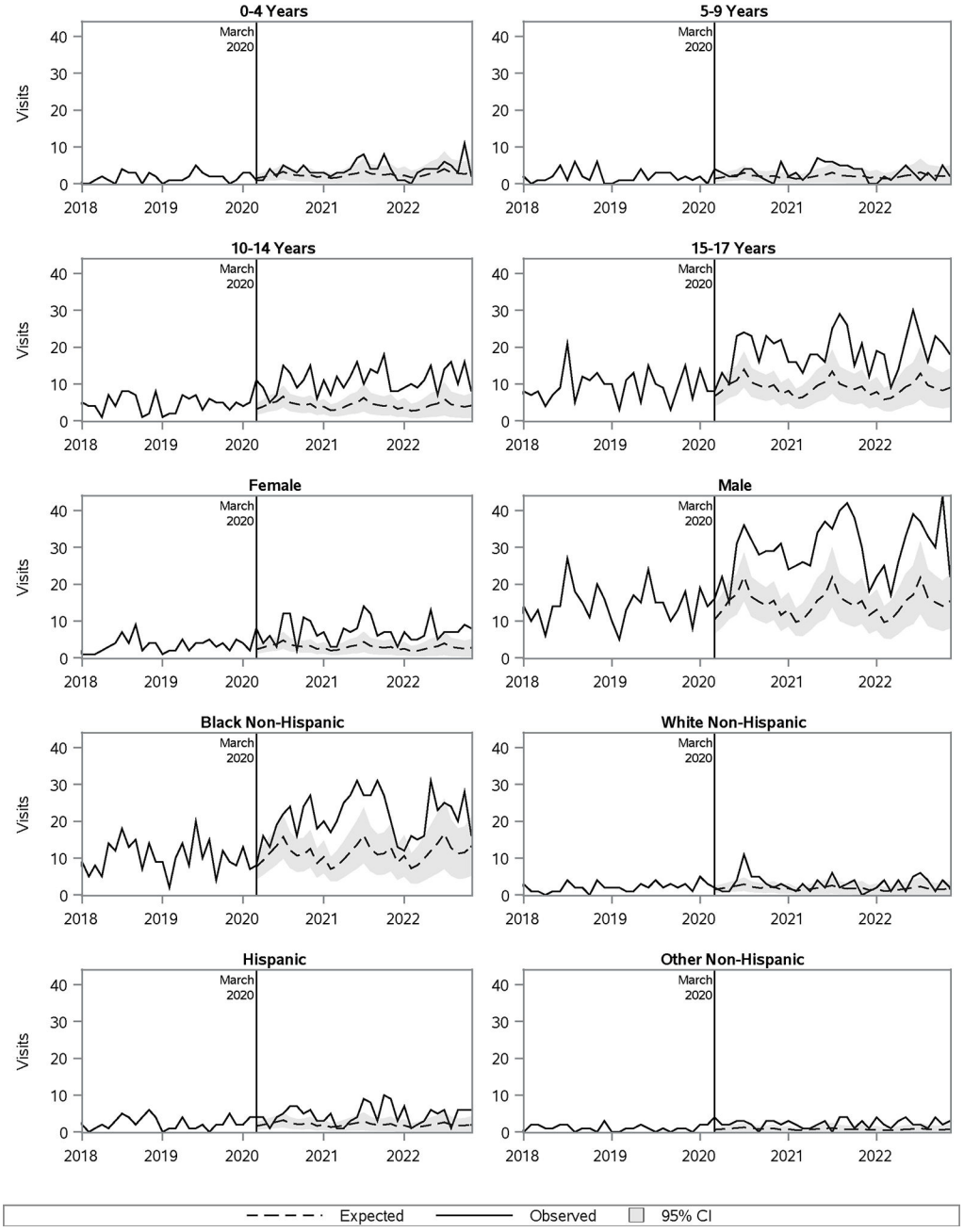

Figure 2. Observed versus Expected Pediatric Firearm Injury Emergency Department Visits by Sociodemographic Characteristics

Separate models were constructed for each of the following sociodemographic characteristics: age, sex, and race and ethnicity. To account for seasonal, geographic, and temporal trends, models adjusted for month, site, the number of months since January 2017, and the sociodemographic characteristic of interest and its interaction with a temporal trend.

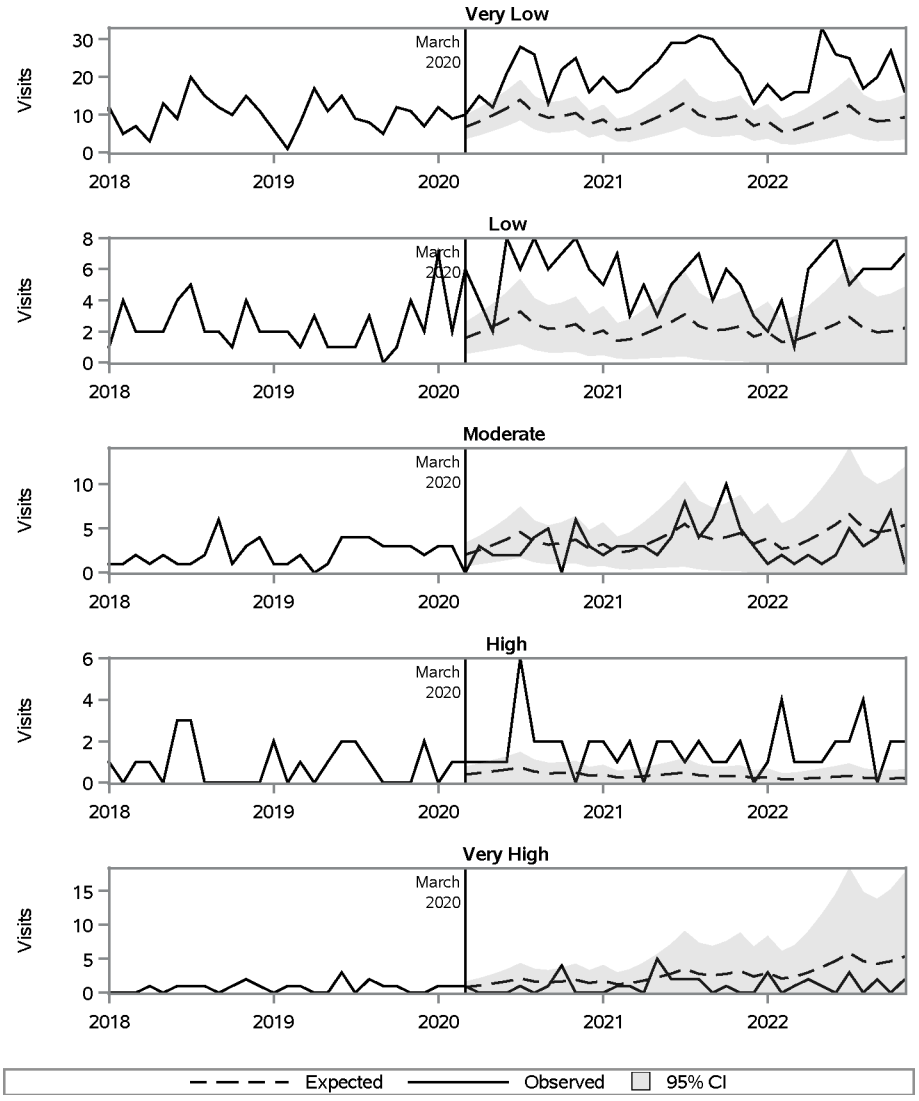

Figure 3. Observed versus Expected Pediatric Firearm Injury Emergency Department Visits by Child Opportunity Index

To account for seasonal, geographic, and temporal trends, the model adjusted for month, site, the number of months since January 2017, and the interaction of Child Opportunity Index with a temporal trend.

Table 1.

Characteristics of Pediatric Firearm Injury Emergency Department Visits by Pandemic Time Period

	Overall (N = 1904)	Jan 2017 - Feb 2020 (N = 694)	Mar 2020 - Nov 2022 (N = 1210)	P-value[1]
Sociodemographic Characteristics				
Age (years)				0.176
0–4	192 (10.1%)	67 (9.7%)	125 (10.3%)	
5–9	171 (9.0%)	71 (10.2%)	100 (8.3%)	
10–14	546 (28.7%)	182 (26.2%)	364 (30.1%)	
15–17	995 (52.3%)	374 (53.9%)	621 (51.3%)	
Sex				0.684
Male	1,523 (80.0%)	552 (79.5%)	971 (80.2%)	
Female	380 (20.0%)	142 (20.5%)	238 (19.7%)	
Unknown	1 (0.1%)	0 (0.0%)	1 (0.1%)	
Race and Ethnicity[2]				0.005
Hispanic	255 (14.9%)	101 (15.8%)	154 (14.4%)	
Black Non-Hispanic	1,084 (63.5%)	386 (60.4%)	698 (65.3%)	
White Non-Hispanic	195 (11.4%)	95 (14.9%)	100 (9.4%)	
Other Non-Hispanic	120 (7.0%)	43 (6.7%)	77 (7.2%)	
Unknown	54 (3.2%)	14 (2.2%)	40 (3.7%)	
Primary payer[2]				0.525
Private	243 (14.2%)	97 (15.2%)	146 (13.7%)	
Public	1,385 (81.1%)	510 (79.8%)	875 (81.9%)	
Other	78 (4.6%)	32 (5.0%)	46 (4.3%)	
Child Opportunity Index (COI)[2]				0.176
Very Low	1,089 (63.8%)	397 (62.1%)	692 (64.7%)	
Low	271 (15.9%)	93 (14.6%)	178 (16.7%)	
Moderate	192 (11.2%)	83 (13.0%)	109 (10.2%)	
High	97 (5.7%)	43 (6.7%)	54 (5.1%)	
Very High	57 (3.3%)	22 (3.4%)	35 (3.3%)	
Unknown	2 (0.1%)	1 (0.2%)	1 (0.1%)	
Clinical Characteristics				
Intent				0.683
Accidental	1,060 (55.7%)	387 (55.8%)	673 (55.6%)	
Assault	280 (14.7%)	92 (13.3%)	188 (15.5%)	
Self-inflicted	14 (0.7%)	5 (0.7%)	9 (0.7%)	
Multiple	527 (27.7%)	201 (29.0%)	326 (26.9%)	
Undetermined	23 (1.2%)	9 (1.3%)	14 (1.2%)	
Triage Category				0.027
ESI 1	828 (43.5%)	267 (38.5%)	561 (46.4%)	
ESI 2	556 (29.2%)	211 (30.4%)	345 (28.5%)	
ESI 3	304 (16.0%)	114 (16.4%)	190 (15.7%)	

	Overall (N = 1904)	Jan 2017 - Feb 2020 (N = 694)	Mar 2020 - Nov 2022 (N = 1210)	P-value[1]
ESI 4–5	77 (4.0%)	35 (5.0%)	42 (3.5%)	
Unknown	139 (7.3%)	67 (9.7%)	72 (6.0%)	
Injury Severity Score				0.578
0–8	1,392 (73.1%)	517 (74.5%)	875 (72.3%)	
9–15	364 (19.1%)	125 (18.0%)	239 (19.8%)	
≥16	148 (7.8%)	52 (7.5%)	96 (7.9%)	
Body Region				
Head or Neck	180 (9.5%)	54 (7.8%)	126 (10.4%)	0.059
Chest	177 (9.3%)	72 (10.4%)	105 (8.7%)	0.220
Abdominal or Pelvic Content	194 (10.2%)	66 (9.5%)	128 (10.6%)	0.458
Extremities or Pelvic Girdle	599 (31.5%)	201 (29.0%)	398 (32.9%)	0.076
Face	127 (6.7%)	48 (6.9%)	79 (6.5%)	0.744
External	1,510 (79.3%)	560 (80.7%)	950 (78.5%)	0.259
ED Disposition[2]				0.288
Admitted/Observation/Transferred	940 (55.0%)	347 (54.3%)	593 (55.5%)	
Discharged	704 (41.2%)	266 (41.6%)	438 (41.0%)	
Died	33 (1.9%)	8 (1.3%)	25 (2.3%)	
LAMA/LWBS/Other/Unknown	31 (1.8%)	18 (2.8%)	13 (1.2%)	
Hospital Length of Stay (Days)[2,3]				0.804
0-<1 day	260 (28.0%)	91 (26.5%)	169 (28.8%)	
1-<2 days	193 (20.8%)	72 (21.0%)	121 (20.6%)	
2-<5 days	221 (23.8%)	87 (25.4%)	134 (22.9%)	
5+ days	230 (24.8%)	86 (25.1%)	144 (24.6%)	
Unknown	25 (2.7%)	7 (2.0%)	18 (3.1%)	
Death in the ED or Hospital[2]	85 (5.0%)	20 (3.1%)	65 (6.1%)	0.007

LAMA: Left against medical advice; LWBS: Left without being seen

[1] Chi-squared test.

[2] Due to data quality issues at one site, 55 visits from Jan 2017-Feb 2020 and 141 visits from Mar 2020-Nov 2022 from that hospital were excluded from these analyses.

[3] Proportions determined among visits with ED disposition of admission or observation.

Table 2.

Observed versus Expected Pediatric Firearm Injury Emergency Department Visits per 30 Days by Pandemic Time Period

	Jan 2017-Feb 2020	Mar 2020-Nov 2022		
	Observed 30 Day Visit Rate	Observed 30 Day Visit Rate	Expected 30 Day Visit Rate (95% CI)	Rate Ratio (95% CI)
Total [1]	18.0	36.1	17.3 (12.4, 22.2)	2.09 (1.63, 2.91)
Sociodemographic Characteristics				
Age (years)				
0–4	1.7	3.7	2.4 (0.3, 4.6)	1.54 (0.82, 13.32)
5–9	1.8	3.0	2.0 (0.3, 3.8)	1.47 (0.79, 10.53)
10–14	4.7	10.9	4.2 (1.9, 6.4)	2.61 (1.69, 5.71)
15–17	9.7	18.5	8.9 (5.5, 12.2)	2.09 (1.51, 3.38)
Sex				
Male	14.3	29.0	14.5 (10.1, 18.9)	2.00 (1.53, 2.86)
Female	3.7	7.1	2.9 (1.2, 4.6)	2.46 (1.55, 6.00)
Race/Ethnicity[2]				
Hispanic	2.6	4.6	2.0 (0.5, 3.5)	2.30 (1.30, 9.91)
Black Non-Hispanic	10.0	20.8	11.1 (6.7, 15.5)	1.88 (1.34, 3.10)
White Non-Hispanic	2.5	3.0	1.8 (0.4, 3.2)	1.69 (0.94, 8.15)
Other Non-Hispanic	1.1	2.3	0.8 (0.0, 1.7)	3.03 (1.39, inf)
Primary payer[2]				
Private	2.5	4.4	2.5 (0.6, 4.5)	1.71 (0.97, 7.24)
Public	13.3	26.1	11.8 (7.8, 15.8)	2.21 (1.65, 3.35)
Other	0.8	1.4	1.3 (0.0, 3.0)	1.05 (0.45, inf)
Child Opportunity Index (COI)[2]				
Very Low	10.3	20.7	9.0 (5.4, 12.6)	2.30 (1.64, 3.86)
Low	2.4	5.3	2.1 (0.4, 3.8)	2.52 (1.38, 14.21)
Moderate	2.2	3.3	3.8 (0.5, 7.1)	0.86 (0.46, 6.45)
High	1.1	1.6	0.4 (0.0, 0.8)	4.59 (2.02, inf)
Very High	0.6	1.0	2.6 (0.0, 7.2)	0.40 (0.15, inf)

[1] The number of encounters excluded from models due to missing information about the characteristic of interest was (N Jan 2017-Feb 2020, N Mar 2020-Nov 2022): Sex (0, 1), Race/Ethnicity (14, 40), Primary payer (0, 2), Child Opportunity Index (1, 1).

[2] Due to data quality issues at one site, 55 visits from Jan 2017-Feb 2020 and 141 visits from Mar 2020-Nov 2022 from that hospital were excluded from these analyses.