



Published in final edited form as:

*Ann Intern Med.* 2025 May ; 178(5): 663–670. doi:10.7326/ANNALS-24-02874.

## Patterns of US Firearm Injury Emergency Department Visits by Month, Day, and Time During 2018–2023

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### Abstract

**Background:** Monitoring temporal trends in firearm injury-related emergency department (ED) visits is challenging because traditional surveillance systems lack detailed, temporal information.

**Objective:** To describe temporal patterns of ED visits for firearm injury using data from Centers for Disease Control and Prevention's (CDC) Firearm Injury Surveillance Through Emergency Rooms (FASTER) program.

**Design:** Cross-sectional analysis of firearm injury-related ED visits.

**Setting:** Nine U.S. states (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, West Virginia) and the District of Columbia, January 1, 2018, to August 31, 2023.

**Patients:** ED visits for firearm injury (n = 93,022) from CDC's FASTER program.

**Measurements:** ED visits for firearm injury per 100,000 ED visits, analyzed by time of day (in 30-minute intervals), day of week, day of year, and holidays.

**Results:** From January 2018 through August 2023, there were 93,022 firearm injury ED visits (73.9 per 100,000 ED visits), approximately one firearm injury every 30 minutes overall. Rates of firearm injury ED visits were highest between 2:30–3:00 am and lowest between 10:00–10:30

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Conflict of interest: None of the authors has a financial relationship that could be viewed as presenting a potential conflict of interest with the work presented here. This work was conducted entirely as part of the authors' normal duties for the Centers for Disease Control and Prevention and involved no outside financial support.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Statistical code: available to interested readers by contacting Dr. Rowh (arowh@cdc.gov)

Data: Conditions of Centers for Disease Control and Prevention's Firearm Injury Surveillance Through Emergency Rooms program data sharing agreement do not permit the reporting of or sharing of raw data. See <https://stacks.cdc.gov/view/cdc/136390> and <https://stacks.cdc.gov/view/cdc/136387> for further details.

am. Nighttime peaks and daily rates were highest on Friday and Saturday. Monthly rates were highest in July and lowest in February; daily rates were disproportionately high on most holidays, especially Independence Day and New Year's Eve.

**Limitations:** Data are limited to 9 states and the District of Columbia and are not nationally representative. Our analysis of ED visits for firearm injury does not distinguish injury intent, and is based on arrival time, not actual injury time.

**Conclusion:** Distinct temporal patterns in firearm injury ED visits highlight resource allocation considerations for prevention and response efforts.

**Primary funding source:** Centers for Disease Control and Prevention

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## Introduction

Firearm-related deaths remain a pressing public health concern in the United States. In 2021, (1) firearm homicides reached their highest level in approximately 3 decades. Although firearm homicides have since decreased nationwide, provisional estimates of 2023 deaths remain elevated relative to pre-pandemic levels. Concerningly, firearm suicides have continued to increase each year and currently are at their highest level in over 50 years (1–4). Further, firearm injuries are the leading cause of death of children and teens in the U.S. (5). While the reasons for these long-term trends are complex, the large number of firearm injuries has prompted growing attention to the problem.

The infrastructure for firearm injury data in the U.S. remains limited, especially for nonfatal injuries, constraining our understanding of temporal patterns (6), especially as most healthcare-based data sources on firearm injuries lack granular temporal information (7). For example, neither the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project (HCUP) administrative claims-based datasets (8) nor the National Electronic Injury Surveillance System (NEISS) (9) release information on the precise day or time of injury. While this helps prevent the disclosure of protected information at the individual level, it precludes researchers from understanding when injuries are most likely to occur.

Prior research on the temporal dynamics of firearm injury and other violence outcomes has observed variation according to time of day (10–12), day of week (10,13–17), and holidays (10,13), with higher rates of firearm injury occurring generally at night, on weekends, and on holidays. Other research in criminology has highlighted similar trends across multiple types of violent incidents and crime (18–20). However, definitions of the temporal variables (e.g., “night”) have varied due to the lack of temporal granularity, limiting comparability across studies. These studies also have limitations in representativeness and timeliness. For example, several of these studies focused primarily on urban areas (10,11,15–17), perhaps because these areas may have greater public availability of firearm injury data provided by law enforcement or media sources. These results, however, may not be generalizable to rural areas (21). Other studies utilizing healthcare-based data sources are limited by substantial lags in data availability and the potential for bias inherent in sampling-based methodologies (6,13,14). Emergency medical services data excludes patients who arrive to a hospital by

other means, which would result in undercounting and may introduce other systematic biases (22).

In this study, we analyzed granular temporal patterns of emergency department (ED) visits for firearm injuries using data from a novel and large-scale syndromic surveillance data source, covering both urban and rural areas, to improve resource allocation. Specifically, we utilized data on the date and time of firearm-related ED visits in 30-minute intervals to understand patterns of firearm injury and interactions between the precise time of day, day of week, month, and holiday. This information expands upon previous research (19) by including detailed data on arrival time as well as incorporating both urban and rural areas. The timeliness of syndromic surveillance data combined with the detail they contain on the timing of patient encounters may be valuable for informing resource allocation (e.g., healthcare facility staffing), prevention, and response efforts.

## Methods

### Data source

Syndromic surveillance data from the CDC's National Syndromic Surveillance Program (NSSP) (23) were analyzed to examine temporal trends in firearm injury ED visits. Approximately 80% of U.S. EDs contribute electronic healthcare record data to NSSP, often within 24 hours of a patient's visit. These data can be used to monitor trends in health conditions that typically present to EDs at the national and local levels. However, to access state-level data and ensure the timely monitoring of specific conditions, CDC has developed state-specific data use agreements; this is sometimes achieved through CDC funding programs. For instance, in 2020, CDC's Division of Violence Prevention established the Firearm Injury Surveillance Through Emergency Rooms (FASTER) Program (24,25) to provide more timely and comprehensive data on firearm injuries at the state and local levels than were previously available through traditional data sources. FASTER utilizes and queries near real-time data from visit-level electronic health records for the purposes of timely monitoring of firearm injury trends (24,25). We analyzed data from 125,862,881 ED visits during January 1, 2018, to August 31, 2023, in 9 FASTER-funded states (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, and West Virginia) and the District of Columbia. ED visits for initial firearm injury encounters (including those classified as unintentional, intentional self-harm, assault, legal intervention, terrorism, and undetermined intent, but not those representing follow-up care or other sequelae, and including all patients regardless of age, sex, or other demographic characteristics) were identified using a syndrome definition that queried diagnosis codes and chief complaint text fields (25–28). This syndrome definition was developed and validated by CDC in partnership with state, tribal, local, and territorial health departments (28). Each of the 10 participating jurisdictions collect and access data from a minimum of 75% of ED's in the jurisdiction, including visits from a minimum of 90% of level 1–3 trauma centers. To reduce the impact from changes in reporting patterns, which can vary among jurisdictions and across time, analyses were restricted to facilities with a coefficient of variation of less than 40% for total visit volume and facilities with more than 75% complete information on discharge diagnoses throughout 2018–2023.

## Analytic approach

Rates of firearm injury were calculated as the proportion of all ED visits that were related to firearm injury per 100,000 ED visits, with 95% confidence intervals (CI) calculated using the Wilson score interval method. Temporal variation by time of day, day of week, date, and across holidays was descriptively assessed. Individual ED visits were coded according to the patient's ED arrival time in 30-minute intervals and analyzed in relation to 24-hour periods beginning at 7:00 am. When analyzing information by day, visits that occurred between midnight and 6:59 am were reported for the previous day (e.g., an arrival time of 2:30 am on January 1<sup>st</sup> would be included in the total for December 31<sup>st</sup>); this was done because such analysis can inform healthcare staffing and clinical preparedness, and overnight clinician shifts routinely begin on the preceding day (i.e., 11 pm to 7 am). Furthermore, firearm injuries that occur late in the evening or in the early morning hours typically follow from and relate to events of the previous day, rather than being associated with risk the following day (e.g., firearm violence occurring following events Saturday evening and resulting in ED visits in the early morning hours of Sunday). Temporal variation in ED visits for firearm injury was analyzed by select U.S. public holidays and other days of interest: Independence Day, Labor Day, Memorial Day, the weekend preceding Monday holidays (i.e., Labor Day and Memorial Day), Christmas, "Superbowl Sunday," Halloween, New Year's Eve, full moons, and the first of every month, hereafter referred to as "holidays." These holidays were chosen a priori based on previous research (10,13,29,30). Annual variations in calendar dates for holidays (e.g., Memorial Day) were accounted for where appropriate. The Mondays of Labor Day and Memorial Day were analyzed separately from the preceding weekends. Temporal variation in ED visits for firearm injury was analyzed using chi-squared and Kruskal-Wallis tests (e.g., rates were calculated individually for each day of the week, then compared across days) using Holm-Bonferroni adjusted *P* values where appropriate (considering the number of tests conducted in each sub-analysis; e.g., 7 for the days of the week sub-analysis). As a sensitivity analysis, calculations were repeated using raw counts of firearm injuries in place of rates. All statistical analysis was conducted using R Statistical Software (31).

## Ethical considerations

This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy (See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.).

## Role of the funding source

This study was conducted as part of the authors' normal duties as employees of CDC, which had no role in the design, conduct, analysis, or decision to submit the study for publication.

## Results

From January 1, 2018, to August 31, 2023, a total of 93,022 firearm injury ED visits were identified out of a total of 125,862,881 ED visits overall. The overall rate of firearm injury ED visits was 73.9 per 100,000 ED visits (95% CI, 73.9 to 73.9).

### Time of day patterns

Firearm injury ED visit rates were not evenly distributed throughout the day ( $P < 0.001$ ). When aggregated across the entire study period, firearm injury ED visit rates were consistently highest between 2:30–3:00 am (224.7 firearm injury ED visits per 100,000 ED visits [CI, 223.9 to 225.5]), and rates were lowest between 10:00–10:30 am (31.3 per 100,000 [CI, 31.3 to 31.4]). Rates gradually climbed during the afternoon to 74.8 (CI, 72.0 to 77.7) firearm injury ED visits per 100,000 ED visits between 8:00–8:30 pm and then consistently increased towards the average nightly peak rate between 2:30–3:00 am.

### Day of week patterns and overall daily differences

Throughout the week, visit rates were highest between approximately 11:00 pm and 4:00 am and lowest between approximately 7:00 am and 3:00 pm (Figure 1A). Rates were heterogeneous throughout the week ( $P < 0.001$ ) (Figure 1B). The daily mean rates on Friday (83.8 firearm injury ED visits per 100,000 ED visits [CI, 82.4 to 85.1]), Saturday (103.0 per 100,000 [CI, 101.5 to 104.6]), and Sunday (81.4 per 100,000 [CI, 80.0 to 82.7]) were higher than the overall mean (73.9 per 100,000 [CI, 73.9 to 73.9]); the daily mean rates on Monday (61.2 per 100,000 [CI, 60.2 to 62.4]), Tuesday (63.2 per 100,000 [CI, 62.1 to 64.4]), Wednesday (63.2 per 100,000 [CI, 62.1 to 64.4]), and Thursday (65.6 per 100,000 [CI, 64.4 to 66.8]) were lower than the overall mean. Nighttime peaks were most pronounced on Friday and Saturday nights (i.e., early Saturday and Sunday mornings).

### Date patterns and overall monthly differences

Rates of firearm injury ED visits were not evenly distributed throughout the year, neither daily ( $P < 0.001$ , Figure 2A) nor monthly ( $P < 0.001$ , Figure 2B). Daily rates were lowest on March 1 (50.8 firearm injury ED visits per 100,000 ED visits [CI, 44.0 to 58.6]) and highest on December 31<sup>st</sup> (i.e., New Year's Eve) (141.1 per 100,000 [CI, 128.5 to 154.9]) and July 4<sup>th</sup> (i.e., Independence Day) (158.7 per 100,000 [CI, 145.7 to 172.8]). Monthly rates of firearm injury ED visits were highest in July (82.1 firearm injury ED visits per 100,000 ED visits [CI, 80.5 to 83.8]) and lowest in February (63.6 per 100,000 [CI, 62.1 to 65.1]).

### Holiday patterns

Holidays defined by a specific date (e.g., Independence Day on July 4<sup>th</sup>) and those that always fall on the same day of the week (e.g., Memorial Day) both demonstrated deviations from the daily mean rate of nonholidays (73.0 firearm injury ED visits per 100,000 ED visits [CI, 72.5 to 73.5]) (Table 1). Holidays with rates significantly higher than the nonholiday mean rate (all  $P < 0.001$ ) included Independence Day (158.7 per 100,000 [CI, 145.7 to 172.8]), New Year's Eve (141.1 per 100,000 [CI, 128.5 to 154.9]), Christmas (112.8 per 100,000 [CI, 100.8 to 126.2]), Memorial Day weekend (i.e., the Saturday and Sunday preceding Memorial Day; 106.7 per 100,000 [CI, 99.3 to 114.6]), Halloween (105.2 per 100,000 [CI, 94.0 to 117.8]), and Labor Day weekend (i.e., the Saturday and Sunday preceding Labor Day; 105.0 per 100,000 [CI, 96.9 to 113.6]). Daily rates on Labor Day (Monday), Memorial Day (Monday), Superbowl Sunday, full moon days, and the first day of the month were not significantly different from nonholiday rates. Analysis of the 4 date-specific holidays with the highest daily rates (i.e., Independence Day, New Year's

Eve, Christmas, and Halloween), stratified by time of day and day of week, demonstrated consistently higher rates of firearm injury ED visits on holidays than on non-holidays during the nighttime hours (approximately 7:00 pm to 7:00 am) (Figure 3).

### Sensitivity analysis

The results of sensitivity analyses using raw counts (data not shown) were equivalent, with the exception that the time of the nightly peak in ED visits for firearm injury was observed slightly earlier (i.e., around 12:00 am rather than 2:30 am).

### Discussion

Our findings highlight significant temporal clustering of firearm injury ED visits, emphasizing the importance of evidence-based resource allocation and the need for targeted interventions during peak times. Specifically, firearm injury ED visit rates were highest during evenings, weekends, summer months, and holidays, with important interactions between temporal patterns (e.g., time of day and holiday status).

The current study is the largest analysis of temporal patterns in firearm injury using ED data to date, and the first to utilize a data source that is simultaneously timely, granular, and inclusive of data from both urban and rural areas. These findings support and expand on previous research demonstrating differences in firearm injury incidence according to time of day (10–12), day of week (10,14,15), holiday status (10,13,15), and time of year (10). Because the FASTER program captures data from throughout each included state, this study is unique in its inclusion of areas other than major metropolitan centers. Rural areas of the U.S. have been relatively understudied in recent work (10); although the current analysis did not stratify by urbanicity, the inclusion of data from rural areas improves generalizability and suggests opportunities for future research.

These insights can inform healthcare staffing and emergency preparedness, potentially reducing mortality rates associated with firearm injuries. Identifying high-burden times for when firearm injuries present in ED settings is important for informing prevention and response efforts, particularly in the form of resource allocation in treatment settings, as delays in care are associated with increased mortality rates following severe gunshot wounds (32). Since time delay between an injury and accessing advanced trauma care is associated with increased mortality (22,32), our findings provide detailed information that can help inform staffing for trauma centers and the surrounding infrastructure (e.g., prehospital emergency services). Furthermore, since a large proportion of firearm injuries are assaults (33), services such as Community Violence Intervention (CVI) or hospital-based violence intervention programs (HVIP), which provide rapid intervention by a violence prevention specialist, could help de-escalate conflicts and prevent retaliatory violence that may occur in a community in a subset of the injuries studied here (34). The implementation of these and other CVI programs could also benefit from the detailed understanding of temporal patterns provided by this study by allocating prevention and response resources when they are most likely to be needed (35).

Other research has also suggested the role of climate (36–38) and weather (15–17) in firearm injury specifically and interpersonal violence in general, as a modifier of underlying temporal patterns. Higher rates of firearm injury have been observed in association with higher daily temperatures and long-term warming trends (15,37), and lower rates with precipitation (16,17). Increases in interpersonal violence have also been observed in association with deviations from historical climate patterns (37). Together, the interplay of local factors such as weather, urbanicity, variations in holiday observances, and potentially other unmeasured confounders highlights the need for further research using data that offer both temporal and spatial granularity. Furthermore, the time period examined included the onset of the COVID-19 pandemic. Previous research using both ED and EMS data (39,40) has documented significant increases in firearm injuries during this period. Additional research is needed to fully understand how the temporal patterns described here may shift over time.

This study has several limitations. First, data are limited to FASTER-funded jurisdictions, including 9 states and the District of Columbia, and are not nationally representative. Second, the syndrome definition used in this analysis might underestimate or overestimate ED visits related to firearm injuries because of variation in coding, reporting, and availability of visit-level data between facilities or over time. The syndrome definition also does not distinguish firearm injury intent, making it impossible to know the proportions of visits related to assaults, unintentional injuries, and self-directed injuries. Further research should explore intent-specific patterns of firearm injuries to refine prevention strategies. Third, temporal analysis of trends in ED visits for firearm injury offer only an approximation of temporal trends in the injuries themselves, as the time between injury and arrival to an ED may vary and could be influenced by unmeasured confounders, including community conditions (41–43). Fourth, the period examined in the current study (approximately 5 years, 8 months) results in a relatively small number of data points for holidays (e.g., 6 instances of July 4<sup>th</sup>) compared to non-holidays. This may distort patterns observed for individual holidays as well as comparisons among holidays. Fifth, some individual patient-level and facility-level information were incomplete or not available (e.g., discharge disposition) and thus could not be analyzed for this study. Additionally, FASTER data available to CDC does not presently contain identifiers denoting multi-victim incidents, a particular type of incident that merits additional research. Finally, temporal patterns in healthcare utilization for other conditions could potentially distort the measurement of firearm injury rates as a proportion of total ED visits. Sensitivity analysis using raw counts of ED visits for firearm injury yielded largely equivalent results, and examining data as rates still can help inform the relative need for certain types of clinical services among all ED care being sought.

Understanding the factors contributing to the temporal patterns of firearm injury presents a valuable opportunity for future prevention efforts, and implementation of policies, programs, and practices grounded in the best available evidence can bolster states' and communities' prevention efforts. For example, some prevention programs account for temporal variation in demand for services, and this data could potentially be used to support such programs by identifying those at highest risk during high-risk periods, monitoring progress or evaluating program effectiveness, or facilitating information-sharing among programs and partners. CDC's Community Violence Prevention Resource for Action (44) highlights a

number of strategies and approaches for preventing community violence, including firearm injury. Strategies like creating protective environments involve approaches such as safe and secure storage of firearms and remediating vacant lots to reduce opportunities for violence. Strengthening youth and young adults' skills through school-based skill building and job training and employment programs can reinforce positive interpersonal, emotional, and behavioral skills from a young age and promote healthy relationships and economic stability. Further, strategies to intervene and lessen future harms include approaches like hospital-based violence intervention programs and street outreach with community norms change. Specifically, implementing and staffing CVI or HVIP programs, particularly during high-risk periods such as those elucidated in this study, are concrete actions that hospitals can take that could help reduce rising firearm injury and mortality rates.

## Acknowledgments

We would like to acknowledge Xinjian Zhang and the jurisdictions that participate in and provide data to the CDC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) program.

### Grant support

This study was not supported by any grant or other funding. Information about the funding of the FASTER program is available at <https://www.cdc.gov/firearm-violence/php/funded-surveillance/index.html>

## References

1. Simon TR, Kegler SR, Zwald ML, Chen MS, Mercy JA, Jones CM, et al. Notes from the Field: Increases in Firearm Homicide and Suicide Rates — United States, 2020–2021. *MMWR Morb Mortal Wkly Rep*. 2022 Oct 7;71(40):1286–7. [PubMed: 36201375]
2. Kegler SR, Simon TR, Sumner SA. Notes from the Field: Firearm Homicide Rates, by Race and Ethnicity - United States, 2019–2022. *MMWR Morb Mortal Wkly Rep*. 2023 Oct 20;72(42):1149–50. [PubMed: 37856328]
3. Kaczowski W, Kegler SR, Chen MS, Zwald ML, Stone DM, Sumner SA. Notes from the Field: Firearm Suicide Rates, by Race and Ethnicity - United States, 2019–2022. *MMWR Morb Mortal Wkly Rep*. 2023 Dec 1;72(48):1307–8. [PubMed: 38032829]
4. Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018–2023 on CDC WONDER Online Database, released in 2024. Data are from the Multiple Cause of Death Files, 2018–2023, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. [Internet]. [cited 2024 Oct 1]. Available from: <http://wonder.cdc.gov/ucd-icd10-expanded.html>
5. Goldstick JE, Cunningham RM, Carter PM. Current Causes of Death in Children and Adolescents in the United States. *New England Journal of Medicine*. 2022 May 19;386(20):1955–6. [PubMed: 35443104]
6. Barber C, Cook PJ, Parker ST. The emerging infrastructure of US firearms injury data. *Prev Med*. 2022 Jul 5;107:129. [PubMed: 35803350]
7. Roman JK, Cook P. Improving data infrastructure to reduce firearms violence. NORC at the University of Chicago; 2021.
8. Healthcare Cost and Utilization Project (HCUP). HCUP Nationwide Emergency Department Sample (NEDS). [Internet]. Rockville, MD: Agency for Healthcare Research and Quality; 2006. Available from: [www.hcup-us.ahrq.gov/nedsoverview.jsp](http://www.hcup-us.ahrq.gov/nedsoverview.jsp)
9. United States Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Injury Prevention and Control. Firearm Injury Surveillance Study, 1993–2021. Inter-university Consortium for Political and Social Research [distributor]; 2023.

10. Klerman EB, Affouf M, Robbins R, Iyer JM, Griggs C, Masiakos PT, et al. Characterizing Gun Violence by Time, Day of the Week, Holidays, and Month in 6 US Cities, 2015–2021. *J Biol Rhythms*. 2024 Feb;39(1):100–8. [PubMed: 37978837]
11. Afif IN, Gobaud AN, Morrison CN, Jacoby SF, Maher Z, Dauer ED, et al. The changing epidemiology of interpersonal firearm violence during the COVID-19 pandemic in Philadelphia, PA. *Prev Med*. 2022 May;158.
12. Ordoobadi AJ, Wickard A, Heindel P, Raykar N, Masiakos PT, Anderson GA. Quantifying Pediatric Gun Violence by Location, Time of Day, and Day of Week. *J Pediatr Surg*. 2023 Nov 7;S0022–3468(23)00685–1.
13. Rahman A, Yanni M, Cukovic L, Herrebut L, Krzyzewski K, Sahakian Y. Trends of emergency department visits for gunshot victims in the United States. *Journal of Emergency and Critical Care Medicine*. 2022 Apr 30;6:1–6.
14. Loder RT. Temporal variation in United States firearm injuries 1993–2008: results from a national data base. *J Inj Violence Res*. 2014 Jan;6(1):1–15. [PubMed: 23669603]
15. Reeping PM, Hemenway D. The association between weather and the number of daily shootings in Chicago (2012–2016). *Injury Epidemiology*. 2020 Jun 22;7(1):31. [PubMed: 32564771]
16. Michel SJ, Wang H, Selvarajah S, Canner JK, Murrill M, Chi A, et al. Investigating the relationship between weather and violence in Baltimore, Maryland, USA. *Injury*. 2016 Jan 1;47(1):272–6. [PubMed: 26233631]
17. Kieleyka J, Kucyala K, Crandall M. Ecologic factors relating to firearm injuries and gun violence in Chicago. *Journal of Forensic and Legal Medicine*. 2016 Jan 1;37:87–90. [PubMed: 26646954]
18. Walker BB, Schuurman N, Hameed SM. A GIS-based spatiotemporal analysis of violent trauma hotspots in Vancouver, Canada: identification, contextualisation and intervention. *BMJ Open*. 2014 Feb 1;4(2):e003642.
19. Andresen MA, Malleson N. Intra-week spatial-temporal patterns of crime. *Crime Science*. 2015 Jul 2;4(1):12.
20. McDowall D, Loftin C, Pate M. Seasonal Cycles in Crime, and Their Variability. *J Quant Criminol*. 2012 Sep;28(3):389–410.
21. Sing RF, Branas CC, MacKenzie EJ, Schwab CW. Geographic Variation in Serious Nonfatal Firearm Injuries in Pennsylvania. *Journal of Trauma and Acute Care Surgery*. 1997 Nov;43(5):825.
22. Seamon MJ, Fisher CA, Gaughan J, Lloyd M, Bradley KM, Santora TA, et al. Prehospital Procedures Before Emergency Department Thoracotomy: “Scoop and Run” Saves Lives. *Journal of Trauma and Acute Care Surgery* [Internet]. 2007;63(1). Available from: [https://journals.lww.com/jtrauma/Fulltext/2007/07000/Prehospital\\_Procedures\\_Before\\_Emergency\\_Department.18.aspx](https://journals.lww.com/jtrauma/Fulltext/2007/07000/Prehospital_Procedures_Before_Emergency_Department.18.aspx)
23. Centers for Disease Control and Prevention. National Syndromic Surveillance Program (NSSP) [Internet]. Atlanta, GA: BioSense Platform; Available from: <https://www.cdc.gov/nssp/index.html>
24. National Center for Injury Prevention and Control. Division of Violence Prevention: Funded Surveillance [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2020. Available from: <https://www.cdc.gov/violenceprevention/firearms/funded-surveillance.html>
25. Zwald ML, Holland KM, Sumner SA, Sheppard M, Chen Y, Wallace A, et al. Trends in Firearm Injuries Treated in Emergency Departments by Individual- and County-Level Characteristics, 2019 to 2023. *Ann Emerg Med*. 2024 Dec 12;S0196–0644(24)01196-X.
26. Zwald ML, Holland KM, Bowen DA, Simon TR, Dahlberg LL, Stein Z, et al. Using the Centers for Disease Control and Prevention’s National Syndromic Surveillance Program Data to Monitor Trends in US Emergency Department Visits for Firearm Injuries, 2018 to 2019. *Annals of Emergency Medicine*. 2022 May 1;79(5):465–73. [PubMed: 35277293]
27. Van Dyke ME, Chen MS, Sheppard M, Sharpe JD, Radhakrishnan L, Dahlberg LL, et al. County-Level Social Vulnerability and Emergency Department Visits for Firearm Injuries - 10 U.S. Jurisdictions, January 1, 2018–December 31, 2021. *MMWR Morb Mortal Wkly Rep*. 2022 Jul 8;71(27):873–7. [PubMed: 35797204]
28. CDC Firearm Injury v2 | Knowledge Repository [Internet]. [cited 2025 Jan 8]. Available from: <https://knowledgerepository.syndromicsurveillance.org/cdc-firearm-injury-v2>

29. Jerrard DA. Male Patient Visits to the Emergency Department Decline During the Play of Major Sporting Events. *West J Emerg Med*. 2009 May;10(2):101–3. [PubMed: 19561829]
30. Zargar M, Khaji A, Kaviani A, Karbakhsh M, Yunesian M, Abdollahi M. The full moon and admission to emergency rooms. *Indian J Med Sci*. 2004 May;58(5):191–5. [PubMed: 15166467]
31. R Core Team. R: A language and environment for statistical computing [Internet]. Vienna, Austria: R Foundation for Statistical Computing; 2023. Available from: <https://cran.r-project.org/>
32. Meizoso JP, Ray JJ, Karcutskie CAI, Allen CJ, Zakrison TL, Pust GD, et al. Effect of time to operation on mortality for hypotensive patients with gunshot wounds to the torso: The golden 10 minutes. *Journal of Trauma and Acute Care Surgery*. 2016 Oct;81(4):685. [PubMed: 27488491]
33. Kaufman EJ, Wiebe DJ, Xiong RA, Morrison CN, Seamon MJ, Delgado MK. Epidemiologic Trends in Fatal and Nonfatal Firearm Injuries in the US, 2009–2017. *JAMA Intern Med*. 2021 Feb 1;181(2):237–44. [PubMed: 33284327]
34. Juillard C, Cooperman L, Allen I, Pirracchio R, Henderson T, Marquez R, et al. A decade of hospital-based violence intervention: Benefits and shortcomings. *Journal of Trauma and Acute Care Surgery*. 2016 Dec;81(6):1156. [PubMed: 27653168]
35. Coupet E Jr, Huang Y, Delgado MK. US Emergency Department Encounters for Firearm Injuries According to Presentation at Trauma vs Nontrauma Centers. *JAMA Surgery*. 2019 Apr 1;154(4):360–2. [PubMed: 30673067]
36. Goin DE, Rudolph KE, Ahern J. Predictors of firearm violence in urban communities: A machine-learning approach. *Health & Place*. 2018 May 1;51:61–7. [PubMed: 29549755]
37. Hsiang SM, Burke M, Miguel E. Quantifying the Influence of Climate on Human Conflict. *Science*. 2013 Sep 13;341(6151):1235367. [PubMed: 24031020]
38. Mares D Climate change and crime: monthly temperature and precipitation anomalies and crime rates in St. Louis, MO 1990–2009. *Crime Law Soc Change*. 2013 Mar 1;59(2):185–208.
39. Rowh A, Zwald M, Fowler K, Jack S, Siordia C, Walters J. Emergency Medical Services Encounters for Firearm Injuries — 858 Counties, United States, January 2019–September 2023. *MMWR Morb Mortal Wkly Rep*. 2024 Jun 20;73(24):551–7. [PubMed: 38900705]
40. Zwald ML, Van Dyke ME, Chen MS, Radhakrishnan L, Holland KM, Simon TR, et al. Emergency Department Visits for Firearm Injuries Before and During the COVID-19 Pandemic — United States, January 2019–December 2022. *MMWR Morb Mortal Wkly Rep*. 2023 Mar 31;72(13):333–7. [PubMed: 36995967]
41. Crandall M, Sharp D, Unger E, Straus D, Brasel K, Hsia R, et al. Trauma Deserts: Distance From a Trauma Center, Transport Times, and Mortality From Gunshot Wounds in Chicago. *Am J Public Health*. 2013 Jun;103(6):1103–9. [PubMed: 23597339]
42. Strong BL, Cosey-Gay F, Wilson KL, Rogers SOJ. When Equality Is Not Equity: The Ethics of Access to Trauma Care A Surgical Perspective. *Annals of Surgery*. 2024 Mar 5;10.1097/SLA.0000000000006258.
43. Poulson M, Jay J, Kenzik K, Torres C, Sanchez SE, Saillant N, et al. Death by the minute: Inequities in trauma care for victims of firearm violence. *J Trauma Acute Care Surg*. 2024 Apr 1;96(4):589–95. [PubMed: 37994476]
44. Centers for Disease Control and Prevention. Resources for Action [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2023. Available from: <https://www.cdc.gov/violenceprevention/communicationresources/pub/resource-for-action.html>

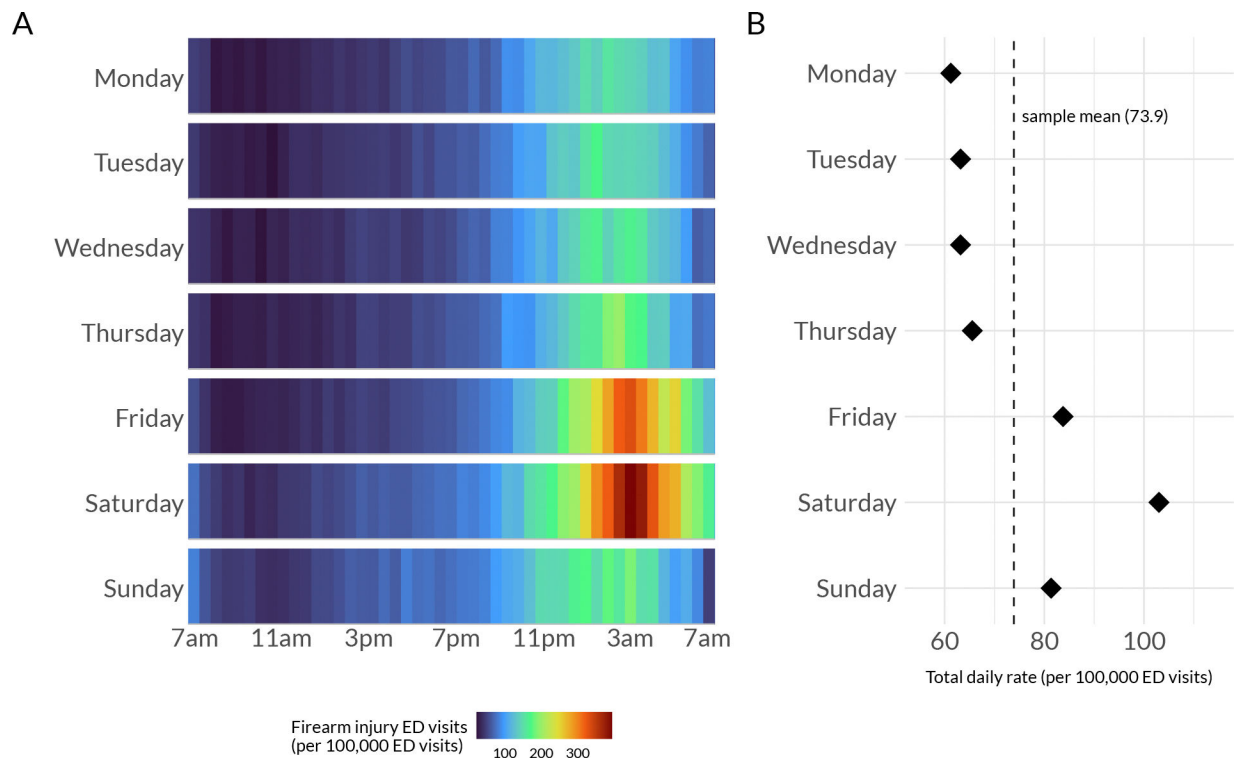


**Figure 1. Rate\* of firearm injuries treated in emergency departments (EDs) by time of day, day of week (A) and differences in daily total rate (B), January 2018 – August 2023**

\* Rate of firearm injury ED visits calculated as the proportion of all ED visits involving firearm injuries per 100,000 ED visits

Data source: CDC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) Program, 9 States (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, and West Virginia) and the District of Columbia

Note: Visits that occurred between midnight and 6:59 am were reported for the previous day.

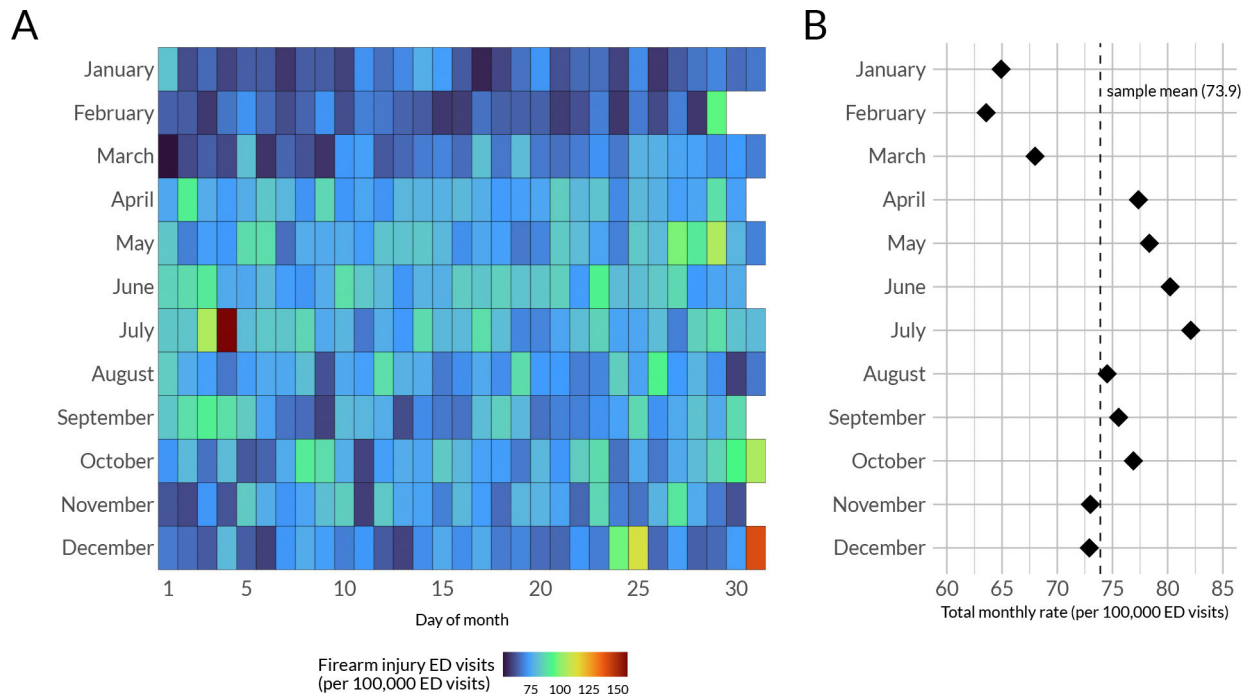


**Figure 2. Rate\* of firearm injuries treated in emergency departments (EDs) by day of month (A) and monthly total rate (B), January 2018 – August 2023**

\* Rate of firearm injury ED visits calculated as the proportion of all ED visits involving firearm injuries per 100,000 ED visits

Data source: CDC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) Program, 9 States (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, and West Virginia) and the District of Columbia

Note: Visits that occurred between midnight and 6:59 am were reported for the previous day.

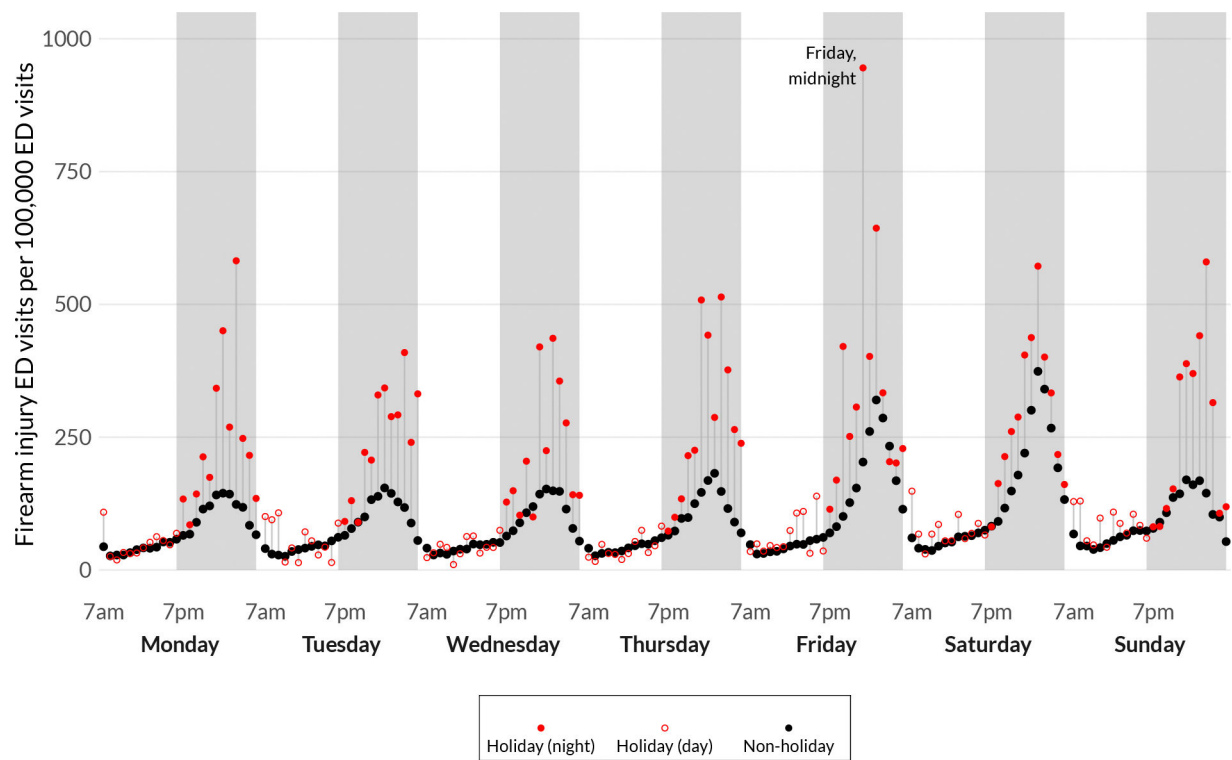


**Figure 3. Rate\* of firearm injuries treated in emergency departments (EDs) by time of day and holiday†, January 2018 – August 2023**

\* Rate of firearm injury ED visits calculated as the proportion of all ED visits involving firearm injuries per 100,000 ED visits

† For this analysis, holidays include the 4 date-specific holidays with the highest daily rates (Independence Day, New Year's Eve, Christmas, and Halloween). All other days are reported as non-holidays.

Data source: CDC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) Program, 9 States (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, and West Virginia) and the District of Columbia

**Table 1.**

Rate\* of firearm injuries treated in emergency departments (EDs) by selected days of interest, January 2018 – August 2023

| Day of interest                | Firearm injury ED visits per 100,000 ED visits | 95% confidence interval |
|--------------------------------|------------------------------------------------|-------------------------|
| Independence Day               | 158.7                                          | 145.7 to 172.8          |
| New Year's Eve                 | 141.1                                          | 128.5 to 154.9          |
| Christmas                      | 112.8                                          | 100.8 to 126.2          |
| Memorial Day weekend (Sat/Sun) | 106.7                                          | 99.3 to 114.6           |
| Halloween                      | 105.2                                          | 94.0 to 117.8           |
| Labor Day weekend (Sat/Sun)    | 105.0                                          | 96.9 to 113.6           |
| Labor Day (Mon)                | 89.1                                           | 79.1 to 100.3           |
| First day of the month         | 74.2                                           | 71.4 to 77.0            |
| <b>All other days</b>          | <b>73.0</b>                                    | <b>72.5 to 73.5</b>     |
| Full moon                      | 72.6                                           | 70.8 to 74.5            |
| Superbowl Sunday               | 71.1                                           | 62.6 to 80.6            |
| Memorial Day (Mon)             | 65.3                                           | 57.6 to 74.0            |

\* Rate of firearm injury ED visits calculated as the proportion of all ED visits involving firearm injuries per 100,000 ED visits

Data source: CDC's Firearm Injury Surveillance Through Emergency Rooms (FASTER) Program, 9 States (Florida, Georgia, New Mexico, North Carolina, Oregon, Utah, Virginia, Washington, and West Virginia) and the District of Columbia

Note: Visits that occurred between midnight and 6:59 am were reported for the previous day.