Original Article

Trends of emergency department visits for gunshot victims in the United States

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Background: The purpose of this study was to evaluate if the number of emergency department (ED) visits due to gunshot wounds were affected by patient demographics, national holidays, and days of the week.

Methods: A total of 2,127 patients presenting with gunshot wounds were extracted from the 2017 National Hospital Ambulatory Medical Care Survey (NHAMCS), which is secondary database of the utilization of ambulatory care services in hospital EDs. The incidence of ED visits due to gunshot wounds were assessed as it relates to various patient demographics, which included age, sex, race, in addition to geographic region, national holidays, and days of the week.

Results: The study found that the incidence of gunshot wounds varies significantly by the time of the year, the days of the week, patient characteristics, and various holidays. Independence Day (38.5%), Fridays (34%), weekends (50.3%), Northeast region (35.6%), and the Black population (44.5%) had the highest number of gunshot wounds as compared to their respective demographic variables. Males had the highest number of ED visits due to gunshot wounds (86.4%). One third (33.1%) of the studied gunshot wounds were fatal.

Conclusions: Additional resources, such as hospital beds, staffing, and funding, should be allocated to ED and trauma centers on Fridays and the weekends. The findings of the study have significant public safety and health implications. The results can aid public safety and law enforcement agencies in identifying patterns of gun violence in order to initiate appropriate steps to address this critical social and healthcare crisis.

Keywords: Emergency department visits (ED visits); gunshot wounds; public health; ambulatory care

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Introduction

Firearm injuries are a serious public health problem and are one of the top five causes of death for people under 64 years old resulting in 109 deaths every day. Of those, more than half the deaths are firearm suicides and more than three out of every 10 are firearm homicides. There are 39,707 firearm-related deaths annually in the United States resulting in tremendous direct, economic, and intangible costs to the society (1,2).

Rates of firearm violence also vary by various demographics, such as age, race, sex and ethnicity. Males are 6.5 times more likely to die from a firearm-related injury versus females (2). Majority of the firearm homicides occurs among teens and young adults 15–34 years of age, and among Black, American Indian, and Hispanic populations. Firearm suicide rates are reported very high among adults 75 years of age and older, American Indian, and White populations. Rates of firearm homicide among children are higher in several states from the South and Midwest region as compared to other parts of the country. Firearm suicides are reported to be more scattered across the United States with the highest prevalence in Western states (2).

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Traditionally, gunshot wound incidents are congregated primarily in poor, Black neighborhoods near downtowns, and these trends persist throughout the nation (3).

Gunshot injuries normally peak in summer and on weekends, but this pattern is not consistent across all regions and demographics (4). It varies by race as Black neighborhoods have a higher rate of homicides throughout the weekdays, while for Hispanics, they are concentrated on Saturday through Monday. The incidence of gunshot wounds increases during holidays, especially on Independence Day weekend. Gun violence and gun trauma are positively correlated with higher temperatures, especially on weekends and holidays (5,6). A rise in 10-℃ temperature is remarkably linked with 34% and 42% more shootings on weekdays, and on weekends or holidays, respectively.

Gun violence disproportionately affects the Black population. Homicide is the primary cause of death for Black males ages 15–34 (7). In 2014, homicide accounted for 48% of deaths among Black males aged 15–24. In contrast, homicide accounted for 7.6% of deaths among white males aged 15–24, although it was still the third leading cause of death in that population. In a study of children injured by firearms in the US, young Black males were admitted to the hospital for firearm injury 10 times as often as their white male counterparts.

The two main causes of firearm deaths in the U.S. are suicide and homicide, accounting for 59.3% and 37.3% of firearm deaths, respectively (8). Firearm ownership could be a major risk factor associated with increased rates of homicide and suicides. The widespread availability of guns is correlated with the number of homicides, which poses a major public health and safety concern.

According to the Nationwide Emergency Department Sample of the Healthcare Cost and Utilization Project, most of the patients arriving alive at the emergency department (ED) for a firearm-related injury are injured in an assault (49.5%) or injured inadvertently (35.3%) (9). Attempted suicides and legal interventions account for 5.3% and 2.4%, respectively, and are more prevalent in younger patients. (9). Black patients who were between 18 and 25 years of age were more likely to visit EDs with a gunshot wound versus their non-Black counterparts (10). Assault is the most common mechanism for a firearm-related injury among patients insured with Medicaid (57.3%) and among those who were categorized as self-pay (52.0%) or no charge (57.3%).

Survivors of firearm-related injury generally experience long-term physical and mental repercussions such as physical disability, trouble with memory, emotions, and post-traumatic stress disorders. The effects of firearm violence affects not only the victims and their immediate families, but also affects the sense of well-being and security of entire communities (1). In a study exploring the relationship between neighborhood gun violence and ensuing pediatric ED visits for mental trauma, the majority of the children were Black (84.5%) and Medicaid beneficiaries (78.1%) (11). Children residing within one-eighth of a mile of a shooting had a higher likelihood of mental health-related ED presentations in the following 14 days. The purpose of this study was to evaluate if the number of ED visits due to gunshot wounds were affected by patient demographics, national holidays, and days of the week. The following article is presented in accordance with the STROBE reporting checklist (available at https://jeccm.amegroups.com/article/view/10.21037/jeccm-21-114/rc).

Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and was approved by the Institutional Review Board of Rosalind Franklin University of Medicine and Science (No. COP20-248). Individual consent for this retrospective analysis was waived as it utilized the secondary database, which is publicly available.

In this retrospective, secondary database analysis research, the incidence of ED visits due to gunshot wounds were assessed among various patient demographics, which included age, sex, race, in addition to geographic region, national holidays, and days of the week. National holidays studied were Memorial Day, Independence Day, Labor Day, Columbus Day, and others. In addition, the ED visit rates due to gunshot wounds were compared by weekdays and weekends. The lack of outcomes information has been listed as a limitation of the study. The severity of injury on presentation to the ED has been added as “Immediate”, “Urgent”, “Semi-urgent”, based on how the severity is reported in the database. A total of 2,127 patients presenting with gunshot wounds, meeting the criteria of assault by unspecified firearm and gun discharge (ICD-10 code: X95), were extracted from the 2017 National Hospital Ambulatory Medical Care Survey (NHAMCS).

Data for this report were from the 2017 NHAMCS, a nationally representative survey of nonfederal, general, and short-stay hospitals conducted by the National Center for Health Statistics (NCHS). Additional information on the

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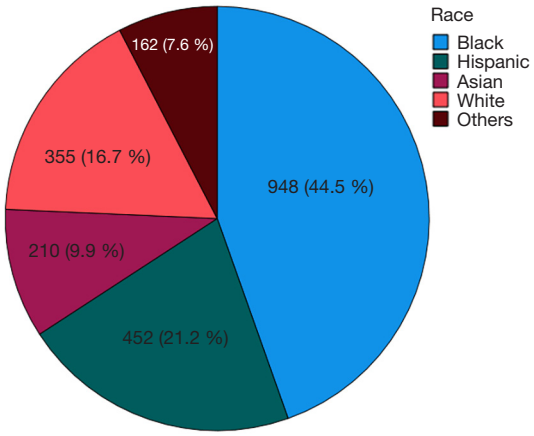

Figure 1 The number of gunshot wounds by race reported to emergency departments.

Table 1 Demographics of gunshot victims who visited the emergency departments in the United States

Demographic variables	Frequency (n=2,127)	Percentage (%)
Sex		
Male	1,839	86.4
Female	288	13.5
Age range (years)		
0–19	413	19.4
20–30	1,168	54.9
31–40	152	7.1
41 and above	394	18.5
Race		
Black	948	44.5
Hispanic	452	21.2
White	355	16.7
Asian	210	9.9
Other	162	7.6
Region		
Northeast	757	35.6
South	441	20.7
Midwest	408	19.2
West	367	17.2
Other	154	7.2

methodology of the NHAMCS is available as public-use data files (12). The NHAMCS is depicted to collect data on the utilization and provision of ambulatory care services in hospital EDs. This database is collected by the NCHS, which is a division of the Department of Health and Human Services. Findings are based on a national sample of visits to the EDs and outpatient departments (13).

Statistical analysis

The extracted data were checked for integrity to meet the predetermined inclusion and exclusion criteria, and exported into Excel®. Missing and partial data entries were filtered, and the refined data was coded. The extracted dataset was checked for missing cases and data integrity. The resultant data was exported into Statistical Package for Social Sciences (SPSS®) version 27.0 for statistical analysis. Data were analyzed using various statistical techniques, including descriptive analysis, analysis of variance (ANOVA), and *t*-tests at an alpha significance level of 0.05.

Results

The total number of people presenting with gunshot wounds was 2,127 of which, one third (33.1%) were fatal. Less than 20 years of age comprised 19.4% of the study population. Over 50% were in the age range of 20 to 30 years old. The lowest percentage of the study population were in the age range of 31–40 years old (7.1%), whereas 18.5% comprised 41 years of age and above.

The majority of people suffering gunshot wounds were males (86.4%), Blacks (44.5%), followed by Hispanics (21.2%), Whites (16.7%), Asians (9.9%), and other races (7.6%) (*Figure 1*). The Northeast region had the most cases (35.6%), followed by South (20.7%). As far as geographical location, Northeast (35.6%) and South (20.7%) had the majority of cases, followed by Midwest (19.2%) and West (17.2%) (*Table 1*).

The breakdown by the type of holidays showed that Independence Day was the holiday with the greatest number of gunshot wounds (38.5%), followed by Memorial Day (26.4%) and Labor Day (21.6%). Other holidays, including Columbus Day, represented only 13.5% of the cases (*Figure 2*). As far as the day of the week, most cases were seen on Fridays (34%) and weekends (23.2% on Saturdays and 27.1% on Sundays).

This study found that the incidence of gunshot wounds varies significantly by the time of the year, patient

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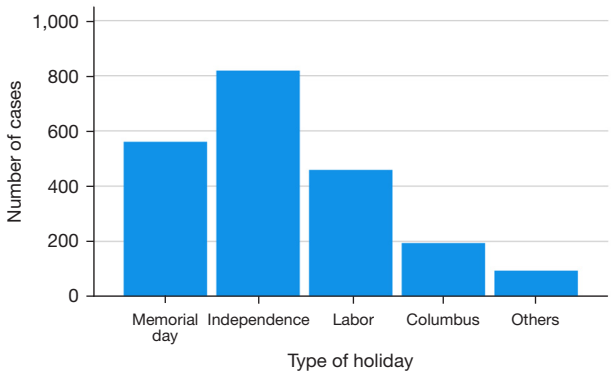

Figure 2 Type of holiday by gunshot count reported to emergency departments.

Table 2 Relationship between demographic characteristics and gunshot incidence

Demographic characteristics	Gunshot incidence	ANOVA† significance (P)
Age	Type of holiday	<0.001‡
	Day of the week	0.595
	Fatalities	<0.001‡
Sex	Type of holiday	0.054
	Day of the week	0.025‡
	Fatalities	0.004‡
Race	Type of holiday	<0.001‡
	Day of the week	<0.001‡
	Fatalities	0.001‡
Region	Type of holiday	0.020‡
	Day of the week	<0.001‡
	Fatalities	<0.001‡

†, analysis of variance; ‡, denotes statistical significance.

characteristics, and various holidays (*Table 2*). There was a statistically significant difference amongst various age groups, with the group of 20–30 years presenting the greatest number of cases (P=0.001). There were no significant differences among the different age groups in the incidence of gunshot wounds during the various days of the week (P=0.595). Males had the highest rates of fatality as compared to females (P=0.004). Blacks (P=0.001) and the Northeast region (P=0.001) had the highest number of cases as compared to other demographics (*Table 2*).

A one-way ANOVA test was performed on the data to determine factors affecting the outcome or the fatality associated with gunshot wounds, the day of the week, and the type of holiday. Various age groups with regards to the type of holiday, fatalities, and the day of the week were significantly different (P<0.001). There was a statistically significant difference by sex in relationship with the day of the week (P=0.025) and fatalities (P=0.004). The type of holiday, however, did not show a statistically significant relationship with sex (P=0.054). There was a statistically significant difference amongst different races in terms of the incidence of gunshot wounds as compared to the type of holiday and the day of the week (P<0.001). Lastly, geographical location affected the incidence of gunshot wounds (P<0.001) as compared to the type of holiday (P=0.020) and the day of the week (P<0.001).

Correlation and multiple regression analyses were conducted to examine the relationship between the intensity level and the various potential predictors. As it can be seen, the type of holiday and race are positively and significantly correlated with the criterion, indicating that those admitted on the Labor Day and Memorial Day tend to have higher intensity level of the wounds upon admission. However, there was no correlation with the days of the week on the intensity of the gunshot wounds and it did not contribute to the multiple regression model (*Table 3*).

Discussion

In this study, Black males 20 to 30 years of age were the prime group visiting the ED for gunshot wounds warranting focused support and intervention for this high-risk group. Several factors are responsible for firearm violence, including geographic locations, drug and firearm trafficking, exposure to gangs, neighborhood disorder, poor family dynamics, and mental health problems (2).

In the present study, holidays and weekends had the highest number of gunshot cases, which could be due to more leisure and alcohol/drug consumption during the holidays. Shootings may be related to outside stay, which increases the likelihood of violent encounters. Outdoor and indoor activities that keep people engaged, such as community get togethers, block parties, indoor games like ping pong and other summer programs for students, would be helpful in lowering the rate of shootings (5,6). Since most cases of gunshot wounds, in the present study, occurred during summer time holidays, such as Memorial Day, Independence Day and Labor Day, it may be an

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Table 3 Multiple regression analysis correlating to gunshot wound intensity levels at emergency departments

Variable	Correlation with intensity of wounds	Multiple regressions weights	
		b	β
Type of holiday	0.603	0.569	0.603
Race	0.064	0.048	0.064
Day of the week	−0.022	−0.033	−0.036

R^2=0.367, P<0.05 for the multiple regressions model.

effective strategy for public safety authorities to patrol communities more often around this time of the year.

In this study, Fridays and weekends had the greatest number of gunshot cases as compared to weekdays. This could be explained by an assumption that people are least busy over the weekends and have free time at their disposal to run errands and thus, be affected by gunshot violence. Since weekends happened to be the days with the most cases of gun violence, additional efforts should be undertaken to ensure that healthcare settings, such as EDs and trauma centers, are properly staffed with enough trauma specialists.

Interventions to minimize gun violence should focus on rigorously evaluated risk factors for future violence, such as past aggressive behavior, domestic violence, substance abuse, which are crucial predictors of risk for gun violence (14,15). Gun violence is related with soaring mental health symptoms among people who later present to the ED. Interventions designed to reducing gun violence and alleviating the associated mental health warnings should be promoted at policy and public level as a priority (11).

This study was limited to the data sources of the NHAMCS 2017 survey of patients who visited the ED and by the operational definitions of the study. The lack of long-term outcomes information is another limitation. The study did not include cases which were not presented or received treatment at the ED and the hospital. The present study did not include data regarding assault with a firearm as a blunt object or injuries related to firearm use (such as harm caused by firearm recoil.

Conclusions

The findings of this study, that the rates of gun violence vary by the day of the week, the type of holiday, and by various demographic factors, such as race, sex, age, and geographic location, have significant public safety implications. The results can help public safety and law enforcement agencies take steps in identifying patterns of gun violence to help protect our communities and combat this vital national safety issue of gun violence. Further research is needed to provide evidence-based and attainable interventions that may lead to reductions in ED visits, potential disability and mortality from this critical public health crisis.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jeccm.amegroups.com/article/view/10.21037/jeccm-21-114/rc

Data Sharing Statement: Available at https://jeccm.amegroups.com/article/view/10.21037/jeccm-21-114/dss

Peer Review File: Available at https://jeccm.amegroups.com/article/view/10.21037/jeccm-21-114/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jeccm.amegroups.com/article/view/10.21037/jeccm-21-114/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are 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. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Institutional Review Board of Rosalind Franklin University of Medicine and Science (No. COP20-248) and individual consent for this retrospective analysis was waived, it utilized the secondary database, which is publicly available.

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