



Trends in pediatric firearm-related injuries over the past 10 years at an urban pediatric hospital



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ABSTRACT

Purpose: Firearm injuries are the second most common cause of trauma deaths in American children. We reviewed gunshot wounds treated at an urban children's hospital to determine the most likely time for injuries to occur over 10 years.

Methods: A retrospective chart review was completed for patients with a firearm injury from January 2003 to December 2012. Patients were excluded if over 17 years or readmitted. Demographics, injury circumstances, interventions, and outcomes were reviewed for 289 patients. Chi square and ANOVA analyses were completed. Alpha was chosen as $p < 0.05$.

Results: Mean age was 12 years, 74% were male and 80% African American. Unintentional injuries occurred in 26% and violence related in 72%. The most common months of injury were August and June, the least common November and October. Unintentional injuries were more likely to occur during the day and violence related injuries were more likely at night ($p = 0.01$). The incidence was lowest 2008–2010 and highest in 2006 and 2011. Mortality was 3.5%.

Conclusions: We noted an increasing incidence of pediatric firearm related injuries in the last two years of the study with over half requiring operative intervention. Most injuries were violence related and occurred in a large city during summer months.

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Firearm injuries present a large health risk to the pediatric population. They are the second leading cause of trauma death in this age group and those who survive may have high morbidity, affecting the remainder of their lives [1,2]. The United States has the highest rate of firearm-related deaths among high-income countries [2]. In 2008, there were 14,831 visits to Emergency Departments in the United States for pediatric firearm injuries [3]. In 2010, there were a total of 2711 deaths by firearm, averaging 7 deaths per day, and 15,576 injuries from firearms in the pediatric population [1,4]. In addition, there is a large economic burden to society in response to these injuries [5,6]. In 2009, an average of 20 pediatric patients were admitted to a hospital daily with firearm injuries and the estimated direct cost of managing these injuries was \$146,710,029 [7].

Many studies have evaluated pediatric firearm injuries in the past 20 years to identify patients who may be at risk. These studies have evaluated laws, firearm possession, and demographics to develop prevention strategies [8–12]. Few studies have looked at the months or time of day when firearm injuries are most likely to occur. Studies of pediatric and adult patients have found that weekends are the most likely days to be shot [7,13–15]. Children under age 14 had no month of increased likelihood while patients ages 15–19 had a peak in August

in the 1990s while an analysis in Alabama found an increased incidence the second half of the year [13,16]. Unintentional pediatric injuries peaked between 4 and 5 pm and assaults peaked between 8 and 9 pm in a review of the National Trauma Database in the early 1990s [14]. The primary objective of this study was to determine the months and time of day when pediatric patients are more likely to sustain a firearm injury. The secondary objectives were to evaluate demographics and trends in the number of firearm injuries and operative interventions.

1. Methods

After obtaining IRB approval (#093513MP4E), a review of our trauma database identified all patients presenting to Children's Hospital of Michigan after a firearm injury between January 2003 and December 2012. Patients were identified through a hospital specific trauma database and included powder and nonpowder firearm injuries. A single author retrospectively reviewed all charts. All patients presenting with a firearm injury were included. Exclusion criteria were an age of 18 years or older, readmission from the same injury, or injury from the gun chamber. There were 306 patients identified in the database, of which 17 were excluded; 14 patients were 18 years of age or older, 1 patient obtained an injury from the gun chamber while loading a gun, and 2 patients were readmitted for pain and the readmission visit was excluded. The remaining 289 charts were reviewed and data were obtained from the Emergency Department, trauma team, and EMS documentation when available. Data abstracted included demographics (patient age,

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gender, race, zip code), details around the incident (intent of injury, shooter, month and year of injury, time of injury, and city of injury), injury details (anatomic location(s), gun type), and management (procedures and operative intervention, radiographic imaging, admission status, length of stay, mortality, and disposition).

The intent of injury categories included violence related, unintentional, and self-inflicted injuries. The violence related category included all assaults and drive-by shootings. Unintentional shootings were the result of a child playing with a gun and accidentally sustaining an injury whether to himself or somebody else and self-inflicted injuries included all suicides and suicide attempts. Details surrounding the incident were reviewed including year, month, time, and city of the shooting. Time of injury was evaluated in 4-h intervals starting at midnight. The injuries sustained and details of each hospital stay including admission status, intensive care admission, management, length of stay, and disposition were reviewed. Injury locations included head, neck, chest, back, abdomen/pelvis, upper extremity, and lower extremity. Multiple sites of injury were also recorded. The need for operative intervention within 24 h and for delayed intervention was recorded. Length of hospital stay and disposition at discharge were also reviewed.

Patients with missing data were removed from each analysis. Statistical analysis was completed with SPSS version 21 (© Copyright IBM Corporation 2011 IBM Corporation Route 100 Somers, NY 10589) with a statistician. A p-value <0.05 was defined as statistically significant. Continuous variables were analyzed using ANOVA with Bonferroni significance, categorical variable were analyzed using Chi square, and monthly incidence was analyzed using Z-scores.

2. Results

The age range was 7 weeks to 17 years with a mean of 11.8 years. There were 214 male patients (74%) and 75 female patients (26%). Males were more likely to have an unintentional (30%) or self-inflicted injury (2%) while 83% of female injuries were violence-related (p = 0.04). The most common race was African American (80%), followed by Caucasian (11%), and Hispanic (6%). The remaining 3% were unknown, multiple, or other. African American and Hispanic children had more violence-related injuries while most Caucasians had unintentional or self-inflicted wounds (p < 0.01). There were 208 patients (72%) injured due to violence. There were 75 unintentional shootings (26%) and five self-inflicted wounds (1.7%). In the cases where a shooter was identified (N = 234), 146 cases (51%) were identified as a stranger, 54 (23%) as a family member, friend, or neighbor, and 35 (15%) were obtained by a self-inflicted wound, intentional or unintentional. Mortality was 3.5% (10), five patients were pronounced dead in the Emergency Department and five died during treatment. Mortality was associated with location of injury with 90% having a head injury and 10% with a chest injury (p < 0.01).

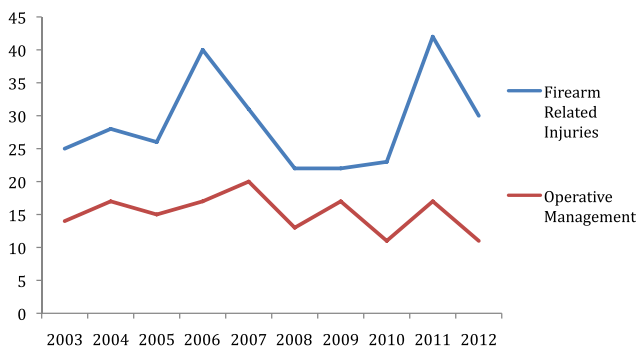


Fig. 1. Number of firearm related injuries and those requiring operative intervention. There was a recent increase in the number of firearm related injuries seen in our pediatric hospital. Fewer patients are requiring operative intervention.

Fig. 1 shows the number of firearm related injuries per year. There was a decrease in incidence from 2007 to 2010, with an increase in the last two years of the study. Seventy-three patients (25%) were discharged home from the Emergency Department, 153 (53%) were admitted to the surgical floor, and 64 (22%) were admitted to the Pediatric Intensive Care Unit. The mean length of stay was 5 days (range 0–52 days). A longer length of stay was seen in females (p = 0.03) and patients with self-inflicted wounds (p < 0.01).

Fig. 2 shows the most common month for injury was August (12.8%) followed by June (11.4%). The least common months were November (3.5%) and October (5.9%) (p < 0.01). Patients were more likely to be injured in the summer months (p < 0.05). Most injuries occurred in the evening hours (Fig. 3). The time of injury (N = 245) associated with the intent of injury with 75% (3) of self-inflicted wounds between 12 pm and 4 pm, 90% (57) of unintentional injuries from 12 pm to 12 am, and 80% (142) of violence-related injuries between 4 pm and 4 am (Fig. 3).

Location of injury and those requiring operative intervention are seen in Fig. 4. Thirty-eight patients had injuries to multiple sites, with 10 presenting with three or more sites of injury. Multiple sites of injury were most common with violence related injuries (p = 0.03). Patients with violence related injuries had more abdomen, pelvis, back, and extremities injuries while patients with unintentional injuries were more likely to sustain head injuries and all self-inflicted injuries were to the head (p < 0.01). Surgical intervention was needed in 175 patients (61%). Of these patients, 138 (48%) had surgery within 24 h of injury, 37 (13%) underwent delayed operation, and 22 (8%) required multiple operations. Operative intervention was not associated with intent of injury (p = 0.28), age (p = 0.21), or multiple sites of injury (p = 0.89). The number of patients requiring operative intervention decreased throughout the years (p = 0.03) (Fig. 1).

3. Discussion

The most commonly injured patient was an African American male in the city, congruent with other studies in urban areas [7,10,15–17]. We did have a larger percent of violence-related injuries compared to some studies but consistent with national numbers [2,10,16–18]. Females were more likely to have an injury from violence than males, who had more unintentional and self-inflicted injuries. This is possibly due to fewer unintentional and self-inflicted injuries in females because they may be less likely to play with firearms or use firearms for suicide attempts. The mortality rate when a patient reached our Emergency Department was 3.5%, however it is likely that many patients who died never made it to the hospital or presented to a different hospital. This mortality rate is lower than reported pediatric firearm mortality rates in similar studies [3,10,15,16,18]. We did not find a higher mortality rate in younger children as reported by Senger et al [16].

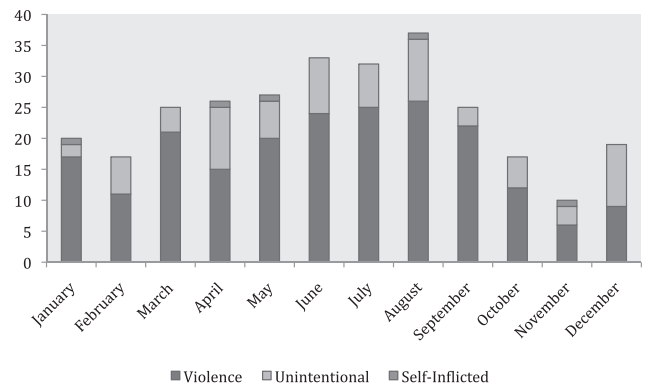


Fig. 2. Number of firearm related injuries by month and intent. Over 40% of injuries occurred during summer months.

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