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# US emergency department visits for fireworks injuries, 2006–2010



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## ABSTRACT

**Background:** Most literature regarding fireworks injuries are from outside the United States, whereas US-based reports focus primarily on children and are based on datasets which cannot provide accurate estimates for subgroups of the US population.

**Methods:** The 2006–2010 Nationwide Emergency Department Sample was used to identify patients with fireworks injury using *International Classification of Diseases, Ninth Revision, Clinical Modification* external cause of injury code E923.0. *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes were examined to determine the mechanism, type, and location of injury. Sampling weights were applied during analysis to obtain US population estimates.

**Results:** There were 25,691 emergency department visits for fireworks-related injuries between 2006 and 2010. There was no consistent trend in annual injury rates during the 5-y period. The majority of visits (50.1%) were in patients aged <20 y. Most injuries were among males (76.4%) and were treated in hospitals in the Midwest and South (42.0% and 36.4%, respectively) than in the West and Northeast (13.3% and 8.3%, respectively) census regions. Fireworks-related injuries were most common in July (68.1%), followed by June (8.3%), January (6.6%), December (3.4%), and August (3.1%). The most common injuries (26.7%) were burns of the wrist, hand, and finger, followed by contusion or superficial injuries to the eye (10.3%), open wounds of the wrist, hand, and finger (6.5%), and burns of the eye (4.6%).

**Conclusions:** Emergency department visits for fireworks injuries are concentrated around major national holidays and are more prevalent in certain parts of the country and among young males. This suggests that targeted interventions may be effective in combating this public health problem.

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## 1. Introduction

A number of researchers around the world have studied fireworks injuries relating to their respective national holidays where fireworks are commonly used, including China, Greece, India, Iran, and the United Kingdom [1–12]. In addition to looking at fireworks injuries in connection with public holidays, most of these researchers also found that these injuries were most prevalent among young males. However, little has been written about the same phenomenon in the United States, particularly with respect to Independence Day (July 4th) and New Year's Eve (December 31st). The most recent publications in the United States based on national data concentrated on pediatric cases occurring between 1990 and 2003 [13,14]. Since that time, consumer fireworks consumption has increased from 107–185.5 million pounds in 2012, with a high of 255 million pounds in 2005, and several states have relaxed their laws concerning fireworks [15–17]. In addition, the Internet has created an environment where firework procurement has become possible even in places where they may not be legal.

We examined emergency department (ED) visits for fireworks-related injuries from the Nationwide Emergency Department Sample (NEDS), Healthcare Cost and Utilization Project, and Agency for Healthcare Research and Quality. This study aims to provide an update of national figures on fireworks-related injury using a data set, which can provide precise estimates for national totals and for descriptive factors. Findings from this study can help EDs to anticipate increases in fireworks-related injuries during certain times of the year and in certain parts of the country, as well as help focus firework-related injury prevention efforts.

## 2. Methods

The NEDS is an all-payer ED database containing approximately 28 million ED visits per year and can be weighted to the entire US population using weights provided by Healthcare Cost and Utilization Project. For 2010, the NEDS included 961 hospitals in 29 states, representing a 20% stratified sample of all hospital EDs in the US. The NEDS provides a variety of information relating to patient demographics, diagnosis, and hospital course. The Johns Hopkins Institutional Review Board approved this study.

NEDS data from 2006–2010 were queried to identify patients who were admitted with fireworks injuries to EDs at hospitals across the United States. Patients with fireworks injuries were identified using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) external cause of injury codes (“E-Codes”) for accidents caused by explosive material, particularly fireworks: E923.0. The NEDS includes up to four E-Codes for each visit, which were searched for the indicated codes. The NEDS also includes up to 15 ICD-9-CM diagnosis codes for each visit, which were examined to determine additional details about the mechanism of injury, type of injury, and location of injury. Type and location of injury were determined using the *International Classification of Diseases Programs for Injury Categorization*

written for Stata [18]. In particular, injuries were categorized using the Barell Injury Diagnosis Matrix [19], which classifies ICD-9-CM diagnosis codes according to body region and nature of injury. If more than one diagnosis code was provided for these patients, the code with the highest severity was chosen, based on the Abbreviated Injury Scale as calculated by the *International Classification of Diseases Programs for Injury Categorization* program. If there was more than one code with the highest severity for a particular patient, the first of these codes was used.

As appropriate, the number of ED visits was divided by the US census population to obtain population rates. ED charges were adjusted for inflation and reported in 2010 dollars.

All analyses were performed using Stata version 12.1, StataCorp, College Station, TX.

## 3. Results

A total of 625,166,156 ED visits between January 1, 2006 and December 31, 2010 were examined, of which 25,691 (41.1 per million ED visits) had an E-code indicating a fireworks injury. Table 1 shows the demographic characteristics of these patients and Figure 1 gives a detailed age distribution. The age distribution of ED visits involving a fireworks injury has two peaks, one between ages 11 and 14 y and another between ages 17 and 19 y. Starting at the age of 20 y, the number of visits declines steadily and the oldest patients in the sample were between the ages of 85 and 95 y. There were considerably more visits for males than for females (76.4% versus 23.6%), and there were more visits to hospitals in the Midwest and South (42.0% and 36.4%, respectively) than in the West and Northeast (13.3% and 8.3%, respectively). There were more visits involving fireworks injuries in the lower two income quartiles (31.3% and 29.2%), with the high-income quartile being the lowest of all (15.7%).

Figure 2 shows the age distribution stratified by gender, illustrating that the age patterns for males and females are

**Table 1 – Demographic characteristics of emergency department visits for injuries due to fireworks.**

| Characteristic  | n (%)         |
|-----------------|---------------|
| Age             |               |
| Mean (SD)       | 22.8 (15.3)   |
| Gender          |               |
| Male            | 19,613 (76.4) |
| Female          | 6062 (23.6)   |
| Region          |               |
| Northeast       | 2124 (8.3)    |
| Midwest         | 10,798 (42.0) |
| South           | 9363 (36.4)   |
| West            | 3406 (13.3)   |
| Income quartile |               |
| 1               | 7915 (31.3)   |
| 2               | 7379 (29.2)   |
| 3               | 6013 (23.8)   |
| 4               | 3978 (15.7)   |
| Total           | 25,691 (100)  |

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