



# **1998 Fireworks-Related Injuries**

**A Study of Fireworks-Related Injuries Treated in Hospital Emergency Rooms between June 23 and July 23, 1998**

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## ***Executive Summary***

This report provides the results of a CPSC staff analysis of 1998 data on fireworks-related injuries. Annual estimates are derived from the National Electronic Injury Surveillance System (1998). Estimates for the July 4<sup>th</sup> period are based on a one-month special survey (June 23 to July 23, 1998) of fireworks-related injuries treated in hospital emergency rooms reporting to NEISS. Highlights are as follows:

- Fireworks devices were involved in an estimated 8,500 injuries treated in U. S. hospital emergency rooms during calendar year 1998. This estimate is significantly lower than estimates for the years 1992 through 1994(12,500).
- There were thirteen deaths from fireworks in 1998. Seven of these deaths occurred from an explosion in a fireworks factory.
- An estimated 5,000 injuries, directly involving fireworks, were treated in U.S. hospital emergency rooms during the one-month period surrounding the Fourth of July, 1998. The highest injury estimates were for firecrackers (1,900), rockets (800), and sparklers (500).
- Over 40 percent of the injuries were to children under age 15. The estimated number of injuries to males (3,700) was approximately three times the number of injuries to females (1,300).
- The parts of the body most often injured were the hands (1,800), eyes (1,100), and head/face (1,000). Over half the injuries involved burns. Burns were the most frequent injury received by all parts of the body except the eye, where contusions and lacerations were the most frequent injuries.

## ***I. Introduction***

The U.S. Consumer Product Safety Commission (CPSC) has maintained an active interest in consumer fireworks safety since the early 1970s. CPSC regulations include a 50 milligram powder limit on firecrackers, fuse burn time limits, requirements to prevent tip-over and blowout, and cautionary labeling requirements. The most recent regulations involve the October 1991 ban on reloadable tube aerial shell fireworks devices with shells larger than a 1.75-inch outer diameter and a March 1996 static stability requirement for multiple tube devices with tubes greater than or equal to an inner diameter of 1.5 inches.

## ***II. Methodology***

Fireworks deaths were obtained from the CPSC Death Certificate file, and the IPII (Injury and Potential Injury Incident) file. Because it takes up to two years to receive reports of deaths from all the states, the number of fireworks deaths for 1998 may actually be greater than reported here.

Total estimated fireworks injuries for 1998 were obtained from the National Electronic Injury Surveillance System (NEISS). NEISS is a probability sample of U. S. hospitals that have emergency departments. All estimates for the number of injuries in this report were obtained using the hospital totals and the sampling weights in NEISS. These weights were adjusted for non reporting. The variance calculations and associated confidence intervals used the standard procedure for a stratified sample (Cochran, 1977, Chapter 5). Estimates were rounded to the nearest 100 injuries. Estimates less than 50 injuries are shown as an asterisk (\*). Percentages were rounded to the nearest 5%.

In addition, from June 23 through July 23, 1998, CPSC conducted a special study that identified 147 fireworks-related injuries treated in hospital emergency rooms. The 1998 special study focused on the types of fireworks involved in injuries and the injuries associated with their use. Victims were asked to identify the fireworks type from illustrations shown to them at the hospital emergency room.

Although estimates are provided in this report for many subsets of the data, such as gender or body part injured, interpretation of estimates for these subsets should be made with caution since estimates based on small sample sizes generally have large amounts of sampling variability. Also the assumption that the sampled injury data follow a normal distribution, which is required for valid confidence intervals, is less plausible for

small samples than large samples. In particular, this means that when comparing subsets of the data, it is not possible to determine how much of the difference is due to sampling variability and how much comes from real differences in national injuries. Because of the large number of different possible comparisons, variances or confidence intervals are not provided in this report except for total injuries.

NEISS data for 1998 are based on a revised sampling frame that first went into effect in 1997 (Kessler and Schroeder, 1998). The new frame reflects changes that have occurred in the population of injuries occurring at U.S. hospital emergency departments. Estimates for total fireworks injuries for years before 1997 have been adjusted to take these changes into account. These estimates are different from the estimates in 1996 and earlier CPSC publications.

### **III. Results**

#### **A. Deaths**

CPSC files contain entries for thirteen deaths that occurred from fireworks during 1998. Below are synopses of the cases:

- Six women and one man between 25 and 52 years old died in an explosion in a fireworks factory in Jefferson Township, Michigan.
- Two girls, 9 and 13 years old, died from smoke inhalation in a mobile home fire in Ellsinore, Missouri that was started by sparks from smoldering fireworks.
- A 12-year-old female was killed in Cleveland, Ohio, when she was struck in the head by a mortar shell at a neighborhood park.
- A 17-year-old man died in Navarino, Wisconsin after being struck by shrapnel from a mailbox where he had placed a lighted firecracker.
- A 29-year-old man drowned in Fox Lake, Illinois after he blew a hole in the bottom of his boat with a large firecracker.
- A 56-year-old Connecticut man was launching fireworks out of a plastic tube in Block Island, Rhode Island. He peered inside the tube when one firework failed. The firework went off and struck him in the head.

## **B. National Injury Estimates for 1998**

Table 1 and Figure 1 present the estimated number of fireworks-related injuries for 1988 through 1998 treated in U.S. hospital emergency rooms both annually and during the one-month period for the special study surrounding the Fourth of July.

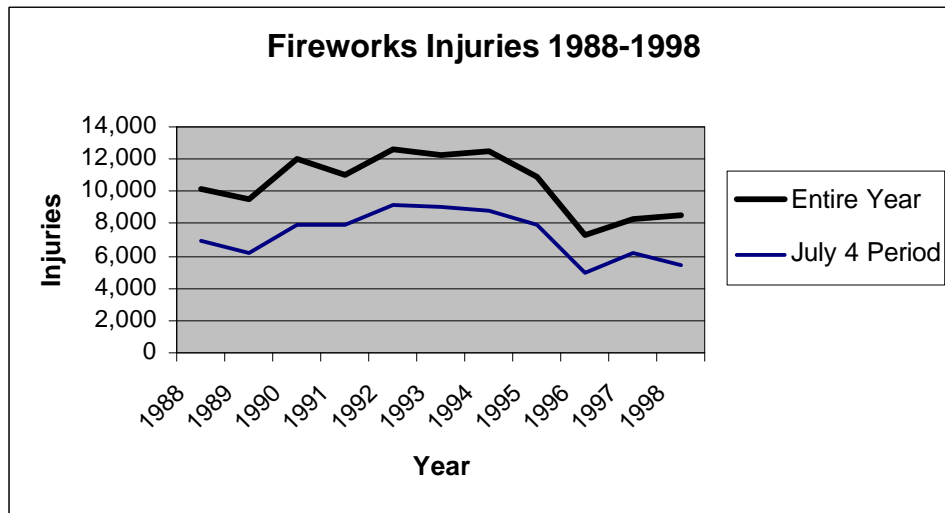
In 1998, there were an estimated 8,500 fireworks injuries for the calendar year (95 percent confidence interval 6,000 - 11,000). Annual estimates were highest in the years 1992-1994, declining to lower levels in 1996-1998. From a statistical point of view, estimated total injuries for 1996, 1997 and 1998 were not significantly different from each other. Estimates for 1996-1998 were significantly lower than the peak years of 1992-1994.

In 1998, 65 percent of fireworks injuries occurred during the July 4th holiday period (June 23 - July 23). Historically, about 60 to 75 percent of fireworks-related injuries occurred during that period.

**Table 1**  
**Estimated Fireworks-Related Injuries**

Year	Estimated Injuries June 23-July 23	Estimated Injuries Calendar Year
1998	5,400	8,500
1997	6,200	8,300
1996	4,900	7,300
1995	7,900	10,900
1994	8,800	12,500
1993	9,100	12,300
1992	9,200	12,600
1991	7,900	11,000
1990	7,900	12,000
1989	6,200	9,600
1988	7,000	10,100

Source: NEISS, U.S. Consumer Product Safety Commission/EHHA. Estimates for 1988-1996 were revised to adjust for a new sampling frame and do not match values published in 1997 or earlier.



### C. 1998 Special Study

The remainder of this report presents the results of the 1998 special study of hospital emergency department treated injuries associated with fireworks that occurred during the July 4 holiday season from the special study period of June 23 to July 23. As indicated in Table 1, an estimated 5,400 injuries occurred during the study period (n=147). However, an estimated 400 of these injuries (n=9) were marginally related to a fireworks device and are excluded from the remainder of this analysis. An example of such an excluded injury is a punctured foot suffered by a 12 year old male who stepped on a nail protruding from a rocket launcher pedestal.

This leaves a total of 5,000 injuries directly related to fireworks. The 95 percent confidence interval for this estimate is 3,000 - 7,100.

#### 1. Fireworks Type and Injury Dispositions

Table 2 categorizes July 1998 holiday season fireworks injuries by device type (see illustrations in Appendix). Firecrackers accounted for about 40 percent (1,900) of all estimated fireworks injuries that occurred during this period. Of these, illegal, large firecrackers, such as M-80's, were involved in 800 estimated injuries. This was about 15% of the total injuries. Among legal consumer devices, rockets (800 injuries), sparklers (500 injuries), and Roman candles (300 injuries) were

the major contributors to injuries. Bottle rockets accounted for 600 of the 800 rocket-related injuries.

**Table 2**  
**Estimated Fireworks-Related Injuries,**  
**by Type and Disposition, June 23-July 23, 1998**  
**n=138**

Fireworks Type	Estimated Injuries
<b>Total</b>	<b>5,000</b>
<b>Firecrackers</b>	<b>1,900</b>
Small	500
Illegal	800
Unknown	700
<b>Rockets</b>	<b>800</b>
Bottle Rockets	600
Other, Unspecified	100
<b>Other Consumer Devices</b>	<b>1,100</b>
Sparklers	500
Fountains	100
Novelties	200
Multiple Tube and Shell	100
Roman Candles	300
<b>Homemade/Altered</b>	<b>100</b>
<b>Public Display</b>	<b>300</b>
<b>Unknown</b>	<b>800</b>

Source: NEISS, U.S. Consumer Product Safety Commission/EHHA. Totals may not add due to rounding. Caution is recommended when using the estimates in this table because of the relatively small sample sizes from which these estimates were derived.

Although most of these fireworks-related injuries were treated at the emergency room and then released, an estimated 300 cases or 6 percent required hospital admission or transfer to another hospital for treatment. This was somewhat higher than the hospitalization and treat and transfer rate of 4.5 percent for all consumer products.

Among the eleven people in the sample who were hospitalized, there were four injuries from firecrackers, two from rockets, two



from Roman candles, two from homemade firecrackers and one record did not specify the type of device. Seven cases involved burns, two were amputations (one an amputation of the hand, the other injury involved the loss of three fingers), one was multiple facial trauma and the last was severe lacerations to the hand. Ten of the victims were male and one was female. The youngest victim was a 2-year-old female and the oldest was a 54-year-old male. Five of the victims were between 5 and 14 years of age.

## 2. Age and Sex of Injured Persons

About seven percent (400 estimated injuries) of all estimated fireworks injuries were to children younger than age 5 (Table 3). These children, along with children in the 5 to 14 age group, accounted for about 40 percent (2,100 injuries) of all injuries. The age group 15 to 24 (1,600) had 35 percent of injuries and 25 to 44 (1,000) had 20 percent of the injuries.

Injury rates per 100,000 population were highest among those between the ages of 5 and 24 years (4.4 - 4.5). Rates were lowest among victims over age 45. There was one recorded injury of a male 65 and over (representing 6.25 estimated injuries).

In general, most (75%) fireworks injuries were to males. Overall, the estimated number of injuries to males (3,700) was 2.9 times the number of injuries to females (1,300).

**Table 3**  
**Estimated Fireworks-Related Injuries,**  
**By Age and Sex, June 23-July 23, 1997**  
**n=138**

Age Group (years)	Male	Female	Total	Injuries per 100,000
Total	3,700	1,300	5,000	1.9
Less than 5	300	100	400	1.9
5 to 14	1,400	300	1,700	4.4
15 to 24	1,200	400	1,600	4.5
25 to 44	700	300	1,000	1.3
45 to 64	100	200	300	0.4
65+	*	*	*	*

Source: NEISS, U.S. Consumer Product Safety Commission/EHHA. Population rates were based on 1998 U.S. population estimates by age and sex, U.S. Bureau of the Census. Totals may not add due to rounding. Estimated injuries less than 50 shown by \*.

### 3. Age of the Injured Person by Type of Fireworks

Table 4 presents the ages of those injured by the type of fireworks device involved in the injury. Among the 600 estimated bottle rocket-related injuries, most were sustained by persons between the ages of 5 and 24 years old. Children between the ages of 5 and 14 sustained 300 bottle rocket-related injuries. Among firecracker-related injuries, children between ages 5 and 14 accounted for about one-third (600). Sparklers were the primary source of injuries among children under 5 years old, with an estimated 300 injuries.

**Table 4**  
**Estimated Fireworks-Related Injuries,**  
**by Device Type and Age Group**  
**June 23-July 23, 1998**  
**n=138**

<b>Fireworks Type</b>	<b>Totals</b>	<b>Age Group (Years)</b>				
		<b>&lt; 5</b>	<b>5-14</b>	<b>15-24</b>	<b>25-44</b>	<b>45-64</b>
<b>Total</b>	<b>5,000</b>	400	1,700	1,600	1,000	300
<b>Firecrackers</b>	<b>1,900</b>	*	600	800	300	200
Small	500	*	300	100	100	*
Illegal	800	*	100	400	200	100
Unspecified	700	*	200	300	100	100
<b>Rockets</b>	<b>800</b>	*	300	300	100	*
Bottle	600	*	300	200	100	*
Other	100	*	*	100	*	*
<b>Other Devices</b>	<b>1,100</b>	300	200	400	200	*
Sparklers	500	300	100	*	200	*
<b>Homemade/Altered</b>	<b>100</b>	*	100	100	*	*
<b>Public Display</b>	<b>300</b>	*	100	*	100	100
<b>Unspecified</b>	<b>800</b>	*	400	100	200	*

Source: NEISS, U.S. Consumer Product Safety Commission/EHHA. Totals may not add due to rounding. Estimated injuries less than 50 shown by \*. Other devices included Fountains, Novelties, Multiple Tube and Shell and Roman Candles in addition to Sparklers.

#### 4. Injury Diagnosis and Body Part Injured

Table 5 presents the types of injuries sustained to specific parts of the body. Most injuries (75%) were to the hands, head, and eyes. Hands and fingers with an estimated 1,800 injuries, accounted for 35% of the total injuries. Eye injuries with 1,100 injuries accounted for 20% of the total. Injuries to the head and face at 1,000 injuries were also about 20% of the total.

Among diagnoses, burns, with 2,800 injuries and 55% of the total, was the most frequent. Contusions and lacerations, at 1,300 injuries and 25% of the total, was the second most frequent

diagnosis. Except for the eyes, burns were the most frequent injury to most parts of the body. Contusions or lacerations were the most common injuries to the eye. Head and facial injuries involved both burns and contusions or lacerations.

**Table 5**  
**Estimated Fireworks-Related Injuries,**  
**By Body Part and Diagnosis**  
**June 23-July 23, 1998**  
**n=138**

Body Part	Total	Diagnosis			
		Burn	Contusion, Laceration	Fracture, Sprain	Other
Total	5,000	2,800	1,300	200	700
Hand/Finger	1,800	1,100	300	200	200
Head/Face	1,000	700	100	*	100
Eye	1,100	200	500	*	400
Leg	400	300	100	*	*
Trunk	100	*	100	*	*
Arm	200	100	100	*	*
Foot/Toe	500	400	100	*	*

Source: NEISS, U.S. Consumer Product Safety Commission/EHHA. Totals may not add due to rounding. Estimated injuries less than 50 shown by \*. Fracture, Sprain includes dislocations. Other includes all other injury categories. Head/Face injuries include the NEISS codes for face, including eyelid, eye area and nose; head; neck; mouth, including lips, tongue and teeth; and ear. Leg includes NEISS codes for upper leg, knee, lower leg, and ankle. Trunk includes NEISS codes for lower trunk, upper trunk (not including shoulders) and pubic region. Arm includes lower arm, elbow, upper arm, shoulder, and wrist.

## 5. Type of Fireworks and Body Part Injured

Table 6 presents estimated injuries by the fireworks device and body part involved. Firecracker injuries occurred most often to the hand (1,000) and the eye (400). Victims sustained injuries from firecrackers while holding the device, or attempting to release it after an ignition. Rockets were represented in more injuries to the eye than any other part of the body (200). Many of these victims sustained injuries from erratic rocket flight patterns, or burning debris from the rocket. Sometimes these scenarios involved a rocket placed on the ground or thrown into the air. Sparkler-related injuries most frequently involved hands (300). A typical sparkler injury occurred when the user touched the glowing end, or inadvertently poked himself or a

bystander with the ignited device.

**Table 6**  
**Estimated Fireworks-Related Injuries**  
**By Type of Device and Body Part**  
**June 23-July 23, 1998**  
**n=138**

Fireworks Type	Total	Body Part				
		Hand	Head Face	Eye	Arm Leg	Other
Total	5,000	1,800	1,000	1,100	1,100	100
Firecrackers	1,900	1,000	200	400	300	*
Sparklers	500	300	100	*	100	*
Rockets	600	100	100	200	100	*
Other Devices	2,000	400	500	400	500	100

Source: U.S. Consumer Product Safety Commission/EHHA. Totals may not add due to rounding. Estimated injuries less than 50 shown by \*. Other devices included fountains, novelties, multiple tube and shell, Roman candles, public display, homemade/altered and unspecified devices.

### **III. Discussion**

Estimated fireworks-related injuries for 1998 were significantly lower than estimates for the years 1992 through 1994 and about the same as 96-97. One can be reasonably confident at this point that there has been a substantial decrease in the number of injuries since the early 1990s.

As in previous years, injuries to children were a major component of fireworks-related injuries in 1998, with children under age 15 accounting for 40 percent of all fireworks-related injuries. The disproportionate involvement of children is further illustrated by the high rate of injury for the 5 to 14 age group, compared to the rate for the population as a whole (4.4 vs 1.9 injuries per 100,000 people).

It should be noted that while estimates are presented by type of fireworks device, evaluation of relative hazard by type requires data on the number of products on the market. Such data

are not available at this time.

### **References**

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