



2002 Fireworks Annual Report

Fireworks-Related Deaths, Emergency Department Treated Injuries, and Enforcement Activities During 2002

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Executive Summary

This report provides the results of the U. S. Consumer Product Safety Commission (CPSC) staff analysis of data on fireworks-related injuries and deaths during 2002. The report also includes a summary of CPSC enforcement activities during that year.

We obtained information on fireworks deaths primarily from news clips in CPSC's Injury/Potential Injury Incident (IPII) database. We estimated fireworks injuries from CPSC's National Electronic Injury Surveillance System (NEISS). More detailed analyses of injuries including the type of injury and the firework involved were based on a special study conducted between June 21 and July 21, 2002.

Highlights of the report are as follows:

- CPSC has reports of 4 deaths from fireworks in 2002. Two deaths occurred at professional fireworks displays. The other deaths were reported to have been associated with delayed explosions of aerial fireworks. CPSC has reports of 4 deaths in 2001 and 10 deaths in 2000.
- Fireworks devices were involved in an estimated 8,800 injuries treated in U.S. hospital emergency departments during calendar year 2002. CPSC staff estimated that there were 9,500 injuries in 2001.
- An estimated 5,700 fireworks-related injuries were treated in U. S. hospital emergency departments during the one month special study period surrounding the Fourth of July, 2002 (June 21, 2002 – July 21, 2002). This estimate is the same as the estimate for 2001.

Results from the special study include the following:

- About three times as many males were injured as females.
- Injuries to children were a major component of total fireworks-related injuries with children under 15 accounting for about half the number of injuries.
- Among different types of fireworks, sparklers were associated with the greatest number of injuries at 1,500, followed by firecrackers at 1,000. Sparklers accounted for about half the injuries to children under 5. Children 5-14 years old were injured by sparklers more frequently than any other fireworks device.
- The parts of the body most often injured were hands (estimated 1,800 emergency department visits), eyes (1,200 visits), and the head/face/ear region (1,000 visits).

- About two-thirds of the injuries involved burns. Burns were the most frequent injury to all parts of the body except the eyes, where contusions, lacerations, foreign bodies and burns occurred with about equal frequencies.

CPSC staff conducted telephone follow-up investigations of some fireworks injuries reported at NEISS hospital emergency departments during the special study period. There were two criteria for selecting cases. About half the cases were selected because they involved the most serious injuries and/or hospital admissions. Serious injuries included many eye injuries, finger or hand amputations or concussions. The other cases were selected from the Fire Injury Project, a separate CPSC staff study involving follow-up of emergency department treated cases that involved burn injuries and were likely to have been attended by fire departments. Cases selected from the Fire Injury Project tended to have less severe injuries.

Findings from completed telephone investigations include the following:

- Some of the causes of injuries included delayed or early fireworks explosions, errant flight paths of rockets, debris from aerial fireworks and mishandling of sparklers.
- While most victims recovered or expected full recovery from their injuries, a few injuries had the potential for permanent consequences. These included eye injuries with associated blurring of vision and increased risk for cataracts and glaucoma; burns resulting in skin graft surgery and scarring; and loss of fingers from explosions.
- Most victims were unable to report the source of the fireworks. Of those who reported, most said the fireworks were obtained from a stand. Less frequently, devices were obtained from stores or were homemade. No victims reported obtaining fireworks from mail order or over the internet.

During 2002, CPSC's Office of Compliance and U. S. Customs Service surveillance ran at a high level due to the volume of fireworks entering the country for the July 4th holiday celebrations. Examples of these activities are as follows:

- CPSC and Customs selectively sampled and tested 375 shipments of fireworks. Approximately 30% of these were found to contain violative fireworks. These shipments accounted for more than 1.9 million units with violations serious enough to warrant seizure or other actions by Customs.
- In cooperation with CPSC's Office of Compliance, two manufacturers recalled sparklers with bamboo-stick handles. When the sparklers were ignited, the handles could catch fire, burn and disintegrate and emit burning fragments during use. Combined, the two recalls accounted for almost 1.8 million boxes of sparklers.

- CPSC staff also initiated and participated in several multi-state criminal investigations. Indictments and prosecutions of several individuals investigated are expected in 2003.

1. Introduction and Methods

This report describes injuries and deaths associated with fireworks during 2002. The report also describes CPSC staff enforcement activities for 2002. The report is part of an annual series. Reports for earlier years can be found on the internet at www.cpsc.gov/library/data.html.

Information sources used in this report are described below followed by a description of the annual special study, in-depth investigations and statistical methods.

Information Sources

Information on non-work-related fireworks deaths occurring during 2002 was obtained from the CPSC Injury/Potential Injury Incident file (IPII) and CPSC's Death Certificate File. Entries in IPII come from sources such as newspaper articles, consumer complaints, referrals by lawyers, medical examiners and other government agencies. These reports are voluntary and can omit some fireworks-related deaths. The Death Certificate file is also not complete for 2002 because it takes up to two years for CPSC to receive all death certificates from the states. Because neither the Death Certificate nor the IPII file can be considered complete at this time, the number of fireworks-related deaths might be greater than the number reported here.

Staff also obtained counts of fireworks related deaths from the National Center for Health Statistics. These data are based on death certificates received by NCHS. The latest year for which data are available is 1999. The NCHS data do not distinguish between work and non-work related deaths.

Estimates for U. S. emergency department treated fireworks injuries were obtained from CPSC's National Electronic Injury Surveillance System (NEISS).

Special study and In-Depth Investigations

CPSC staff conducted a special study of fireworks-related injuries treated in hospital emergency departments using the NEISS data. The study covered emergency department visits for injuries that occurred between June 21, 2002 and July 21, 2002. Historically, most fireworks-related injuries occur during the month surrounding July 4th. In the special study, patients were shown illustrations of various fireworks types at emergency departments to help them identify the device associated with the injury. The

type of fireworks device was not usually recorded during the rest of the year. Most of the analyses in this report involving victim characteristics and fireworks device types were based on information from this one-month period.

Staff also initiated in-depth investigations of selected fireworks-related injuries from those reported in NEISS hospitals during the special study period. There were two criteria for selecting cases. About half the cases were selected because they involved the most serious injuries and/or hospital admissions. Serious injuries included many eye injuries, finger or hand amputations or concussions. The other cases were selected from the Fire Injury Project, a separate CPSC staff study involving follow-up of emergency department treated cases that involved burn injuries and were likely to have been attended by fire departments. Cases selected from the Fire Injury Project tended to have less severe injuries.¹

In this part of the study, victims were telephoned and read a questionnaire. The questions were designed to determine how the injuries occurred, the medical treatment involved and the long-term consequences of the injuries. Respondents were also asked where the fireworks device was obtained.

Staff also conducted in-depth investigations on all fireworks-related deaths included in this report. The purpose of the investigation was to determine the types of fireworks involved and the circumstances that led to the fatal injury.

Statistical Methods for the NEISS Injury Sample

Much of this report is devoted to estimates of the number of U. S. emergency department treated fireworks injuries by various categories. These estimates were made from NEISS, which is a probability sample of U. S. hospitals with emergency departments.² Injuries reported by NEISS sample hospitals were multiplied by the associated sampling weights. Confidence intervals and hypothesis tests were conducted using computer programs that were written to take into account the sampling design.³

¹ The information collected by the Fire Injury Project included almost all the information required for the fireworks special study. The Fire Injury questionnaire was used first during the telephone interview, followed by an abbreviated form of the fireworks questionnaire. This allowed collection of data on many additional fireworks injuries at a relatively low cost.

² For a description of NEISS, including the revised sampling frame, see Kessler and Schroeder (1998). Procedures used for variance and confidence interval calculations, and adjustments for the sampling frame change in 1997 are found in Marker, Lo, Brick, and Davis (1999). SAS statistical software for trend and confidence intervals is documented in Schroeder (2000).

³ Schroeder T (2000), "Trend Analysis of NEISS Data." U. S. Consumer Product Safety Commission, Washington, D. C.

Injury estimates derived from NEISS are rounded to the nearest 100 injuries. Estimates of less than 50 injuries are shown with an asterisk (*). Totals may not add due to rounding.

Although a number of different analyses are provided in this report for different categories of injuries, including the age distribution of victims and the types of fireworks involved in the injury, interpretation of these estimates should be made with caution. This is because estimates based on small sample sizes have relatively large amounts of sampling variability. For example, when comparing subsets of the data, say between injuries associated with two different types of fireworks, or between two different age groups, it is difficult to determine how much of the difference between estimates is associated with sampling variability and how much comes from real differences in national injury totals.

Organization of the Report

The report is organized into 7 sections. The next section, section 2, addresses fireworks-related deaths. Section 3 provides national estimates of fireworks-related emergency department treated injuries for 2002 and compares with previous years. Section 4 is based on the special study of emergency department treated injuries during the month around July 4. That section presents tables of the number of injuries broken down by different categories. Section 5 summarizes the in-depth telephone investigation of fireworks injuries. Section 6 describes enforcement activities by CPSC's Office of Compliance. The main body of the report then concludes with a discussion section. Appendices contain more detail on the telephone investigations that were summarized in Section 5.

2. Fireworks-related Deaths for 2002

CPSC has reports of 4 non-work fireworks-related deaths that occurred in 2002. This is the same as the number of deaths reported for 2001 but fewer than the ten deaths that were reported for 2000.⁴ Brief descriptions of the 2002 incidents are as follows:

- A 49-year-old Michigan man was fatally injured while volunteering at the city's annual Independence Day fireworks display. He loaded a mortar style firework in a steel trash can and lit the fuse. The firework failed to launch and exploded on the ground. The victim was struck in the thigh and bled to death. It was unknown if the firework exploded prematurely.

⁴ See Greene MA and Race PM (2002), "2001 Fireworks Annual Report: Fireworks-Related Deaths, Emergency Department Treated Injuries, and Enforcement Activities During 2000," US Consumer Product Safety Commission, Washington, DC and Greene MA and Race PM (2001), "2000 Fireworks Annual Report: Fireworks-Related Deaths, Emergency Department Treated Injuries, and Enforcement Activities During 2000," US Consumer Product Safety Commission, Washington, DC.

- Also at a public July 4th celebration, a 44-year-old North Dakota firefighter was carrying two 5-inch shells to an area where they would be launched. One shell exploded, possibly as the result of a stray spark from an uncapped fuse. The firefighter died from multiple traumatic injuries.
- A 33-year-old Kansas City man was setting off mortar style fireworks out of a black plastic pipe in his backyard. As he leaned over the device and lit the fuse, the firework immediately went off striking him in the face. He was transported to a hospital where he was pronounced dead from head injuries.
- In a similar incident, a 50-year-old Illinois man placed a 3-inch diameter firework in a launching tube outside the plant where he worked in Illinois. He lit the fuse but the firework did not deploy until he was leaning over the mortar tube. He was struck in the upper chest and left arm and his shirt caught fire. He was transported to the hospital where he died.

According to the Centers for Disease Control and Prevention, there were 59 fireworks related deaths (an average of 6.5 annually) between 1988 and 1999.⁵

3. National Injury Estimates for 2002

Table 1 and Figure 1 present the estimated number of fireworks-related injuries for 1991 through 2002 that were treated in U. S. hospital emergency departments.

⁵ Data from Centers for Disease Control and Prevention, CDC Wonder Compressed Mortality file for 1988-1999, for ICD 9 code 923.0 and ICD 10 code W39. These deaths may include work-related incidents. See www.cdc.gov/wonder.

Table 1
Estimated Fireworks-Related Injuries 1991-2002

Year	Estimated Injuries	Injuries per 100,000 people
2002	8,800	3.0
2001	9,500	3.3
2000	11,000	3.9
1999	8,500	3.1
1998	8,500	3.1
1997	8,300	3.0
1996	7,300	2.7
1995	10,900	4.1
1994	12,500	4.8
1993	12,100	4.6
1992	12,500	4.9
1991	11,100	4.4

Source: NEISS, U. S. Consumer Product Safety Commission/EPHA. There were 271 fireworks-related injuries recorded in NEISS hospital emergency departments during 2002. Estimates for 1991-1996 were revised to adjust for the new sampling frame and do not match values published in reports for 1997 or earlier. U. S. population estimates from eire.census.gov/popest/data/counties/tables/CO-EST2001-12/CO-EST2001-12-00.php for 1991-2000 and from eire.census.gov/popest/data/national/tables/NA-EST2002-01.php for 2001 and 2002.

In 2002, there were an estimated 8,800 fireworks injuries for the calendar year (95% confidence interval 6,600 – 10,900 injuries). Total emergency department treated injuries and per capita injuries declined from 2001 and 2000 levels, but neither difference was statistically significant.⁶

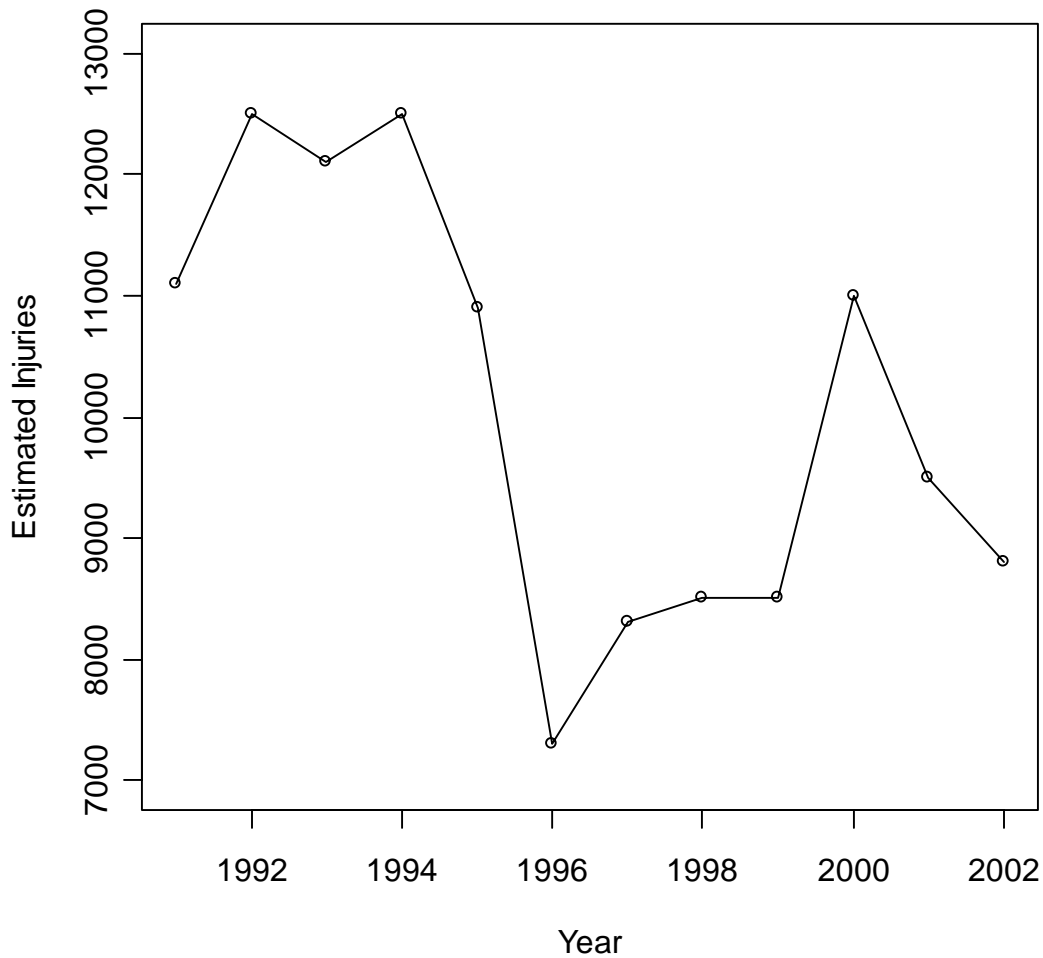
One important distinction between injury totals for 2000 and 2001-2002 is that the more recent years had far fewer fireworks injuries in January. In 2001 and 2002 there were an estimated 400 fireworks-related injuries in that month, in contrast to 1,400 injuries in January 2000. The larger number of injuries in 2000 was probably associated with increased fireworks activities for the millennium celebrations.

Figure 1 below shows the high injury totals between 1991 and 1995, the drop in 1996, ensuing years 1997-1999 at almost the same level, the millennium peak in 2000

⁶ In comparing 2002 with 2001, the one tail *p* value was 0.25, while comparing 2002 with 2000, the *p* value was 0.06.

and the subsequent decline. Fireworks injuries in 2002 were significantly lower than the average of 1992-1994.⁷

Figure 1. Fireworks Injuries 1991-2002



4. Injury Estimates for the 2002 Special Study

The injury analysis in this section presents the results of the 2002 special study of hospital emergency department treated fireworks injuries that occurred between June 21 and July 21, 2002. During this period, there were an estimated 5,700 fireworks-related injuries (95% confidence interval 3,900 – 7,600), accounting for about 65 percent of the total injuries for the year.

The remainder of this section presents estimates for injuries by different categories.

⁷ $p < 0.03$, one tail test.

Fireworks Device Types and Injury Dispositions

Table 2 shows the number and percent of emergency department injuries by fireworks device type.

Table 2
Estimated Fireworks-Related Injuries
By Type of Fireworks Device
June 21-July 21, 2002

Fireworks Device Type	Estimated Injuries	Percent
Total	5,700	100
All Firecrackers	1,000	18
Small	400	7
Illegal	200	4
Unspecified	400	7
All Rockets	800	15
Bottle Rockets	700	12
Other Rockets	100	2
All Selected Other Devices	2,600	46
Sparklers	1,500	26
Fountains	300	6
Novelties	200	4
Reloadables	200	4
Roman Candles	300	6
Homemade/Altered	100	2
Public Display	100	1
Unspecified	1,000	18

Source: NEISS, U. S. Consumer Product Safety Commission/EPHA. Based on 169 reported emergency department visits between June 21, 2002 and July 21, 2002. Subtotals include categories listed directly below them. Totals may not add due to rounding. Estimates rounded to nearest 100 injuries.

As shown in Table 2, sparklers accounted for about 25 percent of the total fireworks-related injuries. These were followed by firecrackers which accounted for almost 20 percent of all injuries. Among these devices, illegal, large firecrackers, such as M-80's were involved in 200 estimated injuries. This was less than 5 percent of the total injuries.

Table 2 shows that victims were unable to identify the fireworks type in almost one-fifth of the injuries. This was because in some of these cases, the firework is thrown or launched at, toward or near the victim by another person accidentally or intentionally. Estimates from previous years have shown a substantial number of injuries where fireworks types were unknown.

With the exception of sparklers, the breakdown of injuries by fireworks types is similar to that of previous years. There were an estimated 900 fewer sparkler injuries during the special study period of 2001.

Age and Sex of Injured Persons

Children under 5 experienced more than 10 percent (700 injuries) of all fireworks-related injuries as shown in Table 3. The injury rate was 3.7 injuries per 100,000 for these children. Children in the 5 to 14 age group accounted for 35 percent (estimated 2,100) of the fireworks-related injuries. Their rate was 5.2 injuries. This was composed of 4.5 injuries per 100,000 for children 5 to 9 and 5.8 per 100,000 for children 10-14. Together, children under 15 accounted for about half the fireworks injuries.

The age group 15 to 24 had 25 percent of the injuries (1,400) as did the 25 to 44 age group (1,300 injuries). Young adults 15 to 24 years old experienced 3.5 injuries per 100,000 people for the special study month. The injury rate declined for older people, for example people between 25 and 44 had 1.6 injuries per 100,000 and those 45 to 64 had 0.3 injuries per 100,000.

Males had 4,100 injuries, representing about 75 percent of the total. This pattern and the concentration of injuries among people 25 and younger has been typical of fireworks injuries for many years.

Table 3
 Estimated Fireworks-Related Injuries
 By Age and Sex
 June 21-July 21, 2002

Age Group			Total	Male	Female	Per 100,000 People
Total			5,700	4,100	1,700	2.0
0	To	4	700	400	300	3.7
5	To	14	2,100	1,600	500	5.2
5	To	9	900	700	200	4.5
10	To	14	1,200	900	300	5.8
15	To	24	1,400	1,000	400	3.5
15	To	19	800	500	300	4.0
20	To	24	600	500	100	3.0
25	To	44	1,300	1,000	300	1.6
45	To	64	200	*	200	0.3
65+			100	100	*	0.2

Sources NEISS, U. S. Consumer Product Safety Commission/EPHA , U. S. population from <http://www.census.gov/population/projections/nation/summary/np-t3-b.txt>. Estimates of less than 50 injuries shown as asterisks (*). See notes for Table 2.

Age and Sex of the Injured Person by Type of Fireworks Device

Table 4 below, shows the ages of those injured by the type of fireworks device involved in the injury. Of the 1,500 estimated sparkler-related injuries, more than half (800 estimated injuries) occurred to children 5-14. Sparklers were associated with more injuries to children under age 15 and young adults 15-24 than any other firework.

Table 4
 Estimated Fireworks-Related Injuries
 By Device Type and Age Group
 June 21-July 21, 2002

Fireworks Type	Total	Age Group (Years)				
		-5	5-14	15-24	25-44	45+
Total	5,700	700	2,100	1,400	1,300	300
Firecrackers	1,000	200	300	400	200	*
Small	400	100	100	200	*	*
Illegal	200	*	*	100	100	*
Size Unknown	400	100	100	200	100	*
Rockets	800	*	200	200	300	*
Bottle Rockets	700	*	200	200	300	*
Other Rockets	100	*	*	100	*	*
Other	2,600	300	1,400	400	300	200
Sparklers	1,500	300	800	300	100	*
Fountains	300	*	200	100	*	*
Novelties	200	*	100	*	200	*
Reloadables	200	*	100	*	*	100
Roman Candles	300	*	200	*	100	100
Homemade/Altered	100	*	*	*	100	*
Public Display	100	*	*	100	*	*
Unspecified	1,000	100	200	300	300	100

Source: NEISS, U. S. Consumer Product Safety Commission/EPHA. See notes for Table 2.

As mentioned above, about 75 percent of injuries were to males, 25 percent to females. This pattern held over the different fireworks types as well, with a few exceptions. Among devices with sizeable numbers of injuries, about 60 percent of firecracker injuries and 60 percent of the unspecified fireworks injuries were to males. Males also experienced 70 percent of sparkler injuries and 90 percent of injuries involving rockets.

Injury Diagnosis and Body Part Injured

Table 5 presents the types of injuries sustained to specific parts of the body. Hands and fingers with an estimated 1,800 injuries, accounted for 30 percent of the total injuries. There were almost as many eye injuries (1,200) as head, face and ear injuries (1,000).

Burns with 3,600 estimated injuries and 60 percent of the total, were the most frequent diagnosis. Contusions and lacerations, at 1,200 injuries and 20 percent of the total were the second most frequent. Head and facial injuries were evenly distributed between burns, and contusions and lacerations. Eye injuries were equally divided among burns, contusions and lacerations and other diagnoses, the last category including foreign bodies in the eye.

Table 5
Estimated Fireworks-Related Injuries
By Body Part and Diagnosis
June 21-July 21, 2002

Body Part	Total	Injury Diagnosis			
		Burns	Contusions Lacerations	Fractures Sprains	Other Diagnoses
Total	5,700	3,600	1,200	100	800
Arm	200	200	*	*	*
Eye	1,200	400	400	*	400
Hand/Finger	1,800	1,300	300	*	200
Head/Face/Ear	1,000	400	500	*	100
Leg	1,100	1,000	*	100	*
Trunk	400	300	*	*	100

Source: NEISS, U. S. Consumer Product Safety Commission/EPHA. See notes for Table 2. Fractures and sprains also included dislocations. Other diagnoses included all other injury categories. Arm includes NEISS codes for upper arm, elbow, lower arm, shoulder and wrist. Head/ Face/Ear includes eyelid, eye area, nose, neck, and mouth. Leg includes upper leg, knee, lower leg, ankle, foot and toe. Trunk includes lower trunk, upper trunk, pubic region, all parts of body, internal and 25-50% of body.

Type of Fireworks Device and Body Part Injured

Table 6 below presents estimated injuries by the type of fireworks device and body part involved.

Table 6
Estimated Fireworks-Related Injuries
By Type of Fireworks Device and Body Part Injured
June 21-July 21, 2002

Fireworks Type	Total	Arm	Eye	Body Part			
				Hands Fingers	Head Face/Ear	Leg	Trunk
Total	5,700	200	1,200	1,800	1,000	1,100	400
Firecrackers	1,000	*	200	300	300	100	100
Small	400	*	100	200	100	*	*
Illegal	200	*	*	*	100	*	100
Size Unknown	400	*	100	100	100	100	*
Rockets	800	*	200	300	300	100	*
Bottle Rockets	700	*	200	200	200	100	*
Other Rockets	100	*	*	*	100	*	*
Other Devices	2,600	100	500	800	300	800	*
Sparklers	1,500	100	200	500	200	500	*
Fountains	300	*	100	100	*	100	*
Novelties	200	*	100	100	*	*	*
Reloadables	200	*	*	*	*	200	*
Roman Candles	300	*	200	*	*	100	*
Homemade/Altered	100	100	*	*	*	*	*
Public Display	100	*	100	*	*	*	*
Unspecified	1,000	*	200	400	100	100	200

Source: NEISS, U. S. Consumer Product Safety Commission/EPHA. See notes for Table 2 and notes for Table 5 for definition of body parts.

Sparkler injuries occurred mostly to hands, fingers and legs. About 85 percent of the sparkler injuries were burns. The other injuries were relatively evenly distributed among the different parts of the body.

Hospital Disposition

Although most of these fireworks-related injuries were characterized as “treat and release,” an estimated 7 percent required hospital admission or transfer to another hospital for treatment. This is somewhat higher than the hospitalization and treat/transfer rate of 4 percent for all consumer product-related injuries for 2002.

5. Telephone Investigations of Fireworks Injuries

CPSC staff requested telephone investigations of some fireworks injuries that occurred during the month surrounding the July 4 holiday. Cases were selected on the basis of injury severity (serious eye injuries, concussions, limb amputations, hospital admissions) or because they met the criteria for the Fire Injury Project (burn injuries with fire department attendance likely). About half the cases met the criteria for being a severe injury.

In the questionnaire, respondents were asked about the hazard patterns associated with the injury, their medical care following the emergency department treatment, and about long term effects, if any, of the injury. Respondents were also asked about the source of the fireworks that caused the injury.

There were 35 completed questionnaires from the 70 cases selected for the telephone survey. The main reasons why questionnaires could not be completed were that that the victim could not be contacted or refused to cooperate.

Summaries of the investigations are found in the Appendix to this report. The investigations are organized in order of emergency department disposition: “Admit to Hospital” followed by “Treat and Transfer” followed by “Treat and Release.” This is a measure of injury severity. Within disposition, cases are sorted by age. Task numbers are given in parentheses following the discussion of the case.

Hazard Patterns

Among investigated cases, errant flight paths for rockets and aerial fireworks were implicated in eight injuries (020925HEP5922, 020708HEP1201, 020708HEP2003, 020709HEP8079, 020712HEP9001, 020712HEP9006, 020716HEP9001, 020717HEP9001). Four victims were struck in the eye, two in the lower leg and one in the neck. One victim was burned when the aerial firework struck a blanket and set it on

fire. In another rocket injury, the victim reported that the rocket was aimed at her (020719HEP9001).

Another pattern that was reported with aerial fireworks was explosions occurring earlier than anticipated. One bottle rocket case resulted in an injury to the victim's hand (020709HEP6745), while another case injured the victim's eye (020719HEP9005). In another case, a mortar exploded rather than firing when lit, burning the victim's face and arm (020807HEP5921). Also, a male was admitted to the hospital when the aerial firework exploded while he was holding it (020712HEP9003) and a female was injured by a fountain that exploded, then shot fireballs at her (020820HEP9001). Another male was injured in a similar incident where a fountain exploded when he bent down to look at it (20726HEP6401).

Another victim was injured by a professional display firework (020715HEP9005). He bent over the launching tube to re-light the device which then exploded striking him in the eye. The victim required surgery to remove the injured eye. This was a similar pattern to one of the fireworks-related deaths.

Although there were a large number of sparkler injuries occurring during the special study period, there were relatively few sparkler injuries in the telephone investigations because few met the criteria for severe injuries or for the Fire Injury Project. Three of the five sparkler injuries were burns. In one incident, a victim picked up a sparkler that had stopped burning by the hot end (020712HEP8942). In a second incident, part of the plastic handle became hot, then separated and fell onto the strap of the victim's sandal (020828HEP9002). Aside from the hospital record, there was no information provided in the third case (020723HEP4081). Another injury involved dermatitis and conjunctivitis. This occurred when victim was swinging a lit sparkler causing ash from the sparkler to go into her eye (020707HEP4241). The last injury resulted from an explosion when the victim ignited a group of sparklers that were twisted together (020716HEP9002). The explosion caused deep lacerations to the victim's hand and a perforated eardrum.

Two victims were injured by large firecrackers. An M-80 was thrown at one victim resulting in burn injuries to her lower trunk (020707HEP0961). A second victim lit the M-80 with the pilot light of a boiler. He was holding it when it exploded. He lost the index finger and top of his middle finger, requiring both surgery and physical therapy (020722HEP9002). Injuries also occurred with other firecrackers. For example, a male was holding a firecracker when it exploded. This resulted in an admission to the hospital and treatment for severe injuries to his hand (020719HEP9004). Another male had a firecracker thrown at him resulting in hospitalization for eye injuries (020716HEP9007).

Long Term Consequences of Fireworks-related Injuries

Victims were asked if there were any long term consequences of their injuries. Most expected a complete recovery. Some of the exceptions were the victims with eye

injuries. One victim lost an eye (020715HEP9005) and the other did not regain vision in the injured eye (020716HEP9007). Other victims with eye injuries were reported to be at increased risk for glaucoma, retinal problems or cataracts (020711HEP9003, 020711HEP9002, 020719HEP9001).

The two victims with finger amputations also were likely to have injuries with long term consequences. One victim reporting losing the index finger and the top of the middle finger (020722HEP9002), while details are uncertain for the second victim (020719HEP9004).

Where Fireworks Were Obtained

In the telephone interview, victims were asked where the fireworks that caused the injuries were obtained. Of the 35 victims with completed telephone interviews, the largest number, 23, did not know where the fireworks were acquired. In some cases, this was because the victim was not the person who acquired the fireworks.

For the 12 victims who were aware of the source of the fireworks, most (9) reported that the fireworks came from a stand. Often the stand was on a highway or main road and was reported to be open only for the 4th of July season. Two respondents said that fireworks were obtained from a store. One respondent said the firework was homemade. No victims reported purchasing fireworks over the internet or by mail order.

6. Enforcement Activities

CPSC's Office of Compliance enforces regulations on the importation, manufacture and sale of fireworks under the provisions of the Federal Hazardous Substances Act. CPSC's enforcement activities are focused on reducing the number of fireworks-related deaths and injuries. A variety of enforcement techniques and initiatives were utilized in 2002 to keep unsafe fireworks from reaching consumers.

CPSC staff continues to work closely with the Bureau of Customs and Border Protection to conduct surveillance on imported shipments of fireworks. Shipments were selected based on past violation history, the category of fireworks type, and whether they were items that had been sampled previously. In 2002, CPSC and Customs selectively sampled and tested 375 shipments of fireworks to determine if they were in compliance with CPSC regulations. Of those, approximately 30 percent were found to contain violative fireworks. These shipments accounted for more than 1.9 million units with violations serious enough to warrant seizure or other actions by Customs.

Another enforcement activity that remains a priority for CPSC is the investigation into firms and individuals that offer kits and components to make illegal and dangerous firecracker type explosives, such as M-80s, Cherry Bombs and Quartersticks.

In cooperation with CPSC staff, two manufacturers recalled sparklers with bamboo stick handles. One recall was in late 2002 and the other in early 2003. Staff found that the sparklers handles could catch fire, burn and disintegrate and emit burning fragments during use. Combined, the two recalls accounted for almost 1.8 million boxes of sparklers.

CPSC staff also participated in several multi-state criminal investigations. Staff worked with other Federal agencies, such as the Bureau of Alcohol, Tobacco, and Firearms and the Department of Justice's Office of Consumer Litigation, as well as state and local law enforcement agencies. Staff provided legal, field, and technical support in several cases involving the distribution of illegal explosive devices and the illegal diversion of professional fireworks to consumers. These criminal investigations led to the seizure of thousands of illegal firecracker-type explosive devices and illegally diverted professional fireworks. Indictments and prosecutions of several individuals investigated are expected in 2003.

7. Discussion

In 2002, both reported deaths and estimated injuries decreased from the 2000 level and were about the same level as in 2001. There were 4 fireworks deaths reported in 2002, the same number as 2001 and 6 fewer than reported in 2000. The total number of estimated fireworks injuries for 2001 was 8,800. This was 700 injuries less than 2001 and 2,200 injuries less than in 2000, the year with the highest number of injuries since 1995. The injury rate decreased to 3.0 injuries per 100,000 people in 2002 from 3.3 in 2001 and 3.9 in 2000.

During the one-month special study period of June 21 to July 21, 2002, there were an estimated 5,700 injuries, the same as estimated in 2001 and about 900 fewer than in 2000. Children under 15 years old accounted for about half the number of injuries. Among all age groups, children aged 10-14 experienced the greatest number of injuries at 1,200 during the special study period. Males were three times more likely to be injured than females.

Sparklers were associated with the greatest number of injuries. Firecrackers were second and rockets (principally bottle rockets) were third. About 85 percent of the sparkler injuries were burns and about two-thirds of the injuries were to the hands and legs. More than half of the victims of sparkler injuries were between 5 and 14.

A review of data from a telephone follow up survey of people injured by fireworks showed that typical causes of injuries included (1) fireworks exploding earlier or later than expected by the user, (2) badly aimed rockets or rockets with errant flight paths, (3) mishandling of sparklers and firecrackers. According to the telephone survey, most victims already had recovered or will recover from their fireworks injuries. But several victims experienced severe eye injuries, putting them at greater risk for future eye problems.

According to the National Fire Protection Association, in 1999 there were 24,000 fires started by fireworks. Most of these were outdoor fires, but 1,000 fire incidents involved residential structures, 700 non residential structures, and 500 were vehicle fires. Between 1990 and 1999 there were an average of 1,200 residential structure fire incidents per year that were associated with fireworks. See Hall (2003).

CPSC's enforcement activities remained at a high level. CPSC's Office of Compliance worked with U.S. Customs to sample imported fireworks and to seize illegal shipments. CPSC staff also worked with two manufacturers to recall a large number of sparklers with bamboo handles. These handles could ignite and cause injuries.

Also during 2002, CPSC staff provided legal, field and technical support in cases involving large-scale distribution of illegal explosive devices and illegal diversion of professional display fireworks to consumers. These investigations have led to seizures of tons of fireworks and will lead to prosecution of several individuals.

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Appendix Completed Telephone Investigations

Task Number	Age	Sex	Treatment Date	Fireworks Type	Diagnosis	Disposition	Body Part Injured	Incident Synopsis	Medical Treatment and Prognosis
020925HEP5922	0.8	Male	7/4/02	Aerial Firework	Burns, thermal	Admit to Hospital	Face	As a result of errant flight path, struck mother who was carrying victim in a blanket. The blanket was set on fire.	Second degree burns to left arm and both hands, third degree burns on face. Surgery expected. Full recovery unknown.
020820HEP9001	4	Female	7/9/02	Fountain	Burns, thermal	Admit to Hospital	Upper trunk	Firework exploded, then tipped over then shot fireballs at victim.	Second and third degree burns to the chest. Admitted to hospital for skin grafts. Fully recovered.
020722HEP9002	6	Male	7/3/02	M80	Contusions, abr.	Admit to Hospital	Hand	Victim lit firework with boiler pilot light. Firework exploded in his hand.	Victim lost index finger and top of middle finger. Skin grafts for damage to palm. Physical therapy. Full recovery uncertain.
020801HEP9002	8	Male	7/14/02	Homemade Fireworks	Burns, thermal	Admit to Hospital	Face, Chest	Victim made a firework by putting powder from left-over fireworks into a tissue. He lit the tissue when then exploded.	First degree burns to face and chest, also eyes. Victim recovered in 2-3 weeks.
020716HEP9007	12	Male	7/3/02	Firecracker, unknown size	Derma/conjunct	Admit to Hospital	Eyeball	Firecracker thrown at victim.	Damage to retina and pupil requiring surgery. Victim will probably not regain normal vision in one eye.
020722HEP9001	13	Male	7/4/02	M80	Fracture or burn	Admit to Hospital	Hand	Details unknown	Victim hospitalized for 3 weeks. No further details provided.
020712HEP9003	19	Male	7/4/02	Aerial Firework	Burns, thermal	Admit to Hospital	Hand	Firework exploded while victim holding it.	Second degree burns. Some scarring but full recovery expected.
020715HEP9006	22	Male	7/4/02	Fireworks, type unknown	Laceration	Admit to Hospital	Eyeball	Unknown	No information available
020719HEP9004	25	Male	7/3/02	Firecracker, unknown size	Amputation	Admit to Hospital	Finger	Firecracker went off in victim's hand. Details vague.	Injuries to several fingers, other details vague.
020807HEP5921	26	Male	7/5/02	Mortar	Burns, thermal	Admit to Hospital	Face	Instead of becoming airborne when lit, firework flashed back on victim. Burned his face and arm.	Spent 5 days in the hospital. Fully recovered after a month.
020715HEP9005	44	Male	7/2/02	Professional display type	Laceration	Admit to Hospital	Eyeball	Victim bent over launching tube to relight firework that ignited and struck his eye.	Severe trauma to the left eye, that had to be surgically removed.
020828HEP9002	12	Female	7/9/02	Sparkler	Burns, thermal	Treat and Transfer	Foot	Burning piece of sparkler's plastic handle separated and fell onto the strap of victim's sandal which then caught on fire.	Victim hospitalized for 3 nights. Fully recovered.
020712HEP8942	1.2	Male	7/11/02	Sparkler	Burns, thermal	Treat and Release	Finger	Victim picked up the hot end of sparkler that had stopped burning	After bandages and a splint, victim fully recovered.

020711HEP9003	3	Female	7/3/02	Small Firecrackers	Hemorrhage	Treat and Release	Eyeball	Hit by cement chip from wall where firecrackers were exploding.	Permanent damage to the iris. At increased risk for glaucoma.
020726HEP6401	6	Male	7/4/02	Fountain	Burns, thermal	Treat and Release	Eyeball	Firework exploded when victim bent down to look at it.	No information available
020716HEP9001	7	Male	7/5/02	Aerial firework (bee-shaped)	Burns, thermal	Treat and Release	Neck	Errant flight path	Second degree burns. Some scarring but full recovery expected.
020712HEP9006	8	Male	7/2/02	Bottle Rocket	Contusions, abr.	Treat and Release	Eyeball	Errant flight path	Retinal burn. Full recovery expected.
020725HEP8214	8	Male	7/8/02	Smoke bomb	Contusions, abr.	Treat and Release	Eyeball	Victim lit a smoke bomb. Flame burned his eye.	No information available
020712HEP9004	10	Male	7/4/02	Reloadable Mortar Shell	Contusions, abr.	Treat and Release	Eyeball	Spark from wick of firework flew into the victim's eye.	Full recovery expected.
020709HEP8079	10	Male	7/6/02	Unknown Aerial Firework	Burns, thermal	Treat and Release	Lower leg	Errant flight path	First and second degree burns. Recovered.
020708HEP2003	11	Male	7/5/02	Roman Candle	Burn, chemical	Treat and Release	Eyeball	Errant flight path	No prognosis information
020719HEP9001	13	Female	7/10/02	Bottle Rocket	Other	Treat and Release	Eyeball	Rocket aimed at victim	Blunt trauma and tearing of the eye. Victim experiencing blurred vision. Increased risk for cataracts, glaucoma and a detached retina.
020719HEP9005	13	Male	7/3/02	Bottle Rocket	Contusions, abr.	Treat and Release	Eyeball	Victim tried to relight a bottle rocket which exploded and struck him in the corner of the eye.	Corneal abrasion. No further details provided.
020723HEP4081	13	Male	7/5/02	Sparkler	Burns, thermal	Treat and Release	Hand	Burns to the victim's hand	No information available
020708HEP1201	14	Male	7/5/02	Roman Candle	Burns, thermal	Treat and Release	Lower leg	Errant flight path	Treated for burns. Recovered.
020706HEP3042	14	Male	7/4/02	Small Firecrackers	Burns, thermal	Treat and Release	Upper leg	Spark from other fireworks ignited firecrackers in victim's pocket.	Sustained second and third degree burns. Received physical therapy in addition to burn treatment. Recovered.
020716HEP9002	15	Male	6/23/02	Sparklers	Laceration	Treat and Release	Upper arm	Victim ignited metal sparklers that were tied together. The sparklers exploded.	Plastic surgery to victim's hand to repair deep lacerations. Also had perforated eardrum. Full recovery expected.
020707HEP4241	16	Female	7/6/02	Sparkler	Derma/conjunct	Treat and Release	Eyeball	Victim swinging sparkler releasing ash into her eye.	Treated for conjunctivities and released. Recovered.
020712HEP9001	16	Male	7/5/02	Bottle Rocket	Contusions, abr.	Treat and Release	Eyeball	Errant flight path	Burns and bruising to the eye, victim fully recovered.
020716HEP9009	16	Male	7/5/02	Firecracker, size unknown	Contusions, abr.	Treat and Release	Eyeball	Exploded in victim's hand; debris in both eyes.	Corneal scratches. No information about recovery.
020709HEP6745	20	Male	7/5/02	Bottle Rocket	Burns, thermal	Treat and Release	Hand	Firework exploded while victim holding it.	No prognosis information
020711HEP9002	25	Female	7/4/02	Firecracker, unknown size	Hemorrhage	Treat and Release	Eyeball	Hit by piece of cardboard from exploding fireworks lit by neighbors.	Treated for cuts. At increased risk for glaucoma and problems with the retina.
020707HEP0961	25	Female	7/3/02	M80	Burns, thermal	Treat and Release	Lower trunk	Firework was thrown at victim	Stomach burns; infection. Recovered.
020716HEP9008	34	Male	7/5/02	Smoke bomb	Burns, thermal	Treat and Release	Eyeball	Victim accidentally dropped a lit smoke bomb into a bag containing other bombs.	Second degree burns. Full recovery expected.

020717HEP9001	50	Male	7/12/02	Aerial firework	Derma/conjunct	Treat and Release	Eyeball	Errant flight path	After follow-up with eye specialist full recovery expected.
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Incomplete Telephone Investigations

Task Number	Age	Sex	Treatment Date	Fireworks Type	Diagnosis	Disposition	Body Part
020716HEP9005	9	Male	7/2/02	Large Firecracker	Laceration	Admit to Hospital	Hand
020718HEP1601	12	Female	7/4/02	Bottle Rocket	Burns, thermal	Admit to Hospital	Lower trunk
020707HEP8921	24	Male	7/5/02	Fireworks, type unknown	Burns, thermal	Admit to Hospital	Hand
020711HEP9004	38	Female	7/5/02	M80	Laceration	Admit to Hospital	Face
020731HEP9001	24	Male	7/5/02	Fireworks, type unknown	Burns, thermal	Treat and Transfer	Lower leg
020711HEP6962	27	Male	7/4/02	Bottle Rocket	Burns, thermal	Treat and Transfer	Eyeball
020923HEP9001	27	Male	7/4/02	Bottle Rocket	Burns, thermal	Treat and Transfer	Eyeball
020731HEP9003	33	Male	7/4/02	Roman Candle	Burns, thermal	Treat and Transfer	Hand
020706HEP4243	1	Female	7/4/02	Fireworks, type unknown	Burns, thermal	Treat and Release	Upper trunk
020712HEP9005	2	Male	7/2/02	Sparkler	Contusions, abr.	Treat and Release	Eyeball
020706HEP4242	4	Female	7/4/02	Fireworks, type unknown	Anoxia	Treat and Release	All parts body
020711HEP9007	5	Male	7/5/02	Sparkler	Burns, thermal	Treat and Release	Eyeball
020724HEP9015	7	Female	7/4/02	Bottle Rocket	Contusions, abr.	Treat and Release	Face
020731HEP9002	7	Female	7/4/02	Roman Candle	Contusions, abr.	Treat and Release	Eyeball
020711HEP9006	8	Male	7/7/02	Firecracker, unknown size	Contusions, abr.	Treat and Release	Eyeball
020711HEP9001	9	Male	7/4/02	Roman Candle	Burns, thermal	Treat and Release	Eyeball
020719HEP9006	9	Male	7/4/02	Sparkler	Contusions, abr.	Treat and Release	Eyeball
020715HEP9007	10	Male	6/27/02	Firecracker, unknown size	Amputation	Treat and Release	Finger
020719HEP9003	10	Male	6/30/02	Sparkler	Burns, thermal	Treat and Release	Eyeball
020716HEP9004	13	Male	7/4/02	Fountain	Contusions, abr.	Treat and Release	Eyeball
020711HEP9005	14	Male	7/5/02	Roman Candle	Burns, thermal	Treat and Release	Eyeball
020718HEP9001	14	Male	7/12/02	Bottle Rocket	Other	Treat and Release	Eyeball
020712HEP9002	15	Male	7/5/02	Sparkler	Burns, thermal	Treat and Release	Hand
020716HEP9003	15	Male	7/4/02	Rocket	Contusions, abr.	Treat and Release	Face
020716HEP9006	15	Male	7/6/02	Bottle Rocket	Hemorrhage	Treat and Release	Eyeball
020723HEP2401	16	Male	7/15/02	Fireworks, type unknown	Other	Treat and Release	Eyeball
020717HEP1363	18	Female	7/4/02	Firecracker, unknown size	Laceration	Treat and Release	Face
020723HEP9001	19	Male	7/16/02	Large Firecracker	Laceration	Treat and Release	Finger
020709HEP6926	24	Female	7/5/02	Public Display	Burns, thermal	Treat and Release	Eyeball
020710HEP0881	24	Female	7/8/02	Public Display	Foreign body	Treat and Release	Eyeball
020708HEP2001	25	Male	7/4/02	Bottle Rocket	Burns, thermal	Treat and Release	Upper leg
020706HEP4241	28	Female	7/4/02	Fireworks, type unknown	Burns, thermal	Treat and Release	25-50% of body

020723HEP9002	31	Male	7/5/02	Fountain	Burns, thermal	Treat and Release	Toe
020711HEP5281	32	Male	7/8/02	Roman Candle	Burns, thermal	Treat and Release	Ankle
020711HEP9008	47	Male	7/4/02	M80	Amputation	Treat and Release	Finger