

U.S. Fire Administration/National Fire Data Center

The Fire Risk to Children

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Findings

- The relative risk of children under age 15 dying in a fire is about the same as the general population. However, when dividing the young into subgroups, over 50% of all child fire deaths occur to those under age 5. These children are usually unable to escape from a fire independently.
- The number of fire injuries are also highest in the under age 5 bracket, decline in the middle years, but rise again in the 10–14 age group. This is a different pattern than deaths, which decrease as children age.
- Boys are at higher risk of death from fire than girls. African American and American Indian children are at an increased risk of death from fire.
- Children in the poorest homes face the greatest risk of death.
- Children playing is the leading cause of child fire injuries; suspicious (arson) activity is the leading cause of child deaths. One-third of arson fires are attributed to children under age 15.
- Fire deaths and injuries have declined over the past decade—both to children and the general population. A major reason for the decline is the greater prevalence of smoke alarms. The mandatory 1994 safety standard that required disposable lighters to be child resistant has prevented thousands of fires in which children would have been at risk.

It is an unfortunate fact that young children face an elevated risk of injury or death in a fire. Very young children are typically dependent to some degree on others for their safety. Those older are more mobile, but may not have sufficient abilities to protect themselves. Although many factors influence the risk children face, more often than not age—and more specifically immaturity—dominates. This topical report provides a brief analysis of the fire risk for children between birth and age 14.

The concept of “risk” with respect to fire casualties can be addressed in several ways: absolute numbers of deaths and injuries, proportions (percent) of these casualties, rates (per unit, usually fires or population), and relative risk. Each measure is useful but in different ways, and each has its drawbacks. The absolute number of casualties is an important consideration—it is a concrete measure of the size or magnitude of the problem, but does not address the magnitude relative to other aspects of the problem. In this case, proportions are used to compare the relative size of the problem. Yet, these proportions do not convey the magnitude of the problem as does the absolute number of casualties. Neither of these two measures is useful for comparisons across different groups. For comparison across groups, a common basis is used to determine rates. These rates then account for any differences in group sizes that might affect the size of the problem.¹ In comparing fire rates, the relative risk of dying or being injured is a helpful measure. The relative risk of a group is calculated by comparing its rate to the rate of the overall population. The result is a measure of how likely a particular group is to be affected. A detailed discussion of per capita rates and relative risk can be found in the Topical Series report, *Fire Risk* (Vol. 4, Issue 7, December 2004).

When evaluated in the aggregate, children have a relative risk of fire death similar to that of the general population. (For 2001, however, this relative risk is lower than the general population.) But grouping all children from

zero to age 14 together can be misleading. The deaths and injuries are substantially higher for the youngest population, those children age four and under. In this analysis, children are divided into age subgroups to better understand how risk varies as children grow older. The groupings are age 4 and under, age 5 to 9, and age 10 to 14.

WHO IS AFFECTED

In 2001, nearly 600 children under the age of 15 were killed as a result of fires (Table 1).² Although fire deaths have decreased in recent years, the fire death record in the United States remains among the highest in the industrialized world. Children aged 14 and under account for 15% to 20% of fire deaths, depending on the data source.³ The youngest children are especially hard hit—over 50% of child fire deaths affect children under the age of 5. For children under age 15 in 2001, deaths from fire and burns are the second leading cause of nontransportation accidental deaths.⁴

TABLE 1. CHILD FIRE DEATHS AND INJURIES, 2001

	All 0-14		0-4		5-9		10-14	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Deaths	599	100	320	53.4	181	30.2	98	16.4
Injuries	2,926	100	1,420	48.5	575	19.7	931	31.8

Source: NCHS (deaths); NFIRS and NFPA (injuries)

Fire injuries affected an estimated 2,900 children in 2001. Again, the youngest suffer a large share of injuries—nearly 50% of child fire injuries occur to children under age 5 (Table 1). Though fire deaths declined consistently in the older age groups, fire injuries declined between the young preschoolers and the younger school-aged children (ages 5 to 9) but rose for older children (Table 1). Children accounted for 14% of all fire injuries.

Age, demographics (e.g., gender), and socioeconomic factors of children and the households where they live all come into play in determining fire risk. As the age of the child increases, the likelihood of dying in a fire decreases. Children under age 5 are more likely to die as the result of fire than the general population while children 5 to 14 have a substantially lower risk. For all age categories, boys were at greater danger than girls (Table 2).⁵ African American children are at greater risk than the national average—African Americans comprise a large and disproportionate share of total fire deaths, accounting for 35% of fire deaths among children. In 2001, African American children age 4 and below had a relative risk of dying that was nearly three times higher than the general population, compared to an elevated risk of only 1.2 for all children in that age group. For children of American Indians that year, the relative risk was 0.8, but in children 4 and under, the risk rose to 1.3.

WHY CHILDREN ARE AT RISK

Escaping from a fire can be difficult for children. A child aged 4 or under is usually too young to escape from a fire independently. Children of this age generally lack the mental faculties to understand the need and the means of quickly escaping a burning structure. In 2001, over half (53%) of child fire fatalities and 49% of child fire injuries were among preschoolers (Table 1). Even in their own homes, very young children lack an understanding of how to escape.

Physiologically, young children are susceptible to severe injury or death from fire. A young child's skin is quite thin compared to adults and older children. As a result, young children can suffer deep burns more rapidly.⁶ Exposure to toxic byproducts of fire are especially serious to children—33% of fatalities in children under age 15 were the result of asphyxiation as compared to 26% of older fatalities, aged 15 and above.

In addition to not recognizing the danger, young children are curious and will touch and manipulate most items left within their reach. This includes matches, cigarette lighters, candles, stoves, and fireworks. The majority of child-playing fires involve matches and lighters, although lighters contribute more often than matches to the deaths, injuries, and property damage in playing-related fires. Playing with these heat sources results in large numbers of fires—over 34,000 fires in 2001, of which 8,000 were in homes. In 2001, playing with fire was the leading cause of fire injuries among children and accounted for 19% of fire-related injuries (Table 3). For school age

TABLE 2. CHILD FIRE DEATHS, 2001

Gender/Race	2001 Population	2001 Fire Deaths	Death Rate (per million)	Relative Risk
ALL CHILDREN (AGE 0-14)				
Total	60,482,119	599	9.9	0.7
Male	30,958,761	361	11.7	0.8
Female	28,523,358	238	8.1	0.6
White	46,280,132	380	8.2	0.6
African American	9,487,444	210	22.1	1.6
American Indian	740,542	8	10.8	0.8
Asian/Pacific	2,343,120	1	0.4	0.0
White Male	23,748,525	228	9.6	0.7
African American Male	4,814,914	126	26.2	1.9
American Indian Male	376,449	6	15.9	1.1
Asian/Pacific Male	1,192,485	1	0.8	0.1
White Female	22,531,607	152	6.7	0.5
African American Female	4,672,530	84	18.0	1.3
American Indian Female	364,093	2	5.5	0.4
Asian/Pacific Female	1,150,635	—	—	—
AGE 0-4				
Total	19,363,555	320	16.5	1.2
Male	9,900,481	196	19.8	1.4
Female	9,463,074	124	13.1	0.9
White	14,788,909	201	13.6	1.0
African American	2,952,590	115	38.9	2.8
American Indian	222,328	4	18.0	1.3
Asian/Pacific	778,931	—	—	—
White Male	7,580,197	126	16.6	1.2
African American Male	1,498,498	67	44.7	3.2
American Indian Male	113,363	3	26.5	1.9
Asian/Pacific Male	393,265	—	—	—
White Female	7,208,712	75	10.4	0.7
African American Female	1,454,092	48	33.0	2.4
American Indian Female	108,965	1	9.2	0.7
Asian/Pacific Female	385,666	—	—	—
AGE 5-9				
Total	20,208,124	181	9.0	0.6
Male	10,347,035	113	10.9	0.8
Female	9,861,089	68	6.9	0.5
White	15,423,793	115	7.5	0.5
African American	3,214,371	64	19.9	1.4
American Indian	249,399	1	4.0	0.3
Asian/Pacific	777,477	1	1.3	0.1
White Male	7,918,050	69	8.7	0.6
African American Male	1,631,914	42	25.7	1.8
American Indian Male	126,424	1	7.9	0.6
Asian/Pacific Male	395,417	1	2.5	0.2
White Female	7,505,743	46	6.1	0.4
African American Female	1,582,457	22	13.9	1.0
American Indian Female	122,975	—	—	—
Asian/Pacific Female	382,060	—	—	—

(continued)

TABLE 2. CHILD FIRE DEATHS, 2001 (cont'd)

Gender/Race	2001 Population	2001 Fire Deaths	Death Rate (per million)	Relative Risk
AGE 10–14				
Total	20,910,440	98	4.7	0.3
Male	10,711,245	52	4.9	0.3
Female	10,199,195	46	4.5	0.3
White	16,067,430	64	4.0	0.3
African American	3,320,483	31	9.3	0.7
American Indian	268,815	3	11.2	0.8
Asian/Pacific	786,712	–	–	–
White Male	8,250,278	33	4.0	0.3
African American Male	1,684,502	17	10.1	0.7
American Indian Male	136,662	2	14.6	1.0
Asian/Pacific Male	403,803	–	–	–
White Female	7,817,152	31	4.0	0.3
African American Female	1,635,981	14	8.6	0.6
American Indian Female	132,153	1	7.6	0.5
Asian/Pacific Female	382,909	–	–	–

Source: NCHS 2001 mortality data; Population Division, U.S. Census Bureau, Table NA–EST2002–ASRO–03—National Population Estimates—Characteristics, Release Date: June 18, 2003, http://www.census.gov/popest/archives/2000s/vintage_2002/NA-EST2002-ASRO-03.html and Population Division, U.S. Census Bureau, detail files for Monthly Population Estimates, 2000 to 2002, http://www.census.gov/popest/archives/2000s/vintage_2002/files/2002RESIDENT2001MONTHS07_12.txt

Note: Relative risk may not compute due to rounding.

TABLE 3. LEADING CAUSES OF CHILD FIRE INJURIES, 2001 (percent)

	All 0–14	0–4	5–9	10–14
Children Playing	19.1	12.8	37.6	16.7
Incendiary/Suspicious	18.0	17.0	19.5	18.7
Cooking	16.2	18.6	9.8	16.7
Open Flame, Ember, Torch	13.9	13.5	12.8	15.3

Source: NFIRS 2001

children, ages 5–14, however, this percentage is higher—playing with fire accounted for 25% of fire-related injuries. Fourteen percent of child fire deaths were the result of children playing (Table 4).

The home is a dangerous place for young children: the majority of casualties to children—approximately 86% of fatalities and 83% of injuries—occurred in residential fires in 2001.⁷

Socioeconomic factors have an effect on the fire risk to the youngest and most dependent children. The danger of death or injury is closely tied to household income. Children in the poorest homes are exposed to the greatest risk. A number of factors contribute to this elevated threat: the poor often live in substandard housing in crowded

TABLE 4. LEADING CAUSES OF CHILD FIRE DEATHS, 2001 (percent)

	All 0–14	0–4	5–9	10–14
Incendiary/Suspicious	22.4	31.4	12.2	13.0
Open Flame, Ember, Torch	14.9	8.6	22.0	21.7
Children Playing	14.2	17.1	14.6	4.3
Cooking	10.4	5.7	14.6	17.4
Electrical Distribution	10.4	11.4	14.6	–

Source: NFIRS 2001

Note: Leading causes shown are determined for all child fire casualties; leading causes in an age group may vary from those shown.

conditions, children are more likely to be left alone than in affluent households, many of these children live in single-parent households, and there are more children to supervise.⁸

CAUSES AND PREVENTION

In recent years, the deaths among younger children from playing has seen a downturn, in part because of product changes to lighters. In 1994, the U.S. Consumer Product Safety Commission (CPSC) set a mandatory safety standard that requires disposable lighters and certain novelty lighters to be child resistant. The standard covers more than 95% of the 600 million lighters purchased in the United States each year.⁹ A study by the Directorate for Epidemiology of the CPSC found a 58% reduction in cigarette lighter fires caused by children resulting in the prevention of 3,300 fires, 100 deaths, 660 injuries, and \$52.5 million in property losses just in the year 1998.¹⁰

Arson was suspected to be the most probable cause of 10% of all residential fires in 2001. FBI statistics suggest that children account for more than half of all arrests for arson, and more than one-third were 14 or younger.¹¹ In 2001, fires of suspicious origin were responsible for 22% of the fire deaths and 18% of the injuries among children. Preteens start fires as part of play in a relatively normal phase of development, but older juvenile firesetters often have psychological problems that may relate to stress, such as child abuse or learning disabilities.¹²

Smoke alarms are unanimously credited with saving thousands of lives each year. Dramatic gains in injury prevention and survival rates have been seen since the devices came onto the market in the 1970s. New studies, however, question the efficacy of these alarms to alerting children. According to research conducted in Australia and Canada, sleeping children do not respond appropriately to the alarm. According to psychologist Dorothy Bruck, Victoria University, Australia, children have different sleep patterns from adults, sleep more soundly for longer periods, and are more difficult to rouse. Bruck has been studying the issue since the late 1990s. For children 15 and under, the reliable waking rate was less than 6%. Bruck and her associates found that the risk factor changed when there was an adult around to wake the children, but many of the children remained groggy for some time and their responses were slowed.¹³

The CPSC has taken the lead in research concerning children, fire, and smoke alarms. Meanwhile, Bruck and other researchers have embarked on a new series of studies to test the effectiveness of smoke alarms in awakening children.

CONCLUSION

Children are some of the nation's most vulnerable residents and merit special attention to reduce their risk of injury or death from fire. Gains have been made in reducing fire deaths and injuries among children. CPSC continues to look at products that pose additional fire risks for children, and education programs are conducted to teach young children about the dangers associated with fire and also to teach their caregivers. Yet large numbers of young children continue to die from fire-related injuries each year.

Appropriate oversight of small children is one of the most effective means of preventing injury or death from all sources. A greater understanding of why children are at an elevated risk of death and injury from fire is still required. So, too, are strategies to lower that risk. A number of resources are available to help address the fire problem for children. Because children account for 15% to 20% of fire deaths and 14% of fire injuries, the USFA has been working toward the goal of reducing fire deaths and injuries to children. A number of resources to help address the fire problem for children and adults are available. USFA's fire safety campaign for babies and toddlers at <http://www.usfaparents.gov/> provides parents with home strategies ranging from the control of matches and lighters to home escape planning to protect young children from fire.

To request additional information or comment on this report, visit
<http://www.usfa.fema.gov/applications/feedback>

Notes:

- ¹ In the case of fire casualties, this common basis is a population of 1 million, which means that fire rates are measured by incidents, deaths, or injuries per million persons.
- ² Fire deaths are extracted from the National Center for Health Statistics (NCHS) mortality data; estimates of fire injuries are from the National Fire Protection Association's (NFPA's) annual survey.
- ³ National Fire Incidence Reporting System (NFIRS) data for 2001 indicates 20% of fire deaths occurred in the 14 and under age group; data extracted from NCHS indicate these deaths are 15% of all fire deaths for 2001.
- ⁴ National Center for Health Statistics, "National Vital Statistics Reports," Vol. 52, No. 3, September 18, 2003.
- ⁵ Due to rounding to one decimal place, the relative risk for boys and girls aged 10–14 appears equal in several instances in Table 2. In these instances, in 2001, boys still have a slightly elevated risk compared to girls.
- ⁶ Fire Smart, <http://nfpa.org/riskwatch/topfireburn.html>
- ⁷ NFIRS data, 2001.
- ⁸ *Socioeconomic Factors and the Incidence of Fire*, U.S. Fire Administration, FA 170, June 1997.
- ⁹ *Child-Resistant Lighters Protect Young Children*, CPSC Document #5021, <http://www.cpsc.gov/CPSCPUB/PUBS/5021.html>
- ¹⁰ "Study of the effectiveness of the US safety standard for child resistant cigarette lighters," *Injury Prevention* 2002:8: 192–196. <http://www.cpsc.gov/LIBRARY/FOIA/FOIA03/os/lighters.pdf>
- ¹¹ *Juvenile Offenders and Victims 1999 National Report*, Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice, 1999.
- ¹² *U.S. Arson Trends and Patterns*, NFPA, January 2000.
- ¹³ Dorothy Bruck, "Non-awakening in children in response to a smoke detector alarm," *Fire Safety Journal*, Vol. 32 Issue 4, June 1999, pp 369–376.