Fire Risk to Children in 2007

These topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS). Each topical report briefly addresses the nature of the specific fire or fire-related topic, highlights important findings from the data, and may suggest other resources to consider for further information.

Findings

- The relative risk of children under age 15 dying in a fire is lower than the general population. However, when dividing the young into subgroups, 52 percent of all child fire deaths occur to those 4 and younger.
- When dividing the young into subgroups, fire injuries are highest in the 4 and under age group, decline in the middle years, but rise again in the 10 to 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 children are at an increased risk of death from fire.

When evaluated in the aggregate over many years, children have a relative risk of fire death similar to that of the general population. For the period studied, however, this relative risk was lower than the general population. But grouping all children from birth to age 14 together can be misleading. The deaths and injuries are substantially higher for the youngest population, those children age 4 and under. In this topical report, children are divided into age subgroups to better understand how risk varies as children grow older. The groupings are ages 0 to 4, ages 5 to 9, and ages 10 to 14.

It is an unfortunate fact that the youngest of children (ages 4 and younger) face an elevated risk of injury or death in a fire when compared to older children. Very young children are typically dependent to some degree on others for their safety. In addition, while older children face a lower risk of death or injury in a fire and are more mobile, they may not have sufficient abilities to protect themselves. This topical fire report provides a brief analysis of the fire risk for children under the age of 15, and also in the previously mentioned age groupings. It is an update to *Fire Risk to Children in* 2004, Volume 7, Issue 6.

Defining Risk

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 each has its drawbacks, as well. 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 of it 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 may affect the magnitude of the problem.[1]

In comparing fire rates, the relative risk of dying or being injured is a helpful measure. Relative risk compares the per capita rate for a particular group (e.g., females) to the overall per capita rate (i.e., the general population).[2] The result is a measure of how likely a group is to be affected.

For the general population, the relative risk is set at 1. From this report, the relative risk of dying in a fire for the total population of children under age 15 in comparison to the total population is 0.6. This is equivalent to the per capita fire death rate for children under age 15 (8.3 deaths per million population) divided by the per capita fire death rate for the entire population (13.2 deaths per million population[3]). Thus the relative risk of a child under age 15 dying from fire is 40 percent less than that of the total population.

Data Sources and Methodology

The findings in this report pertaining to deaths were taken from National Center for Health Statistics (NCHS) mortality data from 2007. For each reported death certificate in the United States, NCHS assigns International Classification of Disease (ICD) codes for all reported conditions leading to death. For this report, ICD codes F63.1, W39–W40, X00–X09, X75–76, X96–97, Y25–26, and Y35.1 within NCHS data were analyzed.[4] These codes include all deaths in which exposure to fire, fire products, or explosion was the underlying cause of death or was a contributing factor in the chain of events leading to death. Only deaths where age was specified were used in the analyses in the relative risk tables.

Further, the latest NCHS mortality data available are from 2007, which were released in the late spring of 2010. For this reason, all analyses in this report and the other topical reports in the Risk Series (*Fire Risk in 2007* and *Fire Risk to Older Adults in 2007*, both to be released in the near future) reference 2007 data for reasons of consistency.

Fire injury estimates in this report are based on data from the 2007 National Fire Incident Reporting System (NFIRS), Version 5.0 and the 2007 National Fire Protection Association (NFPA) survey.

Who Is Affected

In 2007, nearly 510 children under the age of 15 died as a result of fires (Table 1). These children accounted for 13 percent of fire deaths.[5] The youngest children were especially hard hit—52 percent of child fire deaths affected children ages 4 and younger. For children under the age of 15 in 2007, deaths from fire and burns were the second leading cause of nontransportation accidental deaths after drowning.[6]

Table 1. Child Fire Deaths and Injuries, 2007

	Overall (ages 0 to 14)		Ages 0 to 4		Ages 5 to 9		Ages 10 to 14	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Deaths	509	100.0	267	52.5	155	30.5	87	17.0
Injuries	1,897	100.0	864	45.5	438	23.1	595	31.4

Source: National Center for Health Statistics, 2007 (deaths); 2007 NFIRS 5.0 and 2007 NFPA (injuries).

In 2007, fire injuries affected an estimated 1,900 children and, overall, the relative risk of children under the age of 15 being injured in a fire was lower than the general population. Again, however, the youngest suffered a large share of injuries— 46 percent of child fire injuries occurred to children ages 4 and under (Table 1). As in previous years, fire deaths declined with increasing age. Fire injuries, however, declined between the young preschoolers (ages 4 and younger) and the younger school-aged children (ages 5 to 9) but rose for older children (ages 10 to 14). With age groups combined, children accounted for 11 percent of all fire injuries.

In determining fire risk, age, gender, and socioeconomic factors of children and the households where they live all come into play. Because fire deaths decrease as the age of the child increases, the likelihood of dying in a fire also decreases (Table 2). Children ages 4 and under have approximately the same risk of dying in a fire as the general population. By the time a child reaches the 10 to 14 age group, the risk of dying in a fire drops to 34 percent of his/her youngest counterparts. Boys tend to be at greater risk than girls, with the most marked difference in the 4 and under age group. 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 41 percent of fire deaths among children in 2007, an increase from 38 percent in 2004. Moreover, African-American children ages 4 and under still had a relative risk of dying that was 2.6 times higher than both the general population and for all children in that age group. In 2007, for American Indian/Alaskan Native children, the relative risk was below the general population (0.8), and in children ages 4 and under, the risk rose to 1.1.

Why Children Are At Risk

Escaping from a fire can be difficult for children. A child aged 4 and under is usually too young to independently escape from a fire. Children of this age generally lack the mental faculties to understand the need and the means of quickly escaping a burning structure. As shown in Table 1, 52 percent of child fire fatalities and 46 percent of child fire injuries were among preschoolers. 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 more rapidly suffer deep burns.[7] In addition, smoke inhalation from the toxic gases released by fires (and often in conjunction with burns suffered in the fires) accounted for 80 percent of all reported fire deaths in 2007. Young children are as susceptible to this danger as the general population.[8]

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—all items that will readily harm a young child. One of the major leading causes of residential building fire deaths and injuries for children ages 9 and under in 2007 was "playing with a heat source," which includes lighters and matches. Children ages 9 and under accounted for 93 percent of deaths and 38 percent of injuries where the cause of the residential building fire was due to "playing with a heat source" in 2007.[9]

Table 2. Relative Risk of Child Fire Deaths by Age, Race, and Gender, 2007

Gender/Race	Population	Fire Deaths	Death Rate (per million population)	Relative Risk
All Children (Ages 0 to 14)				
Total	61,294,588	509	8.3	0.6
Male	31,356,417	294	9.4	0.7
Female	29,938,171	215	7.2	0.5
White	46,462,664	277	6.0	0.5
African-American	9,229,753	208	22.5	1.7
American Indian/Alaska Native	769,854	8	10.4	0.8
Asian/Pacific	2,793,575	16	5.7	0.4
White Male	23,823,107	161	6.8	0.5
African-American Male	4,684,247	117	25.0	1.9
American Indian/Alaska Native Male	391,580	5	12.8	1.0
Asian/Pacific Male	1,419,336	11	7.8	0.6
White Female	22,639,557	116	5.1	0.4
African-American Female	4,545,506	91	20.0	1.5
American Indian/Alaska Native Female	378,274	3	7.9	0.6
Asian/Pacific Female	1,374,239	5	3.6	0.3

Gender/Race	Population	Fire Deaths	Death Rate (per million population)	Relative Risk
Ages 0 to 4				
Total	20,921,289	267	12.8	1.0
Male	10,697,321	163	15.2	1.2
Female	10,223,968	104	10.2	0.8
White	15,744,788	147	9.3	0.7
African-American	3,086,154	106	34.3	2.6
American Indian/Alaska Native	279,363	4	14.3	1.1
Asian/Pacific	1,014,924	10	9.9	0.7
White Male	8,064,988	94	11.7	0.9
African-American Male	1,567,237	60	38.3	2.9
American Indian/Alaska Native Male	141,952	2	14.1	1.1
Asian/Pacific Male	516,379	7	13.6	1.0
White Female	7,679,800	53	6.9	0.5
African-American Female	1,518,917	46	30.3	2.3
American Indian/Alaska Native Female	137,411	2	14.6	1.1
Asian/Pacific Female	498,545	3	6.0	0.5

Gender/Race	Population	Fire Deaths	Death Rate (per million population)	Relative Risk
Ages 5 to 9				
Total	20,054,444	155	7.7	0.6
Male	10,254,158	86	8.4	0.6
Female	9,800,286	69	7.0	0.5
White	15,249,391	88	5.8	0.4
African-American	2,970,535	59	19.9	1.5
American Indian/Alaska Native	244,020	4	16.4	1.2
Asian/Pacific	911,409	4	4.4	0.3
White Male	7,817,033	45	5.8	0.4
African-American Male	1,506,231	35	23.2	1.8
American Indian/Alaska Native Male	124,277	3	24.1	1.8
Asian/Pacific Male	461,075	3	6.5	0.5
White Female	7,432,358	43	5.8	0.4
African-American Female	1,464,304	24	16.4	1.2
American Indian/Alaska Native Female	119,743	1	8.4	0.6
Asian/Pacific Female	450,334	1	2.2	0.2

Gender/Race	Population	Fire Deaths	Death Rate (per million population)	Relative Risk
Ages 10 to 14				
Total	20,318,855	87	4.3	0.3
Male	10,404,938	45	4.3	0.3
Female	9,913,917	42	4.2	0.3
White	15,468,485	42	2.7	0.2
African-American	3,173,064	43	13.6	1.0
American Indian/Alaska Native	246,471	0	0.0	0.0
Asian/Pacific	867,242	2	2.3	0.2
White Male	7,941,086	22	2.8	0.2
African-American Male	1,610,779	22	13.7	1.0
American Indian/Alaska Native Male	125,351	0	0.0	0.0
Asian/Pacific Male	441,882	1	2.3	0.2
White Female	7,527,399	20	2.7	0.2
African-American Female	1,562,285	21	13.4	1.0
American Indian/Alaska Native Female	121,120	0	0.0	0.0
Asian/Pacific Female	425,360	1	2.4	0.2

Source: National Center for Health Statistics, 2007 Mortality data and U.S. population estimates from the Population Division, U.S. Census Bureau:
Table 1: Annual Estimates of the Population for the United States, Regions, and States and for Puerto Rico: April 1, 2000 to July 1, 2009 (NST-EST2009-01);
Table 1: Annual Estimates of the Population by Five-Year Age Groups and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-01);
Table 3: Annual Estimates of the Population by Sex, Race, and Hispanic or Latino Origin for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-03);
Table 4: Annual Estimates of the White Alone Population by Age and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-04-WA);
Table 4: Annual Estimates of the Black or African-American Alone Population by Age and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-04-BA);
Table 4: Annual Estimates of the American Indian and Alaska Native Alone Population by Age and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-04-IA);
Table 4: Annual Estimates of the Asian Alone Population by Age and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-04-AA); and
Table 4: Annual Estimates of the Native Hawaiian and Other Pacific Islander Alone Population by Age and Sex for the United States: April 1, 2000 to July 1, 2009 (NC-EST2009-04-NA)
Note: The overall male and female estimates include individuals with "2+ races" per the Census. The "2+ races" category accounts for 1.7 percent of the population. NCHS does not include this race category. Thus, the population estimates for the individual race categories will not sum to the total population estimate. Relative risk may not compute due to rounding

The home can potentially be a high-risk environment for the occurrence of child fire injuries and deaths. The majority of casualties to children under the age of 15—approximately 86 percent of fatalities and 81 percent of injuries—occurred in residential properties in 2007.[10]

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 conditions;

children are more likely to be left alone than in affluent households, often because many of these children live in single-parent households where there are more children to supervise.[11]

Efforts to Combat Risk

To help combat fire deaths and injuries in children, 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. These standards, set in 1994, cover more than 95 percent of the 600 million lighters purchased in the United States each year.[12] A study by the Directorate for Epidemiology of the CPSC found a 58-percent 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 in 1998 alone.[13]

Federal Bureau of Investigation (FBI) statistics have suggested that 44 percent of total arson arrests were for those under age 18, while 26 percent of arrests were for those under age 15.[14] This is in contrast to earlier numbers, where children constituted a larger share of the arrests for arson, especially those age 12 and younger.[15] Also, the number of persons under age 18 arrested for arson decreased by 35 percent from 2000 to 2009, while the juvenile arrest rates for arson (for those aged 10 to 17) decreased by 46 percent from 1994 to 2008.[16] Despite these marked improvements, youth fire safety and juvenile arson are still areas of concern. The reasons for juvenile firesetting vary, and the research in this area is expanding our understanding of the problem. Nonetheless, young children appear to start fires as part of play in a relatively normal phase of development. Older juvenile firesetters often have psychological problems that may relate to emotional disturbance, juvenile delinquency, and other issues.[17,18] Across the country, fire departments sponsor programs to identify juvenile firesetters, help provide the necessary intervention, and promote youth fire safety.

Smoke alarms are unanimously credited with saving thousands of lives each year. In fact, from 2006 to 2008, smoke alarms were reported as not present in 23 percent of residential fatal fires, while in 40 percent of these fires, firefighters were unable to determine if a smoke alarm was present.[19] This is in light of the fact that, nationally, only 3 percent of homes do not have a smoke alarm installed.[20] Dramatic gains in injury prevention and survival rates have been seen since the devices came onto the market in the 1970s. Newer studies, however, have questioned the efficacy of these alarms in alerting children. According to research conducted in Australia and Canada in the late 1990s, sleeping children do not respond appropriately to the smoke alarm. Psychologist Dorothy Bruck, Victoria University, Australia, 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.[21] Further studies have shown an increased response to alarms that use parental voices in lieu of the standard tone alarm.[22] While a limited number of voice-recordable alarms are available on the market, experts note that having a family fire and emergency exit plan are critical to saving lives in a fire.

Conclusion

Improvements have been made in reducing fire deaths and injuries among children under age 15 and, as a result, their relative risk of death or injury is lower than the general population. However, children, especially those ages 4 and younger, remain vulnerable and merit special attention to reduce their risk of injury or death from fire.

Appropriate supervision of children, especially the youngest, is one of the most effective means of preventing injury or death from all sources. Also, a number of resources are available to help address the fire problem for children. Because children still account for 13 percent of fire deaths and 11 percent of fire injuries, the USFA has been working toward the goal of reducing fire deaths and injuries to children. USFA's fire safety campaign for babies and toddlers (http://www.usfa.dhs.gov/campaigns/usfaparents/) provides parents with home strategies ranging from the control of matches and lighters to home escape planning to protect young children from fire. In addition, CPSC continues to look at products that pose additional fire risks to children. Finally, many other educational programs are available throughout our Nation to teach young children and their caregivers about the dangers associated with fire.

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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] Per capita rates are determined by the number of deaths or injuries occurring to a specific population group divided by the total population for that group. This ratio is then multiplied by a common population size. For the purposes of this report, per capita rates for fire deaths and injuries are measured per 1 million persons.

[3] The per capita fire death rate for the total population is computed from the total number of fire deaths (3,994) divided by the total population (301,579,895) multiplied by 1,000,000 persons. This rate is equivalent to 13.2 deaths per 1 million population.

[4] The ICD-10 codes used from the NCHS mortality data are as follows: F63.1–Pathological fire-setting (pyromania), W39–Discharge of firework, W40–Explosion of other materials, X00–Exposure to uncontrolled fire in building or structure, X01–Exposure to uncontrolled fire, not in building or structure, X02–Exposure to controlled fire in building or structure, X03–Exposure to controlled fire, not in building or structure, X04–Exposure to ignition of highly flammable material, X05–Exposure to ignition or melting of nightwear, X06–Exposure to ignition or melting of other clothing and apparel, X08–Exposure to other specified smoke, fire, and flames, X09–Exposure to unspecified smoke, fire, and flames, X75–Intentional self harm (suicide) by explosive material, X76–Intentional self harm (suicide) by smoke, fire, and flames, X96–Assault (homicide) by explosive material, X97–Assault (homicide) by smoke, fire, and flames, Y25–Contact with explosive material, undetermined intent, Y26–Exposure to smoke, fire, and flames, undetermined intent, Y35.1–Legal intervention involving explosives.

[5] National Center for Health Statistics (NCHS) 2007 mortality data.

[6] National Center for Health Statistics, "Deaths: Final Data for 2007," *National Vital Statistics Reports*, Vol. 58, No. 19, Table 10, May 2010. This ranking excludes "other and unspecified nontransport" causes. As a group, "other and unspecified nontransport" causes are larger than the leading specified nontransport causes.

[7] Burn Prevention Foundation, *Tools or Toys?*, Safety Lines, Volume 8, Issue 1, http://www.burnprevention.org/userfiles/toolsortoys_08_001.pdf.

[8] NFIRS version 5.0 data, 2007.

[9] NFIRS version 5.0 data, 2007.

[10] NFIRS version 5.0 data, 2007.

[11] U.S. Fire Administration, *Socioeconomic Factors and the Incidence of Fire*, FA-170, June 1997.

[12] Child–Resistant Lighters Protect Young Children, CPSC Document #5021, http://www.cpsc.gov/CPSCPUB/PUBS/5021.html.

[13] "Study of the effectiveness of the U.S. safety standard for child resistant cigarette lighters," Injury Prevention 2002:8: 192–196. http://www.cpsc.gov/LIBRARY/FOIA/FOIA03/os/lighters.pdf.

[14] U.S. Department of Justice, FBI, Criminal Justice Information Services Division, Uniform Crime Reports, "*Crime in the United States*, 2009, Arrest Data Table 41," September 2010. http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2009.

[15] Office of Juvenile Justice and Delinquency Prevention Fact Sheet, "Juvenile Arson, 1997," Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice, February 1999. http://www.ncjrs.gov/pdffiles1/fs9991.pdf.

[16] U.S. Department of Justice, FBI, Criminal Justice Information Services Division, "2008 Crime in the United States, Table 32," September 2009. http://www.fbi.gov/ucr/cius2008/data/table_32.html. And U.S. Department of Justice, Office of Justice Programs, "OJJDP Statistical Briefing Book," October 31, 2009. http://www.ojjdp.ncjrs.gov/ojstatbb/crime/JAR_Display.asp?ID=qa05210.

[17] Juvenile Justice Bulletin, "Juvenile Firesetting: A Research Overview," U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, May 2005. http://www.ncjrs.gov/pdffiles1/ojjdp/207606.pdf.

[18] National Fire Protection Association, *Intentional Fires*, June 2010.

[19] U.S. Fire Administration's *Fatal Fires in Residential Buildings*, Topical Fire Report Series, Volume 11, Issue 2, August 2010.

[20] Greene, Michael and Craig Andres. 2004-2005 *National Sample Survey of Unreported Residential Fires*. Division of Hazard Analysis, Directorate of Epidemiology, U.S. Consumer Product Safety Commission, July 2009.

[21] Bruck, Dorothy, "Non–awakening in children in response to a smoke detector alarm," Fire Safety Journal, Vol. 32 Issue 4, June 1999, pp. 369–376.

[22] Smith, Gary, et al., "Comparison of a Personalized Parent Voice Smoke Alarm With a Conventional Residential Tone Smoke Alarm for Awakening Children," *Pediatrics*, Vol. 118 No. 4, October 2006, pp. 1623-1632, online at: http://pediatrics.aappublications.org/cgi/content/full/118/4/1623.