Fire Risk to Children in 2010

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 National Fire Incident Reporting System. 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

- In 2010, the relative risk of children under age 15 dying in a fire was 50 percent lower than the general population. However, when dividing the young into subgroups, 57 percent of all child fire deaths occurred to those 4 or younger.
- When dividing the young into subgroups, fire injuries were highest in the 4 or younger age group, declined in the middle years, but rose again in the 10 to 14 age group. This is a different pattern than deaths, which decreased as children aged.
- Overall, boys were at a higher risk of death from fire than girls.
- African-American children age 4 or younger were at an increased risk of death from fire.

When evaluated in the aggregate over many years, children younger than 15 had a relative risk of fire death lower than that of the general population. In 2010, this relative risk was 50 percent lower than the general population. Grouping all children from birth to age 14 together, however, can be misleading. The numbers of deaths and injuries were substantially higher for the youngest population, those children age 4 or younger. In this Topical Fire 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 (age 4 or 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 younger than 15, and also in the previously mentioned age groupings. It is an update to "Fire Risk to Children in 2007," Volume 11, Issue 9.

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 it 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 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]

For the general population, the relative risk is set at 1. From this report, in 2010, the relative risk of dying in a fire for the total population of children younger than 15 in comparison to the total population was 0.5. This is equivalent to the per capita fire death rate for children younger than 15 (5.8 deaths per million population) divided by the per capita fire death rate for the entire population (11.1 deaths per million population[3]). Thus the relative risk of a child younger than 15 dying from fire was 50 percent less than that of the total population.

Data Sources and Methodology

The findings in this report pertaining to deaths were taken from the National Center for Health Statistics (NCHS) 2010 Mortality Data File, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. For each reported death certificate in the United States, NCHS assigned International Classification of Disease (ICD) codes for all reported conditions leading to death. For this report, the following ICD codes were analyzed: F63.1, W39-W40, X00-X09, X75-76, X96-97, Y25-26, and Y35.1.[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 2010, which were released in 2012 (release dates vary from year to year). For this reason, all analyses in this report and the other topical reports in the Risk Series, ("Fire Risk in 2010," Volume 14, Issue 7, August 2013 and "Fire Risk to Older Adults in 2010," Volume 14, Issue 9, August 2013), reference 2010 data for reasons of consistency.

Fire injury estimates in this report are based on data from the 2010 National Fire Incident Reporting System (NFIRS), version 5.0 and the 2010 National Fire Protection Association (NFPA) survey.

Who Is Affected

In 2010, 355 children younger than 15 died as a result of fires (Table 1).[5] These children accounted for 10 percent of fire deaths. The youngest children were especially hard hit — 57 percent of child fire deaths affected children age 4 or younger. For children younger than 15 in 2010, exposure to smoke and fire was the second leading cause of nontransportation accidental deaths after drowning.[6]

Table 1. Child Fire Deaths and Injuries, 2010

	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	357	100.0	204	57.1	103	28.9	50	14.0
Injuries	1,988	100.0	964	48.5	441	22.2	583	29.3

Sources: 2010 NCHS Mortality Data File, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program; 2010 NFIRS 5.0 fire injury data; and 2010 NFPA fire injury estimates.

In 2010, fire injuries affected an estimated 2,000 children, and overall, the relative risk of children younger than 15 being injured in a fire was lower than the general population.[7] Again, however, the youngest suffered a large share of injuries — 49 percent of child fire injuries occurred to children age 4 or younger (Table 1). As in previous years, fire deaths declined with increasing age. Fire injuries, however, declined between the young preschoolers (age 4 or 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 decreased as the age of the child increased, the likelihood of dying in a fire also decreased (Table 2). In 2010, children age 4 or younger had 10 percent less risk of dying in a fire than the general population. By the time a child reaches the 10 to 14 age group, however, the risk of dying in a fire dropped to 24 percent of his or her youngest counterparts. Overall, boys tended to be at greater risk than girls. In addition, African-Americans comprised a large and disproportionate share of total fire deaths, accounting for 29 percent of fire deaths among children in 2010, but only 15 percent of the population. Moreover, African-American children age 4 or younger still had a relative risk of dying that was 2.1 times higher than the general population and 2.4 times higher than for all children in that age group. In 2010, for American Indian/Alaskan Native children, the relative risk was below the general population (0.8), but in children age 4 or younger, the risk rose to 1.1.

Why Children Are At Risk

Escaping from a fire can be difficult for children. A child age 4 or 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 from a burning structure. As shown in Table 1, 57 percent of child fire fatalities and 49 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 and delicate compared to that of adults and older children. As a result, young children suffer burns more quickly and easily than adults.[8] In addition, smoke inhalation from the toxic gases released by fires (and often in conjunction with burns suffered in the fires) accounted for 82 percent of all reported fire deaths in 2010. Young children (age 4 or younger) were also susceptible to this danger. Smoke inhalation accounted for 39 percent of fire deaths to children age 4 or younger.[9]

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 reported residential building fire deaths and injuries for children age 9 or younger in 2010 was "playing with a heat source," which includes lighters and matches. Children age 9 or younger accounted for 61 percent of deaths and 28 percent of injuries where the cause of the residential building fire was due to "playing with a heat source" in 2010.[10]

Table 2. Relative Risk of Child Fire Deaths by Age, Race and Gender, 2010

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
All Children (Ages 0 to 14)				
Total	61,205,447	357	5.8	0.5
Male	31,275,886	194	6.2	0.6
Female	29,929,561	163	5.4	0.5
White	45,077,171	240	5.3	0.5
African-American	9,220,566	104	11.3	1.0
American Indian/Alaska Native	970,033	9	9.3	0.8
Asian/Pacific Islander	3,022,927	4	1.3	0.1
White Male	23,098,129	124	5.4	0.5
African-American Male	4,680,883	65	13.9	1.2
American Indian/Alaska Native Male	493,364	4	8.1	0.7
Asian/Pacific Islander Male	1,525,489	1	0.7	0.1
White Female	21,979,042	116	5.3	0.5
African-American Female	4,539,683	39	8.6	0.8
American Indian/Alaska Native Female	476,669	5	10.5	0.9
Asian/Pacific Islander Female	1,497,438	3	2.0	0.2

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Ages 0 to 4				
Total	20,192,942	204	10.1	0.9
Male	10,315,636	117	11.3	1.0
Female	9,877,306	87	8.8	0.8
White	14,661,715	123	8.4	0.8
African-American	3,061,628	73	23.8	2.1
American Indian/Alaska Native	330,236	4	12.1	1.1
Asian/Pacific Islander	1,010,707	4	4.0	0.4
White Male	7,506,201	67	8.9	0.8
African-American Male	1,552,765	46	29.6	2.7
American Indian/Alaska Native Male	168,088	3	17.8	1.6
Asian/Pacific Islander Male	514,892	1	1.9	0.2
White Female	7,155,514	56	7.8	0.7
African-American Female	1,508,863	27	17.9	1.6
American Indian/Alaska Native Female	162,148	1	6.2	0.6
Asian/Pacific Islander Female	495,815	3	6.1	0.5

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Ages 5 to 9				
Total	20,332,370	103	5.1	0.5
Male	10,381,369	52	5.0	0.4
Female	9,951,001	51	5.1	0.5
White	15,024,479	78	5.2	0.5
African-American	3,005,861	22	7.3	0.7
American Indian/Alaska Native	321,336	3	9.3	0.8
Asian/Pacific Islander	1,029,956	0	0.0	0.0
White Male	7,695,886	39	5.1	0.5
African-American Male	1,525,719	13	8.5	0.8
American Indian/Alaska Native Male	163,058	0	0.0	0.0
Asian/Pacific Islander Male	515,130	0	0.0	0.0
White Female	7,328,593	39	5.3	0.5
African-American Female	1,480,142	9	6.1	0.5
American Indian/Alaska Native Female	158,278	3	19.0	1.7
Asian/Pacific Islander Female	514,826	0	0.0	0.0

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Ages 10 to 14				
Total	20,680,135	50	2.4	0.2
Male	10,578,881	25	2.4	0.2
Female	10,101,254	25	2.5	0.2
White	15,390,977	39	2.5	0.2
African-American	3,153,077	9	2.9	0.3
American Indian/Alaska Native	318,461	2	6.3	0.6
Asian/Pacific Islander	982,264	0	0.0	0.0
White Male	7,896,042	18	2.3	0.2
African-American Male	1,602,399	6	3.7	0.3
American Indian/Alaska Native Male	162,218	1	6.2	0.6
Asian/Pacific Islander Male	495,467	0	0.0	0.0
White Female	7,494,935	21	2.8	0.3
African-American Female	1,550,678	3	1.9	0.2
American Indian/Alaska Native Female	156,243	1	6.4	0.6
Asian/Pacific Islander Female	486,797	0	0.0	0.0

Sources: 2010 NCHS Mortality Data File, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program and U.S. population estimates from the U.S. Census Bureau, Population Division, http://www.census.gov/popest/data/index.html:
1. Table 1. Annual Estimates of the Population for the United States, Regions, States and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01). Release date: December 2011.
2. Table 1. Annual Estimates of the Resident Population by Sex and Five-Year Age Groups for the United States: April 1, 2010 to July 1, 2011 (NC-EST2011-01). Release date: May 2012.
3. Monthly Postcensal Resident Population by Single Year of Age, Sex, Race and Hispanic Origin for the United States: July 1, 2010 to December 1, 2010 (NC-EST2011-ALLDATA-R-File02). Release date: May 2012.

Note: The overall male and female estimates include individuals with "2+ races" per the census. The "2+ races" category accounts for 2.3 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 87 percent of fatalities and 81 percent of injuries — occurred in residential buildings in 2010.[11]

Socioeconomic factors also 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 and 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.[12]

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 required disposable lighters and certain novelty lighters to be child-resistant. These standards, set in 1994, covered 95 percent of the 600 million lighters purchased in the U.S. each year.[13] 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.[14]

Federal Bureau of Investigation (FBI) statistics have suggested that 41 percent of total arson arrests were for those younger than 18, while 24 percent of arrests were for those younger than 15.[15] This is in contrast to earlier statistics, where children constituted an even larger share of the arrests for arson, especially those age 12 or younger.[16] Also, the number of people younger than 18 arrested for arson decreased by 43 percent from 2002 to 2011, while the juvenile arrest rates for arson (for those ages 10 to 17) decreased by 62 percent from 1994 to 2010.[17] 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, experiencing an interest in fire is a relatively normal phase of development for some young people.[18] Older juvenile firesetters may have psychological problems that relate to emotional disturbance, juvenile delinquency and other issues.[19] Across the country, fire departments sponsor programs to identify juvenile firesetters, help provide the necessary intervention, and promote youth fire safety.

Smoke alarms are credited with saving thousands of lives each year. In fact, from 2009 to 2011, smoke alarms were reported as not present in 22 percent of residential fatal fires, while in 40 percent of these fires, firefighters were unable to determine if a smoke alarm was present.[20] This is in light of the fact that, nationally, only 3 percent of homes do not have a smoke alarm installed.[21] 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. A group of Australian researchers 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.[22] Further studies have shown an increased response to alarms that use parental voices in lieu of the standard tone alarm.[23] While a limited number of voice-recordable alarms are available on the market, experts note that having a family fire and emergency exit plan is critical to saving lives in a fire.

Conclusion

Improvements have been made in reducing fire deaths and injuries among children younger than 15, and in 2010, their relative risk of death or injury was lower than that of the general population. However, children, especially those age 4 or younger, remained vulnerable and, as a result, 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 accounted for 10 percent of fire deaths and 11 percent of fire injuries in 2010, the U.S. Fire Administration (USFA) has been working toward the goal of reducing fire deaths and injuries to children. The USFA's A Fire Safety Campaign for Babies and Toddlers (http://www.usfa.fema.gov/campaigns/usfaparents/) provides parents with information on 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.

To request additional information or to comment on this report, visit http://apps.usfa.fema.gov/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 people.

[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 people.

[3]The per capita fire death rate for the total population is computed from the total number of fire deaths (3,445) divided by the total population (309,330,219) multiplied by 1,000,000 people. This rate is equivalent to 11.1 fire 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; and Y35.1–Legal intervention involving explosives.

[5] 2010 NCHS mortality data. The count of fire deaths noted in the text is rounded to the nearest five.

[6] NCHS, "Deaths: Final Data for 2010," *National Vital Statistics Reports*, Vol. 61, No. 4, Table 10, May 2013 (http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf). 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] Estimates of fire injuries are calculated by determining the percent of injuries from the NFIRS version 5.0 data and applying the percentage to the NFPA estimate of fire injuries. The fire injury estimate noted in the text is rounded to the nearest 25.

[8] Children's Hospital of Wisconsin, *Children's Burns are Different than Adults*, http://www.chw.org/display/displayFile.asp?docid=37375&filename=/Groups/Everyone/ Children_Burn_Quicker.pdf.

[9] NFIRS version 5.0 data, 2010.

[10] NFIRS version 5.0 data, 2010.

[11] NFIRS version 5.0 data, 2010.

[12] USFA, *Socioeconomic Factors and the Incidence of Fire*, FA-170, June 1997.

[13] "CPSC's Standard for Child-Resistant Lighters to Take Effect," CPSC News Release #94105, July 12, 1994, http://www.cpsc.gov/en/Newsroom/News-Releases/1994/CPSCs-Standard-For-Child-Resistant-Lighters-To-Take-Effect/.

[14] "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.

[15] U.S. Department of Justice (DOJ), FBI, Criminal Justice Information Services Division, Uniform Crime Reports, "*Crime in the United States, 2011*, Arrest Data Table 41," September 2012. http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-41.

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

[17] U.S. DOJ, FBI, Criminal Justice Information Services Division, Uniform Crime Reports "*Crime in the United States 2011*, Table 32," September 2012. http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-32. And U.S. DOJ, OJJDP, "OJJDP Statistical Briefing Book," December 17, 2012, Juvenile Arrest Rate Trends, http://www.ojjdp.gov/ojstatbb/crime/JAR_Display.asp?ID=qa05210.

[18] NFPA, "Parent Safety Tips: Young Firesetters," http://www.nfpa.org/assets/files//PDF/Public%20Education/YoungFiresettersTipSheet.pdf.

[19] Juvenile Justice Bulletin, "Juvenile Firesetting: A Research Overview," U.S. DOJ, Office of Justice Programs, OJJDP, May 2005. http://www.ncjrs.gov/pdffiles1/ojjdp/207606.pdf.

[20] USFA, *Fatal Fires in Residential Buildings (2009-2011)*, Topical Fire Report Series, Volume 14, Issue 3, May 2013. http://www.usfa.fema.gov/downloads/pdf/statistics/v14i3.pdf.

[21] Greene, Michael and Craig Andres. *2004-2005 National Sample Survey of Unreported Residential Fires*. Division of Hazard Analysis, Directorate of Epidemiology, CPSC, July 2009.

[22] 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.

[23] 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/content/118/4/1623.full.