U.S. Fire Administration/National Fire Data Center

Fire Risk

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TOPICAL FIRE RESEARCH SERIES

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Findings

- *Risk by age:* Children under the age of 5 and the population over the age of 54 are at the highest risk of death in fires. The risk of fire injury is greatest (over 1.0) in the 20–44 and the 85+ age ranges.
- *Risk by gender:* Men are 1.6 times more likely to die in a fire than women.
- *Risk by race:* African Americans and American Indians are at much greater risk of death in a fire than the general population.
- *Risk by region:* The risk of dying in a fire in the South is higher than other areas of the United States.
- *Risk by economic factor:* Populations at the lowest income levels are at a greater risk of dying in a fire than those with higher incomes.

The risk from fire is not the same for everyone. More than 4,000 deaths and 20,300 injuries in the United States were caused by fire in 2001.[1] These casualties were not equally distributed across the U.S. population, and the resulting risk of death or injury from fire is not uniform—it is more severe for some groups than for others. Much can be learned from understanding why different segments of society are at heightened risk from the fire problem.

Risk is a factor, element, or course of action involving uncertainty. It is an exposure to some peril, and it often implies a probability of occurrence, such as investment risk or insurance risk. In terms of the fire problem, risk is the potential for injury or death of a person or damage or loss to property.

This topical report focuses on how fire risk—specifically the risk of death and injury—varies with age and how other demographic and socio-economic factors weigh upon that risk.

Per Capita Rates, Risk, and Fire Casualties

When determining fire risk, age, geographic, demographic, and socio-economic factors all come into play. People in the Southeast, the elderly, the very young, and the poor all are at higher risk of being injured in a fire than the rest of the population. Males, African Americans, and American Indians have a considerably higher risk of death or injury from fire than does the population as a whole. These groups have remained at higher risk despite considerable long-term reductions in fires and fire casualties.

Fire casualties across population groups can be assessed in several ways. The simplest method is to look at the distribution of the numbers of deaths or injuries across the factor of interest. In the case of age, the number of fire deaths is greatest for the very young while most fire injuries occur among middle-aged adults.[2] Or, in the case of race, the number of fire deaths is greatest for white Americans and least for Asian Americans.

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Although these findings are informative, they do not account for differences in the basic population groups under comparison. In the case of age, as an age group matures, its population of individuals decreases as a result of deaths and fatal injuries.[3] In the case of race, there are far fewer Asian Americans than white Americans living in the United States. As a consequence, it is possible for an age group to have greater (or fewer) injuries or deaths because the sheer number of individuals for whom it is possible to be injured is larger (or smaller) than other groups.

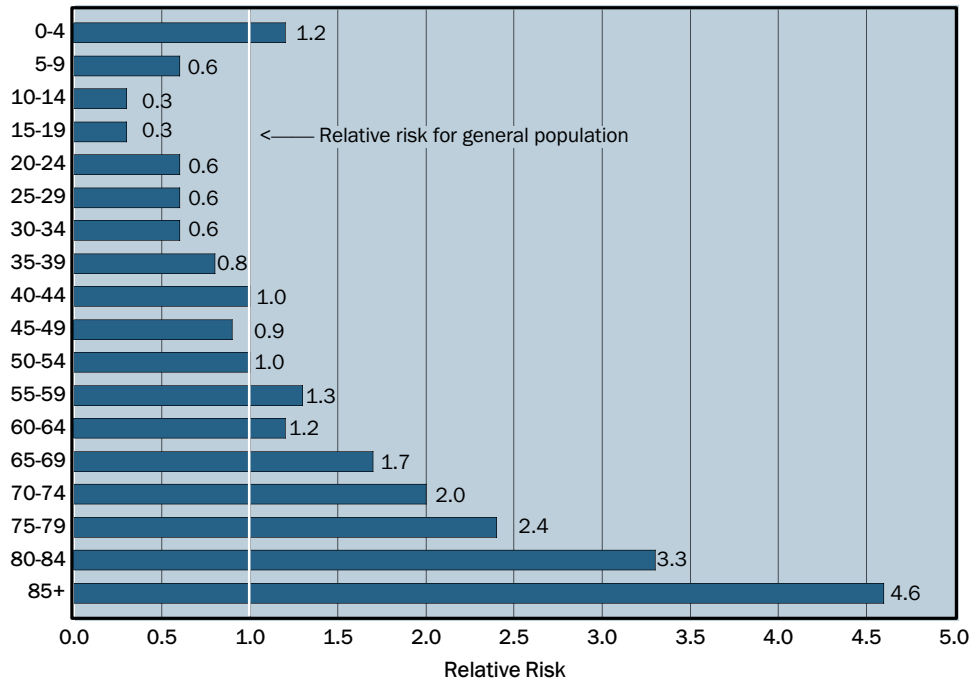
To account for population differences such as these, per capita rates are used. Per capita rates use a common population size, which then permits comparisons between different groups.[4] Perhaps the most useful way to assess fire casualties across groups is to determine the relative risk of dying or being injured. 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). 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. The relative risk of dying in a fire for the total population of females in comparison to the total population is 0.8, which is equivalent to the per capita fire death rate for females (10.7) divided by the per capita fire death rate for the entire population (14.0). Thus the relative risk of a female dying from fire is 20% less than that of the total population.

Age and Risk of Fire Casualty

When physical and cognitive abilities are limited, as is often the case for the very young and the very old, the risk of death and injury from fire rises. The elderly experience large numbers of fire deaths that occur in a small population group. As a result, the risk of dying in a fire for the elderly is 2.5 times higher than for the population as a whole and rises even more for the oldest segment (Figure 1). Individuals age 65–74 are 1.8 times more likely to die in a fire than the general population, while those adults age 85 or older are 4.6 times more likely to suffer fire-related deaths. Increasing frailty and infirmity accompany aging, and the tendency of higher fire death and injury risk to rise with greater age is not surprising.[5] Approximately 2,200 older adults (65 and older) were injured and 1,250 killed in fires in 2001.[6]

FIGURE 1. RELATIVE RISK OF FIRE DEATH BY AGE, 2001



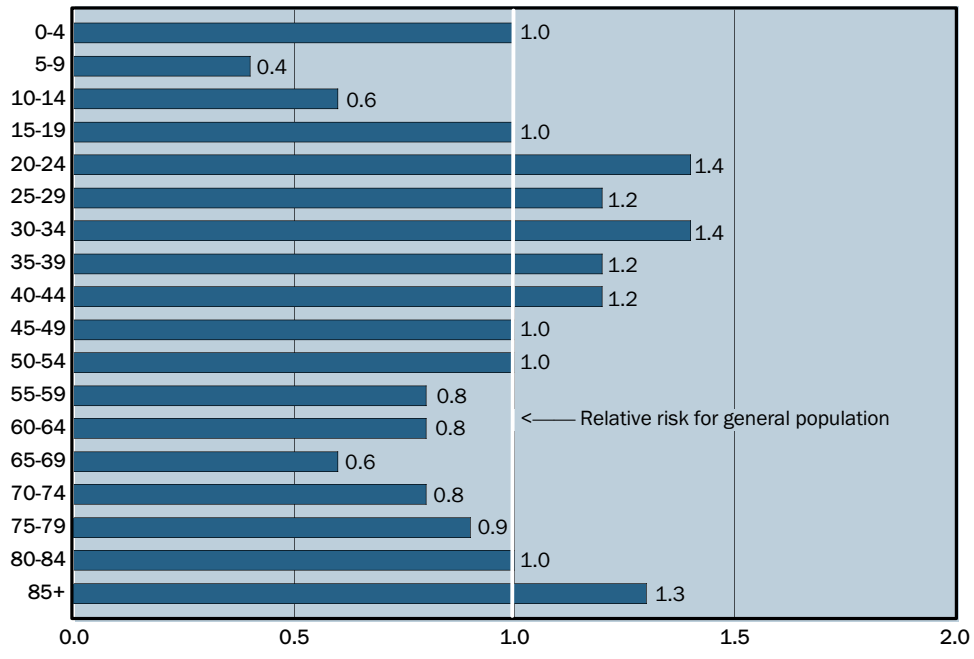
Source: NCHS and U.S. Census Bureau

Children also experience large numbers of fire deaths. Though the risk of death for children from birth to age 14 is slightly below the risk to the population as a whole, some groups of children face greater danger. Children under the age of 5 have a greater risk of death than all other children (Figure 1). As children mature and their cognitive and social abilities develop, the risk of fire death drops sharply. Children between ages 5 and 9 have half the risk of fire death of their youngest counterparts; children between 10 and 14 have half that of the 5 to 9 group. Of the youngest, African American, and American Indian children are most threatened. Children in the age 4 and under group also have a greater relative risk of injury from fire (Figure 2) than their older counterparts.[7] Approximately 2,900 children (14 and younger) were injured and 600 killed in fires in 2001.

After age 19, the risk of fire death increases. By age 55, the risk of death is above average and it continues to increase sharply as the population ages. Although the overall numbers change, these profiles have remained relatively constant from year to year, according to National Center for Health Statistics (NCHS) and U.S. Census Bureau data.

The age profile of risk for fire injuries is very different from that for deaths (Figure 2) with a much narrower range of risk quotients (0.4 to 1.4 vice 0.3 to 4.6 for fire deaths). This difference is thought to be both the result of cognitive and mobility issues that affect children and older adults. As a result, children and older adults are less likely to escape the effects of fire and thus suffer fatal injuries. Middle-aged individuals tend to suffer nonfatal injuries—in 2001, most fire injuries occurred among 30- to 44-year olds.[8] In terms of risk, the risk of injury in a fire is highest for young adults aged 20 to 24, mid-life adults aged 30 to 44, and the elderly over 75. The risk of injury is below average for children under age 15 (Figure 2).

FIGURE 2. RELATIVE RISK OF INJURY BY AGE, 2001



Source: NFIRS, NFPA, and U.S. Census Bureau

Other Factors That Influence Risk

According to USFA's report *Socioeconomic Factors and the Incidence of Fire*,[9] socioeconomic studies repeatedly show income levels are directly or indirectly tied to fire risk. There is an inverse relationship between fire risk and income. The poorer population groups have the highest risk of fire injury or death, while the wealthiest have the lowest. Many elderly people live alone on meager incomes, frequently in substandard housing stock.[10] Closely tied to income is level of education. The groups living in poverty—that is, with income levels below the poverty line—are often undereducated and lack a basic high school education.

Geographic location also comes into effect (Table 1). There is a greater risk of dying in a fire in the South (30%) than other regions. This is, in part, attributed to the intermittent need for occasional heating. Rather than including central heating systems as in northern areas, many households in the South use portable heating devices for heat. By their nature, such heating strategies are more likely to lead to a fire problem. Conversely, the West, with the exception of Alaska, has a much lower risk of fire death. This reduction may also be due, in part, to the role of heating (or lack of) in fire deaths.

TABLE 1. RELATIVE RISK BY GEOGRAPHIC AREA, 2001

Region	Population	Fire Deaths	Death Rate (per million)	Relative Risk
Northeast	53,950,802	655	12.1	0.9
Midwest	64,819,817	991	15.3	1.1
South	101,953,947	1,820	17.9	1.3
West	64,592,993	541	8.4	0.6
Overall U.S.	**285,317,559**	**4,007**	**14.0**	**1.0**

Source: NCHS 2001 mortality data and Population Division, U.S. Census Bureau, Table ST–EST2002–01–State Population Estimates: April 1, 2000 to July 1, 2002, Release Date: December 20, 2002.

Note: Relative risk may not compute due to rounding.

Like age, gender plays a role in the risk of death or injury from fire. For virtually all age groups, males are more likely to die in a fire-related incident (Tables 2–4). Overall, in 2001, men were 1.6 times more likely to die in a fire than women. U.S. Fire Administration data from the National Fire Incident Reporting System (NFIRS) show that men are also likely to suffer more injuries—from 1.5 to 2 times more.[11] Why this is so is subject to speculation. Men may be more willing to take risks than women, and this behavior could account for some of the difference. Previous NFIRS data indicate that more men than women will try to extinguish a fire. This action alone could account for much of the difference in injury rates.

Race, which may be related to societal factors, cannot be ignored. African Americans and American Indians have noticeably higher death rates per capita than the national average. African Americans comprise a large and disproportionate share of total fire deaths, accounting for 25% of fire deaths—60% more than their share of the overall population.[12] In 2001, African Americans had twice the relative risk of dying than the general population. For American Indians that year, the relative risk was also elevated; 30% higher than the overall risk. By contrast, Asian Americans are much less likely than the overall population to die in a fire.

TABLE 2. RELATIVE RISK OF FIRE DEATH BY RACE AND GENDER, 2001
OVERALL POPULATION

Gender/Race	Population	Fire Deaths	Death Rate (per million)	Relative Risk
Total	**285,317,559**	**4,007**	**14.0**	**1.0**
Male	140,075,610	2,455	17.5	1.2
Female	145,241,949	1,552	10.7	0.8
White	230,664,347	2,908	12.6	0.9
African American	36,283,895	1,006	27.7	2.0
American Indian	2,713,047	49	18.1	1.3
Asian/Pacific	11,602,700	44	3.8	0.3
White Male	113,863,214	1,777	15.6	1.1
African American Male	17,256,399	616	35.7	2.5
American Indian Male	1,357,962	33	24.3	1.7
Asian/Pacific Male	5,609,267	29	5.2	0.4
White Female	116,801,133	1,131	9.7	0.7
African American Female	19,027,496	390	20.5	1.5
American Indian Female	1,355,085	16	11.8	0.8
Asian/Pacific Female	5,993,433	15	2.5	0.2

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. RELATIVE RISK OF FIRE DEATH BY AGE, RACE, AND GENDER, 2001
CHILDREN (AGE 0–14)

Gender/Race	Population	Fire Deaths	Death Rate (per million)	Relative Risk
Total	**60,482,119**	**599**	**9.9**	**0.7**
Male	30,958,761	361	11.7	0.8
Female	29,523,358	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	–	–	–

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 4. RELATIVE RISK OF FIRE DEATH BY AGE, RACE, AND GENDER, 2001
ELDERLY (AGE 65+)

Gender/Race	Population	Fire Deaths	Death Rate (per million)	Relative Risk
Total	**35,353,266**	**1,250**	**35.4**	**2.5**
Male	14,619,070	638	43.6	3.1
Female	20,734,196	612	29.5	2.1
White	31,182,858	942	30.2	2.2
African American	2,915,629	283	97.1	6.9
American Indian	154,885	8	51.7	3.7
Asian/Pacific	904,344	17	18.8	1.3
White Male	12,972,922	473	36.5	2.6
African American Male	1,112,495	151	135.7	9.7
American Indian Male	66,748	5	74.9	5.3
Asian/Pacific Male	384,994	9	23.4	1.7
White Female	18,209,936	469	25.8	1.8
African American Female	1,803,134	132	73.2	5.2
American Indian Female	88,137	3	34.0	2.4
Asian/Pacific Female	519,350	8	15.4	1.1

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.

Conclusion

The very young and the very old are some of the nation's most vulnerable residents. These high-risk groups merit special attention to reduce their risk of injury or death from fire. With an aging population, the U.S. demographic profile is changing rapidly. The elderly population is expected to increase from its current 12.5% of the total population to nearly 20% within a few decades,[13] with an assumed corresponding increase in fire deaths and injuries among older adults.

Because children and older adults account for 45% of fire deaths and one-quarter of fire injuries, the USFA has been working toward the goal of reducing fire deaths and injuries to children and older adults. 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. For adults, *A Fire Safety Campaign for People 50-Plus* (http://www.usfa.fema.gov/50plus) addresses lifestyle strategies of safe smoking, safe cooking, and safe heating to reduce the incidence of fires that traditionally affect older adults. For further information, see the USFA Web site (http://www.usfa.fema.gov) or contact your local fire department.

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

Notes:

1 Fire deaths are extracted from the 2001 NCHS mortality data using International Classification of Disease (ICD) codes F63.1, W39-W40, X00-X09, X75-76, X96-97, Y25-26, and Y35.1 where these codes were noted as either the underlying cause of death or a contributing factor in the chain of events leading to death. Only deaths where age and gender were specified were used in this analysis. Estimates of fire injuries are from the National Fire Protection Association's (NFPA's) annual survey.

2 *Fire in the United States 1992–2001*, United States Fire Administration, Federal Emergency Management Agency, 13th Edition.

3 Immigration and changes in U.S. overseas populations have an additive effect on a static population group in the early and mid-life years. Over the lifespan of the population group, however, death rates have a larger, decreasing effect.

4 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. For example, the per capita fire death rate for the total female population is computed from the total number of female fire deaths (1,552) divided by the total female population (145,241,949) multiplied by 1,000,000 persons. This rate is equivalent to 10.7 deaths per 1 million population.

5 See also "The Fire Risk to Older Adults," Topical Report Vol. 4, Issue 9, December 2004.

6 Numbers of fire deaths are extracted from NCHS mortality data using the ICD codes noted previously. Estimates of fire injuries are calculated by determining the percent of injuries from the NFIRS data and applying the percentage to the NFPA estimate of fire injuries.

7 See also "The Fire Risk to Children," Topical Report Vol. 4, Issue 8, December 2004.

8 *Fire in the United States 1992–2001*, loc. cit.

9 *Socioeconomic Factors and the Incidence of Fire*, U.S. Fire Administration, FA 170, June 1997.

10 Idem.

11 *Fire in the United States 1992–2001*, loc. cit.

12 Based on *U.S. Census Bureau* population estimates for July 2001.

13 *U.S. Census Bureau* population data as noted in "The Fire Risk to Older Adults," loc. cit.