Fire Risk 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

- **Risk by age:** In 2010, adults age 45 or older had a greater relative risk of dying in fires than the general population. The elderly age 85 or older had the highest risk of fire death. The relative risk of fire injury was greatest for the 20- to 59-year-olds, peaking for the 30- to 34-year-olds.
- **Risk by gender:** Males were 1.5 times more likely to die in fires than females.
- **Risk by race:** African-Americans and American Indians/Alaska Natives were at a greater relative risk of dying in a fire than the general population.
- **Risk by region:** The relative risk of dying in a fire for people living in the South was higher than for populations living in other regions of the United States.

The risk from fire is not the same for everyone. In 2010, 3,445 deaths and 17,720 injuries in the U.S. were caused by fires.[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 a heightened risk from the fire problem. This Topical Fire Report explores fire risk as it applies to fire casualties in the U.S. population. It is an update to "Fire Risk in 2007," Volume 11, Issue 8.

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 of property as a result of fire.

This topical report focuses on how fire risk, specifically the risk of death and injury, varies with age and how other demographic and socioeconomic factors weigh upon that risk.
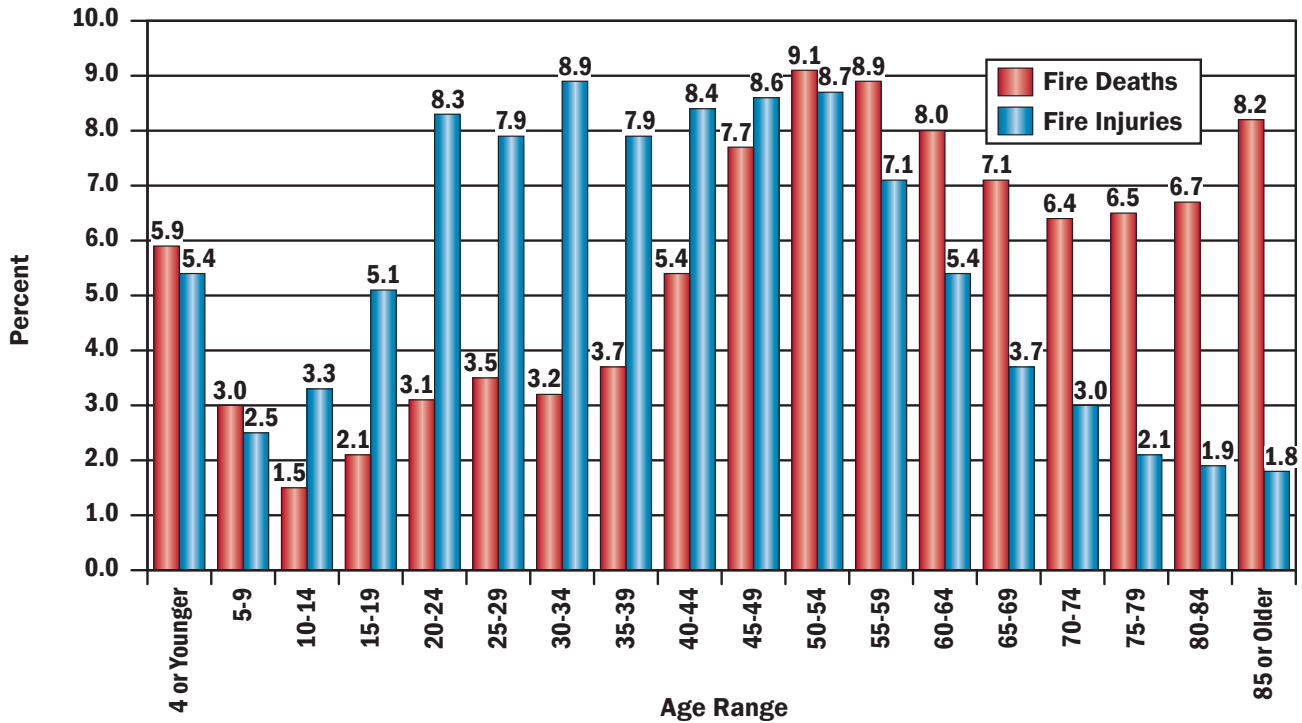
Per Capita Rates, Risk, and Fire Casualties

When determining fire risk, geographic, demographic and socioeconomic factors all come into play. People in the South, the poor, and older adults (age 65 or older) all were at higher risk from dying in a fire than the rest of the population. The very young (age 4 or younger) were also at higher risk of fire death and injury when compared to older children. Males, African-Americans, and American Indians/Alaska Natives also had a considerably higher risk of death from fire than did the population as a whole. These groups still 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. For example, in the case of race, in 2010, the number of fire deaths was greatest for white Americans and least for Asian/Pacific Islander Americans. In the case of age, the number of fire deaths was greatest for the very young, the very old, and older middle-aged adults, while most fire injuries occurred among adults under age 60 (Figure 1).

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Figure 1. Percentage of Fire Deaths and Injuries by Age, 2010

Sources: 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 and 2010 NFIRS 5.0 fire injury data.

Note: Data have been adjusted to account for deaths with unknown age.

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. In the case of race, there are far fewer Asian/Pacific Islander Americans, for example, than white Americans living in the U.S. 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.[2] 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).

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 females in comparison to the total population was 0.8. This is equivalent to the per capita fire death rate for females (8.5 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 female dying from fire was 20 percent less than that of the total population.

Data Sources and Methodology

The findings in this report pertaining to deaths were taken from the 2010 National Center for Health Statistics (NCHS) 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 U.S., 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 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 to Children in 2010," Volume 14, Issue 8, 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.

Age and Risk of Fire Casualty

When physical and cognitive abilities are limited, as is often the case for the very old, the risk of death from fire rises. In 2010, older adults (age 65 or older) experienced large numbers of fire deaths that occurred in a small population group. As a result, the risk of dying in a fire for older adults was 2.7 times higher than for the population as a whole

and rose even more for the oldest segment (Figure 2). Individuals ages 65 to 74 were 1.9 times more likely to die in a fire than the general population, while those adults age 85 or older were 4.6 times more likely to suffer fire-related deaths.[5] Increasing frailty and infirmity accompany aging, and the tendency of higher fire death risk to rise with greater age is not surprising. In 2010, 1,200 older adults (age 65 or older) died and another 2,225 were injured in fires.[6]

Figure 2. Relative Risk of Fire Death by Age, 2010
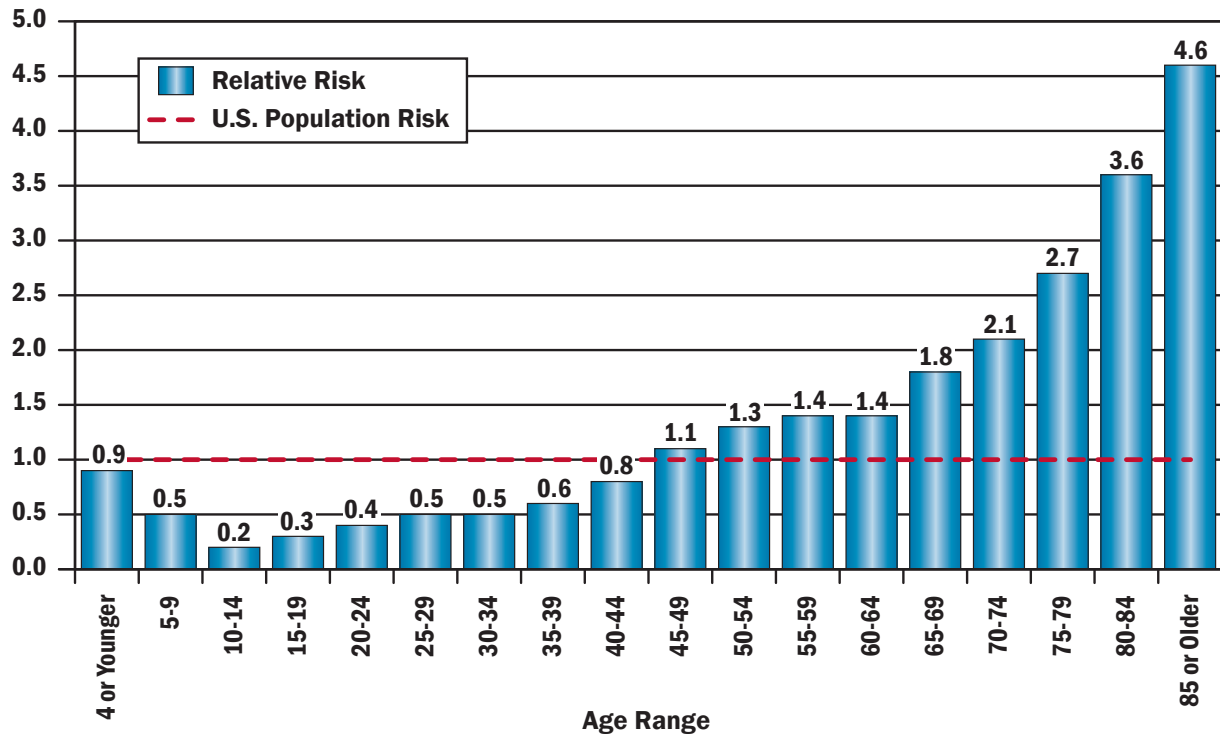
Sources: 2010 NCHS Mortality Data File, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program and U.S. Census Bureau population estimates.
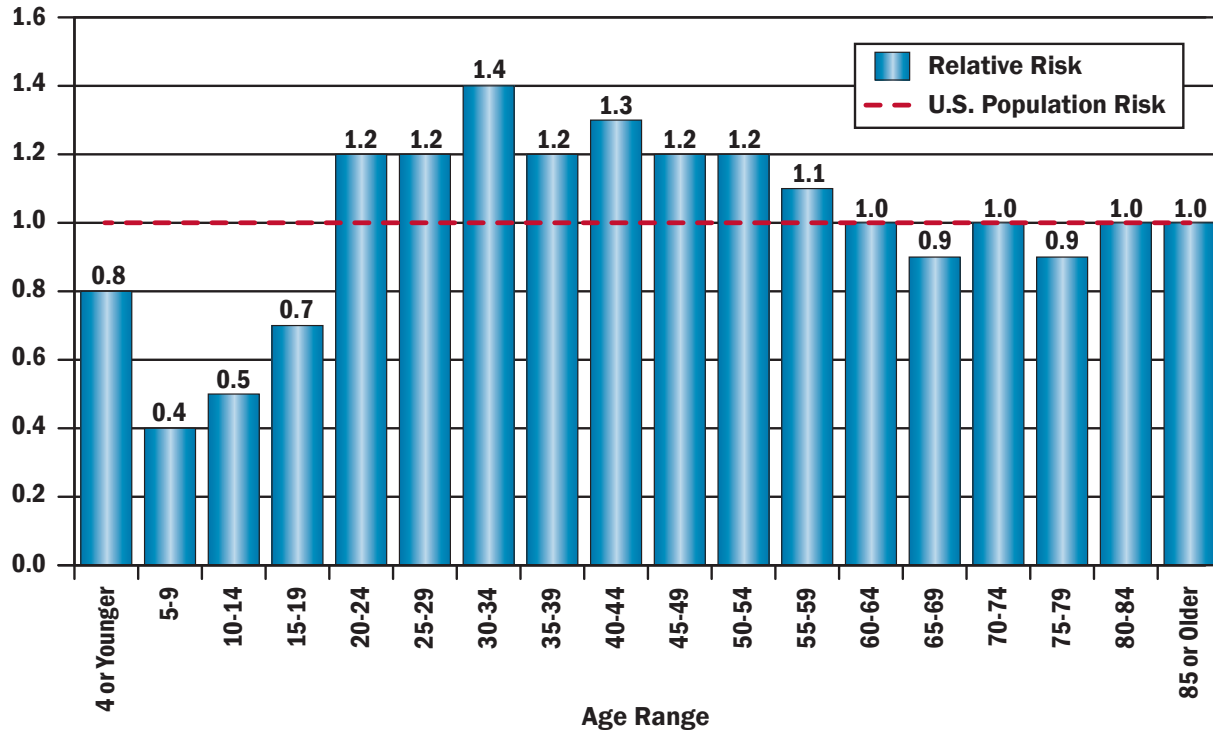Note: Data have been adjusted to account for deaths with unknown age.

Though the risk of death for children from birth to age 14 was below the risk to the population as a whole, some children were more at risk than others. For children age 4 or younger, the risk of fire death was 10 percent less than that of the general population (Figure 2). As children matured and their cognitive and social abilities developed, the risk of fire death dropped sharply. Children between ages 5 and 9 had 50 percent of the risk of fire death of their youngest counterparts; children between 10 and 14 also had almost half that of the 5 to 9 age group. Of the youngest group, African-American and American Indian/Alaska Native children were most threatened. Children in the 4 or younger age group also had a greater relative risk of injury from fire (Figure 3) than their older counterparts. In 2010, 355 children (age 14 or younger) were killed and 2,000 were injured in fires.[7]

After age 14, the risk of fire death began to steadily increase. In 2010, by age 45 the risk of death was above the risk for

the general population, and it continued to increase as the population aged. Although the overall numbers change, these profiles have remained relatively constant from year to year, according to the NCHS and U.S. Census Bureau data.

The age profile of risk for fire injuries was very different from that for deaths (Figure 3), with a much narrower range of risk quotients (0.4 to 1.4 versus 0.2 to 4.6 for fire deaths).[8] This difference is thought to be the result of both cognitive and mobility issues that affect older adults. As a result, these adults were less likely to escape the effects of fire and thus suffer fatal injuries. Middle-aged individuals tended to suffer nonfatal injuries — in 2010, most fire injuries occurred among 20- to 59-year-olds, peaking for the 30- to 34-year-olds (Figure 1). The risk of injury was well below average for children younger than 15 and at or below average for adults older than 59 (Figure 3).

Figure 3. Relative Risk of Fire Injury by Age, 2010

Sources: 2010 NFIRS 5.0 fire injury data, 2010 NFPA fire injury estimates, and U.S. Census Bureau population estimates.
Note: Data have been adjusted to account for injuries with unknown age.

Other Factors That Influence Risk

In the U.S. Fire Administration (USFA) report, Socioeco-
nomic Factors and the Incidence of Fire,"[9] socioeconomic
studies show 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 older adults live alone on meager incomes, often in
substandard housing stock.[10] Closely tied to income is level
of education. Numerous studies, including those associated
with the No Child Left Behind legislation, have demon-
strated that groups living in persistent poverty — that is,
with income levels below the poverty line for long periods
of time — score poorly in educational testing, have higher
high-school dropout rates, and have reduced employment
opportunities. Further, research shows that fire death rates

are higher in states with larger percentages of people who
are African-American, poor and smokers; have less formal
education; and live in rural areas. Many of these states tend
to be in the Southeastern U.S.[11]

Geographic location also has an effect. There was a greater
risk of dying in a fire for people living in the South than for
populations living in other regions (Table 1).[12] This, in part,
may be 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 strate-
gies are more likely to lead to a fire problem. Conversely, the
West had a much lower risk of fire death. This reduction may
be due, in part, to the role of heating (or lack thereof) in fire
deaths, housing stock characteristics, and other factors.

Table 1. Relative Risk of Fire Death by Geographic Area, 2010

Region	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Northeast	55,366,108	488	8.8	0.8
Midwest	66,976,458	799	11.9	1.1
South	114,857,529	1,646	14.3	1.3
West	72,130,124	512	7.1	0.6
U.S. Overall	309,330,219	3,445	11.1	1.0

Sources: 1. 2010 NCHS Mortality Data File, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program.
          2. U.S. Census Bureau, Population Division. July 1, 2010 population estimates from Table 1. Annual Estimates of the Resident Population for the United States, Regions, States and Puerto Rico: April 1, 2010 to July 1, 2011 (NST-EST2011-01), Release date: December 2011.
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 were more likely to die in a fire-related incident than females (Table 2, Table 3 and Table 4). Overall, in 2010, males were 1.5 times more likely to die in fires than females. USFA data from NFIRS also showed that males, overall, were about 1.3 times more likely to suffer injuries than their female counterparts. The reasons for these findings are 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/Alaska Natives had noticeably higher fire death rates per capita than the national average. African-Americans comprised a large and disproportionate share of total fire deaths, accounting for 20 percent of fire deaths in 2010 but only 13 percent of the U.S. population.[13] In 2010, African-Americans had a 50 percent greater risk of dying in a fire than the general population. However, this was down from 80 percent more risk in 2007. For American Indians/Alaska Natives in 2010, the relative risk was also elevated; it was 20 percent higher than the overall risk, but down from 30 percent higher risk in 2007. By contrast, Asian/Pacific Islander Americans were much less likely than the overall population to die in a fire.

Table 2. Relative Risk of Fire Death by Race and Gender, 2010 Overall Population

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Total	309,330,219	3,445	11.1	1.0
Male	152,096,341	2,106	13.8	1.2
Female	157,233,878	1,339	8.5	0.8
White	242,256,518	2,653	11.0	1.0
African-American	40,353,468	694	17.2	1.5
American Indian/Alaska Native	3,754,693	52	13.8	1.2
Asian/Pacific Islander	15,922,304	46	2.9	0.3
White Male	119,878,946	1,637	13.7	1.2
African-American Male	19,259,154	415	21.5	1.9
American Indian/Alaska Native Male	1,897,645	28	14.8	1.3
Asian/Pacific Islander Male	7,603,945	26	3.4	0.3
White Female	122,377,572	1,016	8.3	0.7
African-American Female	21,094,314	279	13.2	1.2
American Indian/Alaska Native Female	1,857,048	24	12.9	1.2
Asian/Pacific Islander Female	8,318,359	20	2.4	0.2

Source: See Notes at the end of the report.

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.

Table 3. Relative Risk of Fire Death by Age, Race and Gender, 2010 Children (Ages 0 to 14)

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
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

Source: See Notes at the end of the report.

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.

Table 4. Relative Risk of Fire Death by Age, Race and Gender, 2010 Older Adults (Age 65 or Older)

Gender/Race	Population	Fire Deaths	Death Rate (per Million Population)	Relative Risk
Total	40,477,304	1,199	29.6	2.7
Male	17,471,907	667	38.2	3.4
Female	23,005,397	532	23.1	2.1
White	34,966,685	965	27.6	2.5
African-American	3,512,217	212	60.4	5.4
American Indian/Alaska Native	235,536	9	38.2	3.4
Asian/Pacific Islander	1,466,824	13	8.9	0.8
White Male	15,223,760	541	35.5	3.2
African-American Male	1,381,440	117	84.7	7.6
American Indian/Alaska Native Male	105,168	4	38.0	3.4
Asian/Pacific Islander Male	634,212	5	7.9	0.7
White Female	19,742,925	424	21.5	1.9
African-American Female	2,130,777	95	44.6	4.0
American Indian/Alaska Native Female	130,368	5	38.4	3.4
Asian/Pacific Islander Female	832,612	8	9.6	0.9

Source: See Notes at the end of the report.

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.

Conclusion

The very old are some of the nation's most vulnerable residents. With an aging population, the U.S. demographic profile is changing rapidly. The older adult population (age 65 or older) is expected to increase from its current 13 percent of the total population to 20 percent by 2040,[14] with an assumed corresponding increase in fire deaths and injuries among older adults. According to U.S. Census Bureau projections, by 2050, the number of individuals age 65 or older is expected to be 88.5 million, more than double the amount in 2010. At the same time, the population age 85 or older is expected to more than triple, increasing from 5.8 million in 2010 to 19.0 million in 2050.[15]

In addition, while the relative risk of death or injury from fire for children under age 15 was lower than the general population, the very young will always remain inherently vulnerable. Physiologically, young children are susceptible to severe injury or death from fire. For example, a young child's skin is quite thin compared to adults and older children. As a result, the very young and very old merit special attention to reduce their risk of injury or death from fire.

Because children and older adults accounted for 45 percent of fire deaths and 24 percent of fire injuries in 2010, the USFA has been working toward the goal of reducing fire deaths and injuries to these populations. A number of resources to help address the fire problem for children and adults are available. 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. For adults, A Fire Safety Campaign for People 50-Plus (http://www.usfa.fema.gov/campaigns/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 website (http://www.usfa.fema.gov) or contact your local fire department.

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

Notes:

Sources for Table 2, Table 3 and Table 4 are the 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:

- 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.

- 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.

- 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.

[1] 2010 NCHS mortality data (deaths) and the 2010 NFPA survey estimates (injuries).

[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. For example, the per capita fire death rate for the total female population is computed from the total number of female fire deaths (1,339) divided by the total female population (157,233,878) multiplied by 1,000,000 people. This rate is equivalent to 8.5 fire deaths per 1 million population.

[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] USFA, "Fire Risk to Older Adults in 2010," Topical Fire Report Series, Volume 14, Issue 9, August 2013.

[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 version 5.0 data and applying the percentage to the NFPA estimate of fire injuries. The count of fire deaths noted in the text is rounded to the nearest five; the fire injury estimate is rounded to the nearest 25.

[7] USFA, "Fire Risk to Children in 2010," Topical Fire Report Series, Volume 14, Issue 8, August 2013. The count of fire deaths noted in the text is rounded to the nearest five.

[8] Estimates of injuries by age are derived from 2010 NFIRS civilian fire casualty age data (version 5.0) in conjunction with 2010 NFPA estimates of overall fire injuries.

[9] USFA, "Socioeconomic Factors and the Incidence of Fire," FA 170, June 1997.

[10] USFA, "Socioeconomic Factors and the Incidence of Fire," FA 170, June 1997.

[11] NFPA, Fire Analysis and Research Division, "Demographic and Other Characteristics Related to Fire Deaths or Injuries," March 2010. http://www.nfpa.org/assets/files/PDF/OS.SocFactors.pdf.

[12] The regions of the U.S. are defined by the U.S. Census Bureau as the:
Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont); **South** (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia); **Midwest** (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin); **West** (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming).

[13] Statistics are based on U.S. Census Bureau population estimates for July 1, 2010.

[14] U.S. Census Bureau, Population Division, Table 3. Percent Distribution of the Projected Population by Selected Age Groups and Sex for the United States: 2010 to 2050 (NP2008-T3). Release date: August 14, 2008. http://www.census.gov/population/projections/data/national/2008/summarytables.html.

[15] U.S. Census Bureau, Population Division, Table 12. Projections of the Population by Age and Sex for the United States: 2010 to 2050 (NP2008-T12). Release date: August 14, 2008. http://www.census.gov/population/projections/data/national/2008/summarytables.html.