Civilian Fire Fatalities in Residential Buildings (2009–2011)

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. Also included are recent examples of fire incidents that demonstrate some of the issues addressed in the report or that put the report topic in context.

Findings

- Ninety-two percent of all civilian fire fatalities in residential buildings suffered from thermal burns and smoke inhalation.
- Bedrooms (53 percent) were the leading specific location where civilian fire fatalities occurred in residential buildings.
- Fifty-one percent of civilian fire fatalities in residential buildings occurred between the hours of 11 p.m. and 7 a.m. This period also accounted for 48 percent of fatal fires in residential buildings.
- Thirty-six percent of fire victims in residential buildings were trying to escape at the time of their deaths; an additional 35 percent were sleeping.
- "Other unintentional, careless" actions (16 percent) and "smoking" (15 percent) were the leading causes of fatal fires in residential buildings.
- Males accounted for 57 percent of civilian fire fatalities in residential buildings; females accounted for 43 percent of the fatalities.
- Forty-five percent of civilian fatalities in residential building fires were between the ages of 40 and 69.
- Thirteen percent of civilian fire fatalities in residential buildings were less than 10 years old.

Fires can strike anywhere — in structures, buildings, automobiles and the outdoors. Fires that affect our homes are often the most tragic and the most preventable. It is a sad fact, but each year over 75 percent of all civilian fatalities occurred as a result of fires in residential buildings — our homes.[1, 2] Between 2009 and 2011, civilian fire fatalities in residential buildings accounted for 82 percent of all fire fatalities. This topical fire report focuses on the characteristics of these fatalities.

Civilian fire fatalities by definition involve people not on active duty with a firefighting organization who die as a result of a fire.[3] These fatalities generally occur when an individual is escaping, sleeping, or is unable to act during a fire.

Annually from 2009 to 2011, an estimated 2,495 civilian fire fatalities resulted from 1,600 fatal fires in residential buildings and an estimated 360,900 residential building fires.[4, 5] Fatal fires are those fires where one or more fatalities occur.

The National Fire Incident Reporting System data are used for the analyses presented throughout the report. For the purpose of this report, the term "residential building fires" is synonymous with "residential fires." "Residential fires" is used throughout the body of this report; the findings, tables, charts, headings and endnotes reflect the full category "fires in residential buildings" or "residential building fires."

Civilian Fire Fatality Rates in Residential Buildings

Not all fires produced fatalities. When civilian fatalities were averaged across all residential fires, the overall fatality rate was nearly 6 civilian fatalities per 1,000 residential fires (Table 1).[6] Residential fires that resulted in fatalities had 1,214 fatalities for every 1,000 fires or slightly more than one fatality per fatal fire. Of the residential fatal fires, 86 percent resulted in one civilian fatality, 10 percent resulted in two civilian fatalities, and 4 percent resulted in three or more civilian fatalities.

Table 1. Fatality Rates for Residential Building Fires per 1,000 Fires (2009–2011)

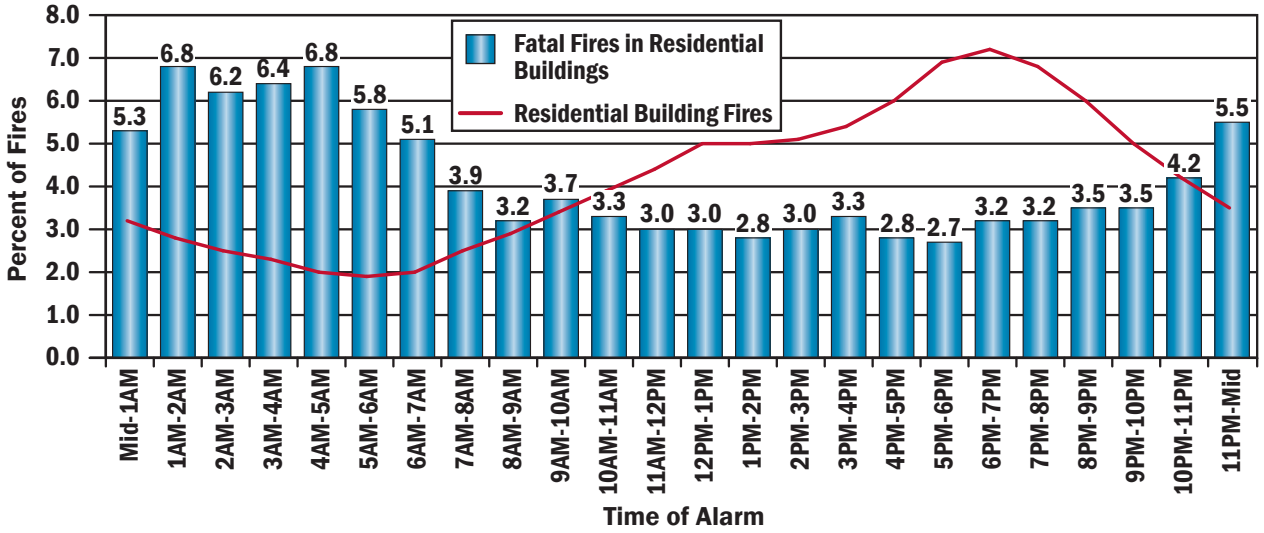
Fatalities per 1,000 Fatal Fires	Fatalities per 1,000 Residential Building Fires
1,213.6	5.5

Source: NFIRS 5.0.

When Fatal Fires in Residential Buildings Occur

As shown in Figure 1, residential fatal fires occurred most frequently late at night or in the very early morning when most people were sleeping, a major factor contributing to the fatality (see Table 2). From 2009 to 2011, fatal fires were highest between 1 to 2 a.m. and 4 to 5 a.m. Fatal fires were most prevalent when overall residential fire incidence was at its lowest, making nighttime fires the most deadly. The 8-hour peak period (11 p.m. to 7 a.m.) accounted for 48 percent of residential fatal fires and 51 percent of fatalities.[7]

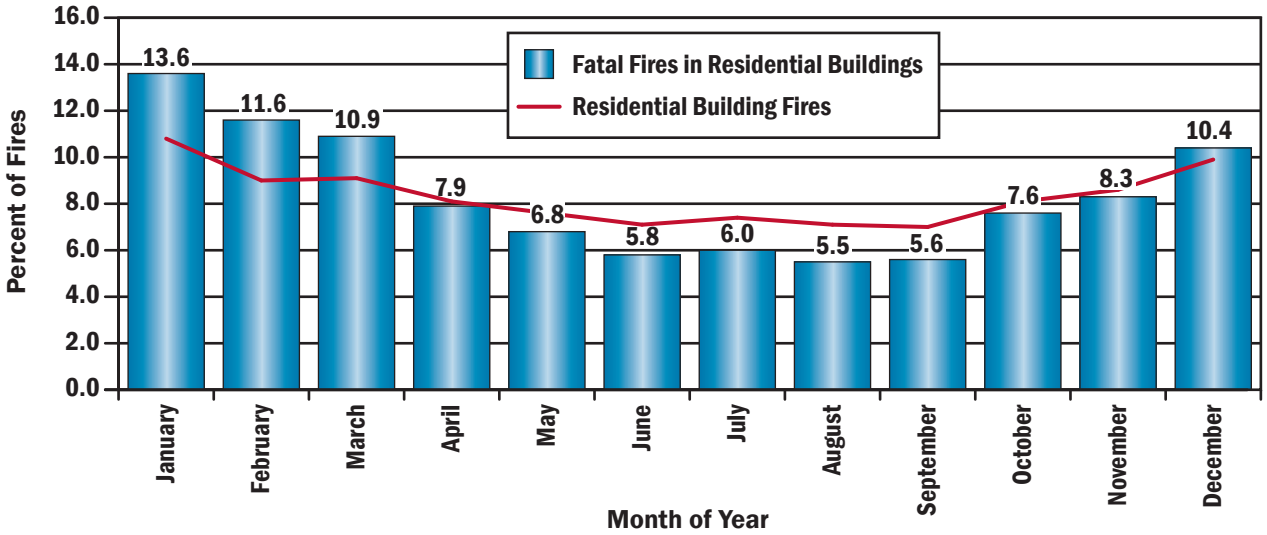
Figure 1. Fatal Fires in Residential Buildings by Time of Alarm (2009–2011)



Source: NFIRS 5.0.
Note: Total does not add up to 100 percent due to rounding.

Residential fatal fires occurred more frequently in the colder months, tracking the overall monthly residential fire incidence (Figure 2). The winter peak occurred during January (14 percent). Residential fatal fires were lowest from June through September (each at 6 percent).

Figure 2. Fatal Fires in Residential Buildings by Month (2009–2011)

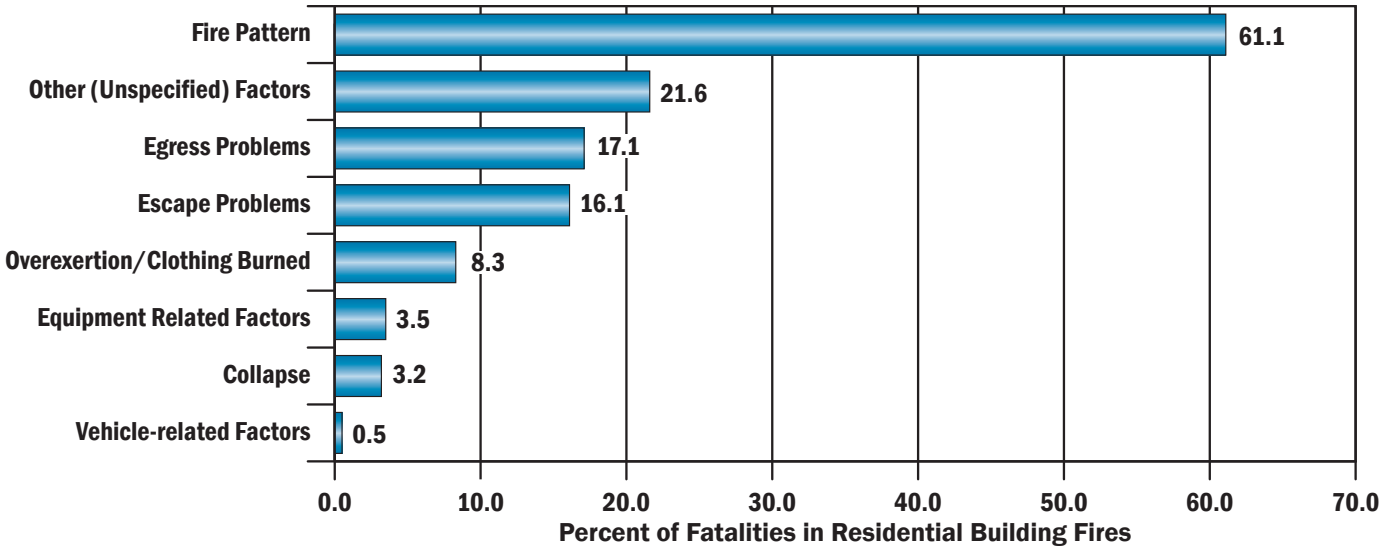


Source: NFIRS 5.0.

Factors Contributing to Civilian Fire Fatalities in Residential Buildings

The most notable factors contributing to the fatalities (outside of "other (unspecified) factors") (Figure 3) were "fire pattern" (61 percent), "egress problems" (17 percent) and "escape problems" (16 percent). Fire pattern factors involve situations where exits are blocked by smoke and flame, vision is blocked or impaired by smoke, and civilians are trapped above or below the fire. Egress problems include such factors as crowded situations, limited exits, locked exits or other exit problems, and mechanical obstacles to the exit. Escape factors include unfamiliarity with exits, excessive travel distance to the nearest clear exit, choice of an inappropriate exit route, re-entering the building, and clothing catching on fire while escaping.

Figure 3. Factors Contributing to Civilian Fire Fatalities in Residential Buildings (2009–2011)



Source: NFIRS 5.0.
Notes: 1. Includes incidents where factors contributing to the fatality were specified.
2. As multiple factors contributing to fatalities may be noted for each fatality, the total sums to more than 100 percent.

Human Factors Contributing to Civilian Fire Fatalities

Human factors played an important role in residential fire fatalities. The leading human factor contributing to fatalities was being "asleep" (45 percent). This finding was not unexpected as the largest numbers of fatalities occurred between 11 p.m. to 7 a.m.

"Physical disability" was the second leading human factor contributing to fatalities (27 percent). This was followed by "possibly impaired by alcohol" and "unconscious" at 20 percent and 9 percent, respectively.

Table 2. Human Factors Contributing to Civilian Fire Fatalities in Residential Buildings (2009–2011)

Human Factors Contributing to Fatality	Percent of Fire Fatalities in Residential Buildings (Unknowns Apportioned)
Asleep	45.2
Physical disability	27.1
Possibly impaired by alcohol	19.5
Unconscious	9.0
Possibly impaired by other drug or chemical	8.1
Possible intellectual disability	8.1
Unattended or unsupervised person	7.1
Physically restrained	1.5

Source: NFIRS 5.0.
Notes: 1. Includes only incidents where human factors that contributed to the fatality were specified.
2. Multiple human factors contributing to the fire fatality may be noted for each incident; total will exceed 100 percent.

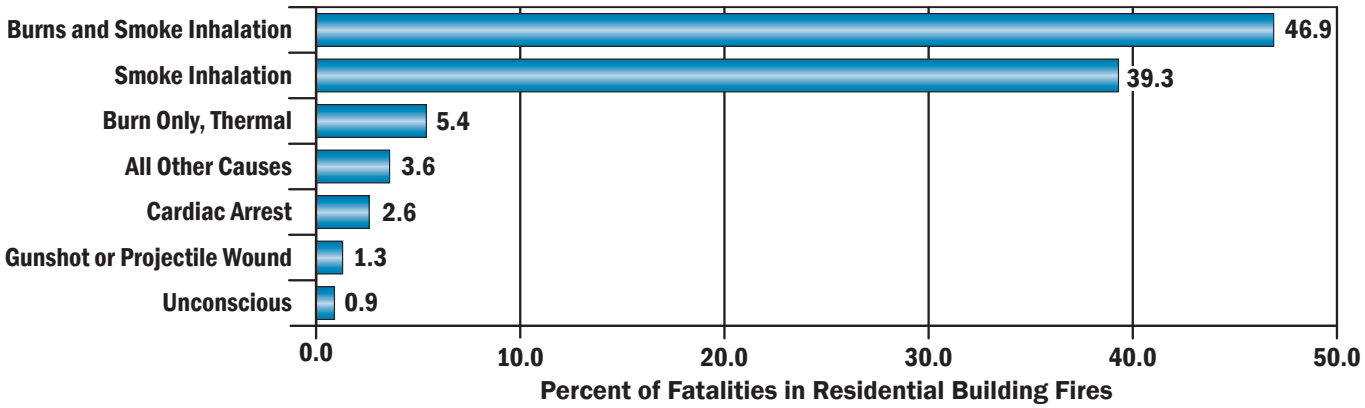
Primary Symptoms of Civilian Fire Fatalities

Ninety-two percent of all fatalities in residential fires suffered from thermal burns and smoke inhalation. Burns and smoke inhalation combined made up 47 percent of the fatalities. Smoke inhalation by itself accounted for 39 percent of residential fire fatalities and thermal burns (as opposed to scalds or chemical or electrical burns) alone accounted for 5 percent of fatalities (Figure 4).[8] Cardiac arrests accounted for only 3 percent of fatalities.

Thermal burns are caused by contact with flames, hot liquids, hot surfaces and other sources of high heat. Eighty-four percent of thermal burn fatalities were the result of thermal burns on multiple body parts.

Smoke inhalation affects the internal organs, specifically the lungs and airways within the body. It results from breathing smoke that contains harmful gases and small particles that are present in the air during a fire. These gases and particles include chemicals or toxins which can lead to inflammation and blockage of the airway.[9]

Figure 4. Primary Symptoms of Civilian Fire Fatalities in Residential Buildings (2009–2011)

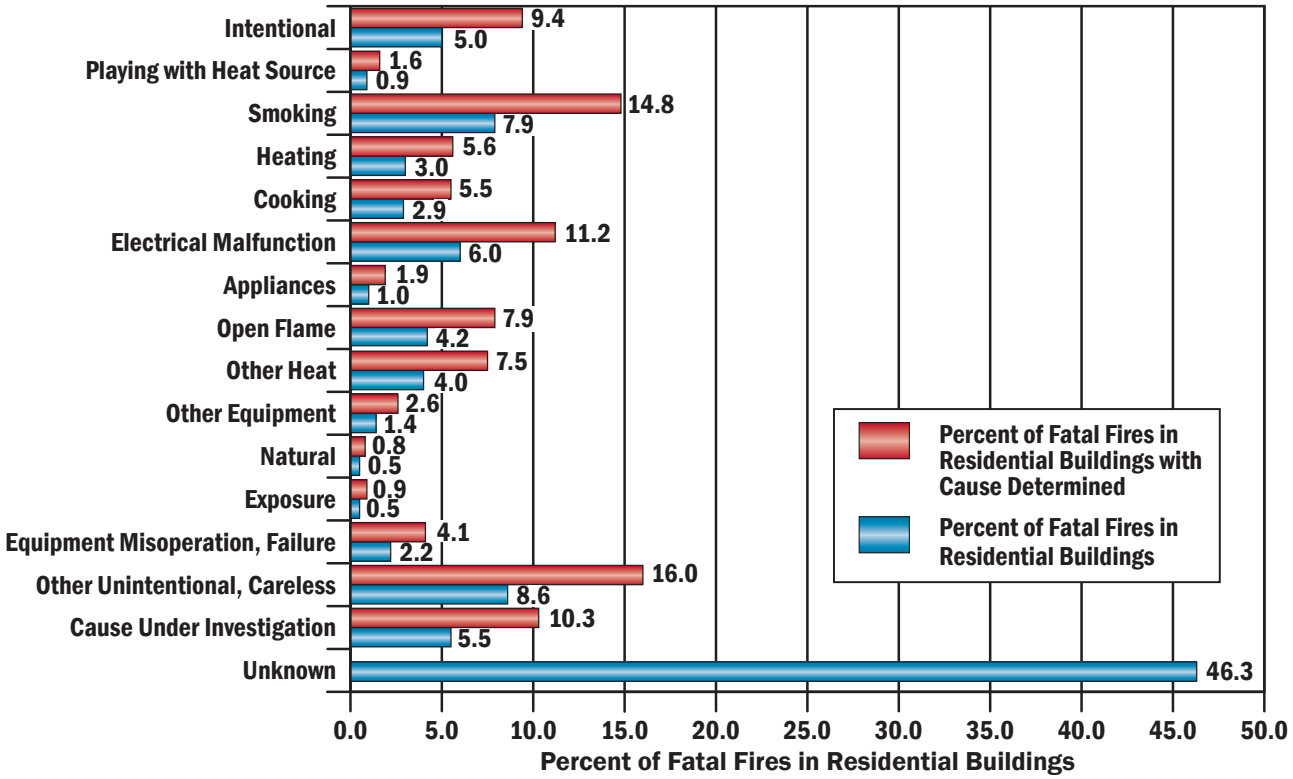


Source: NFIRS 5.0.
Note: Percentages computed only for those fatalities where symptoms were noted.

Causes of Fatal Fires in Residential Buildings

"Other unintentional, careless" actions (16 percent) and "smoking" (15 percent) were the leading causes of residential fires that resulted in fatalities — fatal fires.[10] These two fire causes accounted for 31 percent of all residential fatal fires. "Other unintentional, careless" actions include misuse of materials or products, abandoned or discarded materials or products, and heat source too close to combustibles. The next leading cause, "electrical malfunction," accounted for an additional 11 percent of residential fatal fires as shown in Figure 5.[11] The cause of the fire was "unknown" in 46 percent of fatal fires.

Figure 5. Causes of Fatal Fires in Residential Buildings (2009–2011)

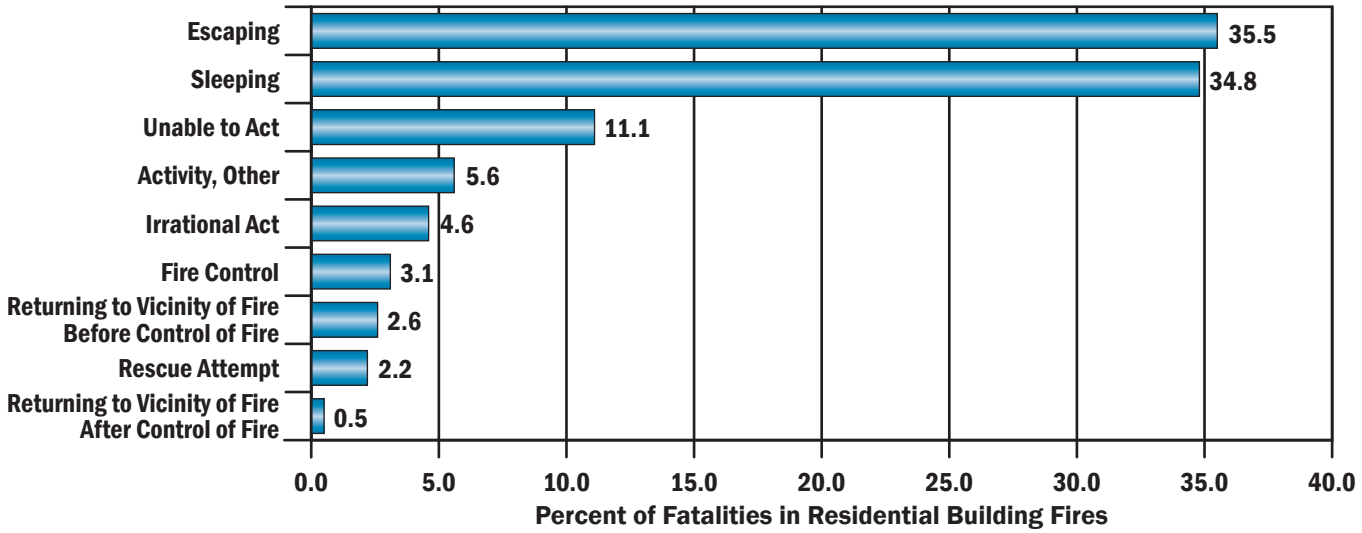


Source: NFIRS 5.0.
Notes: 1. Totals do not add up to 100 percent due to rounding.
2. Causes are listed in order of the U.S. Fire Administration Structure Fire Cause Hierarchy for ease of comparison of fire causes across different aspects of the fire problem. Fires are assigned to one of 16 cause groupings using a hierarchy of definitions, approximately as shown in the chart above. A fire is included in the highest category into which it fits. If it does not fit the top category, then the second one is considered, and if not that one, the third and so on. For example, if the fire is judged to be intentionally set and a match was used to ignite it, it is classified as intentional and not open flame because intentional is higher in the hierarchy.

Civilian Activity Prior to Death

Most civilian fire fatalities occurred when the victim was attempting to escape (36 percent) or sleeping (35 percent) as shown in Figure 6. To escape a fire, many civilians make the mistake of fleeing through the area where the fire is located. The area of a fire has tremendous heat, smoke, and a toxic atmosphere that can render a person unconscious. As a result, it is imperative that an escape plan be prepared and practiced. With a well-thought-out plan and multiple escape options, the chances of survival and escaping greatly increase. In addition, it has been proven that people cannot wake up from the smell of fire while sleeping. Therefore, it is also vital that smoke alarms are installed in homes to alert sleeping people to the presence of fire.[12]

Figure 6. Civilian Activity Prior to Death in Residential Building Fires (2009–2011)



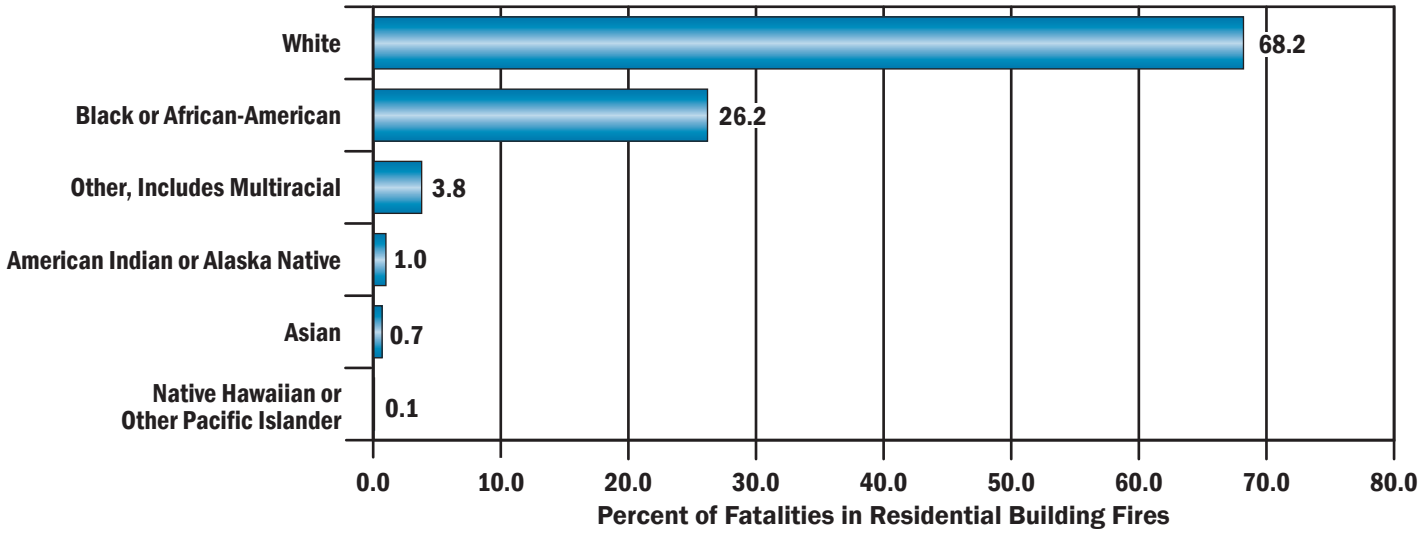
Source: NFIRS 5.0.
Note: Percentages computed for only those fatalities where activity information was available.

Gender, Race and Ethnicity of Civilian Fire Fatalities

Males accounted for 57 percent of residential fire fatalities; females accounted for 43 percent of fire fatalities. Where racial information was provided, whites constituted 68 percent of the fatalities followed by blacks or African-Americans (26 percent). All other races accounted for 6 percent of fire fatalities (Figure 7). Race was not specified for 37 percent of the fatalities.

Where ethnicity data were provided, 91 percent of civilian fatalities were non-Hispanic or non-Latino. The remaining 9 percent were Hispanic or Latino. Ethnicity was not specified for 57 percent of the fatalities.

Figure 7. Civilian Fire Fatalities in Residential Buildings by Race (2009–2011)



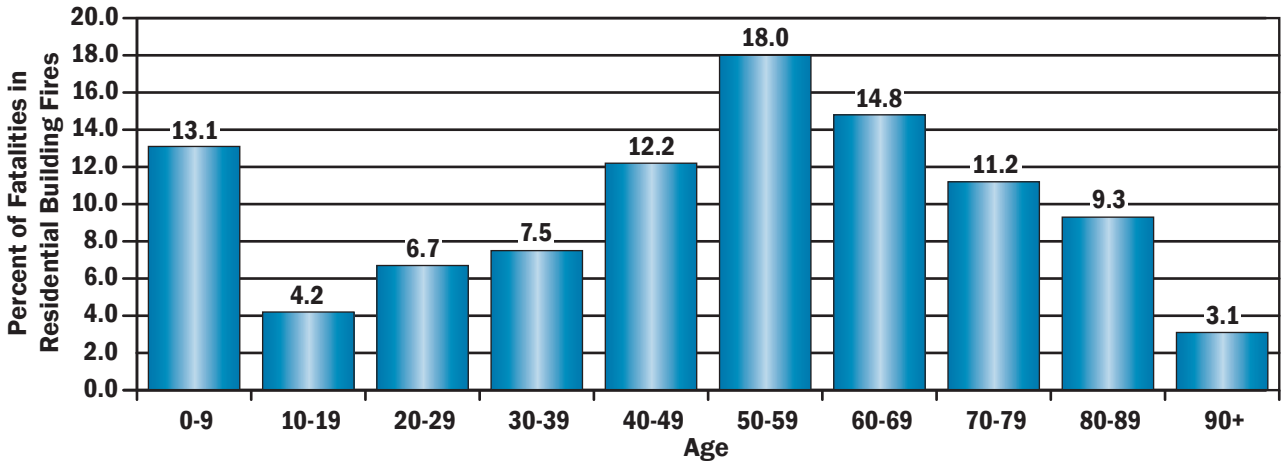
Source: NFIRS 5.0.
Note: Percentages computed for only those fatalities where race information was available.

Age and Activity Prior to Death

Forty-five percent of civilian fatalities in residential fires were between the ages of 40 and 69 (Figure 8). Thirteen percent of fatalities were less than 10 years old. Adults age 70 and over accounted for 24 percent of fatalities.

Where the information was reported, at the time of death, escaping (36 percent) and sleeping (35 percent) were the two leading activities that resulted in fatalities. Children aged 0 to 9 were primarily sleeping (48 percent) over trying to escape (26 percent). Those aged 10 to 49 were also more likely to be sleeping at the time of their deaths. Those aged 50 and over were more likely trying to escape at the time of their deaths as opposed to sleeping (Table 3). Overall, activity at the time of the fatal injury was reported for 34 percent of the fatalities.

Figure 8. Civilian Fire Fatalities in Residential Buildings by Age (2009–2011)



Source: NFIRS 5.0.
Notes: 1. Total does not add up to 100 percent due to rounding.
2. Percentages computed only for those fatalities where age was valid.

Table 3: Leading Activities Resulting in Civilian Fire Fatalities in Residential Buildings by Age Group (Percent of Fatalities Where Age and Activity Reported, 2009–2011)

Age Group	Escaping	Sleeping
0-9	26.0	48.4
10-19	35.6	45.2
20-29	35.2	40.0
30-39	28.4	33.3
40-49	33.1	36.1
50-59	37.6	33.9
60-69	38.5	26.3
70-79	41.0	29.2
80-89	40.0	23.7
90+	47.4	39.5
Overall	35.5	34.8

Source: NFIRS 5.0.
Note: Percentages computed only for those fatalities where age was valid and activity was reported.

Specific Location of Fire Fatality

Bedrooms (53 percent) were the leading specific location where civilian fire fatalities occurred in residential buildings. Common rooms such as dens, family rooms, living rooms, or lounges (9 percent); bathrooms and lavatories (8 percent); other functional areas (7 percent); and kitchens and cooking areas (5 percent) accounted for an additional 29 percent.

While not specific rooms in the home, egress areas accounted for 10 percent of fatalities. Exits such as corridors, stairways and doors can get filled with smoke, fire, or extreme heat, making escape routes treacherous.

Examples

The following recent examples illustrate fire scenarios in which civilian fatalities have occurred:

—January 2013: A 78-year-old man died in an early morning house fire in South Roxana, Ill. When firefighters arrived on scene of the two-alarm fire, they found a fully involved structure fire. After the flames were put out, the victim, who lived alone, was found in the back part of the house and in the area of a wood stove. The man reportedly may have been using the wood stove to help heat the home.[13]

—January 2013: Investigators with the Kentucky State Fire Marshal's Office believe that a space heater that was too close to combustible materials in the living room started a Pike County, Ky., house fire that killed a 39-year-old father and his four children whose ages ranged from 6 months to 5 years. All five victims were found on the mattress pad they were sleeping on in the living room. The children's mother was able to make it out of the house but was admitted to the hospital for treatment of severe burns. The home reportedly did not have working smoke alarms.[14]

—January 2013: Rockdale County officials determined that a boy playing with a lighter started a Conyers, Ga., duplex fire that killed four of his siblings and left his mother badly burned. The fire started near a second-floor bathroom, and the home had one non-working smoke alarm on the first floor. The ages of the four children who died ranged from 8 months to 9 years. The 6-year-old boy who started the fire survived after being thrown by his mother from a second-story window. A grandmother was also inside the house at the time of the fire but survived.[15]

—January 2013: A mother, 52, and daughter, 28, died following an early morning house fire on the north side of Akron, Ohio. Firefighters made an aggressive attack to quickly extinguish the blaze and found the two victims in the bedrooms of the home. While the cause was being investigated, it was determined that the fire started on the first floor of the home and spread to the basement and the second floor. In addition, no working smoke alarms were found inside the home. Damages to the home were estimated at $40,000 with an additional $20,000 in contents.[16]

Escape Planning for Residential Buildings

Everyone should know how to escape from his or her residence. The U.S. Fire Administration recommends leaving fighting a fire to trained firefighters. Instead, efforts should be focused on following a preset escape plan.

A home filled with smoke is a very dangerous situation. Smoke blocks vision, and the toxic gases can cause dizziness, disorientation and ultimately death. Under these conditions, one can easily become lost or trapped in the home. Unfamiliarity with exits, excessive distance to the nearest exit, or an inappropriate choice of exit can hinder a crucial escape. Many civilian fatalities occur as the victim is trying to escape. With a well-thought-out plan and multiple escape options, your chances of survival greatly increase.

The first step in an escape plan is to make sure smoke alarms are installed on every level of the home and are in good working order. Plan and practice at least two escape routes for every room and have procedures in place for those who require additional help such as infants, older adults and individuals with disabilities. For more information on preparing and practicing a fire escape plan, visit http://www.usfa.fema.gov/campaigns/smokealarms/escapeplans/index.shtm.

NFIRS Data Specifications for Civilian Fire Fatalities in Residential Buildings

Data for this report were extracted from the NFIRS annual Public Data Release files for 2009, 2010 and 2011. Only version 5.0 data were extracted.

Civilian fatalities in residential building fires were defined using the following criteria:

—Aid Types 3 (mutual aid given) and 4 (automatic aid given) are excluded to avoid double counting of incidents.

—Incident Types 111 to 123 (excluding Incident Type 112):

Incident Type	Description
111	Building fire
113	Cooking fire, confined to container
114	Chimney or flue fire, confined to chimney or flue
115	Incinerator overload or malfunction, fire confined
116	Fuel burner/boiler malfunction, fire confined
117	Commercial compactor fire, confined to rubbish
118	Trash or rubbish fire, contained
120	Fire in mobile property used as a fixed structure, other
121	Fire in mobile home used as fixed residence
122	Fire in motor home, camper, recreational vehicle
123	Fire in portable building, fixed location

Note: Incident Types 113 to 118 do not specify if the structure is a building.

—Property Use series 400 which consists of the following:

Property Use	Description
400	Residential, other
419	One- or two-family dwelling
429	Multifamily dwelling
439	Boarding/Rooming house, residential hotels
449	Hotel/Motel, commercial
459	Residential board and care
460	Dormitory-type residence, other
462	Sorority house, fraternity house
464	Barracks, dormitory

—Structure Type:

—For Incident Types 113-118:

1—Enclosed building.

2—Fixed portable or mobile structure, and

Structure Type not specified (null entry).

—For Incident Types 111 and 120-123:

1—Enclosed building.

2—Fixed portable or mobile structure.

—Civilian casualty severity: 5 (death).

—Other civilian deaths: greater than 0.

The analyses contained in this report reflect the current methodologies used by the USFA. The USFA is committed to providing the best and most current information on the U.S. fire problem, continually examining its data and methodology to fulfill this goal. Because of this commitment, data collection strategies and methodological changes are possible and do occur. As a result, analyses and estimates of the fire problem may change slightly over time. Previous analyses and estimates on specific issues (or similar issues) may have used different methodologies or data definitions and may not be directly comparable to the current ones.

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

Notes:

[1] In NFIRS 5.0, a structure is a constructed item of which a building is one type. The term "residential structure" commonly refers to buildings where people live. The definition of a residential structure fire has, therefore, changed to include only those fires where the NFIRS 5.0 structure type is 1 or 2 (enclosed building and fixed portable or mobile structure) with a residential property use. Such fires are referred to as "residential buildings" to distinguish these buildings from other structures on residential properties that may include fences, sheds, and other uninhabitable structures. Confined fire incidents without a structure type specified are presumed to be buildings. Nonconfined fire incidents without a structure type specified are considered to be invalid incidents (structure type is a required field) and are not included.

[2] This is based on analysis of residential building fire deaths since 2003, the first year that residential building estimates are available, (http://www.usfa.fema.gov/statistics/estimates/index.shtm) and the National Fire Protection Association annual estimate of fire deaths. (http://www.nfpa.org/itemDetail.asp?categoryID=953&itemID=23033&URL=Research/Fire%20statistics/The%20U.S.%20fire%20problem). The consistency of the percentage of residential building fire deaths leads analysts to believe this proportion has most likely been stable for some time.

[3] Civilians also include emergency personnel who are not members of the fire department, such as police officers or utility workers.

[4] NFIRS 5.0 contains both converted NFIRS 4.1 data and native NFIRS 5.0 data. This topical report includes only native 5.0 data and excludes Incident Type 110 since it is a 4.1 conversion code.

[5] National estimates are based on 2009–2011 native version 5.0 data from NFIRS, residential structure fire loss estimates from the NFPA's annual surveys of fire loss, and the USFA's residential building fire loss estimates: http://www.usfa.fema.gov/statistics/estimates/index.shtm. Fires are rounded to the nearest 100 and deaths to the nearest 5.

[6] The average fire fatality rates computed from the national estimates do not agree with average fire fatality rates computed from NFIRS data alone. The fire fatality rate for fatal fires computed from the national estimates is (1,000*(2,495/1,600)) = 1,559.4 deaths per 1,000 fatal fires in residential buildings. The fire fatality rate for all residential fires computed from the national estimates is (1,000*(2,495/360,900)) = 6.9 deaths per 1,000 residential building fires.

[7] For the purposes of this report, the time of the fire alarm is used as an approximation for the general time the fire started. However, in NFIRS, it is the time the fire was reported to the fire department.

[8] Total does not add up to 92 percent due to rounding.

[9] David S. Caldwell, "Smoke Inhalation and Your Body." ezinearticles.com. http://ezinearticles.com/?Smoke-Inhalation-and-Your-Body&id=4807600.

[10] A large percentage of residential fatal fire incidents reported to NFIRS (46 percent) did not have sufficient information to determine the cause of the fire. The cause analysis reflects only the 54 percent of incidents where enough information and detail were reported to determine the cause of the fatal fire.

[11] The USFA Structure Fire Cause Methodology was used to determine the cause of fatal residential building fires: http://www.usfa.fema.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.

[12] Brown University, "Scents Will Not Rouse Us From Slumber, Says New Brown University Study," *Science Daily*, May 2004, (Providence, RI) http://www.sciencedaily.com/releases/2004/05/040518075747.htm.

[13] Chris Regnier, "South Roxana Fire Victim Identified," www.fox2now.com, January 14, 2013, http://fox2now.com/2013/01/14/fire-destroys-south-roxana-home/ (accessed January 15, 2013).

[14] "Heater Caused House Fire that Killed Father and Four Children," www.wsaz.com, January 14, 2013, http://www.wsaz.com/news/headlines/BREAKING-NEWS--Five-Killed-in-House-Fire-186155261.html (accessed January 15, 2013).

[15] "Playing With Lighter, Child Starts House Fire: Four Dead," www.wctv.tv, January 11, 2013, http://www.wctv.tv/home/headlines/Child-Started-Fire-That-Killed-Four-of-His-Siblings-186202111.html (accessed January 15, 2013).

[16] Cedra Mayfield, "Police: Mother, Daughter Killed in Akron House Fire," www.newsnet5.com, January 10, 2013, http://www.newsnet5.com/dpp/news/local_news/akron_canton_news/2-people-rushed-from-burning-akron-home (accessed January 15, 2013).