

Multiple-Fatality Fires in Residential Buildings

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

- Each year, 250 fires in residential buildings result in multiple fatalities.
- Multiple-fatality fires in residential buildings that result in five or more deaths are few and represent approximately 3 percent of multiple-fatality fires in residential buildings.
- Electrical fires and unintentional or careless fires were the leading causes of multiple-fatality fires in residential buildings.
- Eighty-one percent of multiple-fatality fires in residential buildings occurred in one- and two-family dwellings.
- Thirty-six percent of multiple-fatality fires in residential buildings occurred in December, January, and February.
- The incidence of multiple-fatality fires in residential buildings peaks between 3 a.m. and 5 a.m. This period accounts for 21 percent of these fires.

Between 2004 and 2006, an average of 250 fires in residential buildings each year resulted in two or more civilian fire deaths.^{1,2,3} These multiple-fatality fires were responsible for an estimated 825 deaths, 200 injuries, and \$33 million in fire loss on an annual basis.⁴ Multiple-fatality fires in residential buildings are rare, but tragic, occurrences. Less than one-tenth of a percent (0.1 percent) of all fires in residential buildings result in multiple fatalities. Nonetheless, they account for 29 percent of all fatalities in residential buildings and 70 percent of all multiple-fatality fires in the United States. This topical report focuses on multiple-fatality fires in residential buildings that are reported to the National Fire Incident Reporting System (NFIRS) using the standard fire reporting modules, and examines the causes and basic characteristics of these multiple-fatality fires.

One of the challenges in the analysis of NFIRS fire incident data where fatalities are reported is the large number of unknown, undetermined, or unavailable entries reported. For example, in the analysis of fire cause, the undetermined entries comprise 47 percent of the data, making it difficult to establish concrete conclusions.

Loss Measures

Table 1 presents fire loss rates, averaged over this 3-year period, for fatal residential building fires. Approximately 2-1/2 times as many deaths and injuries per fire occur in multiple-fatality fires than in single-fatality fires in residential buildings. The average loss per fire in a multiple-fatality fire is substantially higher as well.

**Table 1. Loss Measures for Fatal Residential Building Fires
(NFIRS 3-year average, 2004–2006)**

Measure	Multiple-Fatality Residential Building Fires	Single-Fatality Residential Building Fires	All Fatal Residential Building Fires
Average Loss:			
Fatalities per fire	2.51	1.00	1.21
Injuries per fire	.69	.27	.33
Dollar loss per fire	\$101,210	\$69,396	\$73,905

Source: NFIRS 5.0

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As Table 2 shows, two-thirds (67 percent) of multiple-fatality fires in residential buildings involved 2 fatalities; 88 percent of these multiple-fatality fires result in 3 or fewer

fatalities. Multiple-fatality fires in residential buildings that result in five or more deaths are few and represent 3 percent of multiple-fatality fires in residential buildings.

Table 2. Deaths per Fire in Multiple-Fatality Residential Building Fires (NFIRS, 2004-2006)

Deaths per Fire	Percent of Multiple-Fatality Residential Building Fires
2	67.1
3	20.6
4	9.4
5 or more	2.9
Total	100.0

Source: NFIRS 5.0

417 incidents

Note: Total may not add to 100 percent due to rounding.

Property Type

One- or two-family dwellings account for 81 percent of multiple-fatality residential building fires; multifamily dwellings such as those on apartment, townhouse, condominium, and tenement properties account for 16 percent of these multiple-fatality fires. The remaining residential properties

(boarding/rooming houses, residential hotels, hotels and motels, residential board and care, and dormitories and other group housing) account for less than 5 percent of multiple-fatality fires. This distribution of fatal fires is very similar to that of single-fatality fires as shown in Table 3.

Table 3. Property Use for Multiple- and Single-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)

Property	Percent of Multiple-Fatality Residential Building Fires	Percent of Single-Fatality Residential Building Fires
One- or two-family dwelling	80.6	78.1
Multifamily dwelling	15.8	16.6
Other residential properties	3.6	5.3
Total	100.0	100.0

Source: NFIRS 5.0

417 multiple-fatality fire incidents

2,524 single-fatality fire incidents

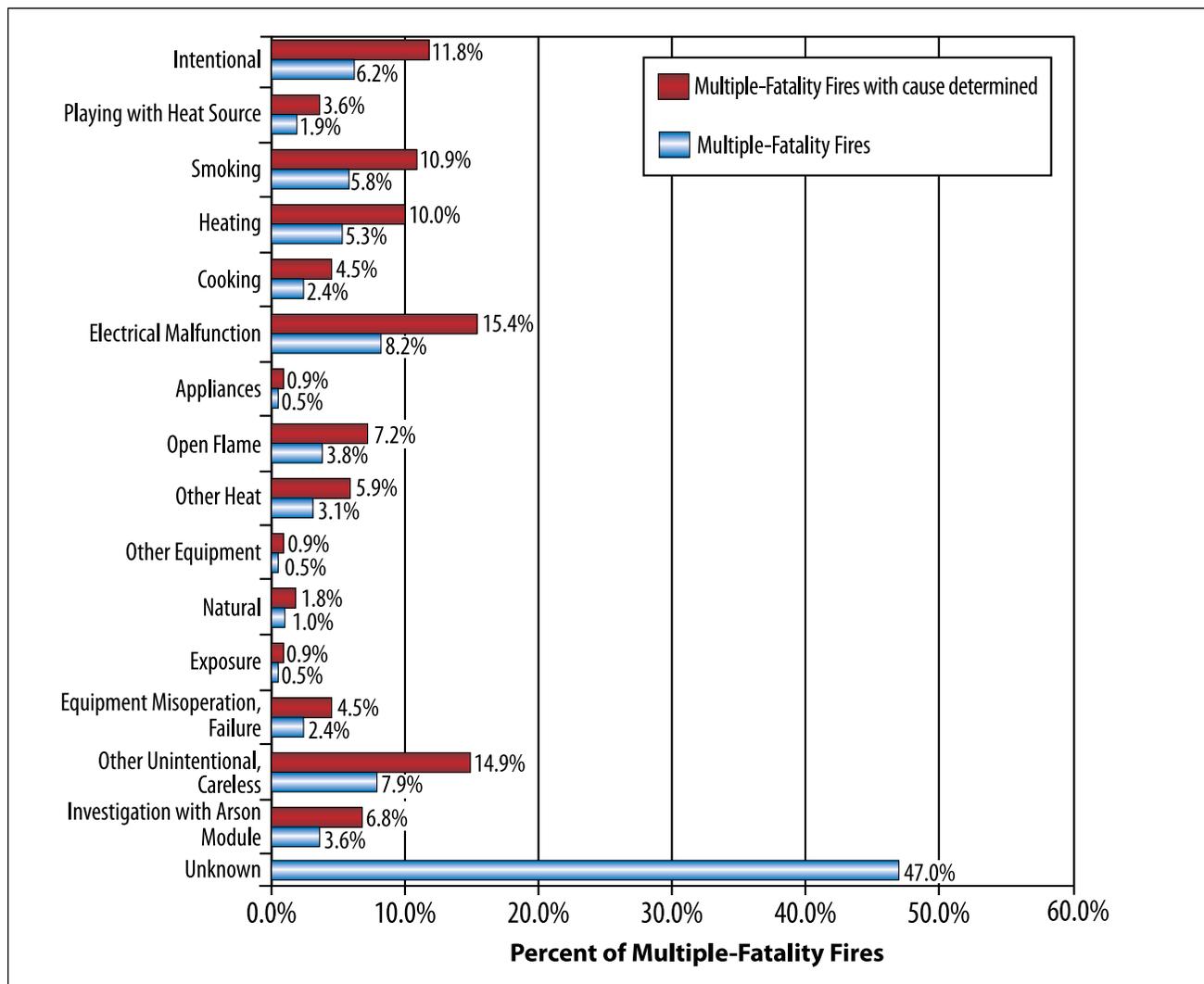
Note: Total may not add to 100 percent due to rounding.

Causes

The leading causes of multiple-fatality fires in residential buildings are electrical malfunction (15 percent) and unintentional/careless actions (15 percent) (Figure 1).

Fires caused intentionally (12 percent) or by smoking (11 percent) also rank high among the list of causes of multiple-fatality fires.⁵ A large number of causes remain unknown (47 percent), which illustrates the need for further investigation and documentation at the time a fire occurs.

Figure 1. Causes of Multiple-Fatality Fires: Raw and Adjusted Percentages of Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)



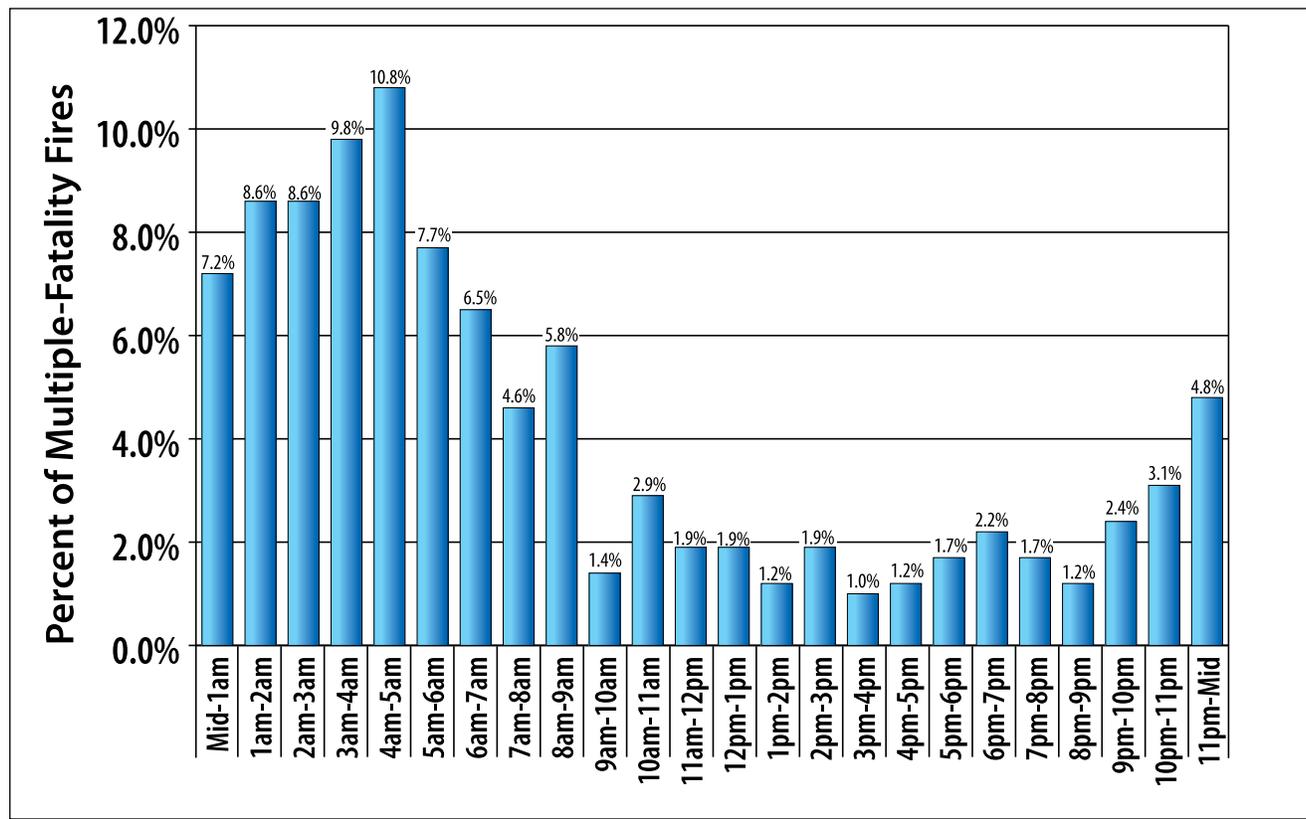
Source: NFIRS 5.0
 417 total incidents
 196 incidents with cause undetermined

When Fires Occur

Figure 2 shows the incidence of multiple-fatality fires in residential buildings by time of day for 2004 to 2006. Most multiple-fatality fires occur in the early hours of the morning, and peak between 3 a.m. and 5 a.m.—intentional and

electrical fires are the leading causes of these multiple-fatality fires. Approximately 53 percent of multiple-fatality fires occur between midnight and 6 a.m. with 21 percent occurring during the peak hours. Multiple-fatality fires are least likely to occur in the late afternoon, between 3 p.m. and 4 p.m.

Figure 2. Time of Day for Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)

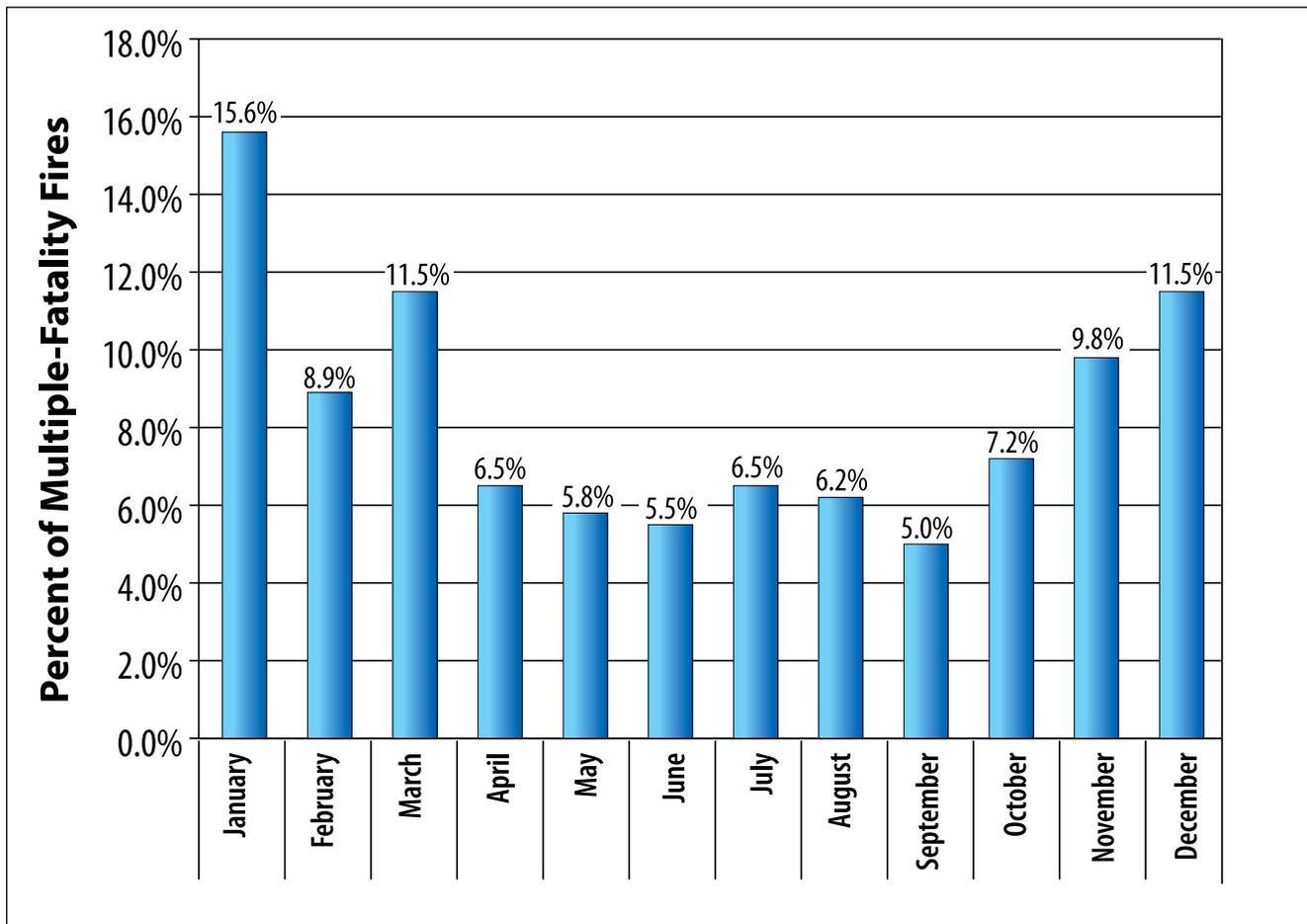


Source: NFIRS 5.0
417 incidents

Figure 3 illustrates the months of the year in which multiple-fatality fires occur in residential buildings. Fifty-seven percent of multiple-fatality fires occur in the cool weather months of November through March. Additionally, the number of deaths occurring in each month is proportional to the number of fires occurring in each month of the year.

While the majority of multiple-fatality fires in residential buildings occur in cool weather months, heating is not the leading cause of these fires. The leading cause is other unintentional or careless actions (20 percent) with electrical malfunction (16 percent) and heating (14 percent) as the second and third leading causes.

Figure 3. Month of Year for Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)



Source: NFIRS 5.0
417 incidents

Where Multiple-Fatality Fires Start

Table 4 illustrates that 26 percent of multiple-fatality residential building fires start in a common room, living room, den, family room, or lounge, with bedrooms as the second most common site of origin (20 percent). These same areas are the leading areas of fire origin for single-fatality

fires, but with bedrooms as the leading area of origin (28 percent) and common rooms second (22 percent). This is due primarily to the importance of smoking as a cause in single-fatality fires as typically fatal smoking fires originate in bedrooms and common areas.

Table 4. Area of Origin for Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)

Area of Origin	Percent of Multiple-Fatality Fires With Area of Origin Determined
Common room, den, family room, living room, lounge	26.1
Bedrooms	20.1
Cooking area, kitchen	12.6
Other unspecified room or area	10.2
Unspecified structural areas	4.5
All other areas of origin	26.4
Total	100.0

Source: NFIRS 5.0

417 incidents

84 incidents with area of origin undetermined

Notes: Total may not add to 100 percent due to rounding.

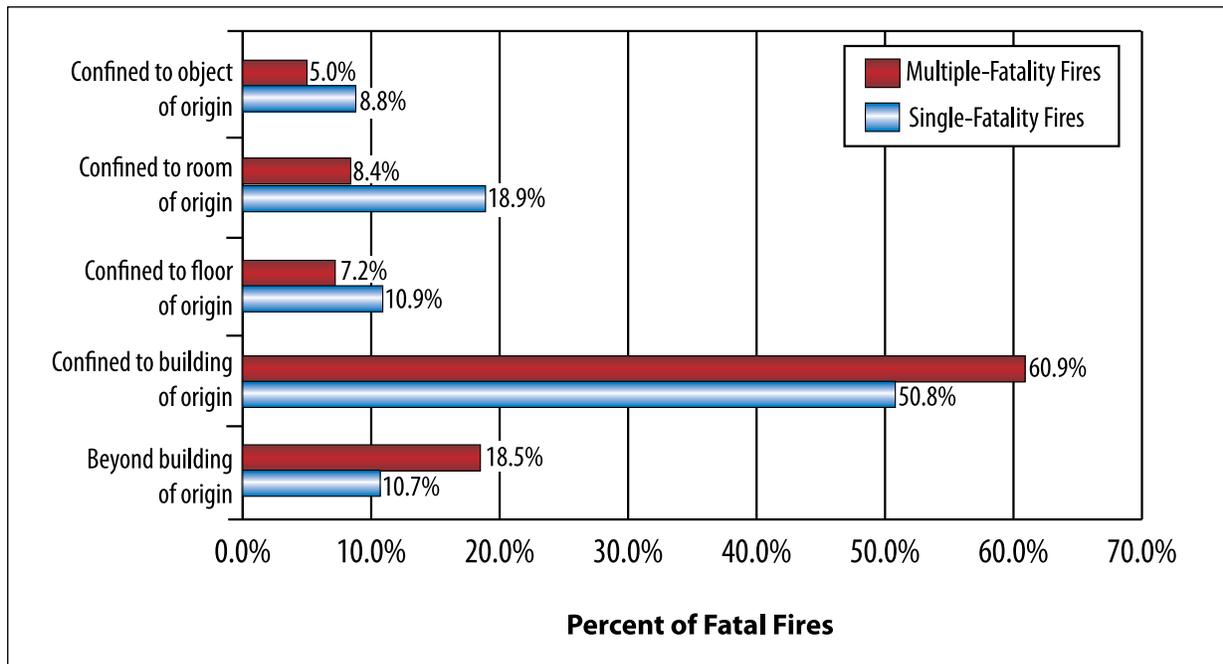
Bedrooms include both those with fewer than five occupants and those with five or more occupants.

Fire Spread

Analysis of flame spread illustrated that flames spread farther in multiple-fatality fires than in single-fatality fires in residential buildings. Seventy-nine percent of multiple-

fatality residential fires are confined to the building or spread beyond the building of origin. In single-fatality fires in residential buildings, these large fires represent 62 percent of fatal fires (Figure 4).

Figure 4. Fire Spread in Multiple- and Single-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)



Source: NFIRS 5.0

417 multiple-fatality fire incidents

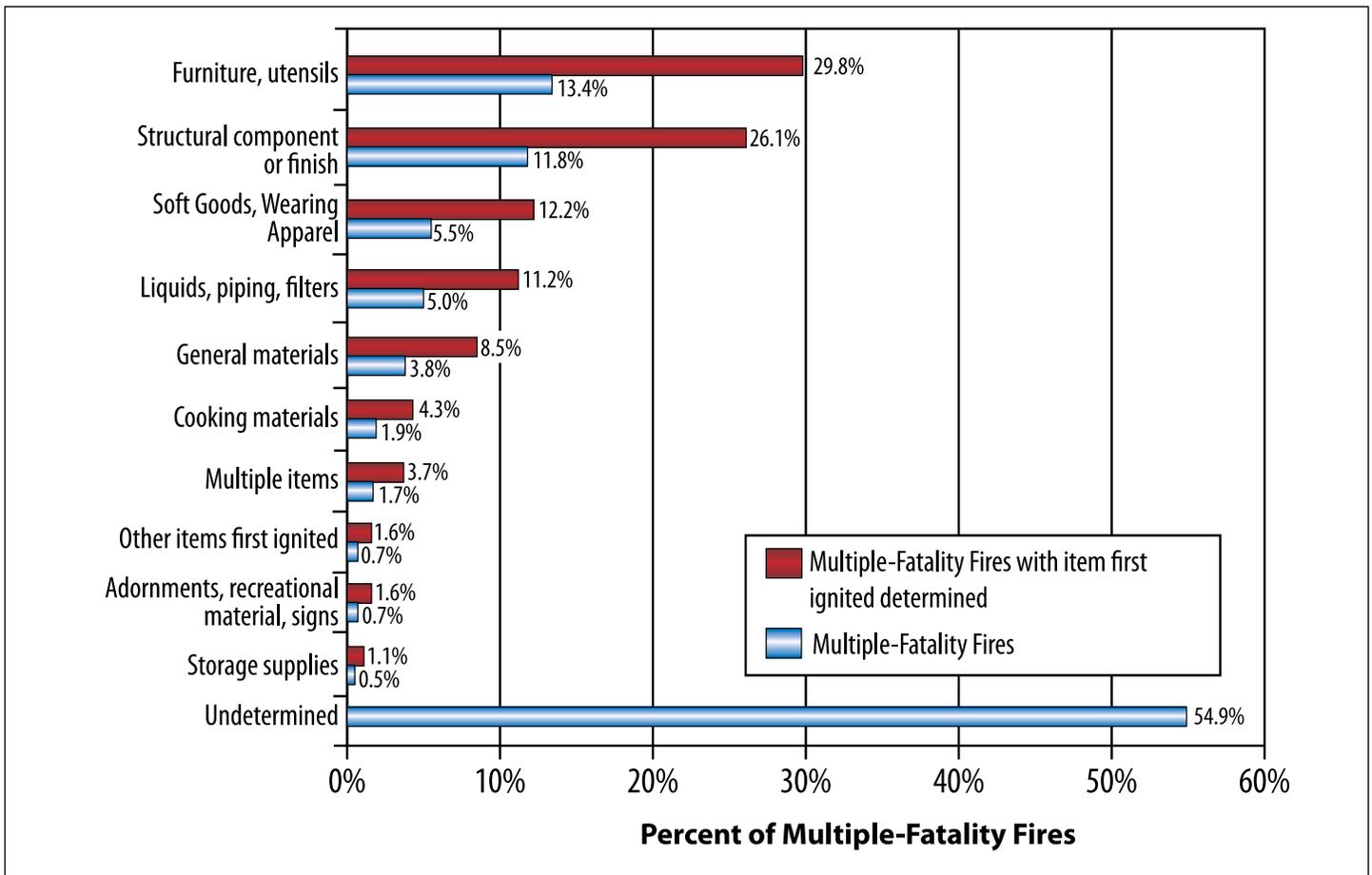
2,524 single-fatality fire incidents

What Catches Fire

Figure 5 shows that furniture and utensils usually were the first to catch fire in multiple-fatality fires between 2004 and 2006. A close second was a structural component or some

type of finish. The percentage of multiple-fatality fires with undetermined items first ignited is extremely high, suggesting the need for further investigation and proper documentation at the time of a fire.

Figure 5. Item First Ignited in Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)



Source: NFIRS 5.0
 417 incidents
 229 incidents with item first ignited undetermined

Smoke Alarms

There was no smoke alarm present in one-quarter of the multiple-fatality fires reported to NFIRS. In another 38 percent of these fires, firefighters were unable to determine if a smoke alarm was present. Smoke alarms were present in only 37 percent of multiple-fatality fires. Smoke alarms are

known to have operated in 12 percent of reported multiple-fatality fires. Note that the data presented in Table 5 are the raw counts from the NFIRS data set and not scaled to national estimates of smoke alarms in residential building multiple-fatality fires.

Table 5. NFIRS Smoke Alarm Data for Multiple-Fatality Fires in Residential Buildings (NFIRS, 2004-2006)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	NFIRS Incident Count	Percent
Present	Smoke alarm operated	Smoke alarm alerted occupants; occupants responded	25	6.0
		Smoke alarm alerted occupants; occupants failed to respond	5	1.2
		Smoke alarm failed to alert occupants	6	1.4
		Undetermined	13	3.1
	Smoke alarm failed to operate		36	8.6
	Undetermined		68	16.3
None present			106	25.4
Undetermined			158	37.9
Total Fires			417	100.0

Source: NFIRS 5.0
417 incidents

Notes: The data presented in Table 5 are raw data counts from the NFIRS data set. They do not represent national estimates of smoke alarms in multiple-fatality fires in residential buildings. They are presented for informational purposes. Total may not add to 100 percent due to rounding.

Examples

Recent examples of multiple-fatality fires:

- January 2009: Five men were killed in a 3 a.m. fire at a homeless shelter in Paris, TX. The fire burned for 3 to 4 hours, destroying the second floor where people slept. The fire was believed to have started in a pile of donated clothes stacked on a table, but a cause was unknown. The fire and smoke were so unbearable that attempts to extinguish the fire lasted only about 10 minutes before victims began to escape. The shelter was a converted bakery.⁶
- June 2007: Five children died of smoke inhalation in a fire that started at 1:23 a.m. in Pittsburgh, PA. The cause of the fire was thought to be children playing with matches. The door to the bedroom where the children were located was locked from the outside. The 17-year-old babysitter could not be found after the fire was extinguished. The fire spread to vacant houses around the home, and the roof collapsed as well. One smoke alarm on the second floor of the home where the fire started was inoperable.⁷
- March 2007: A three-alarm fire occurred in a home where four families lived together in Bronx, NY. Eight children and one adult were killed in the fire which started around 11 p.m. and burned through two of the three stories in the home. The fire was believed to have been caused by a fault in the electrical cord of a space heater in the basement of the home. Batteries in the two smoke alarms in their home were also not functioning.^{8,9}

Conclusion

Multiple-fatality fires result in the loss of hundreds of lives each year. Most of these fires occur at home in winter in the early morning hours. Many can be traced back to electrical malfunctions or negligence.

Information about each multiple-fatality fire can take a substantial amount of time to gather, since investigations may take weeks or even months. Additionally, data collected may not always be complete. Without thorough records of each multiple-fatality fire, it is very difficult to obtain an appropriate estimate of the characteristics of each fire; thus, many causes and attributes of fires remain unknown. Learning more about these tragic fires may lead to the creation and implementation of significant fire safety campaigns for target

audiences, which could, in turn, reduce the occurrence of multiple-fatality fires across the United States and save hundreds of lives. In order to further understand, gather pertinent information, and provide more answers, investigations must be done as completely and precisely as possible and the resulting information reported to NFIRS.

NFIRS Data Specifications for Multiple-Fatality Fires in Residential Buildings

Data for this report were extracted from the NFIRS annual public data release (PDR) files for 2004, 2005, and 2006. Only version 5.0 data were extracted.

Multiple-fatality fires in residential buildings were defined as:

- Incident types 111 to 123:

Incident Type	Description
111	Building fire
112	Fires in structure other than in a building
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 that incident types 113 to 118 do not specify if the structure is a building.

Incident type 112 is included, as previous analyses have showed that incident types 111 and 112 are used interchangeably.

- Aid types 3 (mutual aid given) and 4 (automatic aid given) were excluded to avoid double counting of incidents.
- Property use 400 to 464:

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:
 - 1 - Enclosed building;
 - 2 - Fixed portable or mobile structure; and
 - Structure type not specified (null entry).
- More than one fatality resulted from the fire.

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<http://www.usfa.dhs.gov/applications/feedback/index.jsp>

Notes:

¹ Because the number of NFIRS multiple-fatality fires is small, the analyses in this Topical Report are presented as preliminary findings only, and no definitive conclusions concerning these fires should be drawn.

² Residential buildings include, but are not limited to, one- or two-family dwellings, multifamily dwellings, boarding houses or residential hotels, commercial hotels, college dormitories, and sorority/fraternity houses.

³ In the National Fire Incident Reporting System (NFIRS), version 5.0, a structure is a constructed item of which a building is one type. In previous versions of NFIRS, the term “residential structure” commonly referred to buildings where people live. To coincide with this concept, the definition of a residential structure fire for NFIRS 5.0 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. In addition, incidents that have a residential property use, but do not have a structure type specified, are presumed to be buildings.

⁴ National estimates are based on 2004 to 2006 native version 5.0 data from NFIRS and residential structure fire loss estimates from the National Fire Protection Association’s (NFPA) annual survey of fire loss. Fires are rounded to the nearest 50, deaths to the nearest 5, injuries to the nearest 25, and loss to the nearest \$million.

⁵ The causes of fires for multiple-fatality fires have changed from years past in part due to the changes in the cause methodology implemented for the NFIRS 5.0 data. Arson, heating, smoking, and playing with heat sources played major roles in prior years.

⁶ Associated Press, “Fatal fire at homeless shelter in Paris, Texas,” January 5, 2009, http://www.khou.com/news/state/stories/khou090105_tnt_paris-fire.3e89b7f5.html, (accessed January 2009).

⁷ Torsten Ove, “5 small children die in fire,” *Pittsburgh Post-Gazette*, June 13, 2007, <http://www.post-gazette.com/pg/07164/793640-53.stm> (accessed January 2009).

⁸ Michelle L. Devon, “Bronx Fire in Highbridge Kills 8 Children, 1 Adult.” March 9, 2007, http://www.associatedcontent.com/article/173354/bronx_fire_in_highbridge_kills_8_children.html?singlepage=true&cat=8 (accessed January 2009).

⁹ ABC News, “Devastating NYC Fire Kills 8 Children, 1 Adult,” March 8, 2007, <http://abcnews.go.com/GMA/story?id=2933810> (accessed January 2009).