



RESEARCH

# HOME STRUCTURE FIRES

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# Key findings

People feel safe when they are at home, yet more than one-quarter (27%) of reported fires occurred in the home environment during 2012–2016. Even worse, four of every five (80%) fire deaths and three-quarters (74%) of all reported fire injuries<sup>1</sup> were caused by home structure fires.

During this five-year period, U.S. fire departments responded to an estimated average of 355,400 home structure fires per year. These fires caused an annual average of 2,560 civilian deaths, 11,670 civilian fire injuries, and \$6.5 billion in direct property damage.

The term “home” includes one- and two-family homes, manufactured homes, and apartments or other multi-family housing, regardless of ownership. Sixty-nine percent of reported home fires in 2012–2016 were in one- or two-family homes, including manufactured homes. These fires caused 84% of home fire deaths, 66% of home fire injuries, and 81% of the direct property damage from home fires.

Roughly one of every 326 households per year had a reported home fire during this period. On average, seven people died in a fire in a home per day.

Most home fires and fire casualties result from five causes: cooking, heating, electrical distribution and lighting equipment (including wiring, outlets, switches and cords, and excluding other appliances, electronics or other things that use electricity), and intentional fire setting. Over the five-year period a whole, cooking was the leading cause of home fires and home fire injuries; smoking was the leading cause of home fire deaths.

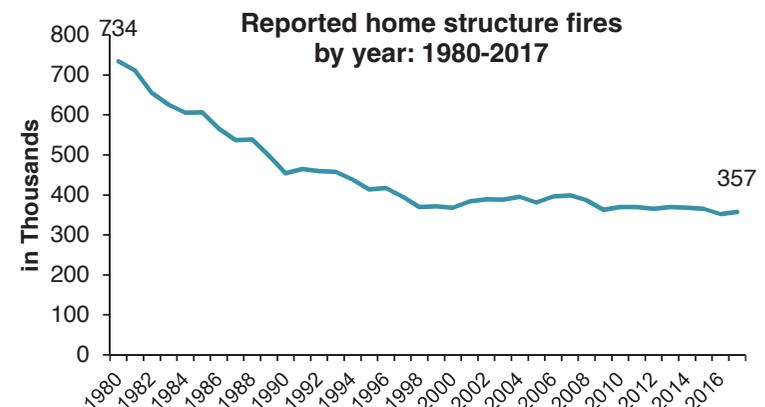
While reported home fires and home fire deaths have been cut roughly in half since 1980, and population-based home fire and fire death rates have fallen by roughly two-thirds, the death rate per 1,000 reported fires has remained fairly consistent, and was actually slightly higher in recent years than in 1980. This was driven by an even more pronounced increase in the rate for one- and two-family homes. It appears that most of the reduction in fire deaths over the

past decades is due to a reduction in fires rather than the prevention of harm after a fire is reported.

Certain scenarios appear more dangerous than in the past. The death rate per 1,000 reported home fires in 2012–2016 was more than twice as high in fires that began with either upholstered furniture or mattresses and bedding as it was in 1980–1984. Comparable death rates from fires in living rooms (including family rooms and dens) and bedrooms almost doubled but were not as high as the rates associated with these two items.

## Trends in reported fires

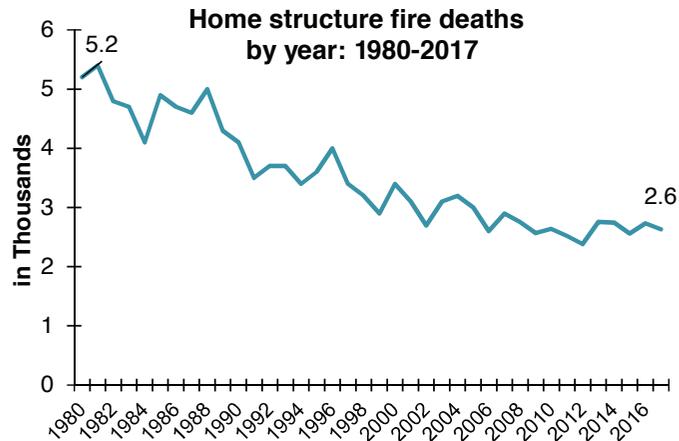
Estimates of reported home fires and home fire deaths in 2017 were roughly half as high as in 1980. Results from NFPA's annual fire experience survey (FES) are provided annually in NFPA's *Fire Loss in the United States* series of reports. Reported home fires fell 51% from 734,000 in 1980 to 357,000 in 2017. The decline was sharpest during the 1980s and continued more slowly in the 1990s before essentially plateauing in the past two decades. From 2016 to 2017, home fires rose 1%.<sup>2</sup>



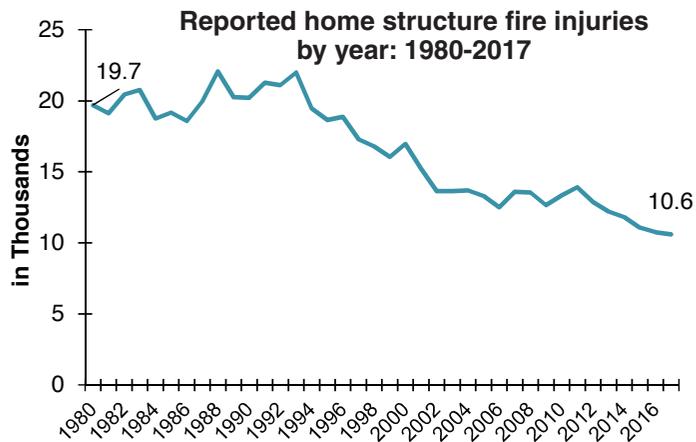
<sup>2</sup> Ben Evarts, *Fire Loss in the United States during 2017*, Quincy, MA: NFPA, 2018.

<sup>1</sup> Death and injury estimates exclude firefighter casualties.

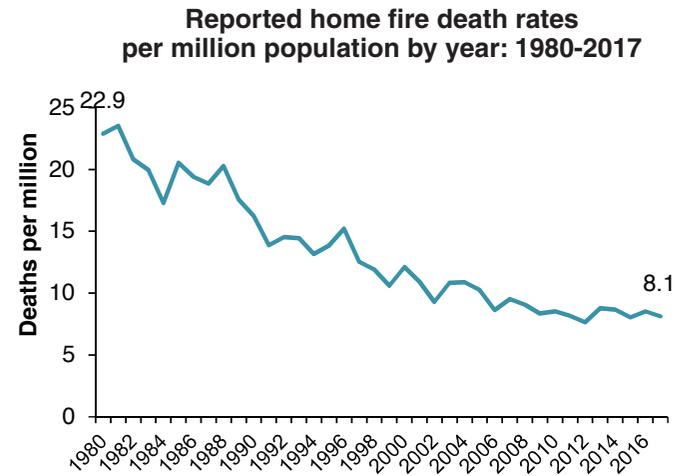
The 2017 home fire death toll of 2,630 was 49% lower than the 5,200 such deaths in 1980.



The 10,600 reported home fire injuries in 2017 was 46% lower than the 19,700 such injuries in 1980, and a new low.



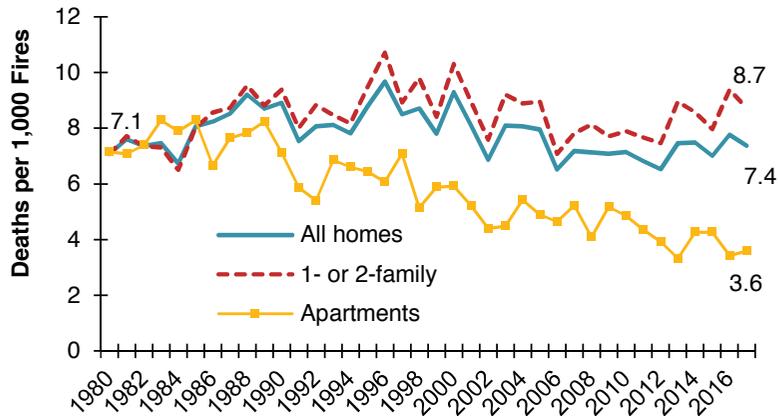
Population-based home fire and fire death rates in 2017 were roughly one third as high as in 1980. The rate of reported home fires per thousand population fell from 3.2 in 1980 to 1.1 in 2017. The home fire death rate fell from 22.9 per million population to 8.1 over the same period.



We have been fairly successful in reducing both the number of fires and fire deaths. However, we have not solved the problem of preventing death in reported fires. In 2017, the death rate per 1,000 fires was 7.4, or 4% higher than the 7.1 rate in 1980. Rates were generally higher from 1985–2005. The peak, in 1996, was 9.7 deaths per 1,000 fires. Overall, this line is much flatter than the other trend lines.

For one- or two-family homes, the death rate per 1,000 reported fires was 23% higher in 2017 than in 1980. For apartments, the rate was cut roughly in half. More code requirements regulate apartments than one- and two-family homes. Apartment buildings are more likely to have monitored detection systems that cause the fire department to be notified when activated. This could result in more minor fires reported in apartment properties. In 2012–2016, 61% of reported apartment fires were confined cooking fires compared to 25% in one- or two-family homes. Many such fires are already extinguished by the time the fire department arrives. Apartments are also more likely to have sprinklers than are one- or two-family homes.

**Deaths per 1,000 Reported Home Fires by Year and Occupancy: 1980-2017**



## What do we know about reported home fires?

The trends discussed above are based on summary data collected by NFPA’s fire department experience survey. Survey results are combined with the more detailed, incident-based NFIRS data to provide a deeper understanding of the causes and circumstances of these fires. The most current NFIRS national dataset is for 2016. Estimates are typically presented as national averages.

## When are home fires most common?

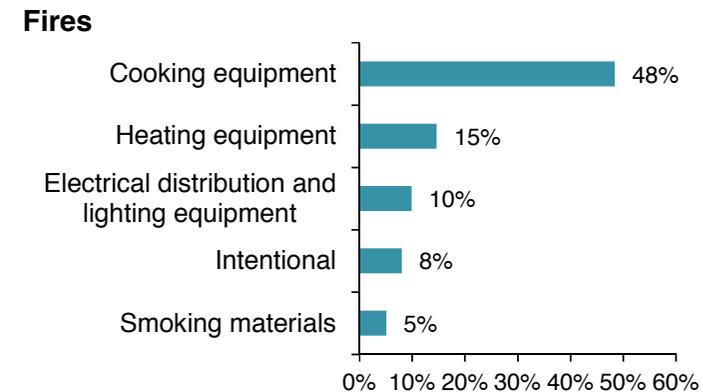
Not surprisingly, home structure fires are more common in cooler months when people spend more time inside and in the hours when people are awake in the home. In 2012–2016, 47% of home structure fires and 56% of home structure fire deaths occurred in the five months of November through March. Reported home fires peaked

from 5:00 to 8:00 p.m. when many people are coming home from work, preparing dinner, or engaged in other household activities. While just one-fifth (20%) of reported home fires occurred between 11:00 p.m. and 7:00 a.m., half (51%) of the home fire deaths resulted from fires reported during these hours when people are normally asleep and not as fast to discover or respond to a fire. One-third (32%) of the people who were fatally injured in home fires during 2011–2015 were asleep at the time.<sup>3</sup>

## Leading causes of home fires

The ranking of fire causes can vary from year to year. The rankings here are based on the annual average percentage of fires and losses in 2012–2016. The likely severity of a reported fire can be measured in deaths or injuries per 1,000 fires and average loss per fire. Note that causes were pulled from several data elements in NFIRS, so double counting is possible.

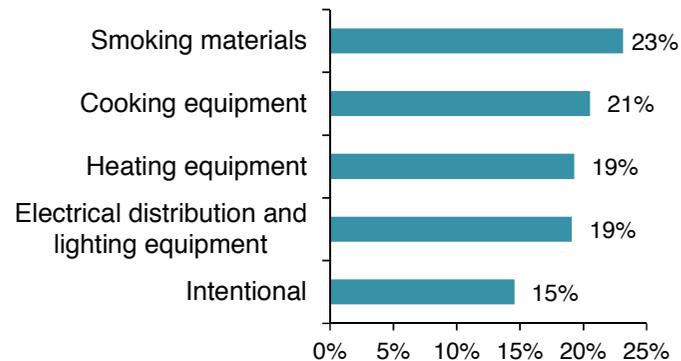
**Leading causes of home structure fires: 2012–2016**



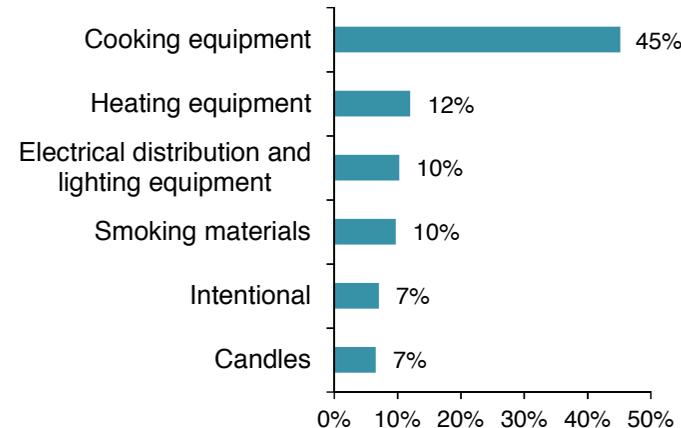
<sup>3</sup> Marty Ahrens, *Fire Deaths and Injuries in Reported Home Structure Fires by Age and Gender: Supporting Tables*, Table 4. “Fire Deaths and Injuries in Reported Home Structure Fires by Age Group and Gender,” Quincy, MA: NFPA, 2018, publication pending.

## Leading causes of home fires: 2012–2016 (continued)

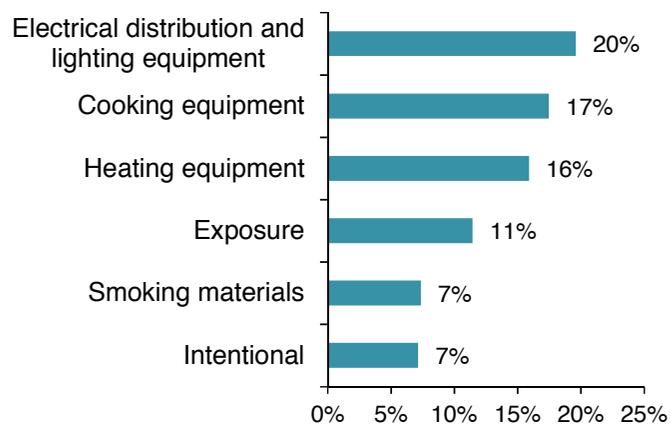
### Civilian deaths



### Civilian injuries



### Direct property damage



Cooking was the leading cause of reported home structure fires and civilian fire injuries and the second leading cause of fire deaths. Cooking activities caused an average of 172,100 home fires per year. These fires caused annual averages of 530 civilian deaths, 5,270 civilian injuries and \$1.1 billion dollars in property damage. Cooking was the leading cause of fires in both one- or two-family homes and apartments or other multi-family homes, but caused a much larger share of fires in the latter (72%) than in one- or two-family homes (38%). While cooking was the leading cause of fires and fire injuries, it ranked lower on the casualties (3 deaths and 31 injuries) per 1,000 reported fires and last among the major causes in average loss per reported fire (\$6,600).

Cooking is also the leading cause of *unreported* fires. In a survey of unreported residential fires in 2004–2005, the Consumer Product Safety Commission (CPSC) found that U.S. households had 50 cooking equipment fires they did not report for every such incident reported to the fire department.<sup>4</sup>

Fires started by smoking materials have long been the leading cause of fire fatalities. This was still true for the 2012–2016 period as a whole. During this period, an estimated average of 18,100 such fires caused averages of 590 deaths, 1,130 injuries, and \$476 million in direct property damage annually. The 33 deaths per 1,000 reported fires was 4.5 times the rate of 7 deaths per 1,000 reported home fires overall.

Heating equipment was the second leading cause of home fires and home fire injuries, and tied with electrical distribution and lighting equipment as the third leading cause of home fire deaths. An average of 52,000 such fires caused 490 deaths, 1,400 injuries and \$1.0 billion in direct property damage per year. Heating equipment was the leading cause of fire deaths in one- or two-family homes.

Chimney fires, usually minor and usually in one- or two-family homes, were the most common type of heating fire. Although space heaters, including portable heaters and those that are permanently installed, were involved in only 4% of total fires, these incidents caused 17% of home fire deaths from all causes.

<sup>4</sup> Michael A. Greene and Craig Andres. *2004–2005 National Sample Survey of Unreported Residential Fires*. U.S. Consumer Product Safety Commission, July 2009, pp. 102, 127–133. Online at [cpsc.gov/s3fs-public/UnreportedResidentialFires.pdf](http://cpsc.gov/s3fs-public/UnreportedResidentialFires.pdf).

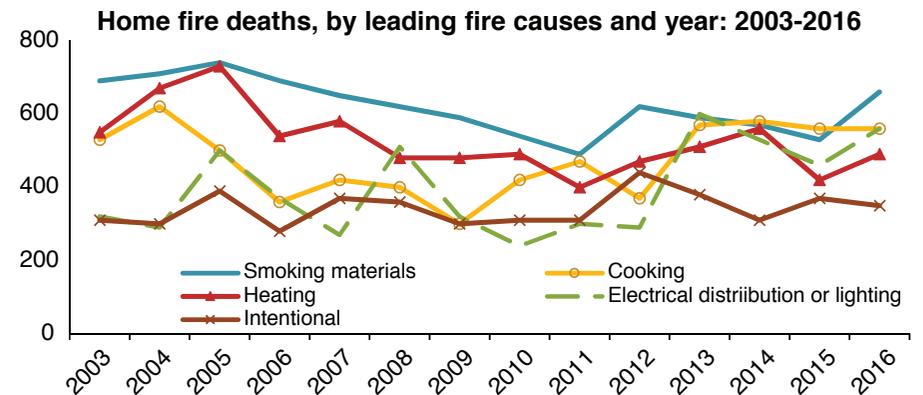
Electrical distribution or lighting equipment was the leading cause of home fire property damage. An average of 35,100 such fires caused 490 deaths, 1,200 injuries and \$1.3 billion in direct property damage per year. Wiring and related equipment accounted for 7% all home fires and 11% of home fire deaths. Cords or plugs were involved in only 1% of the fires, but 6% of the deaths. Extension cords dominated the cord or plug category.

The 28,600 intentional home fires per year caused annual averages of 370 deaths, 820 injuries, and \$463 million in direct property damage. Some deaths from intentional firesetting were suicides. Intentional fires heavily overlap with, but are not identical to, legally defined arson fires. Children under the age of legal responsibility sometimes intentionally start fires.

Candles started an average of 8,200 home fires annually, resulting in an average of 80 deaths, 770 injuries, and \$264 million in direct property damage per year. Candle fires had an injury rate of 93 per 1,000 reported fires, roughly three times the overall injury rate of 33 injuries per 1,000 fires.

Someone, usually a child, playing with fire or other heat source, started an average of 5,700 home fires per year in 2012–2016. These fires caused an average of 60 deaths, 480 injuries, and \$127 million in direct property damage. These incidents had an injury rate of 85 per 1,000 reported home fires. This is almost three times the overall rate of 34 injuries per 1,000 fires.

Fires caused by exposure to another fire had the highest average property loss of the major causes. The 12,900 home fires per year resulting from exposures caused an average of 20 deaths, 70 injuries, and \$742 million in direct property damage. The average loss of \$57,500 per fire was three times the average loss of \$18,200 per fire.



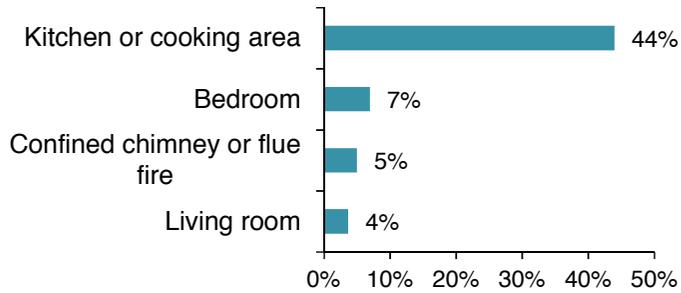
In recent years, the leading causes of home fire deaths have converged more than in the past. For most of the past few decades, smoking materials were clearly the leading cause. While smoking materials were the leading cause of home fire deaths over the five-year period of 2012–2016, cooking was the leading cause in 2014 and 2015. Electrical distribution and lighting equipment caused the largest number of home fire deaths in 2013. Smoking materials started the largest number of fires in 2012 and 2016.

## Area of origin, victim's location, and fire spread

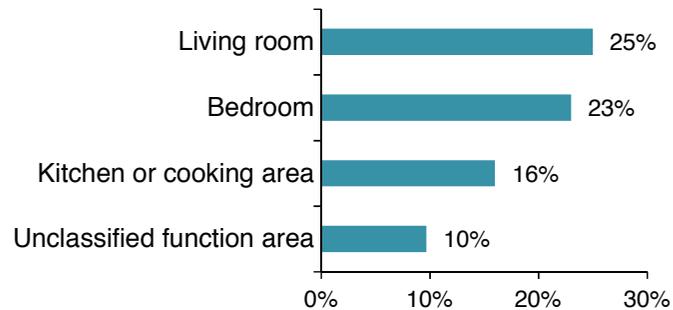
As cooking is the leading cause of home fires and fire injuries, it is not surprising that the kitchen was the leading area of origin for home fires and injuries. Apartment or multi-family housing fires were more likely to start in the kitchen (67%) than were fires in one- or two-family homes (33%).

## Leading areas of origin in home structure fires: 2012–2016

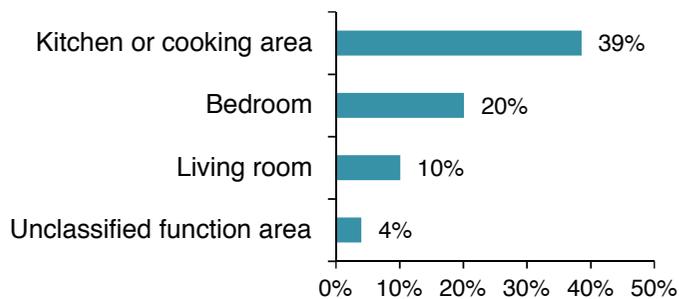
### Fires



### Civilian deaths



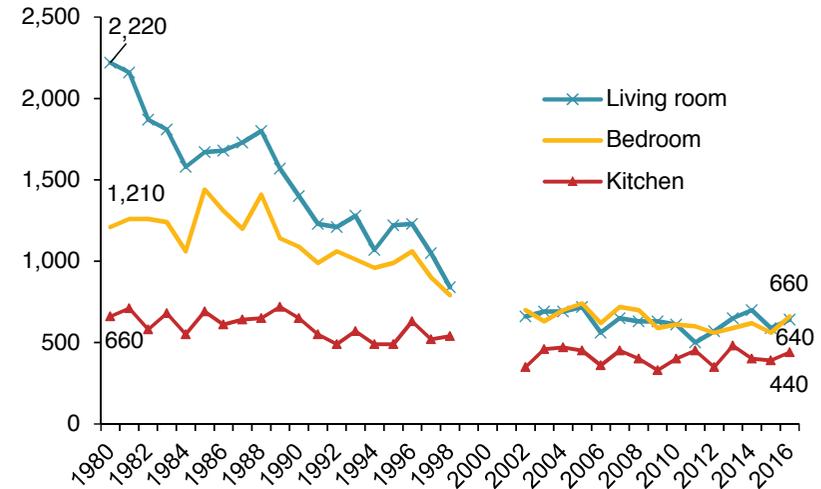
### Civilian injuries



Deaths from fires originating in living rooms fell more sharply than deaths from fires starting in bedrooms and kitchens. Historically, the largest number of fire deaths resulted from fires starting in living rooms. The differences between the three leading areas of origin for home fire deaths have decreased over time, with deaths from fires

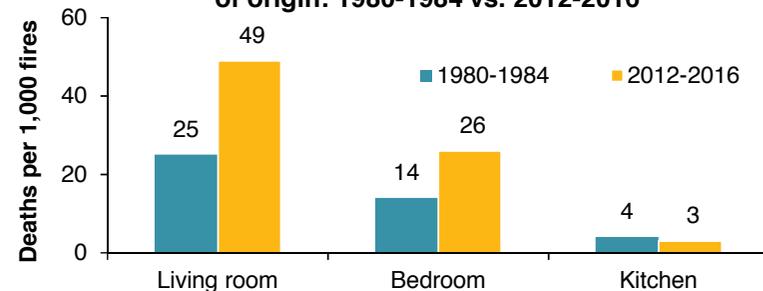
starting in bedrooms now sometimes slightly exceeding the number resulting from fires starting in living rooms.

**Home fire deaths by area of origin and year**



Compared to home fire deaths in 1980–1984, the average number of deaths in 2012–2016 resulting from fires starting in the living room fell 67%; deaths from fires beginning in the bedroom fell 50%; and deaths from kitchen fires dropped 36%.<sup>5</sup>

**Deaths per 1,000 fires in leading areas of origin: 1980–1984 vs. 2012–2016**

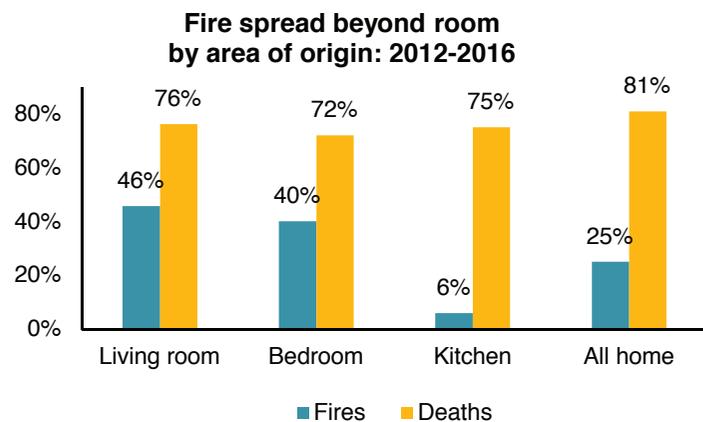


<sup>5</sup> Version 5.0 of NFIRS was introduced in 1999 and adopted gradually over the next several years. Due to the instability of estimates for 1999–2001, the transition years to NFIRS 5.0, estimates for these years are not shown in the graphs.

Fires in the living room were more likely than fires in other areas to cause death. Despite the drops in deaths in all three areas, the average death rate per 1,000 reported fires was nearly twice as high for fires that started in either the living room or bedroom in 2012–2016 as in 1980–1984.

UL conducted experimental burns comparing living room style spaces with modern furniture with more synthetics, and legacy furnishings. They discovered flashover times had decreased from roughly 30 minutes with legacy furnishings to roughly five with the modern items.<sup>6</sup>

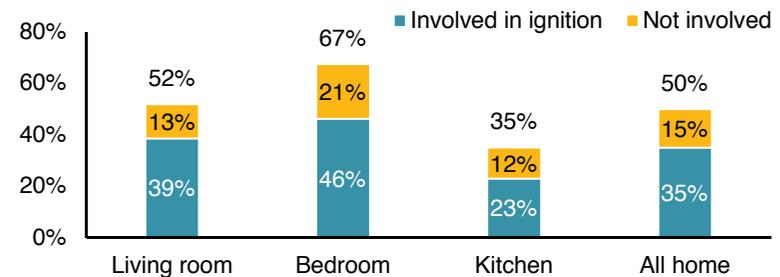
While fire spread beyond the room of origin in only 6% of the kitchen fires, roughly three quarters of the deaths in all three areas resulted from fires that spread beyond the room.



<sup>6</sup> Stephen Kerber, *Analysis of Changing Residential Fire Dynamics and Its Implications on Firefighter Operational Timeframes*, UL, accessed at [ulfirefightersafety.org/docs/Analysis\\_of\\_Changing\\_Residential\\_Fire\\_Dynamics\\_and\\_Its\\_Implications\\_on\\_Firefighter\\_Operational\\_Timeframes.pdf](http://ulfirefightersafety.org/docs/Analysis_of_Changing_Residential_Fire_Dynamics_and_Its_Implications_on_Firefighter_Operational_Timeframes.pdf) on August 30, 2018.

Half of the fatalities from fires in the living room and two-thirds of the bedroom fire fatalities were in the room or area of origin when the fire started, compared to roughly one-third of the kitchen fire deaths. Roughly two-thirds to three-quarters of fatal fire victims who were in the area of origin were also involved in the ignition.

**Home fire deaths in area of origin by involvement in ignition and area of origin: 2012-2016**



## Fire causes by area of origin

The causes of fires in living rooms and in bedrooms in 2012–2016 were fairly similar. Electrical distribution and lighting equipment caused the largest share of fires in both rooms. Smoking materials caused the largest share of fire deaths in both areas.

Ten percent of the bedroom fires were started by someone playing with a heat source such as a lighter, candle or matches. According to NFPA's 2014 report, *Playing with Fire*, 39% of home structure fires caused by fire play started in the bedroom in 2007–2011. Bedroom fires caused 54% of the deaths and 57% of the injuries that resulted from home playing fires.<sup>7</sup> If a fire started in a bedroom with no smoke alarm and the door closed, serious injury could occur before the smoke reached a hallway smoke alarm. Interconnected alarms with bedroom coverage would sound and alert others elsewhere in the home early in the fire's development.

<sup>7</sup> Richard Campbell, *Playing with Fire*, Quincy, MA: NFPA, 2014, p. 6.

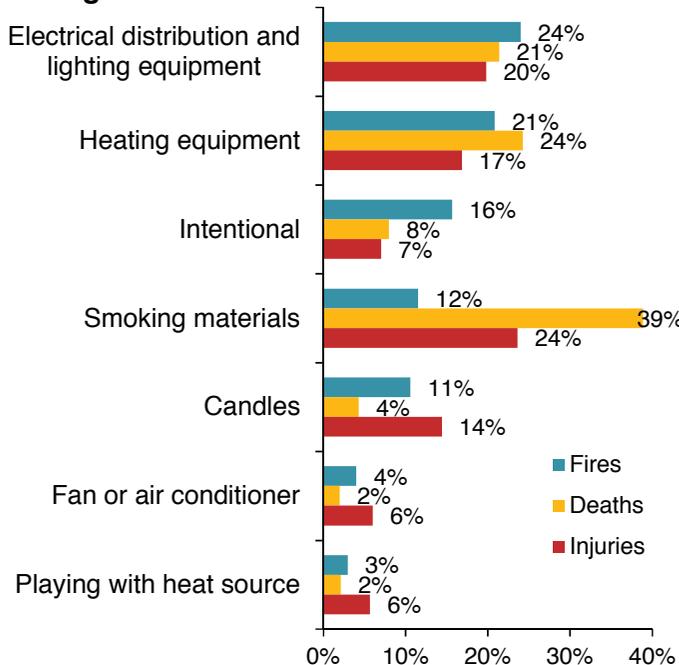
While space heater fires are an issue in both rooms, fireplace and chimney fires are a particular issue in living rooms, family rooms and dens. Most fireplaces and wood stoves are located in these rooms.

As noted earlier, cooking is by far the leading cause of home fires, and, predictably, the cause of the vast majority of kitchen fires and fire casualties. According to NFPA's 2018 report, *Home Cooking Fires*, one-third (34%) of the fatal home cooking fire victims in 2012–2016 were asleep at the time of injury. Fifty-five percent of the non-fatal cooking injuries occurred when someone tried to fight the fire themselves.<sup>8</sup>

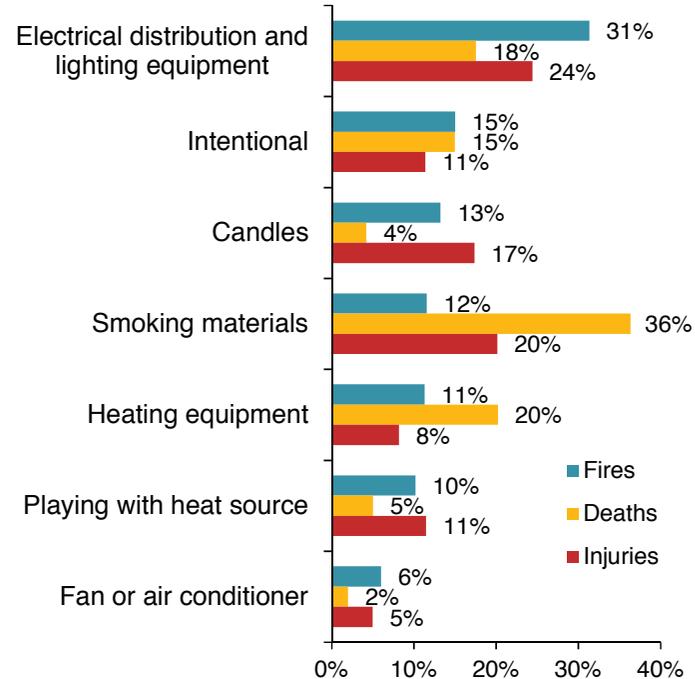
Although heating equipment was the second leading cause of kitchen fire deaths, the heating equipment most often involved was a heating stove. It is also possible that some of these were conventional kitchen ranges that had been miscoded.

### Leading causes of fires and casualties in leading areas of home structure fires: 2012–2016

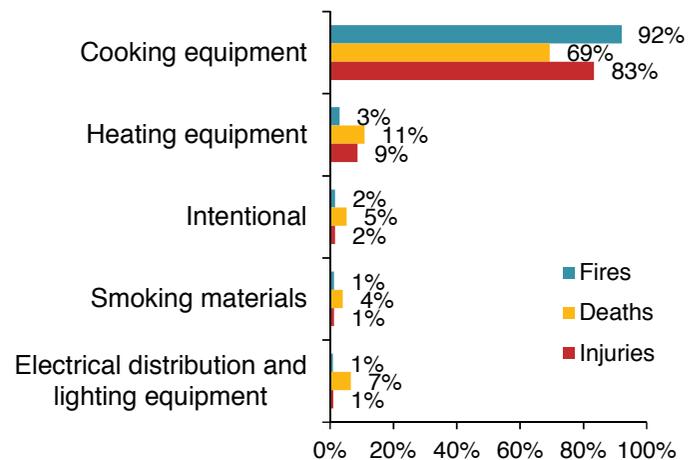
#### Living room



#### Bedroom



#### Kitchen



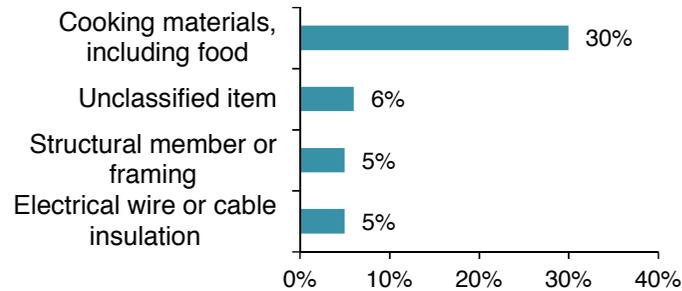
<sup>8</sup> Marty Ahrens, *Home Cooking Fires*, Quincy, MA: NFPA, 2018.

# Leading items first ignited in home structure fires

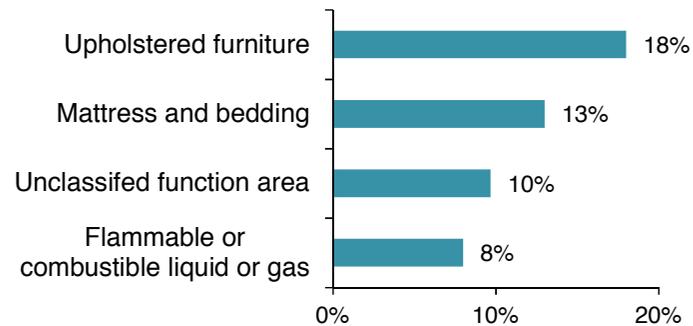
With cooking the leading cause of home fires, it is not surprising that cooking materials are the leading item first ignited. The two leading items in home fire deaths are upholstered furniture and mattresses or bedding.<sup>9</sup> These items are consistent with the leading areas of origin associated with fire deaths.

## Leading items first ignited in home structure fires: 2012–2016

### Fires

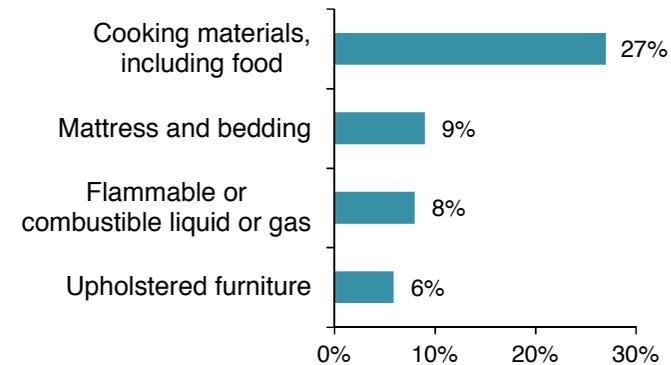


### Civilian deaths



<sup>9</sup> NFIRS groups upholstered sofas, chairs, and vehicle seats into one code choice for item first ignited. NFPA combines two NFIRS item first ignited codes: a) mattress or pillow; and b) bedding, blanket, sheet or comforter; into the category mattress or bedding. Some furniture, such as folded mattresses covered with upholstery fabric (futons), traditional sleep sofas with pull-out mattresses, and upholstered furniture with cloth protectors or throw-style furniture covers could potentially be coded as either upholstered furniture or mattresses and bedding.

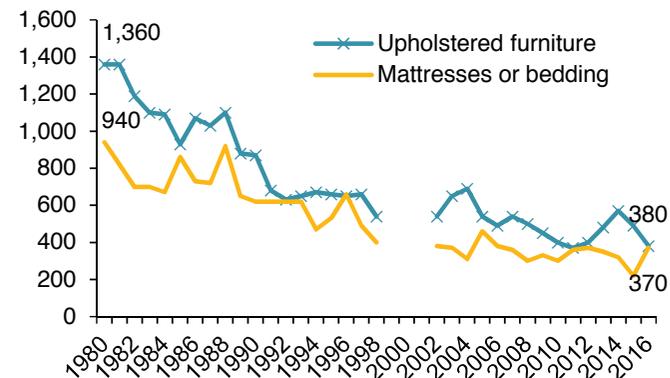
## Civilian injuries



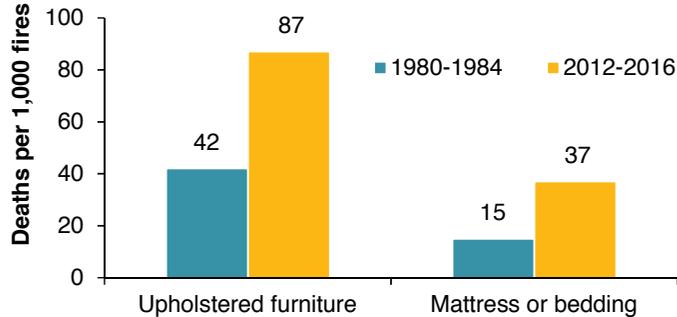
The average number of deaths from home fires beginning with the ignition of upholstered furniture was 62% lower than the 1980–1984 average. Deaths from fires starting with mattresses or bedding were down 57% from the earlier period.

The increase in death rates per 1,000 reported fires is even greater for these two items than in the areas most associated with their use. With fires starting with both upholstered furniture and mattresses or bedding each accounting for roughly 2% of the reported fires in 2012–2016 but 18% and 13% of the home fire deaths, respectively, these events are relatively low frequency, high consequence fires. On average, one of every 11 upholstered furniture fires and one of every 27 mattress or bedding fires in this time period resulted in death.

## Home fire deaths from fires starting with upholstered furniture and mattresses or bedding, by year



**Deaths per 1,000 fires that began with upholstered furniture or mattresses and bedding: 1980-1984 vs. 2012-2016**



Sean McKenna and his colleagues in the United Kingdom (UK) researched the impact of flame retardants on the burning behavior of and smoke toxicity from simple sofa beds. These were described as double mattresses that folded to rest on a frame and make a sofa. Among the issues prompting this research were UK Government statistics showing that the death rate of 25.2 per 1,000 fires for the combination of bedrooms, living rooms, and dining rooms was much higher rate than the 1.9 deaths per 1,000 kitchen fires, and 1.1 deaths per 1,000 fires for other locations. The proportion of fire deaths caused by inhalation of toxic smoke has increased over time. Test results showed that sofa-beds with flame retardants had a somewhat slower burning rate but produced more lethal effluents when burning.<sup>10</sup> Additional research is needed to determine if similar results would be found in the U.S.

Smoking material fire deaths have fallen more than deaths from fires started by small open flames or operating equipment. According to the Center for Disease Control and Prevention (CDC), 33.2% of adults smoked cigarettes in 1980.<sup>11</sup> In 2016, 15.5% of adults were current

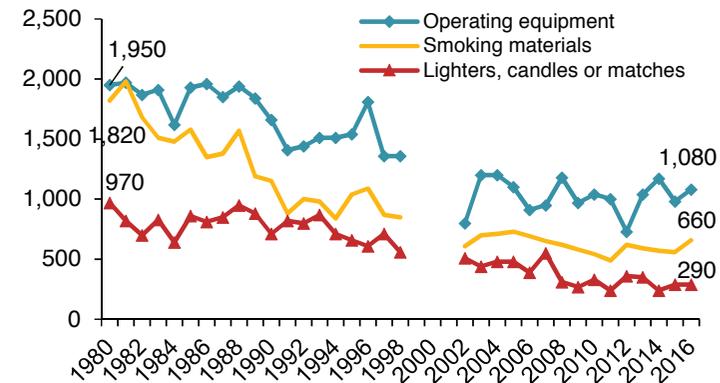
<sup>10</sup> Sean McKenna, Robert Birtles, Kathryn Dickens, Richard Walker, Michael Spearpoint, Anna Stec, and T. Richard Hull, "Flame retardants in UK furniture increase smoke toxicity more than they reduce fire growth rate," *Chemosphere* 196 December 2017 DOI: 10.1016/j.chemosphere.2017.12.017, accessed at [researchgate.net/publication/321631839\\_Flame\\_retardants\\_in\\_UK\\_furniture\\_increase\\_smoke\\_toxicity\\_more\\_than\\_they\\_reduce\\_fire\\_growth\\_rate](https://www.researchgate.net/publication/321631839_Flame_retardants_in_UK_furniture_increase_smoke_toxicity_more_than_they_reduce_fire_growth_rate) on October 29, 2018.

<sup>11</sup> CDC Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, "Trends in Current Cigarette Smoking Among High School Students and Adults, United States, 1965–2014." Accessed at [cdc.gov/tobacco/data\\_statistics/tables/trends/cig\\_smoking/index.htm](https://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm) on November 13, 2018.

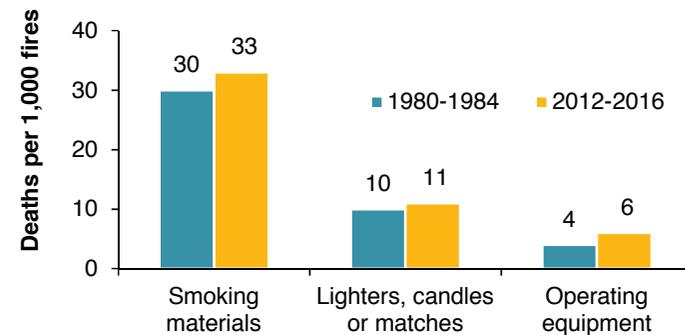
smokers.<sup>12</sup> The annual average death toll from fires started by smoking materials was 65% lower in 2012–2016 than it was in 1980–1984, while deaths from fires started by small open flames (lighters, candles, or matches) were down 61% compared to the earlier period.

The death toll from fires started by operating equipment, including arcing; sparks, embers, flames or radiated or conducted heat or unclassified heat from powered equipment, was 47% lower in the more recent period than in 1980–1984.

**Home fire deaths by selected heat sources and year**



**Deaths per 1,000 fires for selected heat sources: 1980-1984 vs. 2012-2016**



<sup>12</sup> Ahmed Jamal, Elyse Phillips, Andrea Gentzke, David Homa, Stephen Babb, Brian King, and Linda Neff, Current Cigarette Smoking Among Adults—United States, 2016. *MMWR Morb Mortal Wkly Rep* 2018;67:53–59. DOI: [dx.doi.org/10.15585/mmwr.mm6702a1](https://doi.org/10.15585/mmwr.mm6702a1). Accessed on November 13, 2018.

The increase in death rates per 1,000 fires was not as great for the three heat source categories, compared to those for fires starting in furniture or mattresses or bedding, suggesting that the cause of the fire is not driving the change.

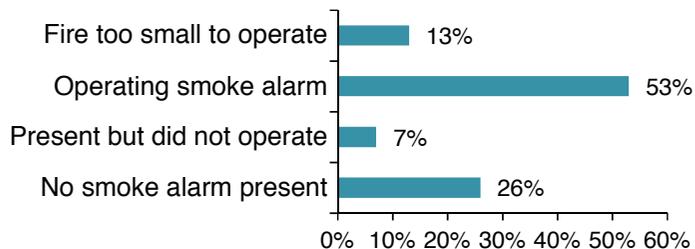
## Preventing fires and fire losses

Safer products can prevent many fires from starting. Considerable progress has been made but more is left to be done. Equipment and other product redesign, or automatic shut-offs on heating equipment, cooking equipment, or irons can mitigate human error and improve safety. Such changes may be the most effective and inexpensive approach to fire prevention. The CPSC issues product safety standards and recalls of unsafe consumer products and collects reports about such products from the public.

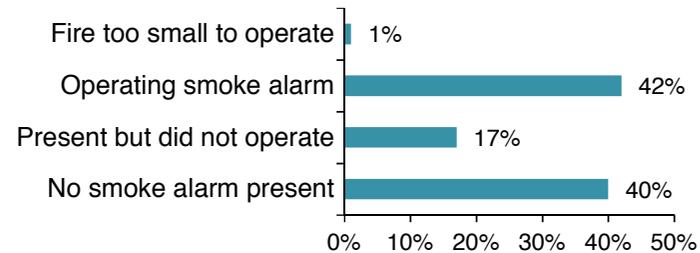
The earlier a fire is discovered, the more time that is available for escape. A smoke alarm was present in three-quarters (74%) of reported home fires, substantially less than the 96% of homes with smoke alarms that were reported in telephone surveys done for NFPA. However, almost three of every five home fire deaths resulted from fires in which either no smoke alarm was present (40%) or at least one alarm was present but did not operate (17%).

### Smoke alarm status in home structure fires: 2012–2016

#### Fires



### Civilian deaths



People who are in the room of fire origin may be intimately involved with ignition. Their clothing or the furniture they are sitting in or lying on may catch fire. Even if they are not intimately involved, being in the room where the fire starts dramatically reduces escape time.

Home fire sprinklers can control a fire until help arrives even when the occupants are unable to act. Fire sprinklers were present in only 7% of reported home fires in 2012–2016. The death rate of 1.1 per 1,000 reported home fires was 85% lower when sprinkler systems were present than the 7.7 deaths per 1000 reported home fires without any automatic extinguishing systems (AES).<sup>13</sup> The \$6,900 average dollar loss in fires with sprinklers was 63% lower than the average \$18,800 in fires without AES. See [firesprinklerinitiative.org](http://firesprinklerinitiative.org) for more information.

Additional safety information can be found at NFPA's website, [nfpa.org](http://nfpa.org).

## Acknowledgments

The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. These firefighters are the original sources of the detailed data that make this analysis possible. Their contributions allow us to estimate the size of the fire problem.

We are also grateful to the U.S. Fire Administration for its work in developing, coordinating, and maintaining NFIRS.

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 E-mail: [research@nfpa.org](mailto:research@nfpa.org)  
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<sup>13</sup> Excludes properties under construction, partial systems, and fires with sprinklers that failed to operate because they were not in the fire area.

# Methodology

Supporting tables for all homes, fires in one- and two-family homes, and in apartments or multi-family home are also available on line [here](#).

Unless otherwise specified, the statistics in this analysis are national estimates of fires reported to U.S. local fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. Estimates are projections based on the detailed information collected in the U.S. Fire Administration's [National Fire Incident Reporting System \(NFIRS\)](#) and the National Fire Protection Association's (NFPA's) annual Fire Experience Survey. Except for property use and incident type, fires with unknown or unreported data were allocated proportionally in calculations of national estimates.

In general, any fire that occurs in or on a structure is considered a structure fire, even if the fire was limited to contents and the building

itself was not damaged. Only civilian (non-firefighter) casualties are discussed in this analysis. For more information, see [How NFPA's National Estimates Are Calculated for Home Structure Fires](#).

The causes shown are those that are well defined and have clear prevention strategies or have historically been of interest. The data comes from several NFIRS data elements. Double counting is possible. For more information see [NFPA's Methodology and Definitions Used in "Leading Causes of Structure Fires"](#) Tables.

Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest hundred, deaths and injuries to the nearest ten, and property damage to the nearest million dollars. Estimates of zero may be true zeroes or may have rounded to zero. Percentages were calculated on unrounded estimates. Annual averages do not include inflation adjustments.