U.S. STRUCTURE FIRES IN NURSING HOMES

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Abstract

In 2002-2005, U.S. fire departments responded to an estimated average of 2,810 nursing home structure fires, annually. These fires caused an annual average of 16 civilian deaths, 130 civilian injuries, and $6.6 million in direct property damage. In this report, nursing home refers only to nursing homes licensed by the state, providing 24-hour nursing care for four or more persons. These estimates are based on data from the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) annual fire department experience survey. More than half of the fires in these properties were caused by cooking, but fires that started with mattresses or bedding material or electrical wire or cable insulation caused a disproportionate share of the casualties and injuries.

Keywords: fire statistics, nursing home

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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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Nursing Home Structure Fire Fact Sheet

In 2002-2005, an estimated 2,810 structure fires in nursing homes were reported to municipal fire departments annually.

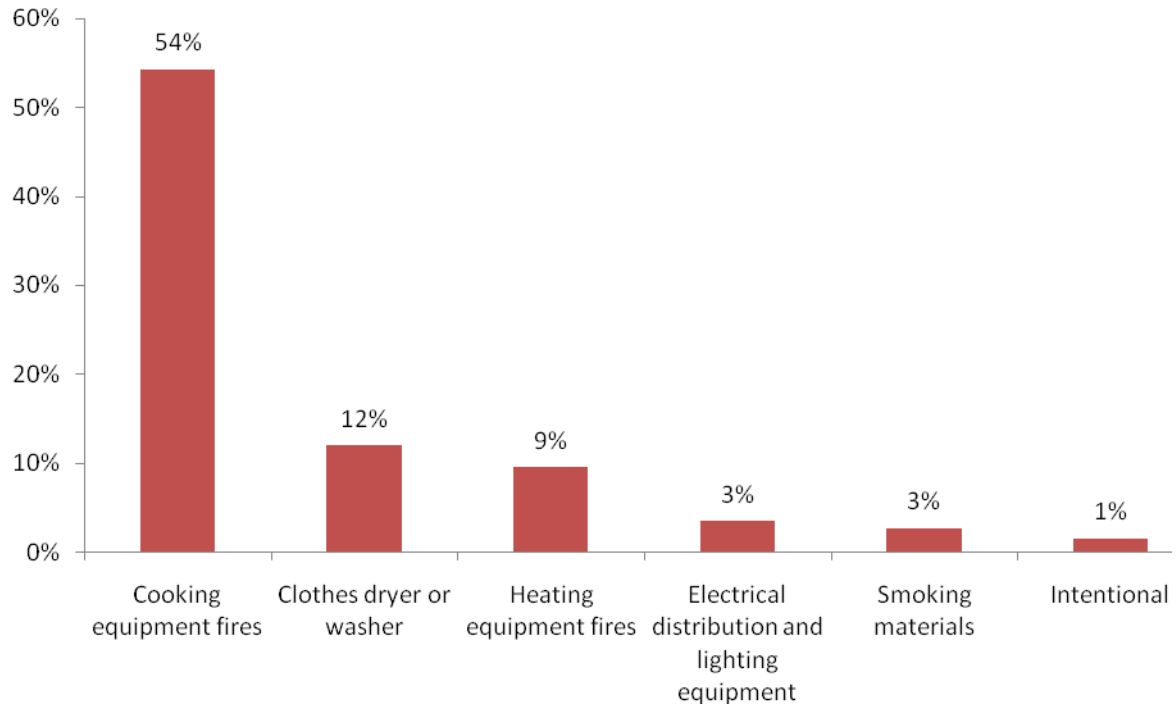
These fires resulted in an estimated 16 civilian deaths, 130 civilian injuries, and $6.6 million in direct property damage, annually.

The kitchen was the leading area of origin for nursing home structure fires; the bedroom was the leading area of origin for civilian fire casualties.

Fires that began with mattress or bedding material and electrical wiring or cable insulation caused a disproportionate share of civilian deaths and injuries.

The deadliest nursing home fire during this period was an intentional fire set in a Connecticut nursing home, killing 16 people and injuring dozens.

Leading Cause of Structure Fires in Nursing Homes, 2002-2005



Source: NFIRS and NFPA Survey

- The death rate per 1,000 fires was 94% lower when automatic suppression systems were present in nursing home structure fires.
- The death rate per thousand non-confined fires was almost sixteen times as high when automatic extinguishing equipment was not present.

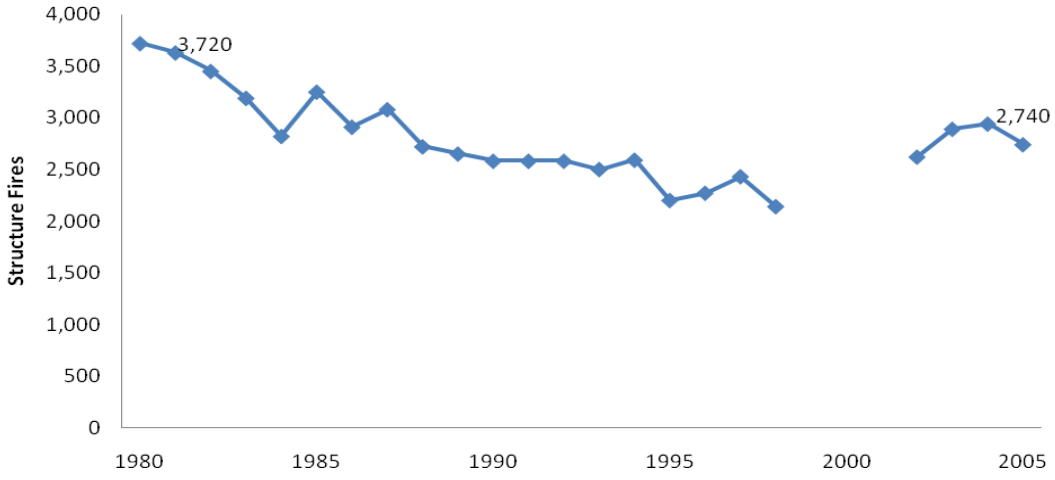
Structure Fires in Nursing Homes

Roughly 2,800 structure fires were reported in these properties per year.
During the four-year period of 2002-2005, an estimated average of 2,810 structure fires were reported per year. These fires caused an annual average of 16 civilian deaths, 130 civilian injuries, and $6.6 million in direct property damage.

In this report, the term "nursing home" refers only to nursing homes licensed by the state, providing 24-hour nursing care for four or more persons. Nursing homes are identified by property use code 311 in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System. See Appendix A for more information on NFIRS and the methodology used in this analysis. Assisted living facilities and residential board and care facilities are not supposed to be coded here and have their own property use code of 459, in the residential group. Elderly housing, where people cook for themselves and maintain their own apartments is considered residential and is not included here. Only fires reported to municipal fire departments are included in these statistics.

A fire with multiple casualties and injuries can have a significant impact on annual averages.
In 2003, an intentional fire in a Connecticut nursing home resulted in the deaths of sixteen casualties and dozens of injuries. At the time of the fire 148 patients were being cared for at the facility. The fire began early in the morning when a patient intentionally lit bedding material with a lighter. The fire department responded to the fire at 2:45 a.m. and found the fire in one wing of the building and staff removing patients from that wing and other affected areas. The fire fighters and staff were faced with a growing fire, heavy smoke, and a large number of non-ambulatory patients exposed to smoke and heat. It was later determined that the patient that started the fire was not competent to stand trial and charges were not pursued. A single fire with multiple casualties and injuries can have a significant impact on annual averages. This incident was included in the calculation of annual averages and therefore estimates of civilian fire deaths and injuries should be considered with caution.

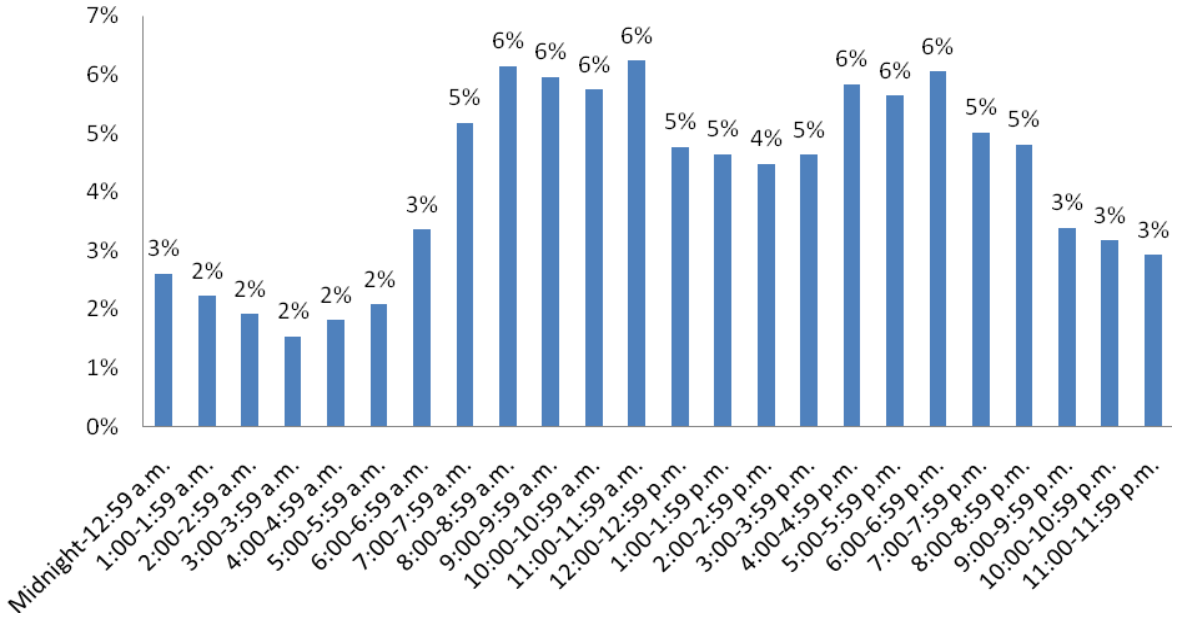
Figure 1. U.S. Structure Fires in Nursing Homes by Alarm Year, 1980-2005



Source: NFIRS and NFPA Survey
*Estimates for 1999-2005 are based on data collected originally in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001these years are not included in Figure 1.

Since 1980, structure fires in nursing homes fell 26%.
As Table 1 and Figure 1 show, structure fires in nursing homes fell 26% from 3,720 in 1980 to 2,740 in 2005. In comparison, structure fires of all types declined 52% from 1980 to 2005 and structure fires in non-homes declined 61%.

Figure 2. Structure Fires in Nursing Homes by Alarm Time, 2002-2005



Source: NFIRS and NFPA Survey

Structure fires in nursing homes peak twice during daytime hours.
Tables 2, 3, and 4 show reported structure fires in these properties by month, day of week and alarm time, respectively. Winter months were the peak months for fires in nursing homes. The smallest number of fires occurred in August. Saturday was the peak day for fires in these properties. Figure 2 shows that fires in these properties peak twice during the day, once between the hours of 8 a.m. to 12 p.m. and again from 4 p.m. to 7 p.m.

More than half of reported structure fires in nursing homes were caused by cooking.
Table 5 shows the leading causes of fires in these properties with data summarized from several NFIRS fields. In some cases, the equipment involved in ignition is most relevant; heat source, the field "cause," and factor contributing to ignition also provide relevant information. The causes shown in this table are not mutually exclusive when they have been pulled from different fields. More detailed information on equipment involved in ignition may be found in Table 6; more information on heat source is in Table 7; further explanation of the methodology used is in Appendix B.

In NFIRS Version 5.0, beginning in 1999, causal data is generally not required for certain types of confined fires, including confined cooking fires, chimney fires, trash fires, and fuel burner or boiler fires. Although causal information is not required for these incidents, it is provided in some cases. Confined fires are analyzed separately from non-confined fires; estimates are based on the share with causal data. Caution should be used when comparing the information with earlier analyses as differences may be due to changes in data collection practices rather than actual variations in the fire experience.

Overall, cooking equipment was involved in 54% of the fires reported in nursing homes; cooking equipment was listed as the equipment involved in ignition in 3% of these fires and an additional 52% reported as confined cooking fires. Clothes dryers or washers were involved in 12% of the fires. Overall, heating equipment was involved in 9% of nursing home fires and civilian fire deaths; heating equipment was listed as the equipment involved in 5% of nursing home fires, with an additional 4% reported as confined heating fires. Electrical distribution or lighting equipment was involved in 3% of the fires. Smoking materials[1] caused 3% of the fires and 5% of the fire deaths in these properties. Only one percent of nursing home structure fires were intentionally set, however these fires caused 75% of the civilian fire deaths. In 2003, an intentional fire set in a nursing home in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths and injuries.

The kitchen was the leading area of origin for nursing home structure fires; the bedroom was the leading area of origin for civilian casualties.

Four percent of the fires in facilities that care for the aged originated in the kitchen or cooking area. Area of origin is generally not collected for confined fires but it is probable that most of the confined cooking fires (52%) also started in the kitchen, meaning that 56% of these fires started in the kitchen. Ten percent started in the laundry room. Although only 7% of fires originated in the bedroom, these fires caused 92% percent of the civilian fire deaths. (See Table 8.)

Fires that started with either (a) electrical wiring or cable insulation or (b) mattress and bedding were more likely to result in injury.

Presumably most of the confined cooking fires (52%) began with food or cooking materials, although this information is not routinely collected for these fires. Cooking materials, including foods, were identified as the items first ignited in 1% of these fires, meaning that more half of the fires in these properties began with these items. Unclassified items were first ignited in 4% of the fires. Although electrical wire or cable insulation was first ignited in 7% of fires, these fires resulted in 25% of the civilian injuries. Mattress or bedding resulted in 19% of civilian injuries.

Table A.
Fire Protection Features in Non-Confined Structure Fires in Nursing Homes Reported to Public Fire Departments:
2002-2005 Annual Averages

Percent of non-confined fires in buildings with automatic extinguishing equipment	71%
Deaths per 1,000 non-confined fires with automatic extinguishing equipment	2.6
Deaths per 1,000 non-confined fires with no automatic extinguishing equipment present	40.6
Reduction in deaths per 1,000 non-confined fires when automatic extinguishing equipment was present	94%
Average loss per non-confined fire when automatic	$5,265

[1] A proportional share of fires involving heat from unclassified open flame or smoking materials is included in the estimates for fires involving candles and smoking materials.

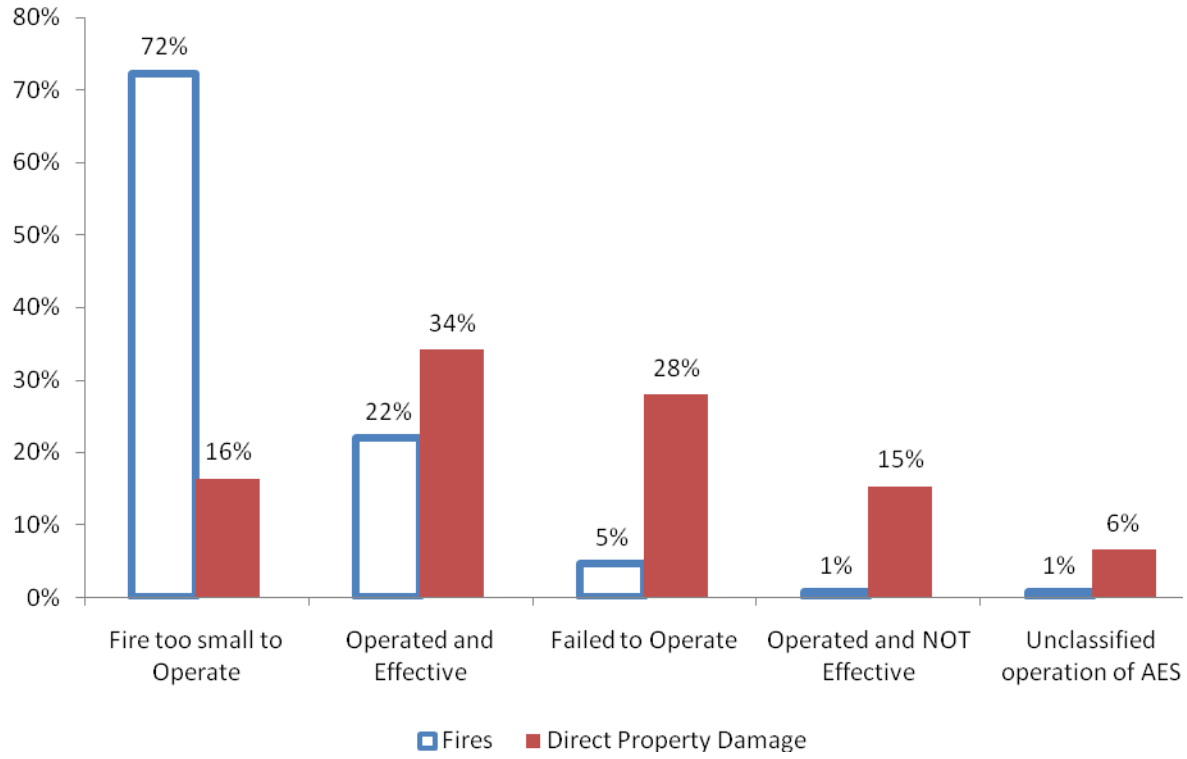
extinguishing equipment was present	
Average loss per non-confined fire with no automatic extinguishing equipment	$7,403
Reduction in loss per non-confined fire when automatic extinguishing equipment was present	-29%

Source: National estimates based on NFIRS and NFPA survey.

The death rate per 1,000 fires was 94% lower when automatic suppression systems were present.

The collection of suppression system data is not required in NFIRS 5.0 when fires are confined; therefore we can only examine the suppression system presence, operation, and type in non-confined fires. As Table A shows, automatic suppression systems were present in 71% of non-confined nursing home structure fires in 2002-2005. The death rate per thousand non-confined fires was almost sixteen times as high when this equipment was not present. The average loss per non-confined fire was higher in properties with suppression equipment. Twenty-eight percent of the direct property damage in nursing homes with suppression systems present was due to the system's failure to operate. Sixteen percent of direct property damage resulted when the fire was too small to cause the sprinkler to operate and another 15% of property damage resulted in fires where the sprinkler operated but was not effective.

Figure 3.
Operation of Automatic Suppression System when System Present in Non-Confined Structure Fires in Nursing Homes 2002-2005 Annual Averages



Source: NFIRS and NFPA Survey

Beginning in March of 2005, the Centers for Medicare & Medicaid Services (CMS) required that battery-operated smoke alarms be installed in all patient rooms and public areas in long-term care facilities, nationwide, that do not have sprinklers. In addition to this requirement, all new sprinkler systems in nursing homes must meet NFPA technical specifications.[2]

Only 3% of nursing home fires spread beyond room of origin.
Sixty-one percent of the reported fires in nursing homes were confined or contained fires. In addition to the 61% of contained or confined fires, 27% were confined to the object of origin. Only 3% spread beyond the room of origin. Ten percent of the civilian fire deaths and 46% of the civilian injuries resulted from fires that were confined to the object of origin. Thirty-seven percent of the civilian injuries resulted from fires that expanded beyond the object of origin but were confined to the room of origin. (See Table 10.)

An average of 1,400 outside and other fires per year were reported at these properties.
During 2002-2005, an estimated annual average of 1,400 outside and other fires on these properties caused an average of eleven civilian injuries and $0.3 million in direct property damage per year. An average of 150 vehicle fires reported on these properties caused an average of three civilian injuries and $0.3 million in direct property damage per year. No civilian fire deaths resulted from vehicle fires reported on these properties that were reported to NFIRS. Civilian fire deaths from outside fires on these properties averaged less than one per year.

Residents of these facilities are particularly vulnerable.
People over 65 face more than twice the risk of dying in a home fires as the general population and risk increases with age.[3] Consequently, the aged are considered a high-risk population. Institutional facilities that care for older adults must work diligently to prevent fires and to train staff and to equip the property (e.g., active systems) for effective response should a fire occur. The deadliest fire in U.S. history in this property class was the 1957 Katie Jane Nursing Home fire in Warrenton, Missouri, that killed 72 people.

Additional information sources
NFPA members can download a number of investigation reports on nursing home and board and care fires at no cost from http://www.nfpa.org/Research/. Non-members may order investigation reports through the NFPA library.

Two chapters found in the 20th edition of the NFPA *Fire Protection Handbook*, "Information and Analysis for Fire Protection" by John R. Hall, Jr. and Arthur Cote, and "Human Behavior and Fire" by John L. Bryan, describe some of the special fire safety concerns for these properties.

[2] FS-World.com, *Fire Sprinkler Systems Mandated for Nursing Homes in USA*, June 24, 2008, http://www.fs-world.com/Show.asp?ID=8477
[3] Jennifer D. Flynn, *Characteristics of Home Fire Victims*, NFPA Division of Fire Analysis and Research July 2008, pg 1.

Table 1.
Structure Fires in Nursing Homes
by Year: 1980-2005

Year	Fires	Civilian Injuries	Direct Property Damage (in Millions) As Reported	Direct Property Damage (in Millions) In 2005 Dollars
1980	3,720	120	$1.5	$3.6
1981	3,630	264	$1.8	$3.9
1982	3,450	129	$1.4	$2.8
1983	3,190	173	$1.6	$3.1
1984	2,820	163	$3.4	$6.4
1985	3,250	170	$4.2	$7.6
1986	2,910	178	$2.0	$3.6
1987	3,080	93	$1.7	$2.9
1988	2,720	160	$2.0	$3.3
1989	2,650	135	$3.0	$4.7
1990	2,580	248	$2.5	$3.7
1991	2,580	295	$3.9	$5.6
1992	2,580	152	$4.7	$6.5
1993	2,500	247	$4.6	$6.2
1994	2,590	250	$5.6	$7.4
1995	2,200	175	$2.3	$3.0
1996	2,270	149	$5.6	$7.0
1997	2,430	264	$3.2	$3.9
1998	2,140	199	$4.0	$4.8
1999	*2,550*	*111*	*$8.5*	*$10.0*
2000	*2,410*	*149*	*$4.2*	*$4.8*
2001	*2,790*	*111*	*$12.4*	*$13.7*
2002	2,620	160	$6.2	$6.7
2003	2,890	137	$9.1	$9.7
2004	2,940	97	$6.4	$6.6
2005	2,740	134	$4.9	$4.9

*Estimates for 1999-2005 are based on data collected in NFIRS 5.0 only. Due to the smaller share of NFIRS data collected in 1999-2001, statistics for these years should be viewed with caution. Deaths are not included in this table due to the large number of deaths in 2003 intentionally set fire in a Connecticut nursing home and its impact on estimates.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars

Sources: NFIRS and NFPA survey. Inflation adjustments were based on Table No. 697, "Purchasing Power of the Dollar: 1950 to 2006," U.S. Census *Bureau's Statistical Abstract of the United States: 2008*, 127th Edition, 2007.

Table 2. Structure Fires in Nursing Homes, by Month, 2002-2005 Annual Averages

Month	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
January	260	(9%)	0	(0%)	14	(11%)	$0.3	(4%)
February	230	(8%)	13	(80%)	17	(13%)	$0.3	(4%)
March	250	(9%)	1	(8%)	20	(15%)	$0.2	(4%)
April	210	(8%)	0	(0%)	5	(4%)	$1.4	(22%)
May	240	(8%)	0	(0%)	10	(8%)	$0.3	(5%)
June	220	(8%)	0	(3%)	8	(6%)	$0.4	(5%)
July	220	(8%)	0	(0%)	11	(9%)	$0.3	(5%)
August	200	(7%)	0	(0%)	7	(5%)	$1.2	(18%)
September	230	(8%)	0	(0%)	8	(6%)	$0.4	(5%)
October	240	(9%)	0	(2%)	7	(5%)	$1.0	(15%)
November	240	(9%)	0	(3%)	8	(6%)	$0.3	(5%)
December	260	(9%)	1	(5%)	17	(13%)	$0.6	(9%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)
Average	230	(8%)	1	(8%)	11	(8%)	$0.5	(8%)

Table 3. Structure Fires in Nursing Homes, by Day of Week, 2002-2005 Annual Averages

Day	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Sunday	410	(15%)	1	(5%)	7	(6%)	$1.0	(16%)
Monday	380	(14%)	1	(8%)	12	(10%)	$0.7	(11%)
Tuesday	370	(13%)	0	(3%)	16	(12%)	$0.6	(10%)
Wednesday	390	(14%)	13	(81%)	23	(18%)	$2.0	(30%)
Thursday	390	(14%)	0	(0%)	26	(20%)	$0.5	(8%)
Friday	420	(15%)	0	(0%)	21	(16%)	$0.9	(13%)
Saturday	440	(16%)	1	(3%)	24	(19%)	$0.8	(13%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)
Average	400	(14%)	2	(14%)	19	(14%)	$0.9	(14%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA survey.

Table 4.
Structure Fires in Nursing Homes,
by Alarm Time
2002-2005 Annual Average

Time of Day	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Midnight-12:59 a.m.	70	(3%)	1	(3%)	4	(3%)	$0.2	(3%)
1:00-1:59 a.m.	60	(2%)	1	(3%)	13	(10%)	$1.2	(18%)
2:00-2:59 a.m.	50	(2%)	12	(75%)	17	(13%)	$0.1	(1%)
3:00-3:59 a.m.	40	(2%)	1	(5%)	1	(1%)	$0.4	(6%)
4:00-4:59 a.m.	50	(2%)	0	(2%)	5	(4%)	$0.1	(2%)
5:00-5:59 a.m.	60	(2%)	0	(0%)	1	(0%)	$0.2	(2%)
6:00-6:59 a.m.	90	(3%)	0	(0%)	3	(2%)	$0.2	(2%)
7:00-7:59 a.m.	150	(5%)	0	(0%)	10	(7%)	$0.1	(2%)
8:00-8:59 a.m.	170	(6%)	0	(0%)	2	(1%)	$0.2	(3%)
9:00-9:59 a.m.	170	(6%)	0	(0%)	5	(4%)	$0.1	(2%)
10:00-10:59 a.m.	160	(6%)	0	(0%)	4	(3%)	$0.2	(2%)
11:00-11:59 a.m.	170	(6%)	0	(0%)	5	(4%)	$0.2	(2%)
12:00-12:59 p.m.	130	(5%)	0	(0%)	3	(2%)	$0.1	(2%)
1:00-1:59 p.m.	130	(5%)	0	(3%)	4	(3%)	$0.1	(2%)
2:00-2:59 p.m.	130	(4%)	0	(0%)	4	(3%)	$0.2	(3%)
3:00-3:59 p.m.	130	(5%)	0	(0%)	4	(3%)	$0.7	(11%)
4:00-4:59 p.m.	160	(6%)	0	(0%)	8	(6%)	$0.5	(7%)
5:00-5:59 p.m.	160	(6%)	0	(0%)	7	(5%)	$0.2	(3%)
6:00-6:59 p.m.	170	(6%)	0	(0%)	7	(5%)	$0.6	(9%)
7:00-7:59 p.m.	140	(5%)	0	(2%)	9	(7%)	$0.2	(4%)
8:00-8:59 p.m.	130	(5%)	0	(3%)	6	(5%)	$0.3	(5%)
9:00-9:59 p.m.	90	(3%)	0	(0%)	3	(2%)	$0.1	(2%)
10:00-10:59 p.m.	90	(3%)	0	(0%)	3	(2%)	$0.1	(2%)
11:00-11:59 p.m.	80	(3%)	1	(5%)	4	(3%)	$0.4	(7%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)
Average	120	(4%)	1	(4%)	5	(4%)	$0.3	(4%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars.

Source: NFIRS and NFPA survey.

Table 5.
Leading Causes of Structure Fires in Nursing Homes
2002-2005 Annual Averages

Causes	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Cooking equipment fires	1,520	(54%)	0	(0%)	15	(11%)	$0.4	(6%)
Confined cooking fires	*1,450*	*(52%)*	*0*	*(0%)*	*6*	*(5%)*	*$0.1*	*(2%)*
Identified cooking equipment	*80*	*(3%)*	*0*	*(0%)*	*9*	*(7%)*	*$0.3*	*(4%)*
Clothes dryer or washer	340	(12%)	0	(0%)	25	(19%)	$2.2	(33%)
Heating equipment fires	270	(9%)	1	(9%)	20	(15%)	$0.4	(6%)
Confined heating equipment	*110*	*(4%)*	*1*	*(5%)*	*1*	*(1%)*	*$0.0*	*(1%)*
Identified heating equipment	*150*	*(5%)*	*1*	*(4%)*	*18*	*(14%)*	*$0.4*	*(6%)*
Electrical distribution and lighting equipment	100	(3%)	0	(0%)	0	(0%)	$0.6	(9%)
Smoking materials	70	(3%)	1	(5%)	15	(11%)	$0.6	(9%)
Intentional	40	(1%)	12	(75%)	13	(10%)	$0.1	(1%)
Contained trash or rubbish fire	150	(5%)	0	(0%)	2	(2%)	$0.0	(0%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are the leading causes, obtained from the following list: intentional (from the NFIRS field "cause"); playing with fire (from factor contributing to ignition); confined heating (including confined chimney and confined fuel burner or boiler fires), confined cooking, and contained trash or rubbish (from incident type); identified heating, identified cooking, clothes dryer or washer , torch (including burner and soldering iron), electrical distribution and lighting equipment (from equipment involved in ignition); and smoking materials, (from heat source). The statistics on smoking materials include a proportional share of fires in which the heat source was heat from an unclassified open flame or smoking material. Because contained trash or rubbish fires are a scenario without causal information, they are shown at the bottom of the table if they account for at least 2% of the fires. Casual information is not routinely collected for confined incidents. The same fire can be listed under multiple causes, based on multiple data elements. Details on handling of unknowns, partial unknowns, and other underspecified codes may be found in the Appendix.

These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand. Property damage has not been adjusted for inflation.

Source: NFIRS and NFPA survey.

Table 6.
Structure Fires in Nursing Homes, by Equipment Involved in Ignition
2002-2005 Annual Averages

Equipment Involved in Ignition	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Confined cooking fire	1,450	(52%)	0	(0%)	6	(5%)	$0.1	(2%)
Clothes dryer or washer	340	(12%)	0	(0%)	25	(19%)	$2.2	(33%)
None	190	(7%)	0	(0%)	23	(18%)	$1.9	(29%)
Confined fuel burner or boiler fire	90	(3%)	1	(5%)	1	(1%)	$0.0	(1%)
Unclassified heating, ventilating and air conditioning	80	(3%)	1	(4%)	18	(14%)	$0.2	(4%)
Fan	60	(2%)	0	(0%)	9	(7%)	$0.6	(10%)
Air conditioner	50	(2%)	0	(0%)	6	(4%)	$0.1	(1%)
Fixed or portable space heater	40	(1%)	0	(0%)	0	(0%)	$0.1	(1%)
Lamp, bulb, or lighting	40	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Wiring switch or outlet	40	(1%)	0	(0%)	0	(0%)	$0.2	(4%)
Range with or without oven, cooking surface	30	(1%)	0	(0%)	7	(6%)	$0.1	(2%)
Unclassified equipment involved in ignition	30	(1%)	0	(0%)	1	(1%)	$0.1	(2%)
Water heater	20	(1%)	0	(0%)	0	(0%)	$0.0	(1%)
Confined chimney or flue fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Dishwasher	20	(1%)	0	(0%)	1	(1%)	$0.0	(0%)
Microwave oven	10	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Other confined fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Other known equipment	150	(5%)	15	(91%)	31	(24%)	$0.8	(12%)
Contained trash or rubbish fire	150	(5%)	0	(0%)	2	(2%)	$0.0	(0%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. These statistics include a proportional share of fires in which the item first ignited was undetermined or not reported. Fires in which the equipment involved in ignition was undetermined or not reported were allocated proportionally among fires with known equipment involved in ignition. Fires in which the equipment involved in ignition was entered as none but the heat source indicated equipment involvement or the heat source was unknown were also treated as unknown and allocated proportionally among fires with known equipment involved. Sums may not equal due to rounding errors. Estimates of zero mean that the actual number rounded to zero – it may or may not actually be zero.

Source: NFIRS and NFPA survey.

Table 7.
Structure Fires in Nursing Homes, by Heat Source
2002-2005 Annual Averages

Heat Source	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Confined cooking fire	1,450	(52%)	0	(0%)	6	(5%)	$0.1	(2%)
Unclassified heat from powered equipment	300	(11%)	0	(0%)	17	(13%)	$1.1	(17%)
Radiated, conducted heat from operating equipment	210	(8%)	1	(3%)	36	(27%)	$0.8	(13%)
Arcing	180	(6%)	0	(0%)	22	(17%)	$2.3	(35%)
Confined fuel burner or boiler fire	90	(3%)	1	(5%)	1	(1%)	$0.0	(1%)
Smoking materials	70	(3%)	1	(5%)	15	(11%)	$0.6	(9%)
Spark, ember or flame from operating equipment	60	(2%)	0	(0%)	4	(3%)	$0.2	(3%)
Unclassified hot or smoldering object	60	(2%)	0	(0%)	2	(1%)	$0.2	(3%)
Unclassified heat source	50	(2%)	0	(0%)	2	(1%)	$0.0	(1%)
Lighter	30	(1%)	14	(87%)	18	(14%)	$0.1	(1%)
Hot ember or ash	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Spontaneous combustion or chemical reaction	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Confined chimney or flue fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Flame or torch used for lighting	10	(1%)	0	(0%)	3	(2%)	$0.2	(3%)
Other confined fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Other known heat source	60	(2%)	0	(0%)	4	(3%)	$0.8	(13%)
Contained trash or rubbish fire	150	(5%)	0	(0%)	2	(2%)	$0.0	(0%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the heat source was unknown or not reported have been allocated proportionally among fires with known heat source. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA survey.

Table 8.
Structure Fires in Nursing Homes, by Area of Origin
2002-2005 Annual Averages

Area of Origin	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Confined cooking fire	1,450	(52%)	0	(0%)	6	(5%)	$0.1	(2%)
Laundry room or area	270	(10%)	0	(0%)	15	(11%)	$0.8	(13%)
Bedroom	190	(7%)	15	(92%)	42	(35%)	$0.4	(7%)
Kitchen or cooking area	120	(4%)	0	(0%)	11	(8%)	$0.3	(5%)
Confined fuel burner or boiler fire	90	(3%)	1	(5%)	1	(1%)	$0.0	(1%)
Lavatory, bathroom, locker room or check room	60	(2%)	0	(0%)	12	(9%)	$0.1	(1%)
Unclassified equipment or service area	30	(1%)	0	(0%)	0	(0%)	$1.2	(19%)
Duct for HVAC, cable, exhaust, heating, or AC	30	(1%)	0	(0%)	0	(0%)	$0.0	(1%)
Common room, living room, family room, lounge or den	30	(1%)	0	(0%)	5	(4%)	$0.2	(3%)
Unclassified function area	30	(1%)	0	(0%)	3	(3%)	$0.1	(1%)
Attic or ceiling/roof assembly or concealed space	30	(1%)	0	(0%)	2	(2%)	$0.8	(12%)
Heating equipment room	20	(1%)	0	(0%)	6	(5%)	$0.1	(1%)
Unclassified area	20	(1%)	0	(0%)	1	(0%)	$0.0	(1%)
Wall assembly or concealed space	20	(1%)	0	(0%)	1	(0%)	$0.3	(4%)
Exterior roof surface	20	(1%)	0	(0%)	0	(0%)	$0.5	(8%)
Closet	20	(1%)	0	(0%)	1	(1%)	$0.0	(1%)
Hallway, corridor, mall	20	(1%)	0	(0%)	6	(4%)	$0.0	(1%)
Confined chimney or flue fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Machinery room or area or elevator machinery room	20	(1%)	0	(0%)	1	(1%)	$0.2	(2%)
Other confined fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Other known area	170	(6%)	0	(3%)	11	(9%)	$1.2	(18%)
Contained trash or rubbish fire	150	(5%)	0	(0%)	2	(2%)	$0.0	(0%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the area of origin was unknown or not reported have been allocated proportionally among fires with known area of origin. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA survey.

Table 9.
Structure Fires in Nursing Homes,
by Item First Ignited
2002-2005 Annual Averages

Item First Ignited	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Confined cooking fire	1,450	(52%)	0	(0%)	6	(5%)	$0.1	(2%)
Electrical wire or cable insulation	200	(7%)	1	(3%)	33	(25%)	$1.8	(27%)
Unclassified item first ignited	110	(4%)	0	(0%)	3	(2%)	$0.3	(4%)
Mattress or bedding material	100	(4%)	13	(84%)	25	(19%)	$0.3	(4%)
Confined fuel burner or boiler fire	90	(3%)	1	(5%)	1	(1%)	$0.0	(1%)
Linen other than bedding	80	(3%)	0	(0%)	2	(1%)	$0.3	(4%)
Clothing	50	(2%)	0	(0%)	6	(5%)	$0.2	(2%)
Appliance housing or casing	50	(2%)	0	(0%)	6	(5%)	$0.1	(2%)
Dust, fiber, lint, including sawdust or excelsior	50	(2%)	0	(0%)	3	(3%)	$0.1	(1%)
Unclassified soft goods or wearing apparel	40	(2%)	0	(0%)	3	(2%)	$0.1	(2%)
Cooking materials, including food	40	(1%)	0	(0%)	4	(3%)	$0.0	(1%)
Structural member or framing	30	(1%)	0	(0%)	4	(3%)	$0.9	(14%)
Insulation within structural area	20	(1%)	0	(0%)	1	(1%)	$0.5	(7%)
Upholstered furniture	20	(1%)	0	(0%)	2	(2%)	$0.1	(2%)
Unclassified furniture or utensils	20	(1%)	0	(0%)	3	(3%)	$0.1	(2%)
Confined chimney or flue fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Household utensils	20	(1%)	0	(0%)	3	(2%)	$0.0	(0%)
Other confined fire	20	(1%)	0	(0%)	0	(0%)	$0.0	(0%)
Other known item	240	(9%)	1	(8%)	21	(16%)	$1.6	(25%)
Contained trash or rubbish fire	150	(5%)	0	(0%)	2	(2%)	$0.0	(0%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the item first ignited was unknown or not reported have been allocated proportionally among fires with known item first ignited. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA survey.

Table 10.
Structure Fires in Nursing Homes,
by Extent of Flame Damage
2002-2005 Annual Averages

Extent of Flame Damage	Fires		Civilian Deaths*		Civilian Injuries		Direct Property Damage (in Millions)	
Confined or contained fire	1,720	(61%)	1	(5%)	10	(7%)	$0.2	(3%)
Confined to object of origin	760	(27%)	2	(10%)	60	(46%)	$1.1	(16%)
Confined to room of origin	260	(9%)	1	(6%)	49	(37%)	$1.6	(24%)
Confined to floor of origin	20	(1%)	0	(0%)	1	(1%)	$0.6	(10%)
Confined to building of origin	40	(2%)	13	(79%)	11	(8%)	$3.1	(47%)
Extended beyond building of origin	0	(0%)	0	(0%)	0	(0%)	$0.0	(0%)
Total	2,810	(100%)	16	(100%)	130	(100%)	$6.6	(100%)

* In 2003 an intentional fire in Connecticut resulted in 16 casualties and dozens of injuries. This incident has a significant impact on the estimated number of deaths per year as well as the percentage of civilian fire deaths.

Note: These are national estimates of fires reported to U.S. municipal fire departments and so exclude fires reported only to Federal or state agencies or industrial fire brigades. National estimates are projections. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Fires are rounded to the nearest ten, civilian deaths and injuries are rounded to the nearest one, and direct property damage is rounded to the nearest hundred thousand dollars. Property damage has not been adjusted for inflation. Non-confined and non-contained structure fires in which the extent of flame damage was unknown or not reported have been allocated proportionally among fires with known extent of flame damage. Totals may not equal sums due to rounding errors.

Source: NFIRS and NFPA survey.

Appendix A.
How National Estimates Statistics Are Calculated

The statistics in this analysis are estimates derived from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual survey of U.S. fire departments. NFIRS is a voluntary system by which participating fire departments report detailed factors about the fires to which they respond. Roughly two-thirds of U.S. fire departments participate, although not all of these departments provide data every year.

NFIRS provides the most detailed incident information of any national database not limited to large fires. NFIRS is the only database capable of addressing national patterns for fires of all sizes by specific property use and specific fire cause. NFIRS also captures information on the extent of flame spread, and automatic detection and suppression equipment. For more information about NFIRS visit http://www.nfirs.fema.gov/. Copies of the paper forms may be downloaded from http://www.nfirs.fema.gov/_download/nfirspaperforms2007.pdf.

Each year, NFPA conducts an annual survey of fire departments which enables us to capture a summary of fire department experience on a larger scale. Surveys are sent to all municipal departments protecting populations of 50,000 or more and a random sample, stratified by community size, of the smaller departments. Typically, a total of roughly 3,000 surveys are returned, representing about one of every ten U.S. municipal fire departments and about one third of the U.S. population.

The survey is stratified by size of population protected to reduce the uncertainty of the final estimate. Small rural communities have fewer people protected per department and are less likely to respond to the survey. A larger number must be surveyed to obtain an adequate sample of those departments. (NFPA also makes follow-up calls to a sample of the smaller fire departments that do not respond, to confirm that those that did respond are truly representative of fire departments their size.) On the other hand, large city departments are so few in number and protect such a large proportion of the total U.S. population that it makes sense to survey all of them. Most respond, resulting in excellent precision for their part of the final estimate.

The survey includes the following information: (1) the total number of fire incidents, civilian deaths, and civilian injuries, and the total estimated property damage (in dollars), for each of the major property use classes defined in NFIRS; (2) the number of on-duty firefighter injuries, by type of duty and nature of illness; and (3) information on the type of community protected (e.g., county versus township versus city) and the size of the population protected, which is used in the statistical formula for projecting national totals from sample results. The results of the survey are published in the annual report *Fire Loss in the United States*. To download a free copy of the report, visit http://www.nfpa.org/assets/files/PDF/OS.fireloss.pdf.

Projecting NFIRS to National Estimates

As noted, NFIRS is a voluntary system. Different states and jurisdictions have different reporting requirements and practices. Participation rates in NFIRS are not necessarily uniform across regions and community sizes, both factors correlated with frequency and

severity of fires. This means NFIRS may be susceptible to systematic biases. No one at present can quantify the size of these deviations from the ideal, representative sample, so no one can say with confidence that they are or are not serious problems. But there is enough reason for concern so that a second database - the NFPA survey - is needed to project NFIRS to national estimates and to project different parts of NFIRS separately. This multiple calibration approach makes use of the annual NFPA survey where its statistical design advantages are strongest.

Scaling ratios are obtained by comparing NFPA's projected totals of residential structure fires, non-residential structure fires, vehicle fires, and outside and other fires, and associated civilian deaths, civilian injuries, and direct property damage with comparable totals in NFIRS. Estimates of specific fire problems and circumstances are obtained by multiplying the NFIRS data by the scaling ratios.

Analysts at the NFPA, the USFA and the Consumer Product Safety Commission have developed the specific analytical rules used for this procedure. "The National Estimates Approach to U.S. Fire Statistics," by John R. Hall, Jr. and Beatrice Harwood, provides a more detailed explanation of national estimates. A copy of the article is available online at http://www.nfpa.org/osds or through NFPA's One-Stop Data Shop.

Version 5.0 of NFIRS, first introduced in 1999, used a different coding structure for many data elements, added some property use codes, and dropped others.

Figure 1.

Fires Originally Collected in NFIRS 5.0 by Year

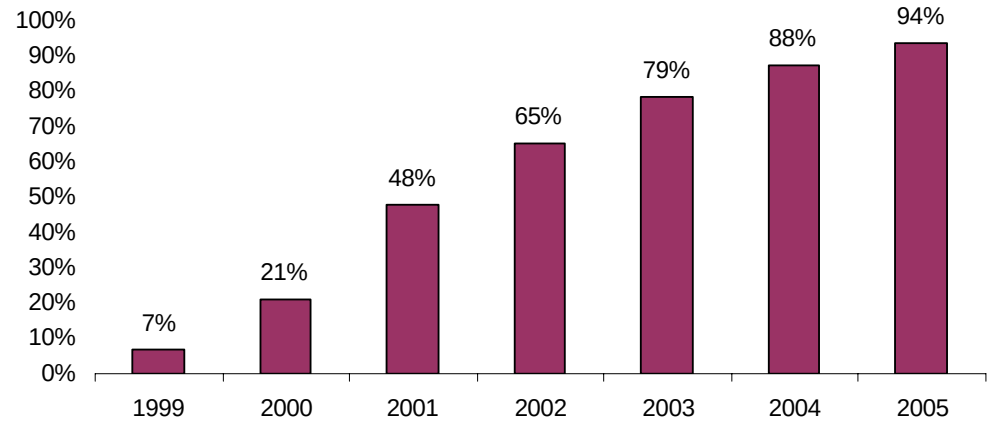


Figure 1 shows the percentage of fires originally collected in the NFIRS 5.0 system. Each year's release version of NFIRS data also includes data collected in older versions of NFIRS that were converted to NFIRS 5.0 codes.

For 2002 data on, analyses are based on scaling ratios using only data originally collected in NFIRS 5.0:

NFPA survey projections
NFIRS totals (Version 5.0)

For 1999 to 2001, the same rules may be applied, but estimates for these years in this form will be less reliable due to the smaller amount of data originally collected in NFIRS 5.0; they should be viewed with extreme caution.

A second option is to omit year estimates for 1999-2001 from year tables.

NFIRS 5.0 has six categories of confined structure fires, including:

- cooking fires confined to the cooking vessel,
- confined chimney or flue fires,
- confined incinerator fire,
- confined fuel burner or boiler fire or delayed ignition,
- confined commercial compactor fire, and
- trash or rubbish fires in a structure with no flame damage to the structure or its contents.

Although causal and other detailed information is typically not required for these incidents, it is provided in some cases. In order for that limited detail to be used to characterize the confined fires, they must be analyzed separately from non-confined fires. Otherwise, the patterns in a factor for the more numerous non-confined fires with factor known will dominate the allocation of the unknown factor fires for both non-confined and confined fires. If the pattern is different for confined fires, which is often the case, that fact will be lost unless analysis is done separately.

For most fields other than Property Use, NFPA allocates unknown data proportionally among known data. This approach assumes that if the missing data were known, it would be distributed in the same manner as the known data. NFPA makes additional adjustments to several fields.

For Factor Contributing to Ignition, the code "none" is treated as an unknown and allocated proportionally. For Human Factor Contributing to Ignition, NFPA enters a code for "not reported" when no factors are recorded. "Not reported" is treated as an unknown, but the code "none" is treated as a known code and not allocated. Multiple entries are allowed in both of these fields. Percentages are calculated on the total number of fires, not entries, resulting in sums greater than 100%. Groupings for this field show all category headings and specific factors if they account for a rounded value of at least 1%.

Type of Material First Ignited (TMI). This field is required only if the Item First Ignited falls within the code range of 00-69. NFPA has created a new code "not required" for this field that is applied when Item First Ignited is in code 70-99 (organic materials, including cooking materials and vegetation, and general materials, such as electrical wire, cable insulation, transformers, tires, books, newspaper, dust, rubbish, etc..) and TMI is blank. The ratio for allocation of unknown data is:

$$\frac{\text{(All fires – TMI Not required)}}{\text{(All fires – TMI Not Required – Undetermined – Blank))}}$$

Heat Source. In NFIRS 5.0, one grouping of codes encompasses various types of open flames and smoking materials. In the past, these had been two separate groupings. A new code was added to NFIRS 5.0, which is code 60: "Heat from open flame or smoking material, other." NFPA treats this code as a partial unknown and allocates it proportionally across the codes in the 61-69 range.

61. Cigarette,
62. Pipe or cigar,
63. Heat from undetermined smoking material,
64. Match,
65. Lighter: cigarette lighter, cigar lighter,
66. Candle,
67 Warning or road flare, fusee,
68. Backfire from internal combustion engine. Excludes flames and sparks from an exhaust system, (11)
69. Flame/torch used for lighting. Includes gas light and gas-/liquid-fueled lantern.

In addition to the conventional allocation of missing and undetermined fires, NFPA multiplies fires with codes in the 61-69 range by

$$\frac{\text{All fires in range 60-69}}{\text{All fires in range 61-69}}$$

The downside of this approach is that heat sources that are truly a different type of open flame or smoking material are erroneously assigned to other categories. The grouping "smoking materials" includes codes 61-63 (cigarettes, pipes or cigars, and heat from undetermined smoking material, with a proportional share of the code 60s and true unknown data.

Equipment Involved in Ignition (EII). NFIRS 5.0 originally defined EII as the piece of equipment that provided the principal heat source to cause ignition if the equipment malfunctioned or was used improperly. In 2006, the definition was modified to "the piece of equipment that provided the principal heat source to cause ignition." However, the 2006 data is not yet available and a large portion of the fires coded as no equipment involved (NNN) have heat sources in the operating equipment category. To compensate, NFPA treats fires in which EII = NNN and heat source is not in the range of 40-99 as an additional unknown.

To allocate unknown data for EII, the known data is multiplied by

$$\frac{\text{All fires}}{\text{(All fires – blank – undetermined –[fires in which EII =NNN and heat source <>40-99])}}$$

Additional allocations may be used in specific analyses. For example, NFPA's report about home heating fires treats Equipment Involved in Ignition Code 120, fireplace, chimney, other" as a partial unknown (like Heat Source 60) and allocates it over its related decade of 121-127, which includes codes for fireplaces (121-122) and chimneys (126-127) but also includes codes for fireplace insert or stove, heating stove, and chimney or vent connector. More general analyses of specific occupancies may not perform as many allocations of partial allocations. Notes at the end of each table describe what was allocated.

Rounding and percentages. The data shown are estimates and generally rounded. An entry of zero may be a true zero or it may mean that the value rounds to zero. Percentages are calculated from unrounded values. It is quite possible to have a percentage entry of up to 100%, even if the rounded number entry is zero. Values that appear identical may be associated with different percentages, and identical percentages may be associated with slightly different values.

Appendix B.
Methodology and Definitions Used in "Leading Cause" Tables

The cause table reflects relevant causal factors that accounted for at least 2% of the fires in a given occupancy. Only those causes that seemed to describe a scenario are included. Because the causal factors are taken from different fields, some double counting is possible. Percentages are calculated against the total number of structure fires, including both confined and non-confined fires. Bear in mind that every fire has at least three "causes" in the sense that it could have been prevented by changing behavior, heat source, or ignitability of first fuel, the last an aspect not reflected in any of the major cause categories. For example, several of the cause categories in this system refer to types of equipment (cooking, heating, electrical distribution and lighting, clothes dryers and washers, torches). However, the problem may be not with the equipment but with the way it is used. The details in national estimates are derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS). This methodology is based on the coding system used in Version 5.0 of NFIRS. The *NFIRS 5.0 Reference Guide*, containing all of the codes, can be downloaded from http://www.nfirs.fema.gov/documentation/reference/.

Cooking equipment and heating equipment are calculated by summing fires identified by equipment involved in ignition and relevant confined fires. Confined fires will be shown if they account for at least 1% of the incidents. **Confined cooking fires** (cooking fires involving the contents of a cooking vessel without fie extension beyond the vessel) are identified by NFIRS incident type 113;

Confined heating equipment fires include **confined chimney or flue fires (**incident type 114) and **confined fuel burner or boiler** fires (incident type 116). The latter includes delayed ignitions and incidents where flames caused no damage outside the fire box. The two types of confined heating fires may be combined or listed separately, depending on the numbers involved.

Contained trash or rubbish fires with no flame damage to structure or its contents are identified by incident type 118. No cause can be ascertained for these incidents, but they account for a substantial share of the incidents in some occupancies. When appropriate, these fires are generally shown at the bottom of a cause table.

Confined or contained fires (incident type 113-118) are excluded from the remaining estimates. Unknown data is allocated proportionally among non-confined fires.

Intentional fires are identified by fires with a "1" (intentional) in the field "cause." The estimate includes a proportional share of fires in which the cause was undetermined after investigation, under investigation, or not reported. All fires with intentional causes are included in this category regardless of the age of the person involved. Earlier versions of NFIRS included codes for incendiary and suspicious; both convert to intentional. Intentional fires were deliberately set; they may or may not be incendiary in a legal sense. No age restriction is applied.

Fires caused by **playing with heat source** (typically matches or lighters) are identified by code 19 in the field "factor contributing to ignition." Because of conversion issues, only data

originally collected in Version 5.0 of NFIRS is used in the initial calculation. It appears that "none" is often being used in place of "unknown." Fires in which the factor contribution to ignition was undetermined (UU), entered as none (NN) or left blank are considered unknown and allocated proportionally. Because factor contributing to ignition is not required for intentional fires, the share unknown, by these definitions, is somewhat larger than it should be. After the Version 5.0 only data has been run for non-confined fires and the unknown data allocated, percentages are calculated for each code of Version 5.0 non-confined fires. Total non-confined structure fires (all versions) are multiplied by these percentages to obtain national estimates. The final percentage of fires is calculated by dividing these estimates by the total number of confined and non-confined fires from all versions.

The heat source field is used to identify fires started by: **smoking materials** (cigarette, code 61; pipe or cigar, code 62; and heat from undetermined smoking material, code 63); **candles** (code 66), **lightning** (code 73); and **spontaneous combustion or chemical reaction** (code 72). Fires started by heat from unclassified open flame or smoking materials (code 60) are allocated proportionally among the "other open flame or smoking material" codes (codes 61-69) in an allocation of partial unknown data. This includes smoking materials and candles. This approach results in any true unclassified smoking or open flame heat sources such as incense being inappropriately allocated. However, in many fires, this code was used as an unknown.

The equipment involved in ignition field is used to find several cause categories. This category includes equipment that functioned properly and equipment that malfunctioned.

Identified cooking equipment refers to equipment used to cook, heat or warm food (codes 600, 620-649 and 654). Fire in which ranges, ovens or microwave ovens, food warming appliances, fixed or portable cooking appliances, deep fat fryers, open fired charcoal or gas grills, grease hoods or ducts, or other cooking appliances) were involved in the ignition are said to be caused by cooking equipment. Food preparation devices that do not involve heating, such as can openers or food processors, are not included here. Unclassified kitchen and cooking equipment (code 600) is included here because a larger share of the whole category involved cooking rather than kitchen equipment.

Identified heating equipment (codes 100 and 120-199) includes central heat, portable and fixed heaters (including wood stoves), fireplaces, chimneys, hot water heaters, and heat transfer equipment such as hot air ducts or hot water pipes. Heat pumps are not included. Unclassified heating, ventilation and air condition equipment (code 100) is included here because a larger share of the whole category involved heating rather than air conditioning or ventilation equipment.

Electrical distribution and lighting equipment (codes 200-299) include: fixed wiring; transformers; associated overcurrent or disconnect equipment such as fuses or circuit breakers; meters; meter boxes; power switch gear; switches, receptacles and outlets; light fixtures, lamps, bulbs or lighting; signs; cords and plugs; generators, transformers, inverters, batteries and battery charges.

Torch, burner or soldering iron (codes 331-334) includes welding torches, cutting torches, Bunsen burners, plumber furnaces, blowtorches, and soldering equipment.

Clothes dryer or washer (codes 811, 813 and 814) includes clothes dryers alone, washer and dryer combinations within one frame, and washing machines for clothes.

Electronic, office or entertainment equipment (codes 700-799) includes: computers and related equipment; calculators and adding machines;, telephones or answering machines; copiers; fax machines; paper shredders; typewriters; postage meters; other office equipment; musical instruments; stereo systems and/or components; televisions and cable TV converter boxes,, cameras, excluding professional television studio cameras, video equipment and other electronic equipment. Older versions of NFIRS had a code for electronic equipment that included radar, X-rays, computers, telephones, and transmitter equipment. Because this code was so broad, it unfortunately converts to equipment involved undetermined.

Shop tools and industrial equipment excluding torches, burners or soldering irons (codes 300-330, 335-399) includes power tools; painting equipment; compressors; atomizing equipment; pumps; wet/dry vacuums; hoists, lifts or cranes; powered jacking equipment; water or gas drilling equipment; unclassified hydraulic equipment; heat-treating equipment; incinerators, industrial furnaces, ovens or kilns; pumps; compressors; internal combustion engines; conveyors; printing presses; casting, molding; or forging equipment; heat treating equipment; tar kettles; working or shaping machines; coating machines; chemical process equipment; waste recovery equipment; power transfer equipment; power takeoff; powered valves; bearings or brakes; picking, carding or weaving machines; testing equipment; gas regulators; separate motors; non-vehicular internal combustion engines; and unclassified shop tools and industrial equipment.

Medical equipment (codes 410-419) includes: dental, medical or other powered bed, chair or wheelchair; dental equipment; dialysis equipment; medical monitoring and imaging equipment; oxygen administration equipment; radiological equipment; medical sterilizers, therapeutic equipment and unclassified medical equipment.

Mobile property (vehicle) describes fires in which some type of mobile property was involved in ignition, regardless of whether the mobile property itself burned. Mobile property includes: highway-type vehicles such as cars, trucks, recreational vehicles, and motorcycles; trains, trolleys and subways; boats and ships; aircraft; industrial, agricultural and construction vehicles; and riding lawn mowers, snow removal vehicles and tractors. Because of conversion issues, only data originally collected in Version 5.0 of NFIRS is used in the initial calculation. The data was obtained by first running Version 5.0 non confined fires only to identify vehicles that were involved in ignition whether or not they burned themselves (mobile property involved codes 2 and 3). After the unknown data was allocated, percentages are calculated for each code of Version 5.0 non-confined fires. Total non-confined structure fires (all versions) are multiplied by these percentages to obtain national estimates. The final percentage of fires is calculated by dividing these estimates by the total number of confined and non-confined fires from all versions.

Exposures are fires that are caused by the spread of or from another fire. These include fires in which the exposure number is greater than 0; the factor contributing to ignition is property too close (code 71); or heat source is heat spreading from another fire via direct flame or convection current (code 80-89). Because exposures are identified by the older hierarchical sort, all non-confined fires with exposure number greater than zero are counted as exposures, but those identified by heat source and factor contributing to ignition include only fires that were not grouped in other categories such as cooking or heating equipment.

Appendix C
Previously Published "Firewatch" Incidents Involving Nursing Homes

The following incidents were taken from the "Firewatch" columns in *NFPA Journal*. Published incidents provide information about what can happen, not what is typical

Smoking with Oxygen Kills One, North Carolina

An occupant of an elder-care facility died and several others suffered injuries from smoke inhalation during a fire that started when smoking materials ignited the victim's clothing while he was using medical oxygen equipment. Accounts differ as to whether the facility was a nursing home or a residential care facility.

The single-story, wood-frame building, which was 150 feet (46 meters) long and 60 feet (18 meters) wide, had brick exterior walls and an asphalt-shingled roof. The full-coverage fire detection system sent an alarm to the fire department. The building had no fire sprinklers.

The victim died as a result of a heart attack brought on by the fire. Damage to the building, valued at $1 million, was estimated at $250,000. Its contents sustained damages estimated at $75,000.

Kenneth J. Tremblay, 2008, Firewatch, *NFPA Journal*, May/June, 32.

Sprinkler Controls Dryer Fire in Nursing Home, Illinois

A fully operational nursing home was evacuated as smoke from burning bedding within a gas-fired clothes dryer filled the building with smoke. Open access panels leading to an elevator shaft provided an avenue for smoke to travel to upper floors. A single sprinkler fused and extinguished the fire, but five occupants suffered smoke inhalation during the incident.

The two-story building was 150 feet (45 meters) long and 75 feet (22 meters) wide and constructed of concrete block walls covered by brick. The wooden roof had asphalt shingles. The facility had 68 patient rooms and was protected by a smoke detection system with pull stations. A wet-pipe sprinkler system provided full coverage and a central station alarm company monitored the system. The occupancy was operating 24 hours a day.

The dryer was overloaded with bed linens. The drum was unable to turn due to the weight and volume. Once the dryer was started, warm air filled the bin. The dryer overheated and ignited some of the linen. Heat and smoke coming from the dryer spread from the laundry room to the first floor and upper floor via the elevator shaft. Activation of the sprinkler system and by an employee provided the alarm at 12:53 p.m.

Firewalls and doors prevented spread of some of the smoke and most of the occupants were protected in place. However, some residents were evacuated as fire crews tried to ventilate the building. Five occupants suffered some smoke inhalation, but none were seriously injured. The building, valued at $1 million with contents of $350,000, suffered only $6,000 in structural loss and $500 of contents loss.

Kenneth J. Tremblay, 2007, Firewatch, *NFPA Journal*, September/October, 32.

Sprinklers Limit Nursing Home Fire Damage Ohio

Several occupants of a nursing home were treated for smoke inhalation when a fire intentionally set by a 69-year-old patient consumed combustibles placed against the door of his room.

The single-story nursing home provided 24-hour nursing care in five separate wings all connected to a central building. The wing in which the fire occurred was of protected non-combustible construction, with prefabricated concrete floors and a wooden roof deck covered with asphalt shingles. The building was protected by a wet-pipe sprinkler system and a fire detection system that included hardwired smoke and heat detectors in the residents' rooms and common spaces. A central station alarm company monitored the sprinkler water flow and the fire alarm system.

Notification from the alarm company at 9:45 p.m. sent fire crews to the scene, where they discovered several patients unable to leave their rooms without assistance. When firefighters and police officers entering the wing encountered heavy, yellowish smoke, the police officers turned back, but the firefighters, wearing self-contained breathing apparatus and using a thermal imaging camera, continued toward the sound of a sprinkler flowing water.

One of the firefighters located the room of origin, but he could only open the door about a foot (30 centimeters). Some firefighters entered the room of origin through a window and removed the occupant, while others helped evacuated patients from other rooms in the wing.

Investigators determined that the man, who had a history of dementia and was heavily medicated for the end-stage of a terminal illness, had barricaded himself in the room by placing upholstered furniture and a mattress against the door to the hallway and stuffing the bathroom door with sheets and towels. They found three separate points of fire origin.

Heat and smoke tripped the fire alarm and activated a sprinkler, which extinguished the fire, but smoke filling the wing injured five other patients ranging in age from 69 to 90. A 24-year old woman also suffered from exposure to fire products when she helped rescue the occupants.

The victim survived the fire and admitted that he started it with matches, which he had managed to acquire despite a nursing home's policy that allows residents to smoke outside only and only with staff supervision. Residents are not allowed to keep lighters, matches, or cigarettes, although a used ashtray and a pack of cigarettes were found in the victim's room.

The building, valued more than $6 million, suffered structural damages estimated at $25,000. Its contents, valued at more than $2 million, sustained losses estimated at $50,000. No firefighters were injured.

Kenneth J. Tremblay, 2006, Firewatch, *NFPA Journal*, July/August, 28.

Light Fixture Starts Fire in Nursing Home, Maryland

An arcing light fixture produced enough sparks to ignite a nursing home patient's bedding and mattress. Fortunately, the nurse in charge saw smoke coming from the room and found the

patient closest to the fire calling for help from the edge of his bed. He placed the patient on the floor and dragged him and the other patient out of the room and away from the fire. He then instructed others to call 911 at 8:30 p.m.

Firefighters arrived to find heavy smoke on the second floor and immediately called for additional resources, fearing that a number of patients might be affected. When fire crews entered the room of origin, they found the mattress on fire and flames spreading to a chair, a nightstand, and the wall.

The visually impaired patient reported hearing a "pop" and smelling smoke from the head of his bed. Investigators found that a light bulb had been screwed into the fixture incorrectly and failed to make proper contact. It eventually arced, igniting the bedding

Damage to the building was estimated at $50,000 and to its contents at $70,000. There were no injuries.

Kenneth J. Tremblay, 2006, Firewatch, *NFPA Journal*, July/August, 28.

Smoke Activates Nursing Home Emergency Plan, Massachusetts

Smoke from an electrical short in a dumb waiter's wiring activated the fire detection system in a three-story nursing home, alerting occupants to a possible fire and putting the home's emergency plan into effect.

The protected wood-frame nursing home covered approximately 2,000 square feet (610 square meters) of floor space on each floor. A monitored fire detection and sprinkler system provided full coverage.

Firefighters, who received the alarm from a municipal fire alarm box at 8:03 a.m., were told by the nursing home staff that there was a fire on the second floor, where they found smoke and the remains of a fire extinguisher that staff members had expelled in the hallway. The officer in command ordered the second floor evacuated, called for hose lines to different sides of the building, and struck a second alarm. The evacuation went smoothly.

As patients were being moved, firefighters found that the smoke was coming from electrical wiring in a motor that powered a dumb waiter. Although the fire detection system operated, the fire was too small to activate the sprinkler system, and firefighters used a portable extinguisher to put the fire out.

There were no injuries, and damage was negligible.

Kenneth J. Tremblay, 2006, Firewatch, *NFPA Journal*, July/August, 28-29.

Sprinklers Control Nursing Home Fire, North Carolina

Two sprinklers and staff members extinguished a fire in the laundry room of an occupied nursing home. The single-story, fire-resistive building, which measured 400 feet (122 meters) by 400 feet (122 meters), was equipped with a fire and smoke detection system and a wet-pipe sprinkler system monitored by a central station alarm company.

The detection system sounded the alarm at 9:38 p.m., alerting staff, occupants, and the fire department to a fire in the laundry room. Firefighters arrived within five minutes and discovered that the fire had nearly been extinguished by two sprinklers and portable fire extinguishers used by the nursing home staff. Only some smoldering material remained.

Investigators determined that the fire began when an electrical wall switch arced, igniting linen stacked on a shelf against the switch. The linen burned until the detection and suppression systems activated. Investigators found significant damage to the wiring in the electrical box for the light switch.

The value of the facility was estimated at $3.5 million. Damage to the building came to $2,000; damage to its contents is estimated at $1,000. There were no injuries, and the fire departments credits the detection and suppression systems and the staff for "lives saved" during the incident.

Kenneth J. Tremblay, 2006, Firewatch, *NFPA Journal*, May/June, 32.

Man Smoking in Bed Starts Fire in Hospice Wing of Nursing Home, Florida

A 62-year-old hospice patient who had already been caught smoking in bed earlier in the day started a fire that fatally injured him and threatened the nursing home's other occupants. At the time of the fire, nursing home patients occupied 177 beds. Seven other beds, including the victim's, were being used by hospice patients.

The single-story, 185-bed nursing home had four wings spread out like a compass around a central hub and. It was protected by a fire detection and suppression system and was fully staffed at the time of the alarm.

On the morning of the fire, a staff member discovered the victim, who was receiving oxygen through a nasal cannula, smoking in his bed. His cigarettes and lighter were taken from him and locked in a drawer. At 8:14 that evening, two nurses heard the fire alarm go off and saw smoke coming from the victim's room. Responding with a fire extinguisher, they saw flames around his legs. Heat drove them from the room before they could extinguish the fire. The nurses closed the victim's door to prevent the fire from spreading and began to evacuate patients from the wing.

The fire department received a central station alarm at 8:14 p.m. and dispatch called the facility, which confirmed the fire. Firefighters arrived a few minutes later to find smoke filling the wing and the staff removing patients. Advancing a hose line to the victim's room, they found that a single sprinkler had extinguished the blaze. They removed the victim to the hallway where he was pronounced dead. After finding another lighter and pack of cigarettes in the victim's pocket, investigators determined that the man had fallen asleep while smoking and his cigarette ignited

the bedding. The victim woke and tried to escape, but he was overcome by smoke. The flames were further fueled by the medical oxygen.

Fire damage was limited to the bedding, the bed, and part of the room. The building's fire protection system had automatically activated the fire doors, confining the smoke damage to the hospice unit. The value of the building and its contents was not reported, but damage to the building was estimated at $6,000. There were no other injuries.

Kenneth J. Tremblay, 2006, Firewatch, *NFPA Journal*, May/June, 32.

Misuse of Lighter Results in Death of Nursing Home Patient, Louisiana

A nursing home patient died from burn injuries two weeks after he attempted to use a cigarette lighter to break a string tie on his nightgown, and set his gown and bedding on fire. The fire was too small to trigger fire sprinklers.

The single-story, 24,450-square-foot (2,271-square-meter) structure was constructed of steel framing with concrete and masonry walls. Four wings were in an X configuration. The 96-bed nursing home was protected by sprinklers. The fire detection system included smoke detectors in the hallways and air conditioning ducts.

At the time of the fire, the door to the patient's room was closed. An employee noticed the smoke and a smoke detector in the air conditioning system sounded a general alarm. The fire department was called at 3:51 a.m. The fire started when the 59-year-old patient, unable to loosen or cut the string from his nightgown, used the lighter to burn the strings. The patient, who needed assistance to get in and out of bed, was severely burned. He died two weeks after the fire. Damage to the home, valued at $2.275 million with contents worth $250,000, was estimated at $2,500.

Kenneth J. Tremblay, 2004, Firewatch, *NFPA Journal*, January/February 2004, online, www.nfpa.org.

Fire Sprinkler Extinguishes Fire in Nursing Home, Florida

A single fire sprinkler extinguished a fire in a nursing home patient's room, as staff and firefighters evacuated the occupants and treated the injured.

The single-story nursing home was 200 feet (61 meters) long and 100 feet (30 meters) wide. Detection and wet-pipe automatic fire sprinkler systems had been installed.

Firefighters responding to the 12:33 p.m. report of a fire arrived within four minutes to find heavy smoke in one wing. The facility's staff told fire crews that that section of the building had already been evacuated and that staff members had used a fire extinguisher to control the flames in the room. While firefighters went to locate the fire, which the single fire sprinkler had already extinguished, the incident commander ordered additional resources to help vent the building, perform triage, and control the fire sprinkler water flow.

Investigators determined that smoking materials in the room of a 70-year-old man ignited a pillow and that the fire burned the mattress, and scorched a wall, and melted one side of an oxygen mask. Oxygen was flowing at the time of the fire. The man was treated and transported to the hospital with unspecified injuries. Two others who were injured refused transport. Some 82 occupants were evacuated.

The multi-million-dollar property and its contents sustained a $2,000 loss.

Kenneth J. Tremblay, 2003, Firewatch, *NFPA Journal*, September/October, 20.

Fire Sprinklers Control Fire Started by Cigarette, Connecticut

A cigarette discarded outside the entrance to a limited-care nursing facility ignited wood chips in a garden border. The fire spread to a wooden fence and up the building's siding to the roof, where three fire sprinklers controlled it while occupants were evacuated.

The one-story, wood-framed facility was 247 feet long (75 meters) and 174 feet (53 meters) and built on a concrete slab. Its walls were covered with vinyl siding, and its wood-truss roof was covered with asphalt shingles. A wet-pipe fire sprinkler system provided full coverage, as did a smoke and fire detection system. The 60-bed facility was fully operational at the time of the fire.

A single engine company responded to a report of a brush fire on the property at 3:09 p.m. When they arrived, firefighters saw heavy, brown smoke coming from the roof of the building and immediately requested a full response assignment followed by a second alarm.

The fire melted the vinyl soffit vents and spread into the attic, where three fire sprinklers activated, controlling the blaze until firefighters could open the roof and complete extinguishment.

The building, valued at $3,274,700, suffered damage estimated at $150,000. Its contents, valued at $400,000, suffered $37,000 in damage. There were no injuries.

Kenneth J. Tremblay, 2003, Firewatch, *NFPA Journal*, July/August, 17.

Nursing Home Employee Extinguishes Heater Fire, New Hampshire

When a malfunctioning electric space heater ignited in a nursing home office, a facility employee activated the fire alarm, located a fire extinguisher, disconnected the heater, and helped extinguish the fire.

The single-story masonry structure had a tile floor built on a concrete slab and a rubber membrane and ballast covered the metal-deck roof. Some rooms were wood-framed. A central station alarm company monitored the full-coverage fire detection system and dry-pipe sprinklers.

The worker discovered smoke coming from an electric space heater in her office and activated a manual pull station, sounding the fire alarm. She then grabbed a fire extinguisher and pulled the

space heater's plug from the wall outlet. A maintenance man responded with another fire extinguisher, and the two emptied both extinguishers onto the burning heater.

The fire had been extinguished before the fire department arrived. No one was injured, and fire losses weren't reported.

Kenneth J. Tremblay, 2003, Firewatch, *NFPA Journal*, January/February 14.

Sprinkler Controls Nursing Home Fire, Illinois

Cleaning rags left in a nursing home laundry room spontaneously ignited, but the fire was quickly doused by a single sprinkler. Fire department notification was delayed when the fire alarm signal wasn't automatically sent to 911, and the night manager had to phone in the alarm. Despite the delay, the property sustained only minimal damage.

The three-story building was of noncombustible construction and had been equipped with a full-coverage fire detection system and a wet-pipe sprinkler system. The facility provides care for nearly 70 residents.

At 8:40 p.m., fire alarms alerted staff to the activation of a basement smoke detector. When the night administrator went to investigate she found the laundry room full of smoke. Returning to the main floor, she expected the fire department to automatically respond. Ten minutes later, she called 911 to confirm their response. However, the fire department had never received the alarm. The fire alarm system had failed to send a signal to 911, but provided notification in the building.

Three engines, a truck company, and an ambulance arrived within four minutes of the administrator's call. Fire crews went to the basement laundry room, where they found that a single sprinkler had extinguished the fire, which started in a pile of cleaning rags stored on a metal cart. Firefighters provided salvage and restored the sprinkler system to full operation.

The grease-laden rags, which had been used in the kitchen, ignited spontaneously. Fortunately, the flames didn't spread beyond the point of origin, and smoke damage was limited to the laundry room.

Losses were estimated at $1,000. There were no injuries.

Kenneth J. Tremblay, 2002, Firewatch, *NFPA Journal*, January/February 21.

Appendix D
Previously Published Catastrophic Fires Involving Nursing Homes

Connecticut

Date, Time of Alarm, Number of Deaths
February 2003, 2:40 am, 16 civilian deaths
Occupancy Type and Use, Construction Type, Number of Stories, Operating Status
One-story nursing home of protected non-combustible construction. Operating at time of fire.
Detection and Suppression Systems
There were smoke alarms in the corridors. One of them activated, alerting the occupants and the fire department. None present. There was a firewall and fire doors that closed when the alarm activated, which kept the fire from spreading to the adjacent wing.
Fire Origin and Path
A patient using a lighter and bedding materials set a fire.
Contributing Factors
Elderly and disabled patients had to be assisted from the structure. The lack of a sprinkler system allowed the fire to spread.

Stephen G. Badger, 2004, *Catastrophic Multiple-Death Fires in the United States 2003*, NFPA, Fire Analysis and Research, Quincy, MA, 14.

Tennessee

Date, Time of Alarm, Number of Deaths
September 2003, 10:18 p.m., 14
Occupancy Type and Use, Construction Type, Number of Stories, Operating Status
Four-story nursing home of protected noncombustible construction. Full operation.
Detection and Suppression Systems
There were smoke alarms in the corridor and one sounded the alarm in a central station and closed the fire doors. There were no suppression systems.
Fire Origin and Path
Fire broke out in a second-story patient room and spread upwards from a bed. Gases built up above a dropped ceiling and the room flashed over. The cause is under investigation. Employees with hand-held extinguishers couldn't put out the large fire.
Contributing Factors
A dropped ceiling allowed smoke to build and delayed the activation of the hallway smoke alarms.

Stephen G. Badger, 2004, *Catastrophic Multiple-Death Fires in the United States – 2003*, NFPA, Fire Analysis and Research Division, Quincy, MA, 15.

Mississippi (this account is based on preliminary information)

Date, Time of Alarm, Number of Deaths
April, 1995, 1:30 am, 3 civilian deaths
Occupancy Type and Use, Construction Type, Number of Stories, Operating Status
Nursing home with 103 residents and 5 staff members; fire-resistive construction; 1 story; operating

Detection and Suppression Systems
Unreported types of smoke detectors were located in hallways. Their operation was not reported. There were not suppression systems.
Fire Origin and Path
A fire of undetermined origin occurred in a room containing two patients. One of the occupants of the fire room survived and the other died. Two others near the room of origin also died.
Contributing Factors
Not reported.

Kenneth J. Tremblay, 1996, "The Catastrophic Fires of 1995" *NFPA Journal*, July/August, 96.

Arkansas

Date, Time of Alarm, Number of Deaths
March 1990, 9:27 pm, 4 civilian deaths
Occupancy Type and Use, Construction Type, Number of Stories and Operating Status
Nursing home; unprotected non-combustible construction; 1 story.
Detection and Suppression Systems
There were hard-wired smoke detectors in patient rooms and corridors, connected to a building alarm system and an annunciator panel at the nurses' station. A partial automatic sprinkler system covered the kitchen, two storage rooms and the laundry.
Fire Origin and Path
A fire of undetermined origin began in a linen closet in the west wing and involved the contents of a clean-linen cart. The fire spread to the other contents of the closet and extended into the space above the suspended ceiling. Heated roof adhesives provided more fuel for the fire, which intensified and spread into patient rooms. Fire spread beyond the west wing was stopped by a complete fire wall. All the victims were patients in the west wing.
Contributing Factors
The lack of a complete automatic sprinkler system. Delay in alarm while staff tried to control the fire. Some patients were found in restraints, hindering escape or rescue. Lack of compartmentation in the room of origin allowed fire to spread through concealed spaces.

Rita F. Fahy and Kenneth J. Tremblay, 1991, "The Catastrophic Fires of 1990" *NFPA Journal*, July/August, 67.

Virginia

Date, Time of Alarm, Number of Deaths
October 1989, 10:18 pm, 12 civilian deaths
Occupancy Type and Use, Construction Type, Number of Stories, Operating Status
Nursing home; fire-resistive construction, 4 stories
Detection and Suppression Systems
Smoke detectors on each side of corridor smoke barrier doors. There were no suppression systems.

Fire Origin and Path
Carless smoking in a second-floor patient room ignited the bedding and resulted in a fire that grew and spread rapidly. The fire was flaming when it was discovered, and flashover occurred 3 to 4 minutes later. The fire heavily involved the room of origin and the adjacent corridor, and smoke spread through the second, third and fourth floors.
Contributing Factors
The door to the room of origin remained open throughout the fire.
Most of the fatalities occurred in room whose doors were partly open.

Rita F. Fahy and Kenneth J. Tremblay, and John J. Barry, III, 1990, "The Catastrophic Fires of 1989" *Fire Journal*, July/August, 76.

Tennessee

Date, Time of Alarm, Number of Deaths
March 1988, 3:43 pm, 3 civilian deaths
Occupancy Type and Use, Construction Type, Number of Stories, Operating Status
Licensed nursing home; fire-resistive construction; 2 stories with a 20story addition of unprotected, noncombustible construction. The home was in full operation; 27 sleeping rooms with 74 patients.
Detection and Suppression Systems
One smoke detector on each floor was used in conjunction with a pair of corridor smoke doors. The detectors were not functional. There were no suppression systems.
Fire Origin and Path
A patient fell asleep in his wheelchair while smoking, and his lit cigarette ignited his clothing. The resulting fire killed the three nonambulatory occupants of the first-floor room. The fire was held to the room of origin as a result of staff efforts at extinguishment.
Contributing Factors
The door to the room of fire origin reportedly remained open throughout the incident while the staff tried to control the fire, allowing smoke and toxic gases to fill the corridor system. The lack of automatic early detection and warning could have resulted in a delay in staff actions. The rapid growth and development of fire resulted from the ignition of combustible furnishing s and contents in the patient room. There were no automatic sprinklers to suppress the fire in its incipient stage. One of the patients was usually non-responsive. Why the other two did not call for help is not known.

Rita F. Fahy and John J. Barry III, 1989, "The Catastrophic Fires of 1988" *NFPA Journal*, July/August, 65.

Appendix E
Nursing Home Fire Investigations

The following are unpublished summaries and abstracts from NFPA fire investigation reports. Full reports are available on NFPA's web site, www.nfpa.org/investigations. Most NFPA fire investigation reports are free for NFPA members. Paper copies of the reports may also be purchased through the NFPA library for a fee, www.nfpa.org/library.

Appendix F
Previously Published Articles from *Fire Journal* and *NFPA Journal* on Fires Involving Nursing Homes