



**RESEARCH**

# **U.S. Firefighter Injuries – 2015**

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## **Abstract**

Based on data the NFPA received from fire departments responding to the 2015 National Fire Experience Survey, the NFPA estimates that 68,085 firefighter injuries occurred in the line of duty in 2015. An estimated 29,130 (42.8%) of all firefighter injuries occurred during fireground operations. An estimated 14,320 occurred at nonfire emergency incidents, while, 13,275 occurred during other on duty activities, 7,560 in training and 3,800 responding and returning from incidents. The leading type of injury received during fireground operations was strain, sprain or muscular pain (52.7%), followed by wound, cut, bleeding, bruise (13.6%). Regionally, the Northeast had the highest fireground injury rate.

Keywords: fire statistics, firefighter injuries, exposures, injury rates, fireground, non-fire emergencies, type of duty, cause of injury, collisions, community size

## **Acknowledgments**

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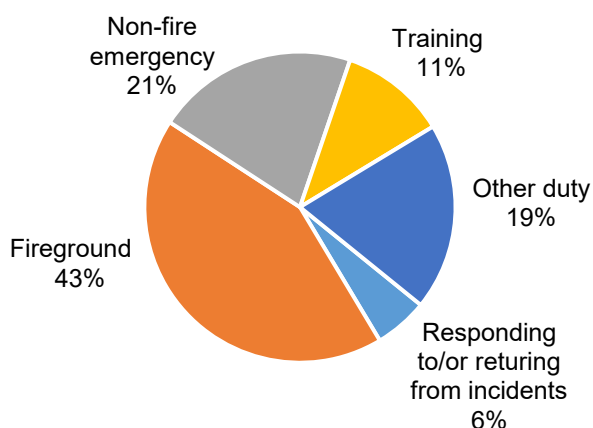
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## U.S. Firefighter Injuries – 2015

**68,085** firefighter injuries were reported in the U.S. during 2015.

- ▶ An increase of 7.5% from 2014.
- ▶ One firefighter injury occurred every 7 minutes 43 seconds.
- ▶ **29,130** (43%) of all firefighter injuries occurred in fireground operations.
- ▶ The leading causes of fireground injuries were **fall, slip, jump (27.2%)** and **overexertion, strain (27.2%)**.
- ▶ **13,275** (19%) occurred during other on duty activities.
- ▶ **3,800** (6%) occurred while responding or returning from an incident.
- ▶ **7,560** (11%) during training activities.
- ▶ **14,320** (21%) during non-fire emergency incidents.
- ▶ An estimated **11,500** injuries or 16.9% of all firefighter injuries resulted in lost time in 2015.

### U.S. Firefighter Injuries by Type of Duty 2015



The **\*Northeast** region reported a higher number of fireground injuries per 100 fires than the rest of the country (\*excluding New York City).

There were **8,350** documented exposures to infectious diseases and **27,250** exposures to hazardous conditions reported.

There were **16,600** collisions involving fire department emergency vehicles, with **1,150** fire fighter injuries resulting from these collisions.

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## Overview of 2015 U.S. Firefighter Injuries

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- 68,085 firefighter injuries occurred in the line of duty in 2015, an increase of 7.5% from the previous year.
- In addition to injuries, there were 8,350 documented exposures to infectious diseases, and 27,250 exposures to hazardous conditions.
- 29,130 or 42.8% of all firefighter injuries occurred during fireground operations. An estimated 13,275 occurred during other on duty activities, 3,800 while responding/returning from an incident, 7,560 during training activities, and 14,320 occurred at nonfire emergency incidents.
- The Northeast region reported a higher number of fireground injuries per 100 fires than other regions of the country (excluding New York City from the analysis).
- The major types of injuries received during fireground operations were: strain, sprain, muscular pain (52.7%); wound, cut, bleeding, bruise (13.6%); burns (5.2%) smoke or gas inhalation (4.4%). Strains, sprains, and muscular pain accounted for 58.0% of all non fireground injuries.
- The leading causes of fireground injuries were fall, slip, jump (27.2%) and overexertion, strain (27.2%).

## Background and Objectives

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Firefighters work in varied and complex environments that increase their risk of on-the-job death and injury. Each year, the NFPA studies firefighter deaths and injuries to provide national statistics on their frequency, extent, and characteristics. Earlier this year, the NFPA reported that there were 68 firefighters fatalities while on duty in 2015 (See, "2015 Firefighter Fatalities ", NFPA Journal July/August) [www.nfpa.org/firefighterfatalities](http://www.nfpa.org/firefighterfatalities). A better understanding of how these fatalities, nonfatal injuries, and illnesses occur can assist in identifying corrective actions which could help minimize the inherent risks of firefighter work.

This report addresses 2015 firefighter injuries in the United States. The results are based on data collected during the NFPA Survey of Fire Departments for U.S. Fire Experience (2015). An earlier report, [\*Fire Loss in the United States during 2015\*](#), measured the national fire experience in terms of the number of fires that fire departments responded to and the resulting civilian deaths, civilian injuries, and property losses that occurred. This year's report includes among its results:

- An estimate of the total number of 2015 firefighter injuries.
- Estimates of the number of injuries by type of duty.
- An estimate of the number of exposures to infectious diseases.
- Trends in firefighter injuries and rates.
- Fireground injuries by cause.
- Fire department vehicle accidents and resulting firefighter injuries.
- The average number of fires and fireground injuries per department by population of community protected.
- Descriptions of selected incidents that illustrate firefighter safety problems.

## Methods

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NFPA annually surveys a sample of fire departments in the United States to make national projections of the fire problem. The sample is stratified by the size of the community protected by the fire department and includes all U.S. fire departments that protect communities with a population larger than 2,500. The 13,565 fire departments in the nine highest strata protect a population of 300,304,722, or 93 percent of the U.S. population as of July 2015. The rest of the sample includes 8,562 randomly selected departments that protect populations under 2,500, for a total sample size of 22,127, or 74 percent of all U.S. fire departments known to NFPA.

The national projections are made by weighting the sample results according to the proportion of total U.S. population accounted for by communities of each size. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty or uncertainty of the estimate. We are confident that the actual number of total firefighter injuries falls within 5 percent of the estimate.

A total of 2,605 departments responded to the 2015 fire experience survey. The results are based on injuries that occurred during incidents attended by public fire departments. No state or federal firefighting entities were included in this sample, and no adjustments were made for injuries that occurred during fires attended solely by private fire brigades, such as those at industrial or military installations.

We enhanced the data collection for the selected incident summaries by sending the fire departments a form requesting information on the type of protective equipment worn, the ages and ranks of the firefighters injured, and a description of circumstances that led to injury.



## Results

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Based on data reported by fire departments responding to the 2015 National Fire Experience Survey, we estimate that 68,085 firefighter injuries occurred in the line of duty in 2015. This is an increase of 7.5% percent from the year before, and the third lowest rate since NFPA began analyzing this data in 1981, the lowest rate occurring in 2014. In recent years, the number of firefighter injuries has been considerably lower than it was in the 1980s and 1990s, due in part to additional survey questions on exposures to hazardous conditions and infectious diseases, information that allows us to place them in their own categories. Previously, some of these exposures might have been included in total injuries under other categories.

NFPA estimates that there were 8,350 exposures to infectious diseases such as hepatitis, meningitis, and HIV in 2015. This amounts to 0.4 exposures per 1,000 emergency medical service runs by fire departments in 2015.

We also estimate there were 27,250 exposures to hazardous conditions such as asbestos, radioactive materials, chemicals, and fumes last year, which amounts to 25.2 exposures per 1,000 hazardous condition runs. This 47 percent increase in exposures from the year before, can in part be explained by the heightened awareness about cancer and other chronic illnesses in the fire service and the importance of documentation. This is a large increase from previous years and could be a result of improved reporting for such exposures.

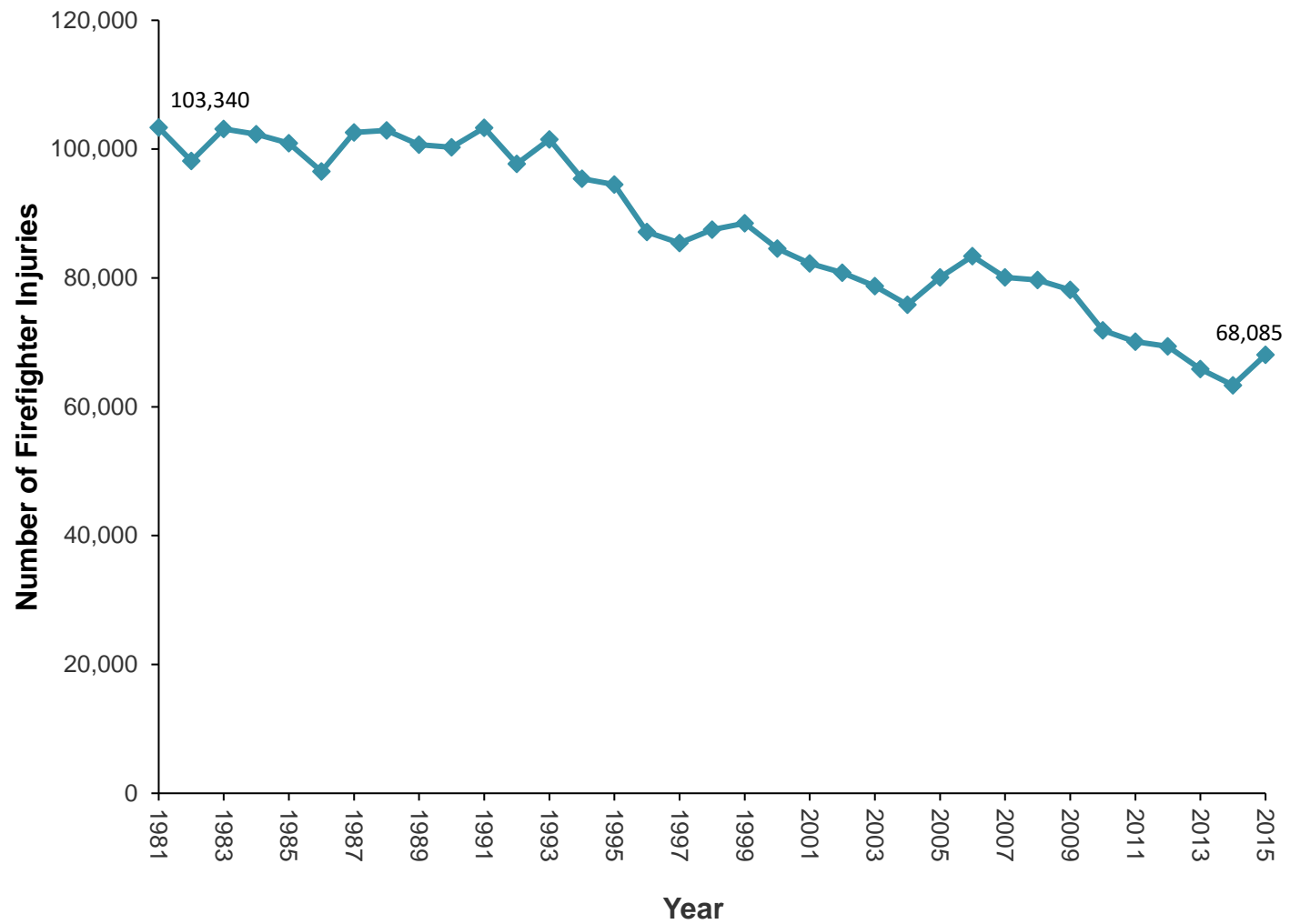
An estimated 11,500 injuries, or 16.9 percent of all firefighter injuries, resulted in lost time.

### **Injuries by Type of Duty**

Estimates of firefighter injuries by type of duty are displayed in Table 2 and Figure 4. As in past reports, type of duty is divided into five categories:

- Responding to or returning from an incident (includes fire and nonfire emergencies).
- Fireground (includes structure fires, vehicle fires, brush fires, etc.); refers to all activities from the moment of arrival at the scene to departure time (e.g., setup, extinguishment, overhaul).

- Nonfire emergency (includes rescue calls; hazardous calls, such as spills; and natural disaster calls).
- Training
- Other on-duty activities (e.g., inspection or maintenance duties).



**Figure 1: Total Firefighter Injuries by Year, 1981-2015**

## **Injuries by Type of Duty**

The type of duty firefighters were performing when injured is divided into five categories: responding to or returning from incidents, including fires and non-fire emergencies; fire ground activities at structure fires, vehicle fires, and brush fires, from the moment firefighters arrive at the scene until they departure; non-fire emergency, including rescue calls, hazardous calls, and natural disasters; training; and other on-duty activities such as inspections and maintenance duties.

Most of the firefighters injured last year were hurt during fire ground operations, where 29,130, or 42.8 percent, of all firefighter injuries occurred. This was an increase of 7.8 percent from the previous year, which was the lowest number since 1981. Injuries at the fireground decreased from a high of 67,500 in 1981 to 29,130 in 2015, a drop of 57 percent. The number of fires also declined steadily, for an overall decrease of 55.1 percent, and the rate of injuries per 1,000 fires over the past 34 years has fluctuated between high of 28.3 injuries per 1,000 fires 1990 and a low of 20.8 injuries per 1,000 fires in 2014. In 2015 the rate increased to 21.7 injuries per 1,000 fires. These results suggest that, even though the number of fires and fireground injuries declined during the period, the injury rate did not, meaning the fireground injury rate per fire risk has not changed much since 1981.

Overall, the number of injuries at non-fire emergencies increased 49.2 percent between 1981 and 2015, from 9,600 to 14,320. During the same period, the number of non-fire emergencies also increased 317% percent, due in large part to an increase in the number of fire department responses to medical emergencies. The injury rate per 1,000 non-fire emergencies declined between 1980 and 2015, from 1.24 to 0.44, because the number of non-fire emergencies increased at a higher rate than the number of injuries at non-fire emergencies.

In addition, 3,800 firefighter injuries occurred while responding to, or returning from, an incident in 2015. Another 7,560 firefighter injuries occurred during training activities, and 13,275 injuries occurred during other on-duty activities.

## **Nature and Causes of Fireground Injuries**

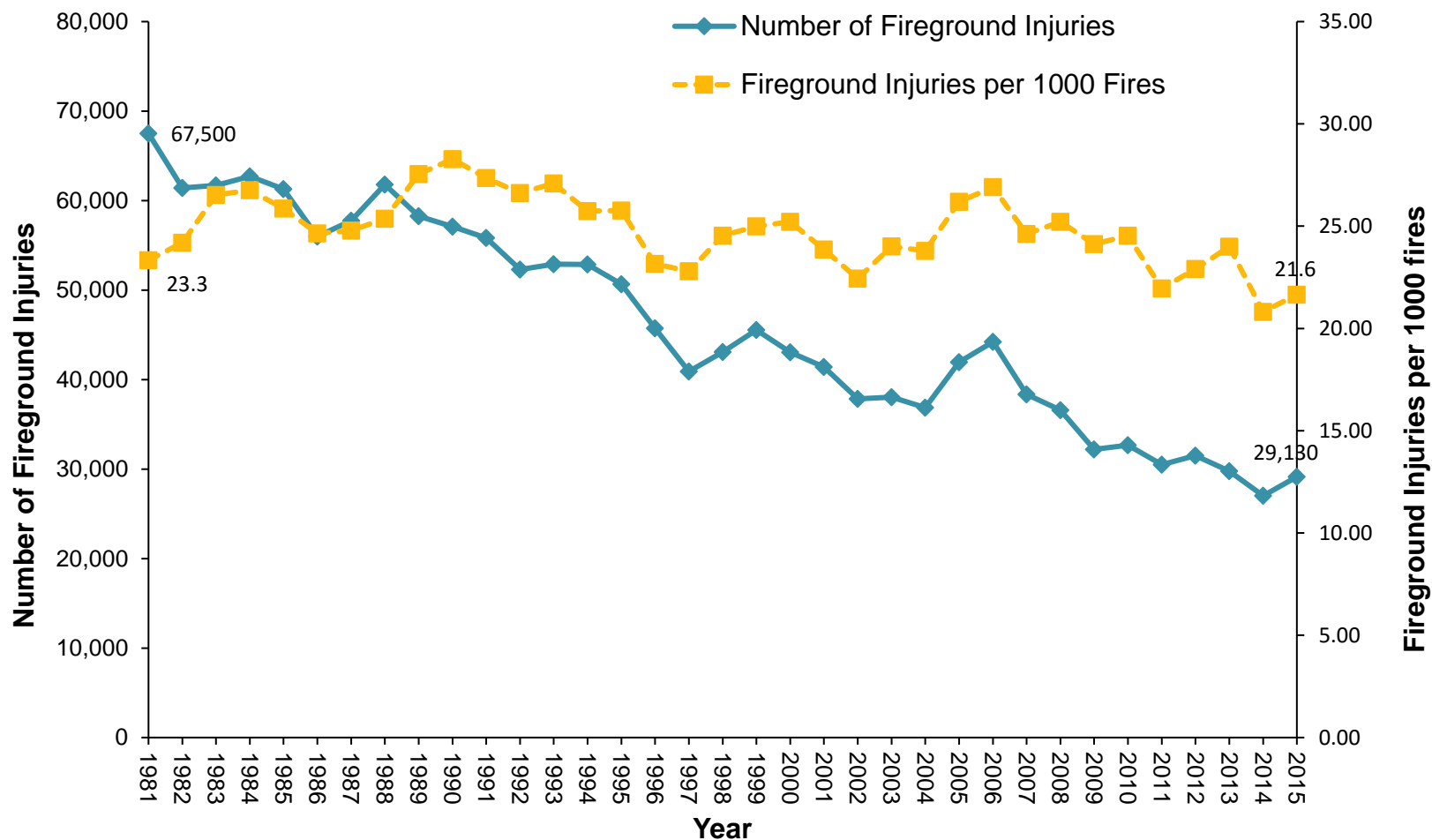
The major types of injuries that occurred during fireground operations were strains and sprains, which account for 52.7 percent of the injuries; wounds, cuts, bleeding, and bruises, which account for 13.6 percent; burns, which account for 5.2 percent; and smoke or gas inhalation, which account for 4.4 percent. These results were fairly consistent during all non-fireground activities, with strains, sprains, and muscular pain accounting for 58.0 percent of all non-fireground injuries, and wounds, cuts, bleeding, and bruises accounting for 16.0 percent (Table 2).

Because fireground injuries are of particular concern from an occupational hazard perspective, we examined their causes, defined here as the initial circumstance leading to the injury. Falls, jumps, and slips, which accounted for 27.2 percent, and overexertion and strains, which also accounted for 27.2 percent, were the leading causes of fireground injuries. Other major causes were struck by an object, which accounted for 9.0 percent, and exposure to fire products, which accounted for 8.2 percent (Figure 5).

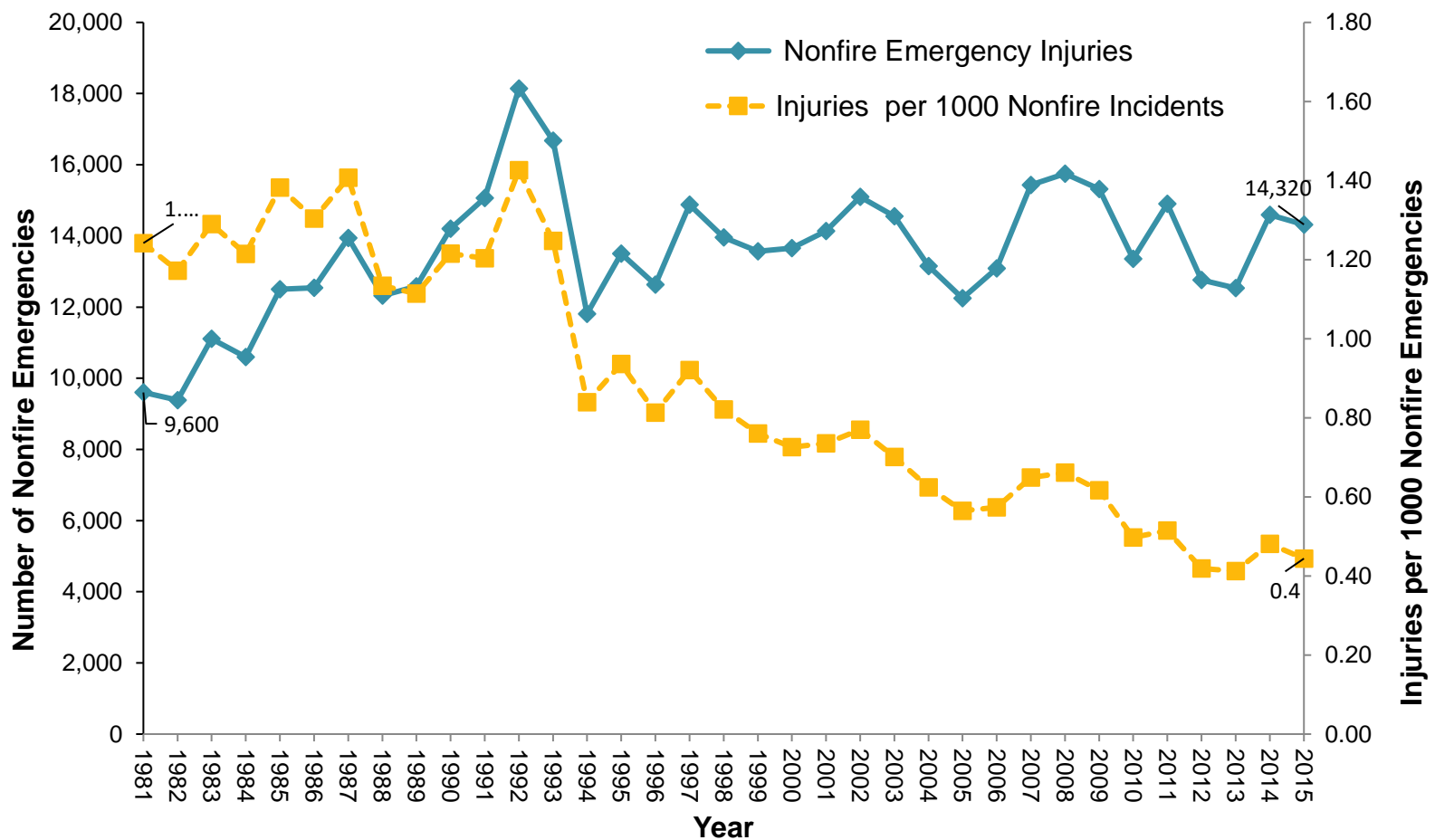
**Table 1:  
Total Firefighter Injuries at the Fireground, and  
at Nonfire Emergencies, 1981-2015**

Year	Total Firefighter Injuries	Firefighter Injuries at the Fireground		Firefighter Injuries at Nonfire Emergencies	
		Injuries	Injuries per 1,000 Fires	Injuries	Injuries per 1,000 Incidents
1981	103,340	67,500	23.3	9,600	1.24
1982	98,150	61,400	24.2	9,385	1.17
1983	103,150	61,700	26.5	11,105	1.29
1984	102,300	62,700	26.8	10,600	1.21
1985	100,900	61,300	25.9	12,500	1.38
1986	96,540	55,900	24.7	12,545	1.30
1987	102,600	57,755	24.8	13,940	1.41
1988	102,900	61,790	25.4	12,325	1.13
1989	100,700	58,250	27.5	12,580	1.11
1990	100,300	57,100	28.3	14,200	1.28
1991	103,300	55,839	27.3	15,065	1.20
1992	97,700	52,290	26.6	18,140	1.43
1993	101,500	52,885	27.1	16,675	1.25
1994	95,400	52,875	25.7	11,810	0.84
1995	94,500	50,640	25.8	13,500	0.94
1996	87,150	45,725	23.1	12,630	0.81
1997	85,400	40,920	22.8	14,880	0.92
1998	87,500	43,080	24.5	13,960	0.82
1999	88,500	45,500	25.0	13,565	0.76
2000	84,550	43,065	25.2	13,660	0.73
2001	82,250	41,395	23.9	14,140	0.73
2002	80,800	37,860	22.4	15,095	0.77
2003	78,750	38,045	24.0	14,550	0.70
2004	75,840	36,880	22.1	13,150	0.62
2005	80,100	41,950	26.2	12,250	0.56
2006	83,400	44,210	26.9	13,090	0.57
2007	80,100	38,340	24.6	15,435	0.65
2008	79,700	36,595	25.2	15,745	0.66
2009	78,150	32,205	24.1	15,455	0.62
2010	71,875	32,675	24.5	13,355	0.50
2011	70,090	30,505	22.0	14,905	0.50
2012	69,400	31,490	22.9	12,760	0.42
2013	65,880	29,760	24.0	12,535	0.41
2014	63,350	27,015	20.8	14,595	0.48
2015	68,085	29,130	21.6	14,320	0.44

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1981-2015).

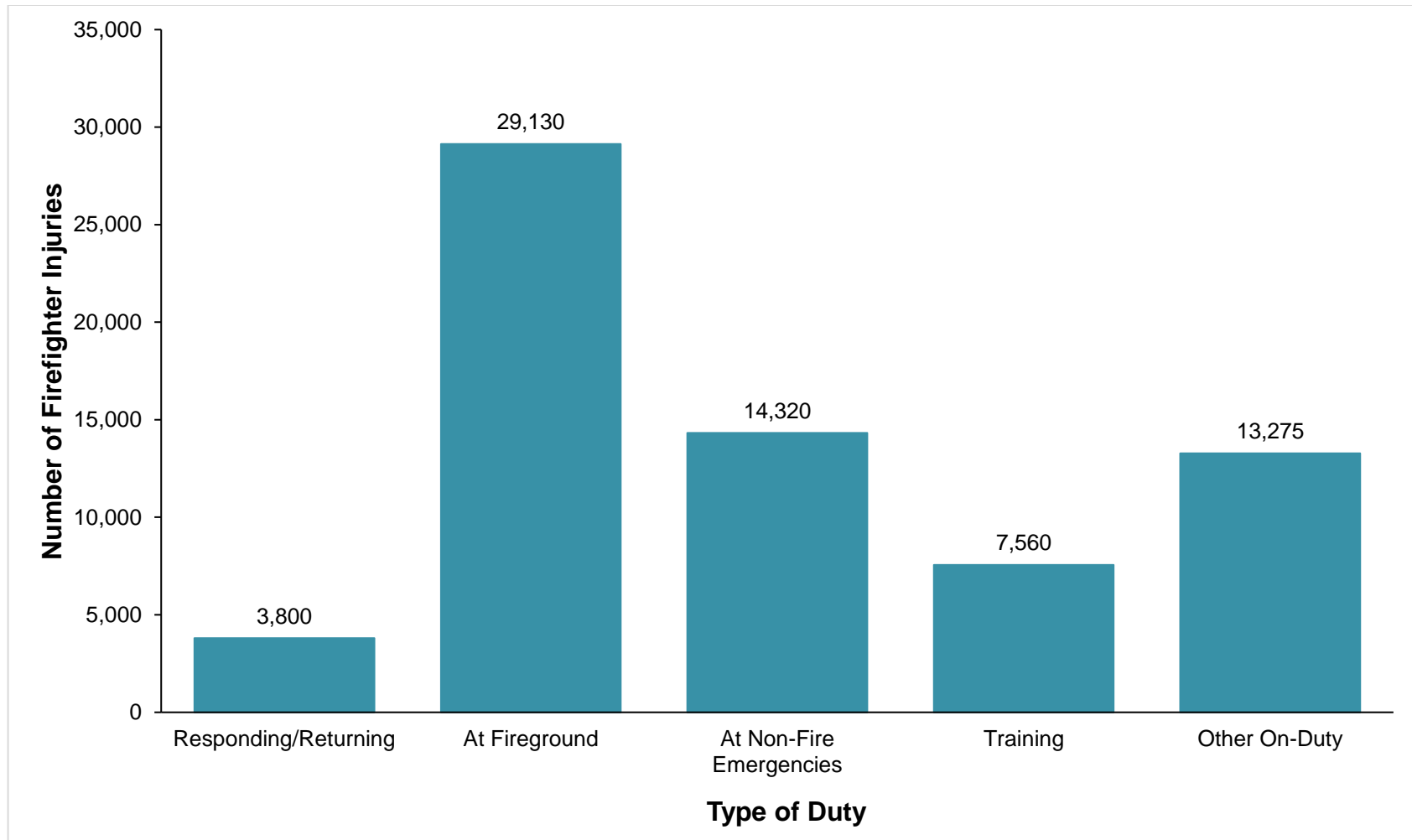


**Figure 2: The number of Injuries at the Fireground and Fireground Injuries per 1,000 fires, 1981-2015**



**Figure 3: The Number of Injuries at Non-fire Emergencies and Injuries per 1,000 Non-fire emergencies**





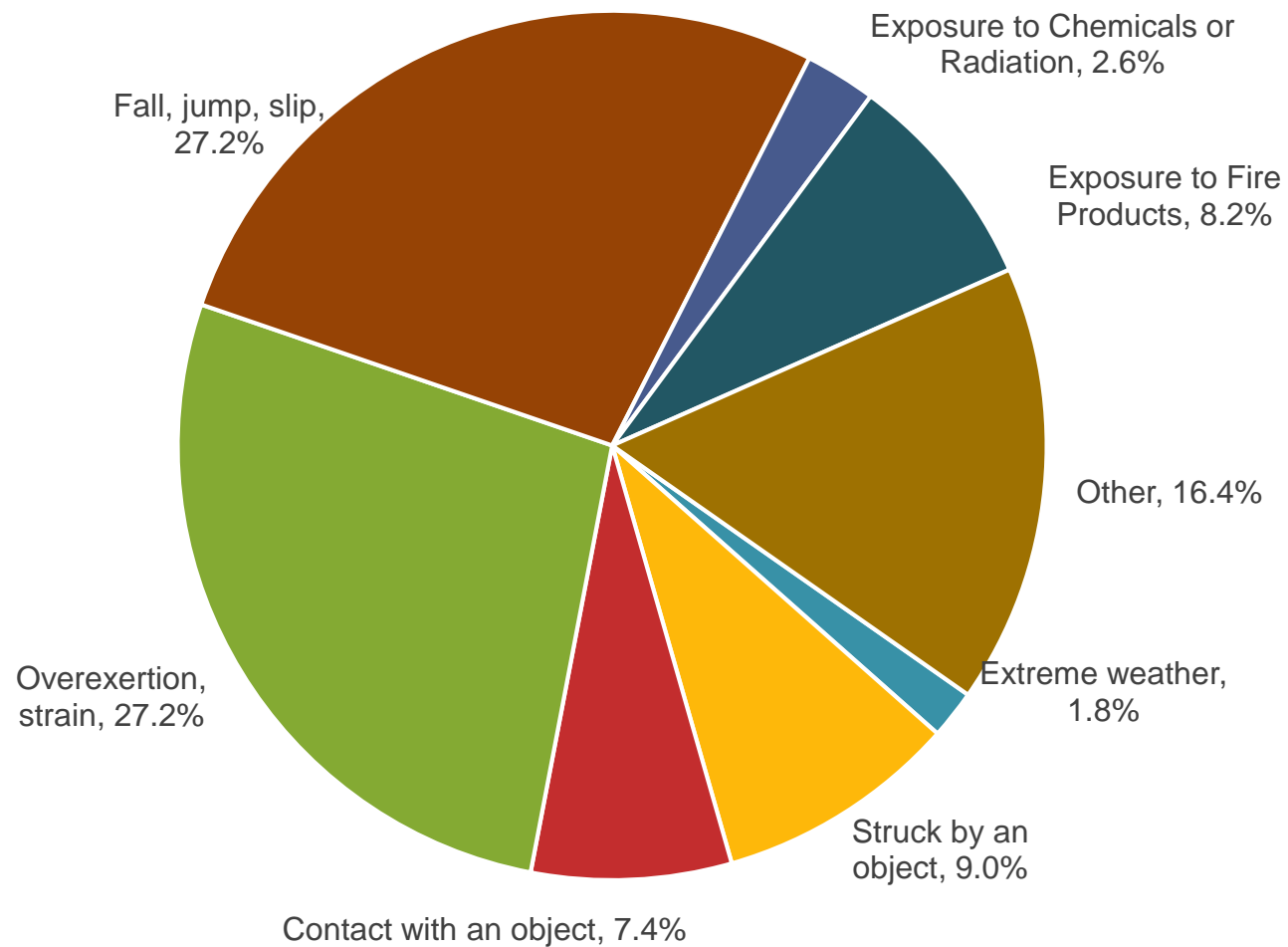
**Figure 4: Firefighter Injuries by Nature of Injury and Type of Duty, 2015**

**Table 2:**  
Firefighter Injuries by Nature of Injury and Type of Duty, 2015

Nature of Injury	Responding to or Returning from an Incident		Fire ground		Nonfire Emergency		Training		Other on Duty		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Burns (Fire or Chemical)	25	0.7%	1,515	5.2%	105	0.7%	170	2.2%	205	1.5%	2,020	3.0%
Smoke or Gas Inhalation	90	2.4%	1,270	4.4%	155	1.1%	70	0.9%	60	0.5%	1,645	2.4%
Other Respiratory Distress	90	2.4%	630	2.2%	125	0.9%	90	1.2%	125	0.9%	1,060	1.6%
Burns and Smoke Inhalation	5	0.1%	410	1.4%	5	0.0%	15	0.2%	100	0.8%	535	0.8%
Wound, Cut, Bleeding, Bruise	950	25.0%	3,975	13.6%	1,580	11.0%	1,430	18.9%	2,270	17.1%	10,205	15.0%
Dislocation, Fracture	95	2.5%	690	2.4%	230	1.6%	340	4.5%	330	2.5%	1,685	2.5%
Heart Attack or Stroke	45	1.2%	145	0.5%	80	0.6%	70	0.9%	580	4.4%	920	1.4%
Strain, Sprain, Muscular Pain	1,915	50.4%	15,345	52.7%	9,490	66.3%	4,520	59.8%	6,675	50.3%	37,945	55.7%
Thermal Stress (frostbite, heat exhaustion)	120	3.2%	2,000	6.9%	195	1.4%	400	5.3%	145	1.1%	2,860	4.2%
Other	465	12.2%	3,150	10.8%	2,355	16.4%	455	6.0%	2,785	21.0%	9,210	13.5%
Total	3,800	100.0%	29,130	100.0%	14,320	100.0%	7,560	100.0%	13,275	100.0%	68,085	100.0%

Note: If a firefighter sustained multiple injuries for the percent incident, only the nature of the single most serious injury was tabulated.

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2014.



**Figure 5: Fireground Injuries by Cause, 2015**

## **Fire Department Vehicle Collisions**

The NFPA reported earlier that 13 firefighters died in motor vehicle collisions in 2015. (See “2015 Firefighter Fatalities” July/August *NFPA Journal* [www.nfpa.org/firefighterfatalities](http://www.nfpa.org/firefighterfatalities)).

In 2015, an estimated 16,600 collisions involved fire department emergency vehicles responding to or returning from incidents. This is the highest number of collisions since NFPA began collecting this information in 1990. To put this number in perspective, fire departments responded to more than 33.6 million incidents in 2015, meaning that the number of collisions represents 0.05 percent of total responses. However, these collisions resulted in 1,150 injuries, or 1.7 percent, of all firefighter injuries.

Another 700 collisions involved firefighters’ personal vehicles, in which they were responding to or returning from incidents. These collisions resulted in an estimated 50 injuries, the lowest it has been since NFPA began collecting this statistic in 1990.

**Table 3:  
Fire Department Vehicle Collisions and  
Resulting Firefighter Injuries While Responding to  
or Returning from Incidents, 1990-2015**

Year	Involving Fire Department Emergency Vehicles		Involving Firefighters Personal Vehicles	
	Collisions	Firefighter Injuries	Collisions	Firefighter Injuries
1990	11,325	1,300	950	175
1991	12,125	1,075	1,375	125
1992	11,500	1,050	1,575	150
1993	12,250	900	1,675	200
1994	13,755	1,035	1,610	285
1995	14,670	950	1,690	190
1996	14,200	910	1,400	240
1997	14,950	1,350	1,300	180
1998	14,650	1,050	1,350	315
1999	15,450	875	1,080	90
2000	15,300	990	1,160	170
2001	14,900	960	1,325	140
2002	15,550	1,040	1,030	210
2003	15,900	850	980	85
2004	15,420	980	1,150	220
2005	15,885	1,120	1,080	125
2006	16,020	1,250	1,070	210
2007	14,650	915	665	120
2008	14,950	670	1,000	70
2009	15,100	820	870	100
2010	14,200	775	1,000	75
2011	14,850	970	790	190
2012	14,300	725	750	70
2013	12,350	730	830	185
2014	14,910	550	620	90
2015	16,600	1,150	700	50

Source: NFPA Survey of Fire Departments for U.S. Fire Experience (1990-2015).

## **Average Fires and Fireground Injuries per Department by Population Protected**

The number of fires a fire department responds to is directly related to the population protected, and the number of fireground injuries incurred by a department is directly related to the number of fires the department attends. The second point is clearly demonstrated when we examine the range of the average number of fireground injuries, which range from a high of 103.2 for departments that protect communities of 1,000,000 or more to a low of 0.2 for departments that protect communities that protect fewer than 2,500 people.

One way to understand the risk that firefighters face is to examine the number of fireground injuries that occur for every 100 fires they attend. This takes into account relative fire experience and allows more direct comparison between departments protecting communities of different sizes. In 2015, the overall range of rates varied from a high of 2.3 injuries per 100 fires for departments that protected communities with populations ranging from 500,000 to 999,999 to a low of 1.2 injuries per 100 fires for departments that protected communities with populations 2,500 to 4,999. The wide range in the average number of fireground injuries by population protected narrows when relative fire experience is taken into account. The overall injury rate for departments that protect communities of 50,000 or more was 1.9 injuries per 100 fires, which is 29 percent higher than the injury rate of 1.5 injuries per 100 fires for departments protecting communities under 50,000.

Larger fire departments generally had the highest rates of fireground injuries; departments protecting communities of 500,000 to 999,999 had experienced 5.1 injuries per 100 firefighters. As the size of the community decreases, the rate of fireground injuries declines steadily, to a low of 0.8 for departments protecting fewer than 2,500 people. That is a difference in risk of injury of more than a 6 to 1 between communities of 500,000 to 999,999 and communities of less than 2,500.

One explanation for this difference is that, although departments protecting communities with populations of 500,000 to 999,999 have, on average, more than 37 times as many firefighters as departments protecting populations smaller than 2,500, larger departments attend more than 200 times as many fires as the smaller departments and incur considerably more fireground injuries. Different policies for documenting minor injuries and different levels of fire engagement could also explain some of this difference.

In 2015, the northeast region of the United States reported a highest fireground injury rate at 2.1 fireground injuries per 100 fires. This observation is consistent with previous years, except in 2014 when the western region reported a higher rate for the first time.

As these statistics attest, firefighting presents risk of personal injury to firefighters, and because of the kind of work they perform and the fire scene hazards they face, it is unlikely that all firefighter injuries can be eliminated. However, a risk management system and the application of existing technology at the local level can offer options to reduce current injury levels and impact of such injuries.

**Table 4:**  
**Average Number of Fires, Fireground Injuries and Injury Rates**  
**by Population of Community Protected, 2015**

Population of Community Protected	Average Number of Fires	Average Number of Fireground Injuries	Number of Fireground Injuries Per 100 Fires	Number of Fireground Injuries Per 100 Firefighters
1,000,000 or more*	4,847.8	103.2	2.1	4.8
500,000 to 999,999	2,301.6	54.0	2.3	5.1
250,000 to 499,999	1023.3	19.3	1.9	4.2
100,000 to 249,999	512.6	6.7	1.3	3.1
50,000 to 99,999	196.8	3.5	1.8	3.5
25,000 to 49,999	104.7	2.1	2.0	3.3
10,000 to 24,999	57.7	0.8	1.4	2.0
5,000 to 9,999	35.4	0.5	1.4	1.5
2,500 to 4,999	23.0	0.3	1.2	1.1
Under 2,500	11.5	0.2	1.3	0.8

\*Excludes New York City

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2015.



## **Average Fires and Fireground Injuries by Population Protected and Region**

[Table 5](#) displays the average number of fires and fireground injuries per department by population of community protected and region of the country<sup>3</sup>. As in the nationwide results in [Table 4](#), the results of each region of the country indicate that the number of fires a fire department responds to is directly related to the population protected, and the number of fireground injuries incurred by a department is directly related to the number of fires attended. The northeast region has historically reported a higher number of fireground injuries per 100 fires. In 2014 this was not the case with the western region reporting a higher rate. In 2015, the northeast region once again reported the highest rate ([Table 5](#)). It is important to note that historically this analysis has excluded New York City. If New York City is included in the analysis then the Northeast region would have the higher number of fireground injuries per 100 fires.

**Table 5:  
Average Number of Fires and Fireground Injuries per Department and Injuries  
per 100 Fires, by Population of Community Protected, and Region, 2015**

Population of Community Protected	Northeast			Midwest			South			West		
	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per 100 Fires	Average Fires	Average of Fireground Injuries	Fireground Injuries per100 Fires
250,000 or more	3,721.8	22.3	0.6	2,482.7	59.4	2.4	1,600.1	44.4	2.8	2,459.5	43.9	1.8
100,000 to 249,999	834.9	14.8	1.8	360.4	6.4	1.8	586.4	6.1	1.0	405.1	5.2	1.3
50,000 to 99,999	357.3	9.2	2.6	156.4	3.4	2.2	206.3	3.2	1.5	190.3	2.0	1.1
25,999 to 49,999	134.2	3.5	2.6	84.7	2.2	2.5	123.9	1.4	1.1	100.5	2.3	2.2
10,000 to 24,999	51.7	1.6	3.2	52.1	0.6	1.2	70.2	0.6	0.8	57.5	0.8	1.3
5,000 to 9,999	32.8	0.9	2.8	29.1	0.3	1.2	45.9	0.5	1.1	38.5	0.3	0.7
2,500 to 4,999	16.5	0.3	1.9	21.2	0.3	1.5	29.8	0.3	0.9	26.5	0.2	0.6
Under 2,500	10.9	0.3	2.6	8.8	0.1	0.7	19.8	0.2	1.2	10.1	0.2	2.0
Overall Regional Rate	41.8	0.87	2.1	36.0	0.5	1.5	52.2	0.7	1.3	62.3	0.9	1.5

Note that the results above do not include New York City. With New York the overall fireground injury rate for the Northeast would be 4.2.

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2015.

## Conclusions

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Since 1981 when firefighter injury data was first collected for this report, the overall trend is a decreasing number of firefighter injuries. The Northeastern region continues to report a higher fireground injury rate per 100 fires relative to the rest of the United States.

As the statistics in this report and previous reports attest, firefighting presents risks of personal injury to firefighters. Moreover, due to the kind of work performed and the hazards of the incident scene environment, it is unlikely that all firefighter injuries can be eliminated. A risk management system and the application of existing technology, however, can offer options to reduce present injury levels and bring about corresponding reductions that are recommended by NFPA that could be taken at the local level.

### NFPA Code and Standards References

- Commitment on the part of top fire service management to reducing injuries [NFPA 1500 Standard on Fire Department Occupational Safety and Health Program](#), Section 4.3.
- Establishment of a safety committee headed by a safety officer to recommend a safety policy and the means of implementing it [NFPA 1500, Section 4.5.](#)
- Develop and implement an investigation procedure that includes all accidents, near misses, injuries, fatalities, occupational illnesses, and exposures involving members. [NFPA 1500, 4.4.4. and 4.4.5](#)
- Provision of appropriate protective equipment and a mandate to use it. [NFPA 1500, Section 7.1 through 7.8](#)
- Development and enforcement of a program on the use and maintenance of SCBA [NFPA 1500, Section 7.9 through 7.14](#)
- Development and enforcement of policies on safe practices for drivers and passengers of fire apparatus [NFPA 1500, Section 6.2 and 6.3](#)
- Development of procedures to ensure response of sufficient personnel for both fire fighting and overhaul *duties*. [NFPA 1500, 4.1.2; NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments;](#) and [NFPA 1720,, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency, Medical Operations, and Special Operations to the Public by Volunteer Fire Department\)](#)
- Implementation of regular medical examinations and a physical fitness program [NFPA 1500, Section 10.1 through 10.3](#) [NFPA 1582, Standard o Comprehensive Occupational Medical Program for Fire Departments](#) [NFPA 1583, Standard on Health-Related Fitness Programs for Firefighters-](#)
- Adoption and implementation of an incident management system. [NFPA 1500,Standard on Fire Department Occupational Safety and Health Program,](#)

[Section 8.1; and NFPA 1561, Standard on Emergency Services Incident Management System](#)

- Training and education for all members related to emergency operations [NFPA 1500, Chapter 5](#)
- Implementation of programs for the installation of private fire protection systems, so that fires are discovered at an earlier stage, exposing the firefighter to a less hostile environment [NFPA 1 Uniform Fire Code](#) [NFPA 101 Life Safety Code.®](#); Increased efforts in the area of fire safety education programs, so that citizens are made aware of measures to prevent fires and of correct reactions to the fire situation [NFPA 1201, Standard for Providing Emergency Services to the Public, Chapter 6](#)

Other NFPA standards that may help in reducing firefighter injuries include:

- [NFPA 1584, Standard on the Rehabilitation Process for members During Emergency Operations and Training Exercises](#), 2008 Edition, Chapter 4 Preparedness and Chapter 6 Incident Scene and Training Rehabilitation
- [NFPA 1002, Standard for Fire Apparatus Driver Operator Professional Qualification Risk Management](#), 2010 Edition, Section 4.8 The Risk Management process
- [NFPA 1620, Standard for Pre-Incident Planning](#), 2010 Edition, Chapter 4 Pre-Incident Planning Process, Chapter 5 Physical & Site Considerations, Chapter 7 Water supplies & Fire Protection Systems, Chapter 8 Special Hazards

Efforts need to be made to recognize that firefighter injuries can be reduced. By addressing the priorities listed above, Fire Service organizations can make significant strides towards reducing the number and impact of such injuries.

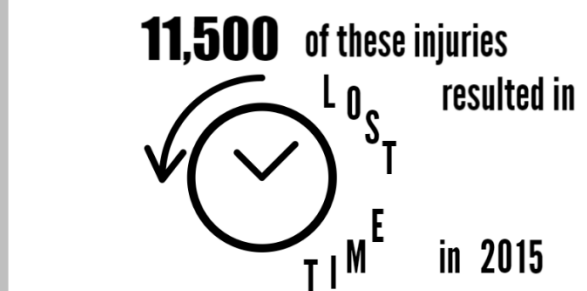
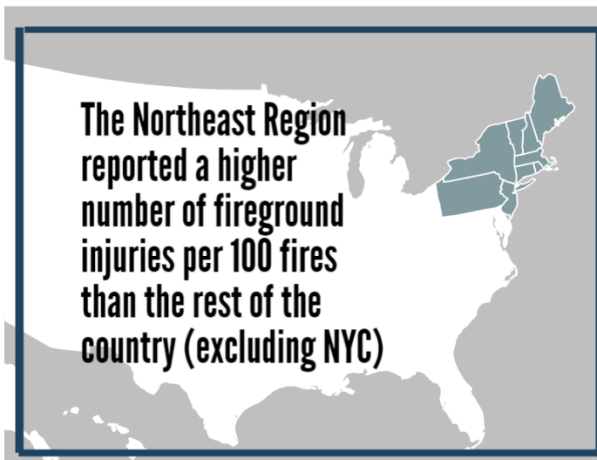
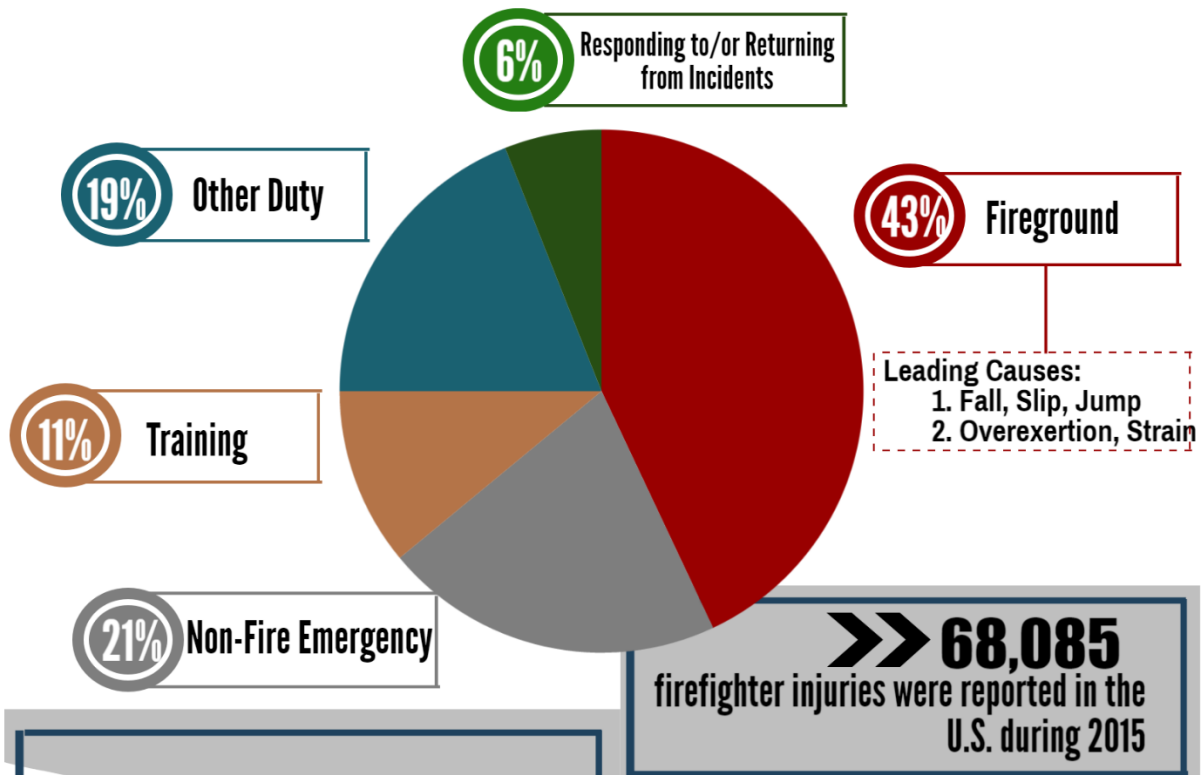
## **Definition of Terms**

**Fire:** Any instance of uncontrolled burning. Excludes combustion explosions and fires out on arrival (whether authorized or not), overpressure rupture without combustion; mutual aid responses, smoke scares, and hazardous materials responses, e.g., flammable gas, liquid, or chemical spills without fire.

**Incident:** The movement of a piece or pieces of fire service apparatus or equipment in response to an alarm.

**Injury:** Physical damage suffered by a person that requires (or should require) treatment by a practitioner of medicine (physician, nurse, paramedic, EMT) within one year of the incident (regardless of whether treatment was actually received), or that results in at least one day of restricted activity immediately following the incident.

# U.S. Firefighter Injuries



**16,600** collisions involving fire department emergency vehicles resulted in 1,150 firefighter injuries.



**27,250** exposures to hazardous conditions were reported

**8,350** exposures to infectious diseases were reported



## Selected Individual Incidents

(These incidents were selected to illustrate typical firefighter safety problems)

### Structure Fire

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A firefighter suffered a severe respiratory injury after running out of air and becoming disoriented while operating in a bedroom fire at a single-wide mobile home.

When the fire department arrived at the old vacant single-wide trailer, fire was venting from a small bedroom window on one end. Two firefighters quickly assembled at the front door and entered the burning structure with a charged hose line. Visibility was extremely poor and the smoke level was approximately 1 foot (30.4 cm) off the floor, with elevated temperatures at the ceiling. After they took several steps inside the door, the 1 ¾" (4.44 cm) hand line became entangled, slowing the advance of the hand line. The backup firefighter followed the line back to the front door, freed the entanglement and followed the line back to the nozzle.

When he arrived back at the nozzle, his partner was missing. He transmitted a mayday over the radio and then heard a plea for help coming from his right. The backup firefighter stated his partner's calls for help did not sound muffled as they would if he was wearing his face piece. He turned towards his pleas, entering a room to his right. He began his search and heard the sound of rushing air similar to air escaping from a face piece. He looked under the layer of smoke and could see the green lights from his partner's self-contained breathing apparatus. Later, it was determined the green lights were from the heads up display inside the nozzle man's face piece laying on the floor. He quickly converted the downed firefighter's self-contained breathing apparatus into a harness, loosened a shoulder strap on the downed firefighter and began dragging him towards the front door.

The incident commander, who was just outside the door, did not hear the mayday but could tell something was wrong with the interior crew, and called a mayday that was understood by everyone on the scene. Two other firefighters nearing the door with a second hand line, heard the chief transmit the mayday and immediately entered the structure and encountered the interior team coming out. The downed firefighter was quickly brought outside to the front lawn where he was treated for respiratory burns and smoke inhalation. The 48-year-old firefighter was transported and hospitalized with life-threatening injuries.

The department conducted a thorough injury investigation and identified several key issues contributing to the near death event. Issues with protective clothing, self-contained breathing apparatus, and radio communications were highlighted in the report. Recommendations were identified for improvements.

The victim's structural firefighting ensemble was a collection of borrowed gear from other firefighters including the face piece for his self-contained breathing apparatus. Recommended improvements in the department's personal protective clothing program included compliance with NFPA 1851: Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting.

The internal investigative report identified a mechanical failure of the victim's SCBA to provide sufficient tidal volume causing the victim to be deprived of air in a highly toxic environment. The report also states the lack of positive pressure allowed smoke and products of combustion to enter the victim's face piece. Improvements in the department's medical monitoring and establishing SCBA face piece fit testing for each member along with regular testing and maintenance of self-contained breathing apparatus that is compliant with NFPA 1981: Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services.

The thorough report also identified antiquated portable radios as a contributing factor in the original mayday not being heard. The portable radio used by the interior firefighter calling the mayday was over 15 years old. By implementing a maintenance program that meets NFPA 1802: Standard on Personal Portable (Hand-Held) Two-Way Radio Communications Devices for Use by Emergency Services Personnel in the Hazard Zone, the probability of this communication system failure would be minimized.

It is unknown if the victim has returned to fire duty.

## Responding to emergency

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Two firefighters responding in an engine truck to a fire alarm activation suffered minor injuries after the truck left the road and overturned.

During the emergency response with lights and siren, the front right tire left the roadway. The driver immediately tried to correct the truck's course by turning to the left. He overcorrected the turn, subsequently driving the truck off the left side of the road. He once again



tried to correct his course by turning to the right, causing with the 2005 engine truck with a 1,000 gallon (3,785 L) tank to roll over onto its driver's side.

The 35-year-old driver, who had 20 years' firefighting experience, suffered a minor head injury and was treated and released. He was able to remove himself from the cab of the truck after kicking out the windshield. The officer of the truck, who was wearing his bunker pants, boots, coat and helmet, suffered a shoulder injury. He was unable to perform firefighting activities for 30 days. The department credits the use of seatbelts in minimizing injuries.

## Structure Fire

An occupant of a two-family home awoke to the sound of smoke alarms at 03:30AM and discovered thick acrid smoke on the second floor. The occupant called her roommate, who was on his way home. She opened a door leading outside to a second-floor porch and called the fire department.

The origin and cause investigation determined that the fire originated in the kitchen after flames from unattended cooking extended to newspapers, books and newsletters stored too close to the stove. It was ventilation-controlled for approximately 30 minutes. Once the occupant opened the door to the second-floor porch to escape the house, she introduced air into the smoke-filled atmosphere. Compounding the problem, the roommate who upon returning home opened the front door. The fire transformed from ventilation-limited to free burning, and rapidly spread throughout the home and extending onto the exterior porches on the first and second floor.

The fire department arrived on scene five minutes after the initial call and encountered heavy smoke with fire rapidly extending throughout the wood-frame home, and the occupant trapped on the second-floor porch. Firefighters quickly raised a ground ladder to the porch and began rescue operations.

During the rescue operation, two firefighters suffered burns and smoke inhalation. They were transported to the hospital and treated. Both were able to return to firefighting activities one to three months after the incident. A third firefighter suffered a sprained ankle while assisting in the rescue operation, but only missed one day.

The fire department report recommended several improvements. First, all members wear full structural protective ensemble while operating at fires. Second, educating the public to notify 911 immediately after discovering a fire.

## Apparatus crash

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On a cool rainy morning, an engine company staffed with seven firefighters was dispatched to a box alarm. While responding, the 1995 apparatus crashed into a telephone pole after a near collision at an intersection.

The driver of the engine, when approaching the intersection, noticed a passenger car coming from his left into the intersection, cutting off the responding apparatus. The truck turned to the right and drove off the road over the curb, striking a traffic sign and a utility pole, before resting on its left side against the severed utility pole. All seven firefighters were able to extricate themselves from the overturned apparatus and were transported to the hospital.

The fire department investigation compiled witness statements, along with drive camera video and pictures, and video from nearby store security cameras, to determine the cause of the crash.

The apparatus approached the intersection with its warning lights on but not using its audible warning devices. The car had the right of way because it had the green light. The apparatus had plenty of time to slow down and come to a complete stop before entering the intersection. Speed was excessive, especially for the slippery road conditions.

The department disciplined the driver and officer for numerous motor vehicle and department violations. Recommendations from the department safety officer include improving annual driver training in accordance with NFPA 1451: Standard for a Fire and Emergency Service Vehicle Operations Training Program.

## Structure Fire

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On a cold overcast windy Thursday morning, a neighbor noticed the house next door was on fire and promptly called the fire department. The fire department dispatched two engine trucks, a ladder truck and two battalion chiefs. After receiving several more phone calls, including one

from the occupants stating they were trapped on the second floor, the response was upgraded to include a third engine truck and an emergency medical truck. The first engine truck arrived within four minutes, and staffed with a company officer, driver/pump operator and a firefighter. The remaining responding units arrived, bringing the overall fire ground staffing to a total of 19 personnel.

Upon their arrival, firefighters found several rooms on fire on the first floor. The officer and firefighter from the first engine advanced a hose line into the first-floor living room, extinguishing fire as they advanced. Two members of the ladder truck began searching for trapped occupants on the second floor. Horizontal ventilation was performed during fire attack on both the windward and leeward sides of the two-story wood-frame single-family residence. A strong wind from the southwest, blowing between 15 to 25 mph (24 to 40 km/h) with gusts around 30-32 mph (48-51 km/h), rapidly intensifying the flames.

The wind-driven fire rapidly extended throughout the first floor and up the interior stairs, trapping the occupants and two rescuers on the second floor, blocking their egress. The two firefighters on the hand line in the first-floor living room had to retreat to the outside and suffered minor burns. Members from the third engine company raised two ground ladders to the roof of the front porch and a bedroom window on the side of the house in order to remove the trapped occupants and rescuers.

The flames not only blocked their egress but were extending over their heads as they retreated into a bedroom. One of the rescuers, a company officer, pushed the occupant and firefighter out of a window leading to the front porch roof. With flames licking over his head the officer then performed a head-first emergency bailout maneuver onto a ground ladder placed under a separate window on the side of the house.

A total of seven firefighter injuries occurred at this fire. Four suffered from first degree burns when the fire rapidly intensified. All four were operating inside the structure. Two were operating a hand line on the first floor and the other two were rescuing a trapped occupant on the second floor. Most importantly, their burns were minimized because they had worn their structural firefighter protective ensemble properly. Two other firefighters operating outside on ground ladders while assisting in rescue efforts suffered smoke inhalation because they did not wear the face piece to their self-contained breathing apparatus. Lastly, a firefighter strained his

back while pulling hose outside the structure on the front lawn. One occupant suffered burns and smoke inhalation while trying to escape the fire

The NFPA Fire Protection Research Foundation (FPRF), National Institute for Standards and Technology (NIST), and the New York City Fire Department (FDNY) and New York University (NYU) have done research into wind driven fires. The NFPA report on Fire Fighting Tactics under Wind Driven Conditions can be found online at:

<http://www.nfpa.org/news-and-research/fire-statistics-and-reports/research-reports/for-emergency-responders/fireground-operations/fire-fighting-tactics-under-wind-driven-conditions>

## Structure Fire

Residents living in a seven-unit apartment complex were alerted by local smoke alarms of a fire. They noticed smoke in the hallway of the second floor in the residential / commercial mixed use occupancy of Type III construction. The seven apartments located directly above several retail stores which were not open for business at the time of the fire.

Arriving firefighters were told that one occupant was still in the building. Two firefighters made entry onto the second floor to begin search and rescue operations. They encountered high heat conditions and completely obscured visibility. They advanced a 1 ¾” (4.44 cm) attack hand line and searched for the missing occupant. The company officer was on the nozzle and advanced into an apartment on the right while the other firefighter stayed at the door, ensuring there were no kinks in the hose and helping feed hose into the room. During the search, a catastrophic failure of the timber roof system collapsed on top of the company officer, trapping him under flaming debris.

The company officer, a captain with 26 years’ experience, removed one of his gloves and made three attempts to call a mayday. Each time he was unsuccessful and received a “busy tone”. A successful mayday was called 10 minutes after the alarm was dispatched. According to the department, there was no dedicated rapid intervention team in place at the time of the collapse, but incoming resources were quickly assigned to the rescue effort.

The officer was able to free himself from the debris by loosening the straps to his self-contained breathing apparatus (SCBA) and sliding out from the straps, effectively removing the SCBA. He was able to push debris off himself and slide out from under the debris. He followed voice commands to a window where he was removed from the structure.

The 54-year-old captain suffered burns on his hand, foot, shins, and buttocks. The most severe were 2nd and 3rd degree burns on the top of his foot. A single layer of leather from his boots burned through because smoldering debris landed on the top of his foot. He required skin grafts during his treatment. At this time, he has not returned to the fire service and is still undergoing rehabilitation.

The fire department report officially listed the cause of the fire as undetermined but indicated the fire originated in the cockloft with structural framing as the first material ignited. The smoke alarms in the second-floor hallway activated and alerted the occupants. A 54-year-old male occupant died from smoke inhalation and the report did not indicate any conditions preventing his escape from the burning structure.

## Footnotes

1. Hylton J.G. Haynes, "2015 Fire Loss in the United States", *NFPA Journal*, Vol. 107, No. 5 (August 2014).
2. Around any estimate based on a sample survey, there is a confidence interval that measures the statistical certainty (or uncertainty) of the estimate. Based on data reported by fire departments responding to the NFPA Survey for U.S. Fire Experience (2015), the NFPA is very confident that the actual number of firefighter injuries falls within the range of 65,100 to 71,075.
3. The four regions as defined by the U.S. Census Bureau include the following 50 states and the District of Columbia:

