



RESEARCH

Patterns of Female Firefighter Injuries on the Fireground

July 2017

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Abstract

In 2010-2014, there were an estimated average of 1,260 fireground injuries experienced each year by U.S. female firefighters. Approximately two-thirds (65%) of the injuries were experienced by career firefighters, with volunteer firefighters experiencing the remaining 35% of injuries. The leading cause of injury was overexertion or strain for both career (23% of injuries) and volunteer (30%) firefighters, followed by exposure to hazard (17% career, 22% volunteer), and slip or trip (16% for career and volunteer).

The vast majority of injuries occurred while fighting structure fires (86% career, 71% volunteer). Overall, 31% of injuries resulted in lost work time and were classified as either moderately severe (29%) or severe (2%) injuries. A higher share of career firefighter injuries were moderately severe (35%) than was the case for volunteer firefighters (18%). Younger age groups accounted for a greater share of injuries experienced by volunteer firefighters than among career firefighters, with 41% of volunteer injuries among firefighters aged 20 to 29, compared to 19% of career firefighter injuries in this age group.

Keywords: firefighter injuries, female firefighters, fireground injuries, worker health and safety, occupational injury, workplace hazards, firefighter safety.

Acknowledgements

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

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Patterns of Female Firefighter Injuries on the Fireground

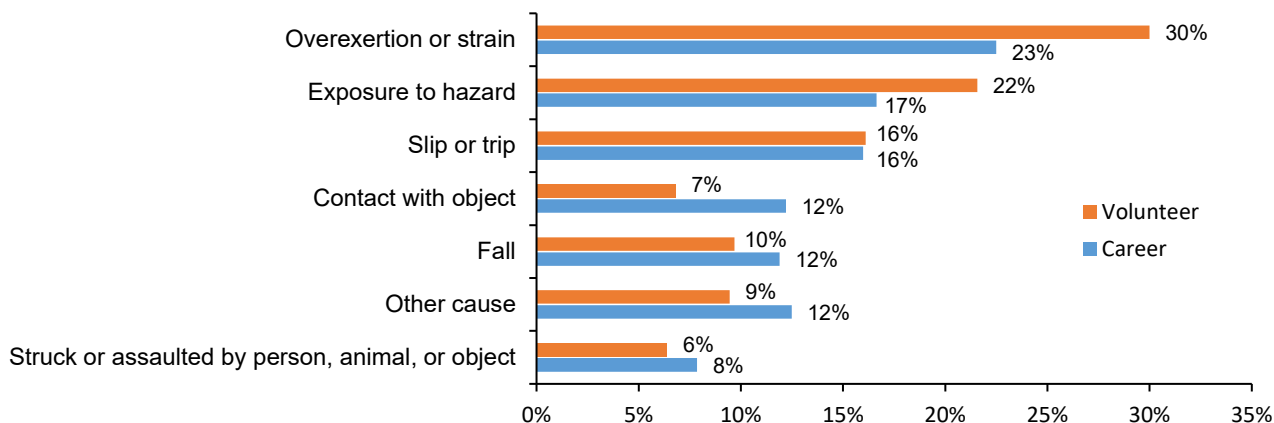
NFPA estimates that female firefighters experienced an average of 1,260 injuries on the fireground each year from 2010 to 2014. There were an estimated 82,550 female firefighters in 2014, according to the 2014 U.S. Fire Department Profile report.

Approximately two-thirds (65%) of the injuries were experienced by career firefighters. Volunteer firefighters experienced the remaining 35% of injuries.

The leading cause of injury was overexertion or strain for both career (23% of injuries) and volunteer (30%) firefighters, followed by exposure to hazard (17% career, 22% volunteer), and slip or trip (16% for career and volunteer).

- ▶ For career firefighters, other leading causes of injury were contact with an object (12%), fall (12%), and being struck or assaulted (8%).
- ▶ For volunteer firefighters, the other leading causes were fall (10%), contact with an object (7%) and being struck or assaulted (6%).

Female Fireground Injuries by Cause of Injury, 2010–2014 Annual Averages



The leading primary injury symptom was strain or sprain for both career (29%) and volunteer (19%) firefighters.

- ▶ Other leading primary injury symptoms for career firefighters included pain only (15%), contusion or bruise (9%), and exhaustion or fatigue (6%). Thermal burns, cut or laceration, and swelling each came to 6% of the total.
- ▶ For volunteer firefighters, other leading primary symptoms were exhaustion or fatigue (12%), smoke inhalation (10%), pain only (7%), and breathing difficulty or shortness of breath (6%). Thermal burns and cut or laceration each accounted for 5% of the volunteer firefighter injury total.

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Introduction

This report presents national estimates of fireground injuries experienced by female firefighters in the U.S. for the five-year period from 2010 through 2014. Literature on firefighter injuries has generally devoted little attention to female firefighters, who currently comprise approximately 7% of the firefighting workforce.¹ It is accordingly important to document the extent of female firefighter injuries and describe the patterns of injury characteristics in order to identify trends and plan potential future prevention efforts. To this end, this report on female firefighter injuries on the fireground serves as a supplement to NFPA's traditional report, [*Patterns of Firefighter Fireground Injuries*](#).

The data presented in this report are limited to non-fatal injuries and do not include work-related illnesses, fatal injuries, or injuries that occurred off the fireground, such as those occurring during travel to or from fire incidents. Accordingly, some of the major components of the firefighter injury experience, such as most vehicular incidents, are not covered in this report. The Research, Data and Analytics Division of the National Fire Protection Association annually publishes two additional reports that examine aspects of the firefighter injury problem not covered here: [*Firefighter Fatalities in the United States*](#)² and [*U.S. Firefighter Injuries*](#).³ The latter provides the latest estimates of all firefighter injuries experienced by municipal firefighters and includes injuries occurring off the fireground, as well as documented exposures to infectious disease. An additional source of comprehensive information on U.S. fire departments and personnel is the [*U.S. Fire Department Profile – 2015*](#).

The national estimates of firefighter injuries for the categories in this report are based on data derived from the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS) in conjunction with the Annual Fire Experience Survey administered by the National Fire Protection Association. The use of NFIRS data allows a more detailed examination of factors relating to injury incidents than data produced by the NFPA survey alone in the *U.S. Firefighter Injuries* report. The data in this report are estimates of firefighter injuries reported to U.S. municipal fire departments and do not include firefighter injuries reported only to federal or state agencies or industrial fire brigades. In the tables and figures, fires and fireground injuries are rounded to the nearest ten. Totals may not equal sums due to rounding. More detailed notes on the methodology used in producing the injury estimates are found in Appendix A.

¹ See [*U.S. Fire Department Profile - 2015*](#) by Hylton J.G. Haynes and Gary P. Stein.

² See [*Firefighter Fatalities in the United States-2015*](#) by Rita F. Fahy, Paul R. Leblanc, and Joseph L. Molis.

³ See [*U.S. Firefighter Injuries-2015*](#) by Hylton J.G. Haynes and Joseph L. Molis.

Section 1: Patterns of Female Firefighter Injuries on the Fireground

NFPA estimates that U.S. female firefighters sustained an average of 1,260 fireground injuries each year between 2010 and 2014, representing 4% of an estimated annual average of 30,290 fireground injuries experienced by all firefighters during this period.⁴ Of the injuries to female firefighters, 820 (65% of total) each year were experienced by career firefighters and 450 (35%) were experienced by volunteer firefighters, as shown in [Table 1](#). Overall, 31% of injuries resulted in lost work time and were classified as either moderately severe (29%) or severe (2%), as shown in Table A below. A higher share of career firefighter injuries were moderately severe (35%) than for volunteer firefighters (18%), while 80% of volunteer firefighter injuries were minor, compared to 64% of career firefighter injuries. Just 2% of injuries in both affiliation categories were classified as severe.

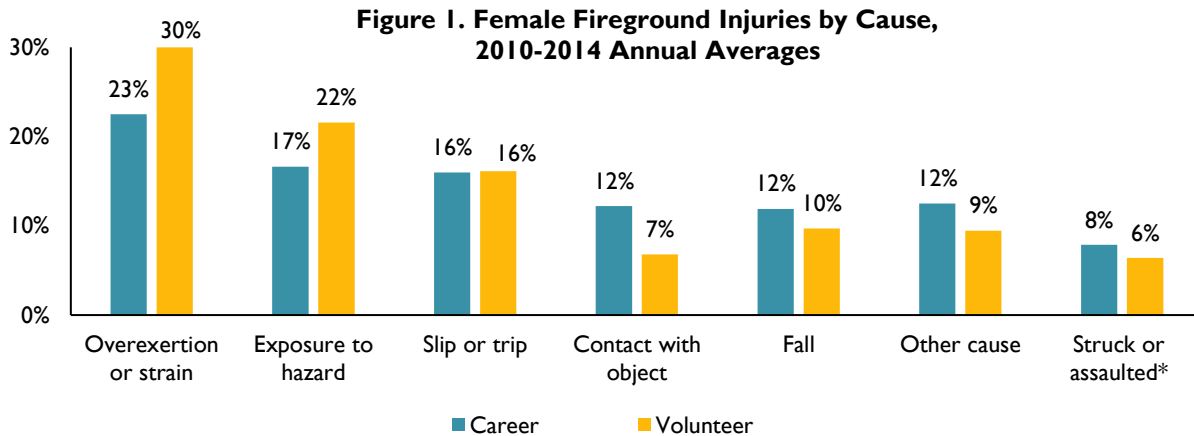
Table A. Female Fireground Injuries by Severity of Injury, 2010-2014 Annual Averages

Severity of Injury	All Female Firefighters		Career		Volunteer	
Minor	880	(69%)	520	(64%)	360	(80%)
Report only, including exposure	310	(24%)	250	(31%)	60	(12%)
First aid only	240	(19%)	120	(14%)	120	(27%)
Treated by physician, not a lost-time injury	330	(26%)	150	(18%)	180	(41%)
Moderate	360	(29%)	280	(35%)	80	(18%)
Lost time injury, moderate severity	360	(29%)	280	(35%)	80	(18%)
Severe	20	(2%)	20	(2%)	10	(2%)
Lost time injury, severe	20	(2%)	20	(2%)	10	(1%)
Lost time injury, life threatening	0	(0%)	0	(0%)	0	(1%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Causes of Injury

[Figure 1](#) shows cause of injury for career and volunteer firefighters. The leading cause of injury was overexertion or strain for both affiliations, but was higher for volunteer firefighters (30% of injuries) than career (23% of injuries). The share of volunteer firefighter injuries caused by exposure to hazard was also higher (22%) than for career firefighters (17%). Injuries caused by slip and trip accounted for 16% of injuries for each affiliation. Career firefighters were more likely to be injured by contact with object (12% of injuries) than volunteers (7%). The share of career firefighter injuries caused by falls (12%) or by being struck or assaulted (8%) were slightly higher than for volunteers (10% falls, 6% struck or assaulted by). More complete information on injuries by cause is available in [Table 2](#).

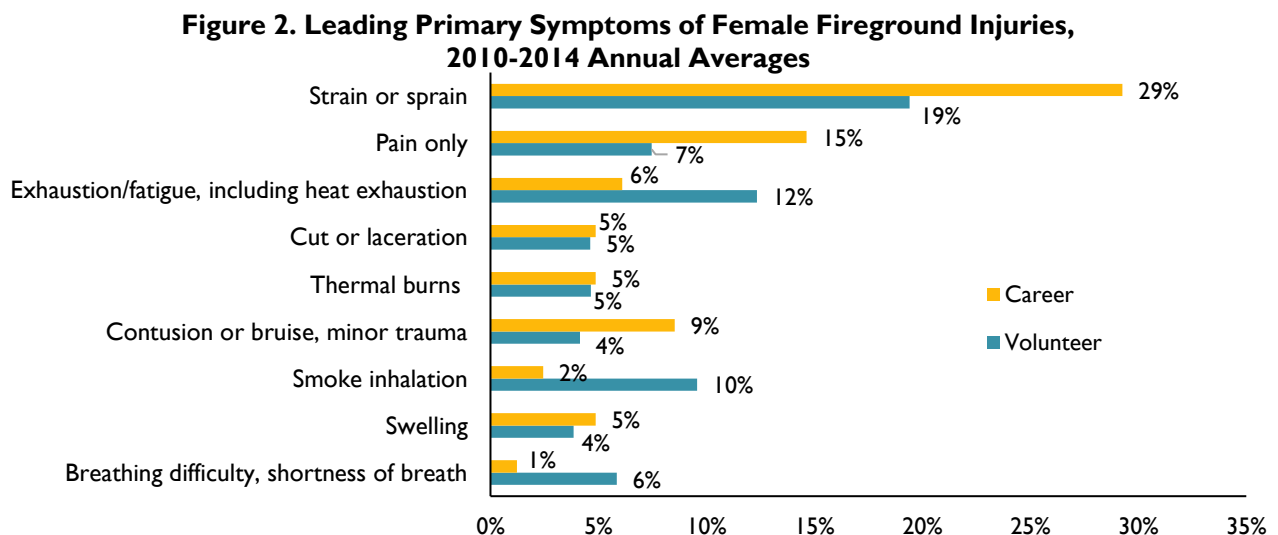
⁴ See [Patterns of Firefighter Fireground Injuries](#) by Richard Campbell.



*Struck or assaulted by person, animal or object.

Primary Symptoms

There were some notable differences between career and volunteer firefighters in their respective primary symptoms of injury. The leading primary symptom of injury was strain or sprain for female firefighters in both affiliation categories, but accounted for a greater share of career firefighter injuries (29% of total) than for volunteers (19%), as shown in Figure 2. Other leading primary injury symptoms for career firefighters were pain only (15%), contusion or bruise (9%), and exhaustion or fatigue (6%), while thermal burns, cut or laceration, and swelling each had 5% of the total. For volunteer firefighters, other leading primary symptoms were exhaustion or fatigue (12%), smoke inhalation (10%), pain only (7%), breathing difficulty or shortness of breath (6%). Thermal burns and cut or laceration each accounted for 5% of the volunteer firefighter injury total. The injuries of volunteer firefighters were more likely than those of career firefighters to involve exhaustion fatigue, smoke inhalation, or breathing difficulty, as Figure 2 indicates. Additional information is available in [Table 3](#).



Type of Incident

The vast majority of female firefighter injuries occurred while fighting structure fires, although the share of career firefighter injuries at structure fires (86%) was higher than that of volunteer firefighters (71%), as shown in Table B below and Table 4. Mobile properties used as structures accounted for another 2% of career firefighter injury incidents and 4% of volunteer firefighter injury incidents. Volunteer firefighter injuries were more likely to occur at natural vegetation fires (14%) than those of career firefighters (3%). Five percent of career firefighter injuries and 4% of volunteer injuries occurred at mobile property fires. Seven percent of volunteer firefighter injuries occurred at outside rubbish fires, special outside fires, unclassified fires, or cultivated vegetation or crop fires, compared to 3% of career firefighter injuries for these incidents.

**Table B. Female Fireground Injuries by Incident Type,
2010-2014 Annual Averages**

Incident Type	Career		Volunteer	
Structure fire	700	(86%)	320	(71%)
Mobile property (vehicle) fire	40	(5%)	20	(4%)
Natural vegetation fire	30	(3%)	60	(14%)
Outside rubbish fire	20	(2%)	10	(2%)
Fire in mobile property used as a fixed structure	10	(2%)	20	(4%)
Special outside fire	10	(1%)	10	(2%)
Unclassified fire	0	(0%)	10	(2%)
Cultivated vegetation or crop fire	0	(0%)	0	(1%)
Total	820	(100%)	450	(100%)

Injuries by Occupancy

Fires at residential properties were associated with the largest shares of firefighter injuries, but a substantially higher share of career firefighter injuries (74%) occurred at these properties compared to volunteer firefighters (57%), as shown in Table C and Table 5. The majority of the injuries occurred at one- or two-family homes – 57% of career firefighter injuries and 51% of volunteer firefighter injuries. The remaining injuries at residential properties occurred in apartments or multi-family homes, with a greater share of career firefighter injuries at these properties (15%) than volunteers (5%).

Other injury locations included outside or special properties, storage properties, mercantile or business properties, public assembly properties, manufacturing or processing properties, and industries, utility, defense, agriculture, or mining properties. As Table C and Table 5 indicate, a greater share of the injuries experienced by volunteer firefighters occurred at outside or special properties (17% versus 9% career) or storage properties (12% versus 5% career). Industrial, utility, defense, agriculture, or mining properties, while not a major site of firefighter injuries, nevertheless also accounted for a greater share of volunteer (4%) than career (1%) injuries.

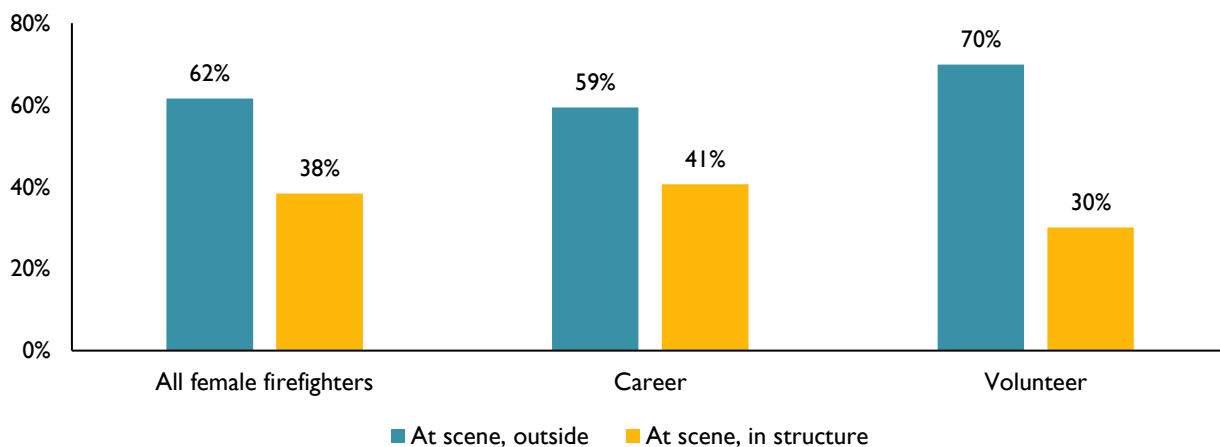
Table C. Female Fireground Injuries by Type of Occupancy, 2010-2014 Annual Averages

Property Use	Career		Volunteer	
Residential	610	(74%)	260	(57%)
One- or two-family home	460	(57%)	230	(51%)
Apartment or multi-family home	120	(15%)	20	(5%)
Outside or special property	70	(9%)	80	(17%)
Highway, street, or parking area	40	(4%)	20	(4%)
Open land, beach, or campsite	30	(3%)	40	(10%)
Storage	40	(5%)	50	(12%)
Vehicle storage, garage, or fire station	20	(2%)	20	(5%)
Mercantile or business	40	(5%)	20	(4%)
Public assembly	30	(3%)	20	(3%)
Manufacturing or processing	20	(2%)	10	(2%)
Industrial, utility, defense, agriculture, or mining	10	(1%)	20	(4%)
Educational	10	(1%)	0	(0%)
Total	820	(100%)	450	(100%)

General Injury Location in Structure Fires

Approximately six in 10 (62%) of female fire firefighter injuries which occurred at structures fires took place at the scene and outside the structure, with 38% of injuries occurring inside the structure. As Figure 3 shows, a higher share of career firefighters were inside the structure (41%) when sustaining the injury than volunteer firefighters (30%). Note that this data is for *structure fires only*. See also [Table 6](#).

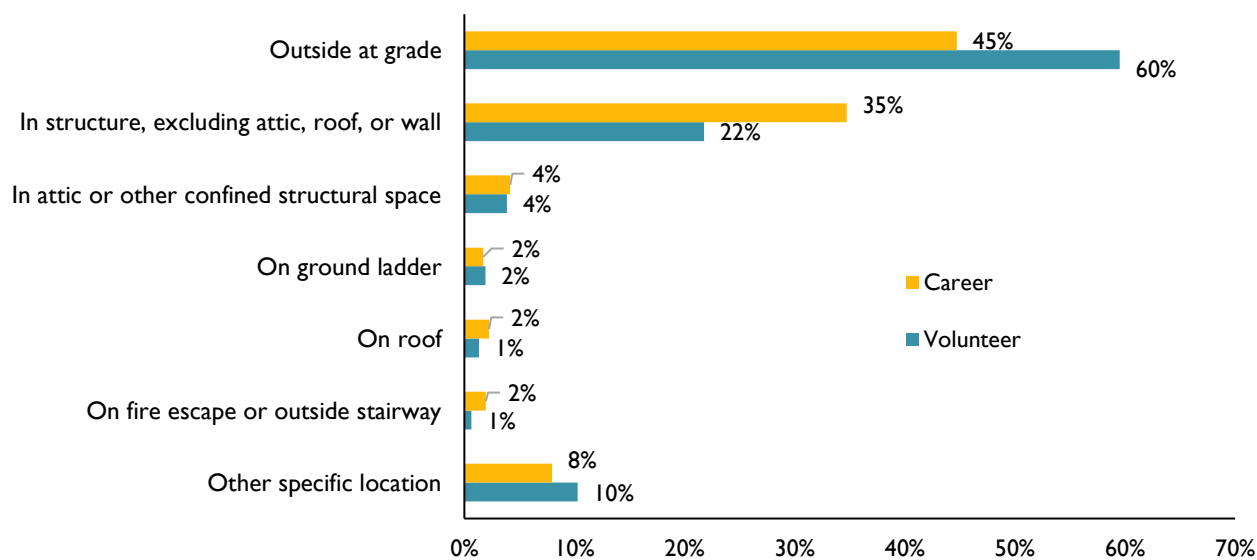
Figure 3. General Location of Female Fireground Injuries in Structure Fires, 2010-2014 Annual Averages



Specific Injury Location

Information is also available on the specific location where firefighters sustained their injuries, as shown in Figure 4. Analysis in this table is again limited to injuries in structure fires only. The data indicate that just over four in 10 (45%) of career firefighter injuries and 60% of volunteer firefighter injuries in structure fires occurred outside, at grade. A higher share of career firefighter injuries were sustained in the structure, but excluding attic, roof, or wall, with 35% of career and 22% of volunteer injuries occurring at this location. Four percent of injuries among career as well as volunteer firefighters were sustained in an attic, while 2% of injuries in each affiliation occurred on a ground ladder, and 2% of career and 1% of volunteer injuries occurred on a roof. Two percent of the career injuries occurred on a fire escape or outside stairway, as did 1% of volunteer injuries. Additional information is available in [Table 7](#).

Figure 4. Female Fireground Injuries in Structure Fires, by Leading Specific Injury Location, 2010-2014 Annual Averages



Firefighter Activities When Injured

Nearly half of career (46%) and volunteer (49%) injuries occurred while firefighters were extinguishing a fire or involved in neutralizing incidents, as shown in [Table D](#). A higher share of volunteer injuries in these incidents occurred while handling charged hose lines (31%) relative to career firefighters (22%). Just over one-fifth of injuries occurred during suppression support activities (22% of career injuries, 23% of volunteer), primarily during overhaul (8% career, 12% volunteer). Other leading activities associated with firefighter injuries included picking up tools, equipment, or hose on the scene (5% of career injuries, 4% of volunteer), EMS or rescue (4% of career injuries, 3% of volunteer), operating fire department apparatus (3% of injuries across affiliations), driving or riding vehicle (3% of career injuries, 4% of volunteer), and access or egress activity (4% career injuries, 1% of volunteer). Additional information is available in [Table 8](#).

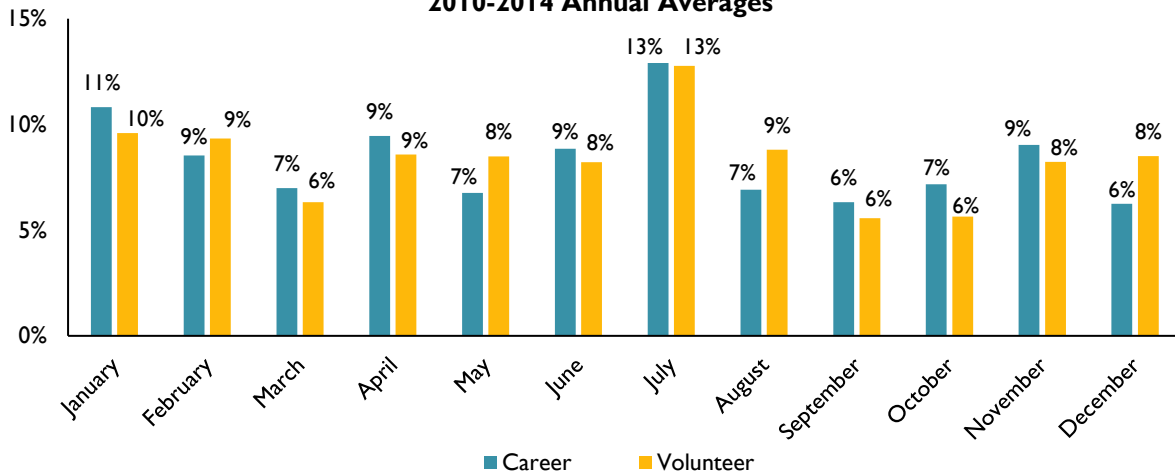
**Table D. Female Fireground Injuries by Activity when Injured,
2010-2014 Annual Averages**

Activity When Injured	Career		Volunteer	
Extinguishing fire or neutralizing incident	370	(46%)	220	(49%)
Unclassified extinguishing fire or neutralizing incident	140	(17%)	50	(11%)
Handling charged hose lines	180	(22%)	140	(31%)
Using hand tools in extinguishment activity	40	(5%)	30	(6%)
Suppression support	180	(22%)	100	(23%)
Unclassified suppression support	70	(9%)	40	(9%)
Ventilation with hand tools	10	(2%)	10	(1%)
Overhaul	60	(8%)	50	(12%)
Other incident scene activity	120	(15%)	60	(14%)
Picking up tools, equipment, or hose on scene	40	(5%)	20	(4%)
Other incident scene activity	30	(3%)	10	(2%)
Laying hose	10	(2%)	10	(3%)
Moving tools or equipment around scene	20	(3%)	10	(2%)
EMS or rescue	30	(4%)	10	(3%)
Rescuing fire victim	10	(2%)	0	(0%)
Operating fire department apparatus	30	(3%)	10	(3%)
Operating engine or pumper	30	(3%)	10	(2%)
Driving or riding vehicle	20	(3%)	20	(4%)
Getting off fire department vehicle	10	(2%)	10	(3%)
Access or egress	30	(4%)	0	(1%)
Other activity	30	(3%)	0	(0%)
Incident investigation, during incident	20	(2%)	0	(0%)
Unclassified activity	10	(1%)	20	(4%)
Total	820	(100%)	450	(100%)

Firefighter Injuries by Month

As shown in [Figure 5](#), career and volunteer firefighter injuries generally followed a similar pattern in injuries by month. The high month for injuries was July, with 13% of the annual injury total for both affiliations, followed by January, with 11% of career firefighter injuries and 10% of volunteer injuries, suggesting an impact of hot or cold environmental conditions on risk of injury. Months with the fewest injuries included September, with 6% of injuries for each affiliation, October (7% of career injuries, 6% of volunteer), and March (7% of career injuries and 6% of volunteer). See [Table 9](#) for more information.

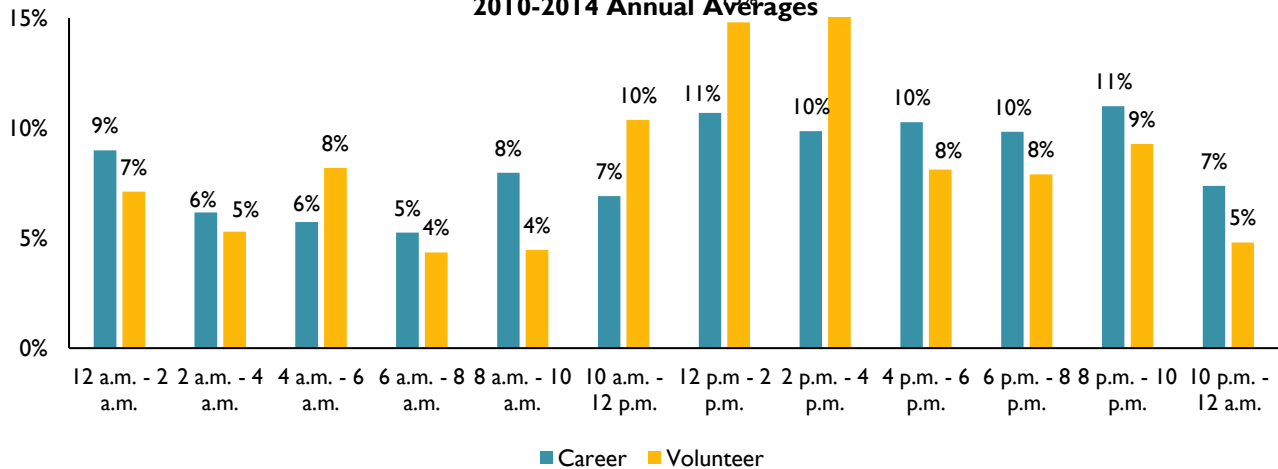
Figure 5. Female Fireground Injuries by Month, 2010-2014 Annual Averages



Fireground Injuries by Time of Day

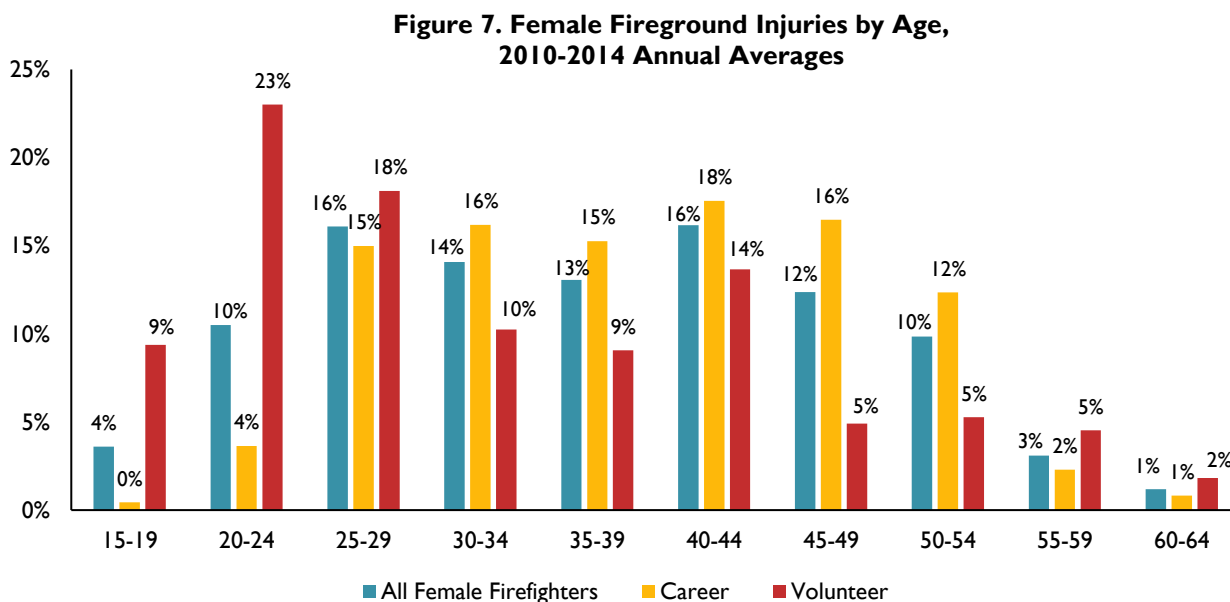
Figure 6 shows that there was some variation in the distribution of firefighter injuries by time of day. The fewest injuries occurred between 6 a.m. and 8 a.m. (5% of career injuries, 4% of volunteer injuries), while the greatest number of injuries occurred between noon and 2 p.m. (11% of career injuries, 15% of volunteer injuries) and between 2 p.m. and 4 p.m. (10% of career injuries, 15% of volunteer injuries). It is worth noting that the 30% share of volunteer injuries during these peak periods was considerably higher than the 21% share of career firefighter injuries. See also [Table 10](#).

Figure 6. Female Fireground Injuries by Time of Day, 2010-2014 Annual Averages



Firefighter Injuries by Age

There were some notable differences in the distribution of fireground injuries between career and volunteer firefighters, as shown in Figure 7 and Table 11. Among volunteer firefighters, younger age groups had a much higher share of injuries than their career counterparts; firefighters aged 29 years or younger accounted for one-half (50%) volunteer firefighter injuries, compared to 19% of career injuries were in these age groups. The disparity was even greater when comparing injuries among firefighters aged 24 years or younger, who accounted for more than three in 10 volunteer injuries (32%), while just 4% of career firefighter injuries were in these age groups. By contrast, 65% of career firefighter injuries were experienced by firefighters between the ages of 30 and 49, with 38% of volunteer firefighter injuries in the same age groups. The contrast was particularly noticeable among firefighters between 45 and 54 years, with just 10% of volunteer injuries in these age groups, almost three times higher than the 29% of career firefighters aged 45 to 54.



Primary Body Part Injured

As shown in Table E, firefighter injuries most often involve injuries to lower extremities (25% of career injuries, 20% of volunteer injuries) and upper extremities (18% of career injuries, 17% of volunteer injuries). Injuries to the knee (12% career, 8% volunteer) and ankle (7% career, 8% volunteer) predominated the lower extremity injuries, while upper extremity injuries most often occurred to the hand and fingers (11% career, 9% volunteer). Other injury sites included the head (11% of career injuries, 13% of volunteer injuries), multiple body parts (9% of career injuries, 12% of volunteer), neck and shoulders (12% of career injuries, 8% of volunteer), internal injuries (6% of career injuries, 14% of volunteer), thorax (6% of career injuries, 4% of volunteer), abdominal area (3% of career injuries, 4% of volunteer), and spine 3% of career

injuries, 1% of volunteer). In general, career and volunteer firefighter injuries followed a similar pattern by body part, with the primary difference in the higher share of internal injuries experienced by volunteer firefighters, a disparity most evident in injuries involving the trachea and lungs, which was the injury site of 11% of volunteer injuries, compared to 4% of career injuries. See [Table 12](#) for more detailed information.

Table E. Female Fireground Injuries by Primary Body Part Injured, 2010-2014 Annual Averages

Primary Body Part Injured*	All		Career		Volunteer	
Lower extremities	290	(23%)	200	(25%)	90	(20%)
Knee	140	(11%)	100	(12%)	40	(8%)
Ankle	100	(8%)	60	(7%)	40	(8%)
Upper extremities	230	(18%)	150	(19%)	70	(17%)
Hand and fingers	130	(11%)	90	(11%)	40	(9%)
Head	150	(12%)	90	(11%)	60	(13%)
Head, unclassified	80	(6%)	40	(5%)	30	(7%)
Eye	30	(2%)	20	(2%)	10	(3%)
Multiple parts	130	(10%)	80	(9%)	60	(12%)
Multiple body parts - whole body	100	(8%)	60	(7%)	40	(10%)
Neck and shoulders	130	(10%)	100	(12%)	30	(8%)
Shoulder	90	(7%)	60	(8%)	30	(6%)
Internal	110	(9%)	50	(6%)	60	(14%)
Trachea and lungs	80	(6%)	30	(4%)	50	(11%)
Thorax	70	(5%)	50	(6%)	20	(4%)
Back, except spine	40	(3%)	30	(4%)	10	(2%)
Chest	30	(2%)	20	(2%)	10	(2%)
Abdominal area	50	(4%)	30	(3%)	20	(4%)
Spine	30	(2%)	20	(3%)	0	(1%)
None	60	(5%)	30	(4%)	30	(6%)
Total	1,260	(100%)	820	(100%)	450	(100%)

*This table includes main information only. See [Table 12](#) for complete information.

Injury Factor

A variety of factors may influence whether an injury occurs, as well as the type and severity of injury. For female firefighters, the leading factor associated with fireground injury was slippery or uneven surfaces, which accounted for 27% of career firefighter injuries and 23% of volunteer injuries. Factors involving fire development was the second leading factor (18% of career firefighter injuries, 21% of volunteer) contributing to injury, primarily injuries influenced by fire progress, including smoky conditions (12% of career firefighter injuries, 18% of volunteer

injuries). Some type of collapse or falling object was a factor in 8% of career firefighter injuries and 9% of volunteer injuries, while a vehicle or apparatus was a factor in 3% of career firefighter injuries and 1% of volunteer firefighter injuries, and holes were a factor in 2% of injuries among both firefighter affiliations. Being lost, caught, trapped, or confined was also a factor in 2% of career firefighter injuries, but no volunteer injuries. Additional information is available in [Table 13](#).

Table F. Female Fireground Injuries by Injury Factor, 2010-2014 Annual Averages

Injury Factor*	All		Career		Volunteer	
Slippery or uneven surfaces	320	(25%)	220	(27%)	100	(23%)
Uneven surface, including holes in the ground	90	(7%)	50	(6%)	40	(9%)
Icy surface	90	(7%)	70	(9%)	20	(4%)
Slippery or uneven surfaces, unclassified	70	(5%)	50	(6%)	20	(4%)
Wet surface, including water, soap, foam, etc.	50	(4%)	30	(4%)	20	(4%)
Loose material on surface	30	(2%)	20	(3%)	10	(1%)
Fire development	240	(19%)	150	(18%)	90	(21%)
Fire progress, including smoky conditions	180	(14%)	100	(12%)	80	(18%)
Fire development, unclassified	40	(4%)	40	(4%)	10	(2%)
Collapse or falling object	110	(9%)	70	(8%)	40	(9%)
Falling objects	30	(3%)	30	(3%)	10	(1%)
Ceiling collapse	40	(3%)	20	(3%)	20	(3%)
Collapse or falling object, unclassified	30	(2%)	10	(2%)	10	(3%)
Vehicle or apparatus	30	(2%)	20	(3%)	10	(1%)
Vehicle or apparatus, unclassified	20	(2%)	20	(2%)	10	(1%)
Holes	30	(2%)	20	(2%)	10	(2%)
Lost, caught, trapped or confined	10	(1%)	10	(2%)	0	(0%)
None	320	(25%)	200	(25%)	110	(26%)
Total	1,260	(100%)	820	(100%)	450	(100%)

*This table includes main information only. See [Table 13](#) for complete information.

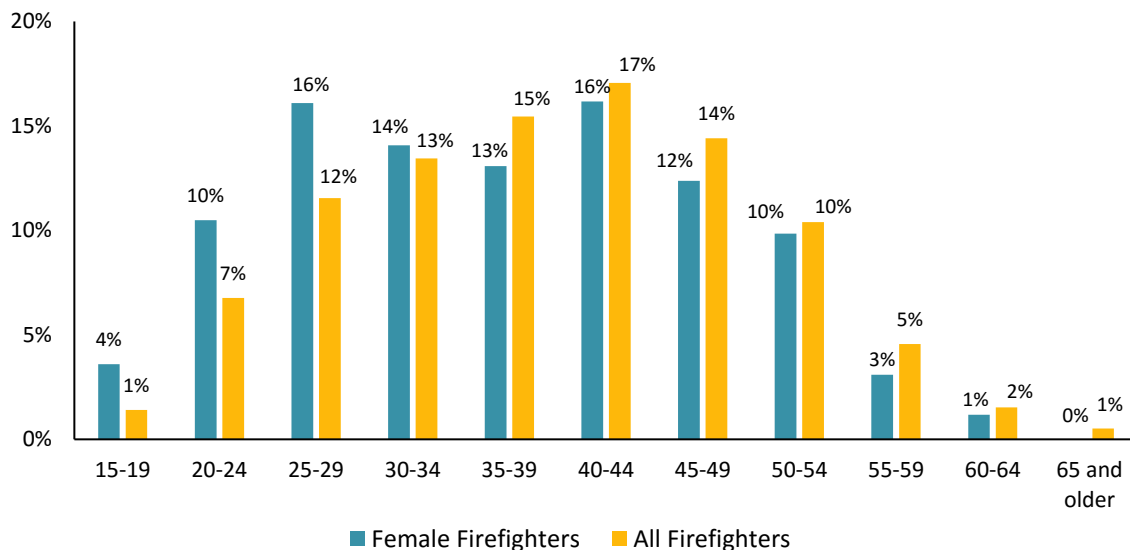
Section 2: Injury Patterns of Female Firefighters and All Firefighters

It is instructive to make some brief comparisons between the fireground injury patterns of female firefighters and those observed in our earlier report on firefighter fireground injuries, in which the vast majority of injuries (96%) were sustained by male firefighters. Moving forward, a goal for future research will be to undertake more direct and systematic analysis of the patterns of injury between male and female firefighters.

Age of Injury Victim

One notable difference is in the distribution of fireground injuries by age, with a larger share of injuries experienced by younger age groups in the female firefighter population relative to all firefighters. As shown in Figure 8, 30% of injuries among female firefighters were 29 years of age or younger, compared to 20% of the injuries among all firefighters in these age groups. This distinction may reflect the age distribution of female firefighters, reflecting their relatively recent entry into the fire service. However, because we do not have information on the age distribution of firefighters in these two groups, we are unable to draw conclusions about the differences.

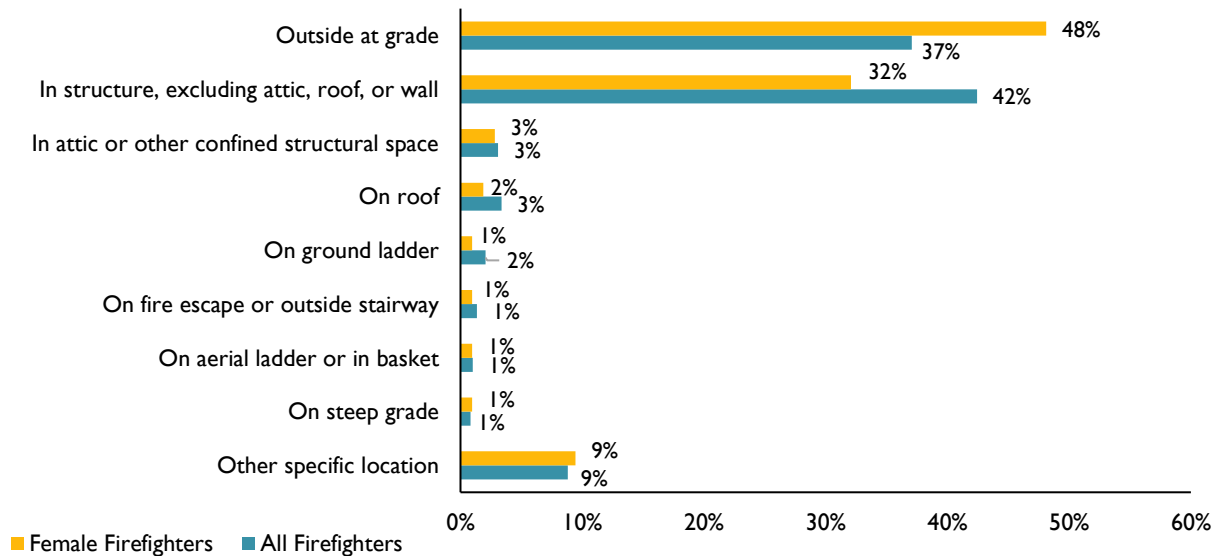
Figure 8. Fireground Injuries by Age, 2010-2014 Annual Averages



Location of Injury

Figure 9 shows injuries by specific location for *structure fires only*. Female firefighters were more likely to be outside at grade when injured (48% of injuries) than the all-firefighter injury group (37%), while the latter was more likely to be in a structure, excluding attic, roof, or wall when injured (42%) than female firefighters (32%). Other injury locations were similar in both groups as indicated in Figure 9.

Figure 9. Fireground Injuries in Structure Fires by Leading Specific Injury Location, 2010-2014 Annual Averages



Severity of Injury

The severity of injuries experienced by female firefighters were similar to those of all firefighters, as shown in Table G. The distribution of injuries between minor, moderate, and severe injuries was similar in both groups, with the major difference being a higher share among female firefighters requiring treatment by a physician for minor injuries.

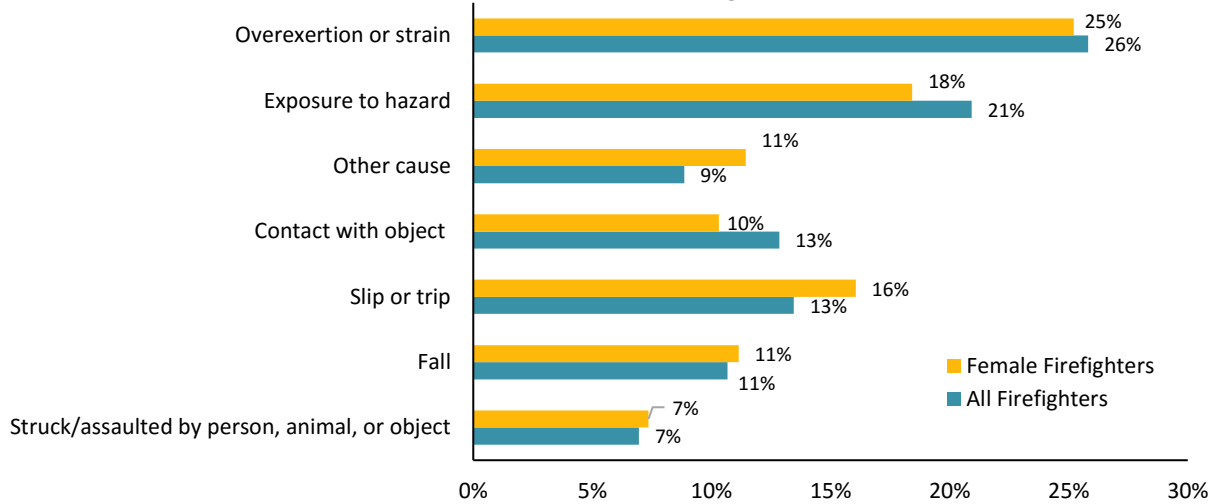
Table G. Fireground Injuries by Injury Severity, 2010-2014 Annual Averages

Severity of Injury	Female Firefighters	All Firefighters
Minor	69%	68%
Report only, including exposure	24%	30%
First aid only	19%	16%
Treated by physician, not a lost-time injury	26%	22%
Moderate	29%	30%
Lost time injury, moderate severity	29%	30%
Severe	2%	2%
Lost time injury, severe	2%	2%

Female firefighter injuries also followed a similar pattern by injury cause to that of all firefighters. Overexertion or strain was the leading cause of injury for females (25%) and all firefighters (26%), while exposure to hazard accounted for a slightly greater share of injuries among all firefighters (21%) than females (18%). Female firefighter injuries were somewhat less

likely to be caused by contact with object (10%) compared to all firefighters (13%), but somewhat more likely to be caused by a slip or trip -- 16%, versus 13% of all firefighter injuries.

Figure 10. Fireground Injuries by Cause, 2010-2014 Annual Averages



**Table 1. Female Fireground Injuries by Affiliation,
2010-2014 Annual Averages**

Affiliation	Firefighter Injuries	
Career	820	(65%)
Volunteer	450	(35%)
Total	1,260	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 2. Female Fireground Injuries by Cause of Injury,
2010-2014 Annual Averages**

All Firefighters		
Cause of Injury	All	
Overexertion or strain	320	(25%)
Exposure to hazard	230	(18%)
Slip or trip	200	(16%)
Contact with object (firefighter moved into or onto)	130	(10%)
Fall	140	(11%)
Other cause	140	(11%)
Struck or assaulted by person, animal, or object	90	(7%)
Total	1,260	(100%)

Career Firefighters		
Cause of Injury	All	
Overexertion or strain	180	(23%)
Exposure to hazard	140	(17%)
Slip or trip	130	(16%)
Contact with object (firefighter moved into or onto)	100	(12%)
Fall	100	(12%)
Other cause	100	(12%)
Struck or assaulted by person, animal, or object	60	(8%)
Career firefighter total	820	(100%)

Volunteer Firefighters		
Cause of Injury	All	Percentage
Overexertion or strain	130	(30%)
Exposure to hazard	100	(22%)
Slip or trip	70	(16%)
Fall	40	(10%)
Other cause	40	(9%)
Contact with object (firefighter moved into or onto)	30	(7%)
Struck or assaulted by person, animal, or object	30	(6%)
Volunteer firefighter total	450	(100%)

Note: Injuries in which the cause of injury was coded as "undetermined" or not reported have been allocated proportionally among injuries with known causes of injury. Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 3. Female Fireground Injuries by Primary Symptom,
2010-2014 Annual Averages**

Primary Symptom of Injury	All		Career		Volunteer	
Strain or sprain	330	(26%)	240	(29%)	90	(19%)
Pain only	150	(12%)	120	(15%)	30	(7%)
Exhaustion or fatigue, including heat exhaustion	110	(8%)	50	(6%)	60	(12%)
Contusion or bruise, minor trauma	80	(7%)	70	(9%)	20	(4%)
Thermal burns	70	(5%)	40	(5%)	20	(5%)
Cut or laceration	70	(5%)	40	(5%)	20	(5%)
Smoke inhalation	70	(5%)	20	(2%)	40	(10%)
Swelling	60	(5%)	40	(5%)	20	(4%)
Breathing difficulty or shortness of breath	40	(3%)	10	(1%)	30	(6%)
Hazardous fumes inhalation	20	(2%)	20	(2%)	0	(1%)
Nausea	20	(2%)	10	(1%)	10	(3%)
Unclassified symptom	20	(1%)	10	(1%)	10	(1%)
Crushing	20	(1%)	10	(1%)	0	(1%)
Cardiac symptoms	20	(1%)	10	(1%)	10	(2%)
Abrasion	20	(1%)	10	(1%)	10	(2%)
Other burns*	10	(1%)	10	(1%)	0	(1%)
Stab or puncture wound	10	(1%)	10	(1%)	0	(0%)
Eye trauma, avulsion	10	(1%)	10	(1%)	0	(1%)
Dislocation	10	(1%)	10	(1%)	0	(0%)
Electric shock	10	(1%)	10	(1%)	0	(0%)
Allergic reaction, including anaphylactic shock	10	(1%)	10	(1%)	0	(0%)
Numbness or tingling, paresthesia	10	(1%)	0	(0%)	10	(1%)
Frostbite	10	(1%)	0	(0%)	10	(2%)
Foreign body obstruction	10	(0%)	10	(1%)	0	(0%)
Other known primary symptom	20	(2%)	10	(1%)	10	(3%)
Total	1,260	(100%)	820	(100%)	450	(100%)

*Includes burns and smoke inhalation, scald burns, and chemical burns

Note: Injuries in which the primary symptom was coded as "none," "undetermined," or not reported have been allocated proportionally among injuries with known primary symptoms.

Source: NFIRS and NFPA Survey.

**Table 4. Female Fireground Injuries by Incident Type,
2010-2014 Annual Averages**

Incident Type	All		Career		Volunteer	
Structure fire	1,020	(81%)	700	(86%)	320	(71%)
Natural vegetation fire	90	(7%)	30	(3%)	60	(14%)
Mobile property (vehicle) fire	60	(5%)	40	(5%)	20	(4%)
Fire in mobile property used as a fixed structure	30	(2%)	10	(2%)	20	(4%)
Outside rubbish fire	20	(2%)	20	(2%)	10	(2%)
Special outside fire	20	(1%)	10	(1%)	10	(2%)
Unclassified fire	10	(1%)	0	(0%)	10	(2%)
Cultivated vegetation, crop fire	0	(0%)	0	(0%)	0	(1%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 5. Female Fireground Injuries by Type of Occupancy,
2010-2014 Annual Averages**

Type of Occupancy	Career		Volunteer	
Residential	610	(74%)	260	(57%)
One- or two-family home	460	(57%)	230	(51%)
Apartment or multi-family home	120	(15%)	20	(5%)
Outside or special property	70	(9%)	80	(17%)
Highway, street, or parking area	40	(4%)	20	(4%)
Open land, beach, or campsite	30	(3%)	40	(10%)
Storage	40	(5%)	50	(12%)
Vehicle storage, garage, or fire station	20	(2%)	20	(5%)
Mercantile or business	40	(5%)	20	(4%)
Public assembly	30	(3%)	20	(3%)
Manufacturing or processing	20	(2%)	10	(2%)
Educational	10	(1%)	0	(0%)
Industrial, utility, defense, agriculture, or mining	10	(1%)	20	(4%)
Totals	820	(100%)	450	(100%)

**Table 6. Female Fireground Injuries by General Location in Structure Fires,
2010-2014 Annual Averages**

General Location When Injured	All		Career		Volunteer	
At scene, outside	650	(62%)	430	(59%)	230	(70%)
At scene, in structure	410	(38%)	290	(41%)	100	(30%)
Total	1,060	(100%)	720	(100%)	340	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

Table 7. Female Fireground Injuries by Specific Location in Structure Fires, 2010-2014 Annual Averages

Specific Location When Injured	All		Career		Volunteer	
Outside at grade	510	(48%)	320	(45%)	200	(60%)
In structure, excluding attic, roof, or wall	340	(32%)	250	(35%)	70	(22%)
In attic or other confined structural space	30	(3%)	30	(4%)	10	(4%)
On roof	20	(2%)	20	(2%)	0	(1%)
On ground ladder	10	(1%)	10	(1%)	10	(2%)
On steep grade	10	(1%)	10	(1%)	0	(1%)
On fire escape or outside stairway	10	(1%)	10	(2%)	0	(1%)
On vertical surface or ledge	10	(1%)	10	(1%)	0	(0%)
On aerial ladder or in basket	10	(1%)	0	(0%)	0	(1%)
Other specific location	90	(8%)	50	(7%)	30	(9%)
Total	1,060	(100%)	720	(100%)	340	(100%)

Note: Injuries in which the location was coded as "none," "undetermined," or not reported have been allocated proportionally among injuries with known locations. Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 8. Female Fireground Injuries by Activity,
2010-2014 Annual Averages**

Activity When Injured	All		Career		Volunteer	
Extinguishing fire or neutralizing incident	590	(47%)	370	(46%)	220	(49%)
Unclassified extinguishing fire or neutralizing incident	190	(15%)	140	(17%)	50	(11%)
Handling charged hose lines	320	(25%)	180	(22%)	140	(31%)
Using hand extinguishers	10	(1%)	10	(1%)	0	(0%)
Operating master steam device	0	(0%)	0	(0%)	0	(0%)
Using hand tools in extinguishment activity	70	(6%)	40	(5%)	30	(6%)
Shutting off utilities, gas lines, etc.	0	(0%)	0	(0%)	0	(0%)
Suppression support	280	(22%)	180	(22%)	100	(23%)
Unclassified suppression support	110	(9%)	70	(9%)	40	(9%)
Forcible entry	10	(1%)	10	(1%)	0	(0%)
Ventilation with power tools	10	(1%)	10	(1%)	0	(0%)
Ventilation with hand tools	20	(2%)	10	(2%)	10	(1%)
Salvage	20	(1%)	10	(1%)	10	(1%)
Overhaul	110	(9%)	60	(8%)	50	(12%)
Other incident scene activity	180	(14%)	120	(15%)	60	(14%)
Other incident scene activity	40	(3%)	30	(3%)	10	(2%)
Directing traffic	0	(0%)	0	(0%)	0	(0%)
Catching hydrant	20	(1%)	10	(1%)	10	(2%)
Laying hose	30	(2%)	10	(2%)	10	(3%)
Moving tools or equipment around scene	30	(3%)	20	(3%)	10	(2%)
Picking up tools, equipment, or hose on scene	60	(5%)	40	(5%)	20	(4%)
Setting up lighting	0	(0%)	0	(0%)	0	(0%)
EMS or rescue	40	(3%)	30	(4%)	10	(3%)
Unclassified EMS or rescue	0	(0%)	0	(0%)	0	(0%)
Searching for victim	10	(1%)	10	(1%)	0	(1%)
Rescuing fire victim	20	(1%)	10	(2%)	0	(0%)
Rescuing non-fire victim	0	(0%)	0	(0%)	0	(1%)
Providing EMS care	10	(1%)	10	(1%)	0	(1%)
Operating fire department apparatus	40	(3%)	30	(3%)	10	(3%)
Operating engine or pumper	40	(3%)	30	(3%)	10	(2%)
Operating rescue vehicle	0	(0%)	0	(0%)	0	(0%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 8. Female Fireground Injuries by Activity,
2010-2014 Annual Averages (Continued)**

Activity When Injured	All		Career		Volunteer	
Driving or riding vehicle	40	(3%)	20	(3%)	20	(4%)
Unclassified driving or riding vehicle	0	(0%)	0	(0%)	0	(0%)
Boarding fire department vehicle	0	(0%)	0	(0%)	0	(0%)
Driving fire department vehicle	0	(0%)	0	(0%)	0	(0%)
Getting off fire department vehicle	30	(2%)	10	(2%)	10	(3%)
Access or egress	30	(3%)	30	(4%)	0	(1%)
Unclassified access or egress	10	(1%)	10	(1%)	0	(0%)
Carrying ground ladder	0	(0%)	0	(0%)	0	(0%)
Raising ground ladder	10	(0%)	0	(0%)	0	(0%)
Climbing ladder	10	(1%)	10	(1%)	0	(0%)
Escaping fire/hazard	10	(0%)	0	(0%)	0	(0%)
Other activity	30	(2%)	30	(3%)	0	(0%)
Incident investigation, during incident	20	(1%)	20	(2%)	0	(0%)
Incident investigation, after incident	10	(1%)	10	(1%)	0	(0%)
Administrative work	0	(0%)	0	(0%)	0	(0%)
Unclassified activity	30	(2%)	10	(1%)	20	(4%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Injuries in which the activity when injured was coded as "undetermined" or not reported have been allocated proportionally among injuries with known activities. Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 9. Female Fireground Injuries by Month,
2010-2014 Annual Averages**

Month	All		Career		Volunteer	
January	130	(10%)	90	(11%)	40	(10%)
February	110	(9%)	70	(9%)	40	(9%)
March	90	(7%)	60	(7%)	30	(6%)
April	120	(9%)	80	(9%)	40	(9%)
May	90	(7%)	60	(7%)	40	(8%)
June	110	(9%)	70	(9%)	40	(8%)
July	160	(13%)	110	(13%)	60	(13%)
August	100	(8%)	60	(7%)	40	(9%)
September	80	(6%)	50	(6%)	20	(6%)
October	80	(7%)	60	(7%)	30	(6%)
November	110	(9%)	70	(9%)	40	(8%)
December	90	(7%)	50	(6%)	40	(8%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 10. Female Fireground Injuries by Time of Day,
2010-2014 Annual Averages**

Time of Day	All		Career		Volunteer	
Midnight- 12:59 a.m.	50	(4%)	30	(4%)	20	(4%)
1:00-1:59 a.m.	50	(4%)	40	(5%)	20	(3%)
2:00-2:59 a.m.	30	(3%)	20	(3%)	10	(3%)
3:00-3:59 a.m.	40	(3%)	30	(4%)	10	(3%)
4:00-4:59 a.m.	50	(4%)	30	(4%)	20	(4%)
5:00-5:59 a.m.	40	(3%)	20	(2%)	20	(4%)
6:00-6:59 a.m.	30	(2%)	20	(3%)	10	(2%)
7:00-7:59 a.m.	30	(3%)	20	(3%)	10	(3%)
8:00-8:59 a.m.	40	(4%)	40	(4%)	10	(2%)
9:00-9:59 a.m.	40	(3%)	30	(3%)	10	(3%)
10:00-10:59 a.m.	50	(4%)	20	(3%)	20	(5%)
11:00-11:59 a.m.	60	(4%)	30	(4%)	20	(5%)
12:00-12:59 p.m.	80	(7%)	50	(6%)	30	(7%)
1:00-1:59 p.m.	70	(6%)	40	(5%)	30	(7%)
2:00-2:59 p.m.	80	(6%)	50	(6%)	30	(6%)
3:00-3:59 p.m.	70	(6%)	30	(4%)	40	(9%)
4:00-4:59 p.m.	50	(4%)	30	(4%)	20	(4%)
5:00-5:59 p.m.	70	(6%)	50	(6%)	20	(4%)
6:00-6:59 p.m.	80	(6%)	50	(6%)	30	(6%)
7:00-7:59 p.m.	40	(3%)	30	(3%)	10	(2%)
8:00-8:59 p.m.	80	(7%)	50	(7%)	30	(6%)
9:00-9:59 p.m.	50	(4%)	30	(4%)	10	(3%)
10:00-10:59 p.m.	30	(2%)	20	(3%)	10	(2%)
11:00-11:59 p.m.	50	(4%)	40	(5%)	10	(3%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 11. Female Fireground Injuries by Age,
2010-2014 Annual Averages**

Age of Victim	All		Career		Volunteer	
15-19	50	(4%)	0	(0%)	40	(9%)
20-24	130	(10%)	30	(4%)	100	(23%)
25-29	200	(16%)	120	(15%)	80	(18%)
30-34	180	(14%)	130	(16%)	50	(10%)
35-39	170	(13%)	120	(15%)	40	(9%)
40-44	200	(16%)	140	(18%)	60	(14%)
45-49	160	(12%)	130	(16%)	20	(5%)
50-54	120	(10%)	100	(12%)	20	(5%)
55-59	40	(3%)	20	(2%)	20	(5%)
60-64	10	(1%)	10	(1%)	10	(2%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 12. Female Fireground Injuries by Primary Body Part Injured,
2010-2014 Annual Averages**

Primary Body Part Injured	All		Career		Volunteer	
Lower extremities	290	(23%)	200	(25%)	90	(20%)
Upper leg	10	(1%)	10	(1%)	0	(1%)
Lower leg	20	(2%)	10	(2%)	10	(2%)
Knee	140	(11%)	100	(12%)	40	(8%)
Ankle	100	(8%)	60	(7%)	40	(8%)
Foot and toes	20	(2%)	20	(3%)	0	(0%)
Upper extremities	230	(18%)	150	(19%)	70	(17%)
Upper arm, not including elbow or shoulder	10	(1%)	0	(0%)	10	(2%)
Lower arm, not including elbow or wrist	30	(3%)	20	(3%)	10	(3%)
Elbow	20	(2%)	20	(3%)	0	(1%)
Wrist	20	(2%)	10	(2%)	10	(2%)
Hand and fingers	130	(11%)	90	(11%)	40	(9%)
Head	150	(12%)	90	(11%)	60	(13%)
Head, unclassified	80	(6%)	40	(5%)	30	(7%)
Ear	20	(1%)	10	(2%)	0	(1%)
Eye	30	(2%)	20	(2%)	10	(3%)
Nose	10	(1%)	10	(1%)	0	(1%)
Mouth, including lips, teeth and interior	10	(1%)	0	(0%)	10	(1%)
Multiple parts	130	(10%)	80	(9%)	60	(12%)
Multiple body parts - upper part of body	20	(2%)	10	(2%)	10	(2%)
Multiple body parts - lower part of body	0	(0%)	0	(0%)	0	(0%)
Multiple body parts - whole body	100	(8%)	60	(7%)	40	(10%)
Neck and shoulders	130	(10%)	100	(12%)	30	(8%)
Neck	40	(3%)	30	(4%)	10	(1%)
Throat	10	(1%)	10	(1%)	0	(0%)
Shoulder	90	(7%)	60	(8%)	30	(6%)
Internal	110	(9%)	50	(6%)	60	(14%)
Internal, unclassified	10	(1%)	10	(1%)	10	(1%)
Trachea and lungs	80	(6%)	30	(4%)	50	(11%)
Heart	10	(1%)	0	(0%)	10	(1%)
Stomach	10	(1%)	0	(0%)	10	(1%)
Thorax	70	(5%)	50	(6%)	20	(4%)
Back, except spine	40	(3%)	30	(4%)	10	(2%)
Chest	30	(2%)	20	(2%)	10	(2%)

**Table 12. Female Fireground Injuries by Primary Body Part Injured,
2010-2014 Annual Averages (Continued)**

Primary Body Part Injured	All		Career		Volunteer	
Abdominal area	50	(4%)	30	(3%)	20	(4%)
Abdomen	10	(1%)	0	(0%)	10	(3%)
Pelvis or groin	10	(1%)	10	(1%)	0	(0%)
Hip, lower back or buttocks	30	(2%)	20	(3%)	10	(1%)
Spine	30	(2%)	20	(3%)	0	(1%)
Unclassified body part	20	(2%)	20	(2%)	10	(2%)
None	60	(5%)	30	(4%)	30	(6%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Injuries in which the primary body part was coded as "undetermined" or not reported have been allocated proportionally among injuries with known primary body parts. Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

**Table 13. Female Fireground Injuries by Injury Factor,
2010-2014 Annual Average**

Injury Factor	All		Career		Volunteer	
Slippery or uneven surfaces	320	(25%)	220	(27%)	100	(23%)
Uneven surface, including holes in the ground	90	(7%)	50	(6%)	40	(9%)
Icy surface	90	(7%)	70	(9%)	20	(4%)
Slippery or uneven surfaces, unclassified	70	(5%)	50	(6%)	20	(4%)
Wet surface, including water, soap, foam, etc.	50	(4%)	30	(4%)	20	(4%)
Loose material on surface	30	(2%)	20	(3%)	10	(1%)
Fire development	240	(19%)	150	(18%)	90	(21%)
Fire progress, including smoky conditions	180	(14%)	100	(12%)	80	(18%)
Fire development, unclassified	40	(4%)	40	(4%)	10	(2%)
Flashover	10	(1%)	10	(1%)	0	(0%)
Explosion	0	(0%)	0	(0%)	0	(0%)
Collapse or falling object	110	(9%)	70	(8%)	40	(9%)
Falling objects	30	(3%)	30	(3%)	10	(1%)
Ceiling collapse	40	(3%)	20	(3%)	20	(3%)
Collapse or falling object, unclassified	30	(2%)	10	(2%)	10	(3%)
Floor, stair, roof, or wall collapse	10	(1%)	0	(1%)	10	(1%)
Vehicle or apparatus	30	(2%)	20	(3%)	10	(1%)
Vehicle or apparatus, unclassified	20	(2%)	20	(2%)	10	(1%)
Firefighter standing on apparatus	10	(1%)	10	(1%)	0	(0%)
Holes	30	(2%)	20	(2%)	10	(2%)
Holes, unclassified	20	(2%)	10	(1%)	10	(2%)
Hole burned through floor	10	(1%)	10	(1%)	0	(0%)
Lost, caught, trapped or confined	10	(1%)	10	(2%)	0	(0%)
Unclassified lost, caught, trapped, or confined	0	(0%)	0	(1%)	0	(0%)
Person physically caught or trapped	0	(0%)	0	(0%)	0	(0%)
Operating in confined structural areas	0	(0%)	0	(1%)	0	(0%)
Operating under water or ice	0	(0%)	0	(0%)	0	(0%)
Other contributing factors	200	(15%)	120	(15%)	80	(17%)
Other known contributing factors	10	(1%)	0	(1%)	0	(0%)
None	320	(25%)	200	(25%)	110	(26%)
Total	1,260	(100%)	820	(100%)	450	(100%)

Note: Injuries in which the injury was coded as "undetermined" or not reported have been allocated proportionally among injuries with injury factors. Totals may not equal sums due to rounding.

Source: NFIRS and NFPA Survey.

Improving Firefighter Safety

As the statistics in this report and previous reports attest, firefighting presents great risks of personal injury to firefighters. Moreover, because of 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.

- 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; NFPA1582, Standard on Comprehensive Occupational Medical Program for Fire Departments; NFPA1583, 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,](#)[®]; [NFPA 5000 Building Construction and 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

Continued efforts are needed to implement programs and procedures that can reduce the risk of firefighter injury. By addressing recognized priority areas, fire service organizations can make significant strides towards reducing the number and impact of such injuries.

Appendix: A

How National Firefighter Fireground Injury Estimates 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. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates. NFIRS provides the most detailed incident information of any national database not limited to large fires. For more information about NFIRS visit <http://www.nfirs.fema.gov/>.

Methodology may change slightly from year to year.

NFPA is continually examining its methodology to provide the best possible answers to specific questions, methodological and definitional changes can occur. *Earlier editions of the same report may have used different methodologies to produce the same analysis, meaning that the estimates are not directly comparable from year to year.*

NFPA's fire department experience survey provides estimates of the big picture.

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; (3) the number and nature of non-fire incidents; and (4) 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 that a second database -- the NFPA survey -- is used 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.

This report includes injuries that occurred at all fires (incident type 110-171) on the fireground (where injury occurred codes 5 and 6), and severity of injury (1 to 5) in the years from 2010 through 2014. The analysis in this report is based on 1,260 injuries that met these criteria. Except where otherwise noted, all tables are based on fireground injuries that occurred at all fires. The national annual estimates of firefighter injuries were weighted for the individual years using total fireground injuries from the annual NFPA Fire Experience Survey.

In most of NFPA's analyses, unknown data are assumed to have the same proportional distribution as the distribution where the data were known. Because this analysis separately analyzes career and volunteer firefighter injuries, injuries in which firefighter affiliation was not reported were distributed proportionally among career and volunteer firefighter injuries. During the 2010-2014 period, career affiliation was not reported for 24% of female firefighter injuries. These injuries were redistributed by multiplying the raw career and volunteer injury results by a multiplier, which was created by dividing total female firefighter injuries by total female firefighter injuries *minus* female firefighter injuries with affiliation not reported:

$$\text{multiplier} = \frac{\text{total female firefighter injuries}}{\text{total female firefighter injuries} - \text{female firefighter injuries with career affiliation not reported}}$$

The multiplier was applied to career and volunteer injury results for each injury variable to produce the final injury estimates.

Note that the number of occurrences fireground injuries has been rounded to the nearest ten and percentages are rounded to the nearest whole percent. Totals in tables may not equal sums due to rounding.