

U.S. FIREFIGHTER INJURIES – 2004

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Abstract

NFPA estimates that 75,840 firefighter injuries occurred in the line of duty in 2004, a decrease of 3.7% from the year before. Almost half (48.6%) of the all firefighter injuries occurred during fireground operations. An estimated 14,250 occurring during other on duty activities, while 13,150 occurred at nonfire emergency incidents. The leading type of injury received during fireground operations was strain, sprain or muscular pain (48.5%), followed by wound, cut, bleeding, bruise (17.2%). Regionally, the Northeast had the highest fireground injury rate, more than twice the rate for the rest of the country.

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

Acknowledgments

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Overview of 2004 Firefighter Injuries

- 75,840 firefighter injuries occurred in the line of duty in 2004, a decrease of 3.7% from the year before.
- 36,880 or 48.6% of all firefighter injuries occurred during fireground operations. An estimated 14,250 occurred during other on duty activities, while 13,150 occurred at nonfire emergency incidents.
- Regionally, the Northeast had the highest fireground injury rate with 4.2 injuries occurring per 100 fires; this was more than twice the rate for the rest of the country.
- The major types of injuries received during fireground operations were: strain, sprain, muscular pain (48.5%); wound, cut, bleeding, bruise (17.2%); burns (7.8%); smoke or gas inhalation (5.5%). Strains, sprains, and muscular pain accounted for 56.4% of all nonfireground injuries.

Background

Firefighters work in varied and complex environments that increase their risk of on-the-job death and injury. A better understanding of how these fatal accidents, nonfatal injuries, and illnesses occur can help identify corrective actions which, could help minimize the inherent risks.

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 103 firefighters died on duty (See, "2004 Firefighter Fatalities ", NFPA Journal July/August).

This report addresses 2004 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 (2004). An earlier report measured the national fire experience in terms of the number of fires that fire departments attended and the resulting civilian deaths, civilian injuries, and property losses that occurred¹.

This year's report includes among its results:

- An estimate of the total number of 2004 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.

Overall Results

Based on survey data reported by fire departments, the NFPA estimates that 75,840 firefighter injuries occurred in the line of duty in 2004. This is a decrease of 3.7% and the lowest it's been since 1977 when the NFPA started using its current survey methodology. However, the lower number of injuries since 1994 is due in part to additional questions on exposures which allows us to place them in their own categories. Previously some of these exposures may have been included in total injuries under other categories.

The NFPA estimates that there were 10,550 exposures to infectious diseases (e.g., hepatitis, meningitis, HIV, others) in 2004. This amounts to 0.7 exposures per 1,000 emergency medical runs by fire departments in 2004.

The NFPA estimates that there were 18,300 exposures to hazardous conditions (e.g., asbestos, radioactive materials, chemicals, fumes, other) in 2004. This amounts to 17.9 exposures per 1,000 hazardous condition runs in 2004.

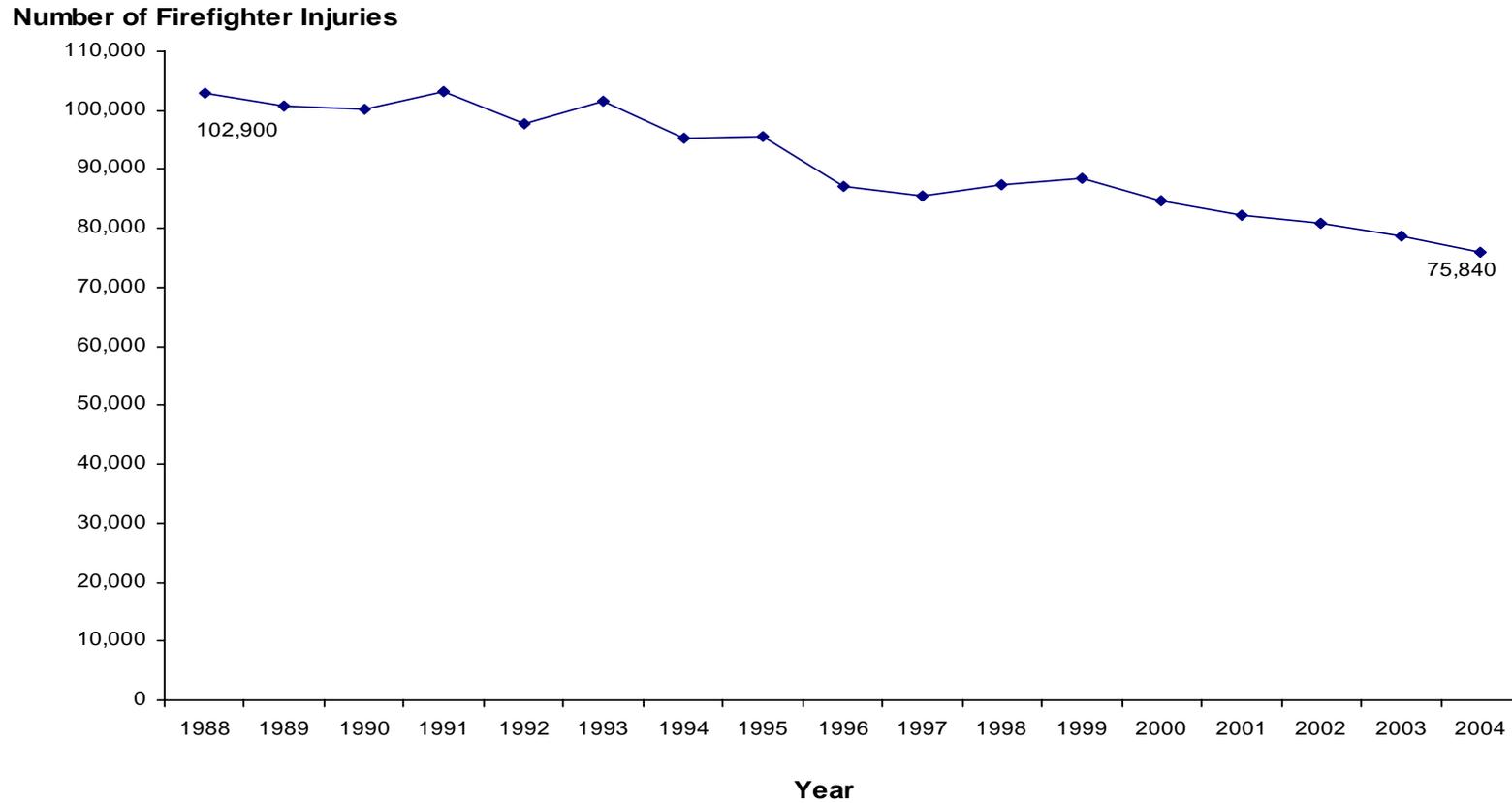
An estimated 18,200 firefighter injuries resulted in lost time in 2004.

Injuries by Type of Duty

Estimates of firefighter injuries by type of duty are displayed in Figure 2. 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.), and 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).

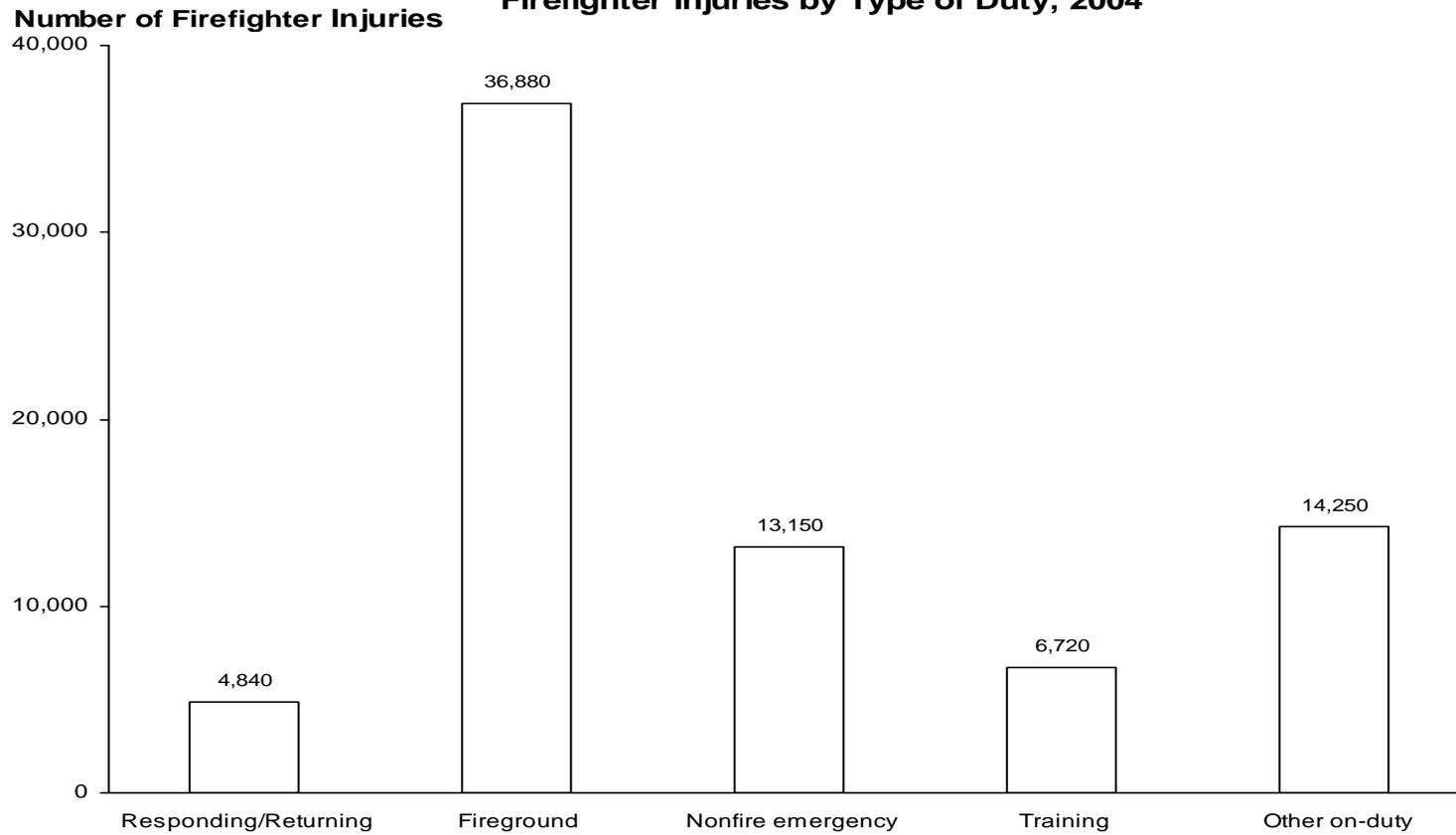
Figure 1
Total Firefighter Injuries by Year (1988-2004)



Source: NFPA Annual Survey of Fire Departments for U.S. Fire Experience (1988-2004)

From 1994 on, number of exposures was collected separately

Figure 2.
Firefighter Injuries by Type of Duty, 2004



Source: NFPA Annual Survey of Fire Departments
for U.S. Fire Experience (2004)

Results by type of duty indicate not surprisingly that the largest share of injuries occur during fireground operations: 36,880 or 48.6% of all firefighter injuries in 2004. Table 1 displays firefighter injuries at the fireground and injury rates for the 1989-2004 period. Prior to 1988, firefighter injuries were around 100,000 per year, with no trend up or down, since NFPA's first calculation of estimates in 1977. Injuries at the fireground decreased from their high of 61,790 in 1988 to a low of 36,880 in 2004 for a decrease of 40.3%. The rate of injuries per 1,000 fires has generally decreased during the period. This is because the number of fire incidents also decreased a considerable 36.4% for the 1988 to 2004 period.

In addition to injuries at the fireground, an estimated 14,250 or 18.8% occurred during other on-duty activities, while 13,150 or 17.3% occurred at nonfire emergencies.

Nature of Fireground Injuries

Estimates of 2004 firefighter injuries by nature of injury and type of duty are displayed in Table 2. The nature of injury cause categories are based with modifications on NFPA 901, *Uniform Coding for Fire Protection*. Table 2 indicates that the four major types of injuries that occur during fireground operations are strain, sprain (48.5%); wound, cut, bleeding, bruise (17.2%); burns (7.8%); smoke or gas inhalation (5.5%); thermal stress (5.1%).

Results were fairly consistent during all non-fireground activities, with strains, sprains, and muscular pain accounting for 56.4% of all non-fireground injuries, and wound, cut, bleeding, bruise accounting for 17.4%.

Causes of Fireground Injuries

Because fireground injuries are of particular concern their causes were examined (see Figure 3). The definition of cause here refers to the initial circumstance leading to the injury. The cause categories included on the survey were also based on NFPA 901, *Uniform Coding for Fire Protection*. Fall, slip, jump (29.7%), overexertion, strain (25.7%) were the leading causes of fireground injuries. Other major causes were contact with object (9.0%); exposure to fire products (8.8%).

Table 1
Firefighter Injuries at the Fireground, and
at Nonfire Emergencies, 1988-2004

Year	At the Fireground		At Nonfire Emergencies	
	Injuries	Injuries per 1000 Fires	Injuries	Injuries per 1,000 Incidents
1988	61,790	25.4	12,325	1.13
1989	58,250	27.5	12,580	1.11
1990	57,100	28.3	14,200	1.28
1991	55,830	27.3	15,065	1.20
1992	52,290	26.6	18,140	1.43
1993	52,885	27.1	16,675	1.25
1994	52,875	25.7	11,810	0.84
1995	50,640	25.8	13,500	0.94
1996	45,725	23.1	12,630	0.81
1997	40,920	22.8	14,880	0.92
1998	43,080	24.5	13,960	0.82
1999	45,500	25.0	13,565	0.76
2000	43,065	25.2	13,660	0.73
2001	41,395	23.9	14,140	0.73
2002	37,860	22.4	15,095	0.77
2003	38,045	24.0	14,550	0.70
2004	36,880	22.1	13,150	0.62

Source: NFPA Survey of Fire Departments
for U.S. Fire Experience (1988-2004)

Table 2. Firefighter Injuries by Nature of Injury and Type of Duty, 2004

Nature of Injury	Responding to or Returning from an Incident		Fireground		Nonfire Emergency		Training		Other on-duty		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Burns (Fire or Chemical)	50	1.0	2,860	7.8	110	0.8	380	5.7	260	1.8	3,660	4.8
Smoke or Gas Inhalation	115	2.4	2,040	5.5	105	0.8	45	0.7	80	0.6	2,385	3.1
Other Respiratory Distress	100	2.1	875	2.4	200	1.5	180	2.7	125	0.9	1,480	2.0
Burns and Smoke Inhalation	5	0.1	585	1.6	15	0.1	25	0.4	25	0.2	655	0.9
Wound, Cut, Bleeding Bruise	910	18.8	6,325	17.2	2,010	15.3	1,035	15.4	2,840	19.9	13,120	17.3
Dislocation, Fracture	230	4.8	1,045	2.8	275	2.1	245	3.7	375	2.6	2,170	2.9
Heart Attack or Stroke	80	1.7	290	0.8	125	1.0	50	0.7	325	2.3	870	1.2
Strain, Sprain Muscular Pain	2,955	61.0	17,890	48.5	7,735	58.8	3,840	57.1	7,460	52.4	39,980	52.6
Thermal Stress (frostbite, heat exhaustion)	35	0.7	1,875	5.1	175	1.3	345	5.1	80	0.6	2,510	3.3
Other	360	7.4	3,095	8.4	2,400	18.3	575	8.6	2,680	18.8	9,110	12.0
	4,840		36,880		13,150		6,720		14,250		75,840	

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2004

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

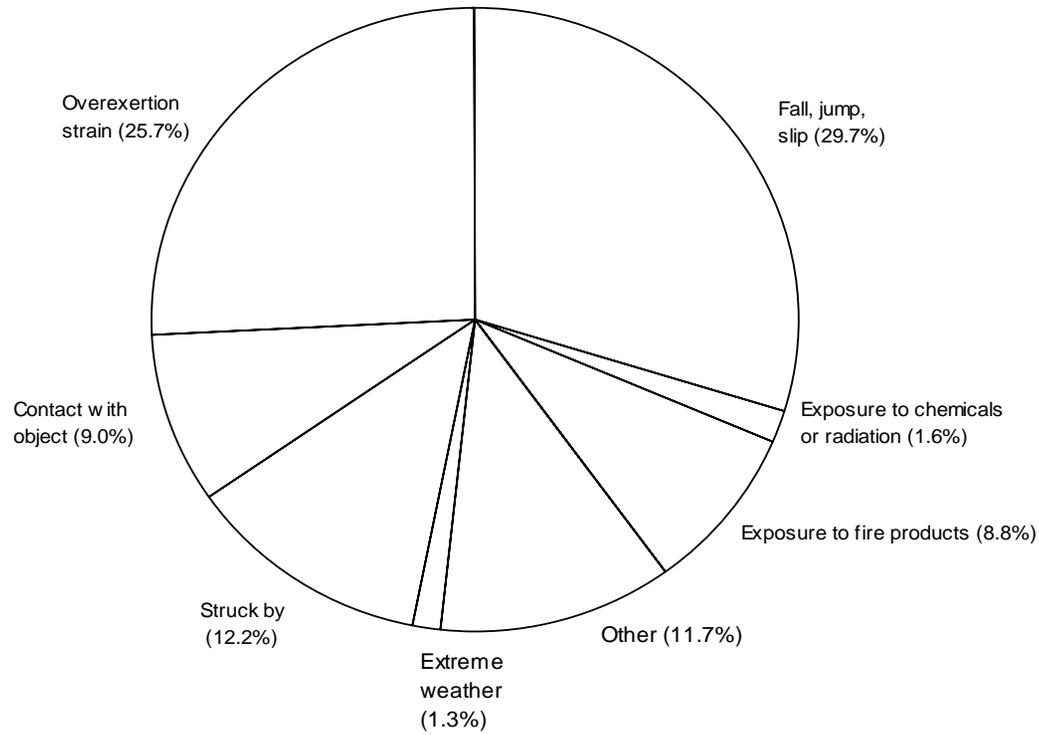
Fire Department Vehicle Collisions

The NFPA reported earlier that 17 firefighters died in motor vehicle collisions in 2004. (See “2004 Firefighter Fatalities” July/August NFPA Journal).

In 2004, there were an estimated 15,420 collisions involving fire department emergency vehicles, where departments were responding to or returning from incidents (see Table 3). To put this number in perspective however, fire departments responded to over 22.6 million incidents in 2004 so that the number of collisions represents about one tenth of 1 percent of total responses. However, these collisions resulted in 980 firefighter injuries or 1.2% of all firefighter injuries.

Also, 1,150 collisions involving firefighters’ personal vehicles occurred in 2004 while departments were responding to or returning from incidents. These collisions resulted in an estimated 220 injuries.

**Figure 3.
Fireground Injuries by Cause, 2004**



Source: NFPA Annual Survey of Fire Departments
for U.S. Fire Experience (2004)

Table 3
Fire Department Vehicle Collisions and
Resulting Firefighter Injuries
While Responding to or Returning From Incidents, 1990-2004

Year	Involving Fire Department Emergency Vehicles		Involving Fire Fighters' Personal Vehicles	
	Collisions	Fire Fighter Injuries	Collisions	Fire Fighter 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

Source: NFPA Survey of Fire Departments
for U.S. Fire Experience (1990-2004)

Average Fires and Fireground Injuries per Department by Population Protected

The average number of fires and fireground injuries per department by population of community protected in 2004 are displayed in Table 4. These tabulations show (1) that the number of fires a fire department responds to is directly related to the population protected, and (2) that the number of fireground injuries incurred by a department is directly related to its exposure to fire, i.e., and the number of fires attended by the department. The second point is clearly demonstrated when we examine the range of the statistic: from a high of 86.0 for departments that protect communities of 500,000 to 999,999 to a low of 0.2 for departments that protect communities of less than 2,500.

A useful way to look at firefighter injury experience and to obtain a reading on the relative risk that departments face is to examine the number of fireground injuries that occur for every 100 fires attended. This takes into account relative fire experience and allows more direct comparison between departments protecting communities of different sizes. The number of fireground injuries per 100 fires is displayed in column 4 of Table 4. The overall range of rates varied little from a high of 5.0 for departments that protect communities 250,000 to 499,999 to a low of 1.5 for departments that protect communities of 2,500 to 4,999 population. Thus, the wide range noted in average fireground injuries by population protected narrows when relative fire experience is taken into account. The overall injury rate for departments protecting communities of 50,000 population or more was 2.6 injuries per 100 fires or 70% higher than the injury rate for departments protecting communities of less than 50,000 population.

The risk of fireground injury per 100 firefighters by size of community protected was also calculated and is displayed in column 5 of Table 4. Larger departments generally had the highest rates with departments protecting communities of 250,000 to 499,999 having the highest rate with 12.4 injuries per 100 firefighters. As community size decreases, the rate drops quite steadily to a low of 0.9 for departments protecting less than 2,500 people. That is a more than a thirteen-to-one difference in risk of injury between communities of 250,000 to 499,999, and the smallest communities (less than 2,500).

An explanation for this difference is that although a department protecting a community with a population of 250,000 to 499,999 has, on average, more than 23 times as many firefighters than a department protecting a population of less than 2,500, the larger department attends more than 110 times as many fires, and as a result, it incurs considerably more fireground injuries.

Table 4
Average Number of Fires, Fireground Injuries and Injury Rates
by Population of Community Protected, 2004

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
500,000 to 999,999	2,998.9	86.0	2.9	6.8
250,000 to 499,999	1,358.8	67.6	5.0	12.4
100,000 to 249,999	655.6	11.7	1.8	4.9
50,000 to 99,999	277.9	6.4	2.3	5.6
25,000 to 49,999	139.8	2.4	1.7	3.9
10,000 to 24,999	73.0	1.2	1.6	2.8
5,000 to 9,999	40.5	0.7	1.7	2.0
2,500 to 4,999	26.6	0.4	1.5	1.3
Under 2,500	12.2	0.2	1.6	0.9

Source: NFPA Survey of Fire Departments
for U.S. Fire Experience, 2004

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 country³. 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 reported a substantially higher number of fireground injuries for most community sizes where all departments reported sufficient data by region.

Table 5

Average Number of Fires and Fireground Injuries per Department and Injuries per 100 Fires, by Population of Community Protected, and Region, 2004

**Column 1: Average Reported Number of Fires
 Column 2: Average Reported Number of Fireground Injuries
 Column 3: Number of Fireground Injuries per 100 Fires**

Population of Community Protected	Northeast			Northcentral			South			West		
	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3
500,000 to 999,999	*	*	*	*	*	*	3,434.0	53.7	1.6	2,684.2	49.8	1.9
250,000 to 499,999	*	*	*	2,037.3	86.7	4.3	1,360.8	26.2	1.9	797.0	26.6	3.3
100,000 to 249,999	738.0	27.2	3.7	744.7	17.3	2.3	760.4	7.3	1.0	452.6	10.1	2.2
50,000 to 99,999	361.1	16.6	4.6	241.5	6.0	2.5	321.1	5.4	1.7	211.1	3.0	1.4
25,999 to 49,999	118.0	4.2	3.6	109.1	2.8	2.6	169.1	1.7	1.0	147.4	1.5	1.0
10,000 to 24,999	61.9	1.5	2.4	60.5	1.4	2.3	97.0	0.8	0.8	72.9	1.1	1.5
5,000 to 9,999	31.2	0.8	2.6	35.0	0.7	2.0	53.2	0.6	1.1	52.3	0.5	1.0
2,500 to 4,999	20.9	0.5	2.4	22.2	0.3	1.4	35.5	0.3	0.8	30.3	0.4	1.3
Under 2,500	11.4	0.2	1.8	9.6	0.2	2.1	18.4	0.2	1.0	12.6	0.2	1.6
Overall Regional Rate			4.2			2.5			1.3			1.7

Source: NFPA Survey of Fire Departments for U.S. Fire Experience, 2004
 *Insufficient data

Improving Firefighter Safety

As the statistics in this report and previous reports attest, fire fighting 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 reduce present injury levels and bring about corresponding reductions in lost time, and medical costs. The following are some examples of proactive actions taken at the local level that can reduce injury rates:

- Commitment on the part of top fire service management to reducing injuries
- Establishment of a safety committee headed by a safety officer to recommend a safety policy and the means of implementing it. The policy should include a thorough investigation of all time loss injuries
- Provision of appropriate protective equipment and a mandate to use it
- Development and enforcement of a program on the use and maintenance of SCBA
- Development and enforcement of policies on safe practices for drivers and passengers of fire apparatus
- Development of procedures to ensure response of sufficient personnel for both fire fighting and overhaul duties.
- Implementation of regular medical examinations and a physical fitness program
- Adoption and implementation of an incident management system.
- Training and education for all members related to emergency operations.
- 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
- 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

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.

Every fire service organization, needs to make a commitment to reduce firefighter injuries. Practically all of the priorities listed above are components of NFPA 1500, *Fire Department Occupational Safety and Health Program*, which provides a framework for a safety and health program. It is a good place to begin when developing programs for the reduction of firefighter 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 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.

Description of NFPA Survey and Data Collection Method

The NFPA annually surveys a sample of 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. All U.S. fire departments that protect communities of 100,000 or more are included in the sample, because they constitute a small number of departments with a large share of the total population protected. For departments that protect less than 100,000 population, stratifying the sample by community size permits greater precision in the estimates. Survey returns in recent years have ranged from 2,700 to 3,500 departments annually. The national projections are made by weighting sample results according to the proportion of total U.S. population accounted for by communities of each size.

The results in this report are based on injuries that occurred during incidents attended by public fire departments. No adjustments were made for injuries that occurred during fires attended solely by private fire brigades, e.g., industrial or military installations.

Data collection for the selected incident summaries was enhanced by a form that was sent to departments requesting information. The form included questions on type of protective equipment worn, age and rank of firefighters injured, and description of circumstances that led to injury.

Footnotes

1. Michael J. Karter, Jr., "2004 Fire Loss in the United States", *NFPA Journal*, Vol. 99, No. 5 (November 2005).
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 (2003), the NFPA is very confident that the actual number of firefighter injuries falls within the range of 66,840 to 87,840.
3. The four regions as defined by the U.S. Census Bureau include the following 50 states and the District of Columbia:
 - Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
 - Northcentral: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
 - South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.
 - West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

SELECTED INDIVIDUAL INCIDENTS

(These Incidents were Selected to Illustrate Typical Firefighter Safety Problems)

Firefighter Struck by Vehicle

A firefighter was struck by a vehicle and thrown nearly 80 feet (24 meters) while extinguishing a vehicle fire. A second vehicle drove through a traffic control perimeter, consisting of traffic cones and the company officer directing traffic. The company officer yelled to the two firefighters extinguishing the fire but neither heard his warnings. The vehicle struck one of the firefighters and fled the scene. The firefighter was hospitalized for 33 days in serious condition suffering from multiple traumatic injuries.

A fire department investigation cited several factors that contributed to the severity of the firefighter's injuries. The primary factor was apparatus placement. The truck did not properly block oncoming traffic, leaving the work area vulnerable to the flow of traffic. Another factor was the victim's decreased awareness while wearing full-protective clothing. The firefighter did not hear the officer's warnings because wearing SCBA reduced his peripheral vision, hearing, and sight. Other factors included lack of a lookout in communication with the suppression team, time of day (0200 hours), and a communications delay when using "emergency traffic" over the radio, which delayed the proper dispatch of appropriate resources for several minutes.

After three surgeries and 11 months of rehabilitation, the injured firefighter is now on restricted duty and expected to return to full duty.

Emergency Medical Incident

A fire department dispatched two firefighters to assist a person suffering from a seizure on a busy four-lane thoroughfare. The unit arrived on scene and located their patient on the opposite side of the road. The paramedic, who was not wearing any protective clothing, exited the truck and began crossing the busy road. An approaching vehicle sped up, in an attempt avoid traffic, drove around the stopped vehicles, and struck the firefighter. The vehicle was traveling approximately 30 miles (48 kilometers) per hour. The 34-year-old firefighter/paramedic broke his right leg in several places and has been out of work for nine months.

Training

A 41-year-old male firefighter recruit collapsed during training. He was participating in a search and rescue evolution at the fire department's training facility. Immediately after he collapsed, two instructors removed the blindfolded trainee from the darkened building and transferred care to two onsite paramedics.

The recruit suffered from heat exhaustion and dehydration and was diagnosed with rhabdomyolysis. He has not returned to the fire academy as of this time and has not been medically cleared to perform firefighting duties. His future with the department is undetermined at this time

Fire Suppression

A 38-year-old firefighter was severely injured during an explosion at a pet food manufacturing company. The fire department was called to investigate a small amount of smoke coming from a storage bin containing a fine cellulose material. Investigators believe that some embers from a small fire in a conveyor belt bearing the previous day had ignited product in the bin. The fire department supervised the removal process while company employees slowly began to remove product from the bin using a mixer affixed to the bin. After several hours of removing the material, workers saw some charred but cool material exiting from the mixer. The work continued until the bin was empty. The only remaining material was in the mixer as crews slowly removed remnants.

After several hours of operations, the fire department began terminating the incident. The firefighter then went on a catwalk 20 feet (6 meters) directly above the mixer to retrieve some equipment when a violent explosion occurred. The firefighter was sent flying where he landed on another catwalk nearly 50 feet (15 meters) above the mixer. After being located by fellow firefighters, he was removed from the building and transported to the hospital in an advanced life support unit.

The victim was not wearing a full protective ensemble at the time of injury, primarily because he was not in an IDLH (immediately dangerous to life and health) atmosphere and was picking up tools and hose. He was only wearing his coat, bunker pants, gloves, and boots. He was hospitalized for 21 days with multiple compound fractures in his legs. He has not returned to full duty after 11 months of rehabilitation. He experienced several infections and complications during surgery, prolonging his recovery.

Fire Suppression

A company officer was injured while operating at an electrical fire on the first story of a two-family dwelling quickly spread throughout the balloon-frame structure. The injured officer was backing down after searching for fire victims in the attic area that was converted to a bedroom. As he turned to exit, the floor collapsed and he became lodged between the structural members, flooring and ceiling materials.

A dedicated rapid intervention crew of six firefighters removed the company officer from the structure. He was burned over 15 percent of his body, with 10 percent of those burns being third degree. He was wearing a full protective ensemble with a fully integrated PASS device that activated automatically. He returned to work eight months after the incident.

Several other firefighters suffered injuries ranging from heat exhaustion, to minor burns, and a shoulder sprain. The department specifically credits the proper use of protective fire hoods and earflaps on helmets in preventing burns that could have been more serious to all members. The other injured members all returned to work within three weeks.

Fire Suppression

A 20-year veteran company officer received extensive injuries after being struck in the head by a falling object. The object, believed to be some ductwork, fell on the captain while he was performing overhaul of a ceiling. The object struck him in the back of the helmet, which drove his head forward. Two firefighters in the area heard the object fall and turned to find the captain kneeling holding his head. The injured officer was dazed and confused and having difficulty moving and breathing. The firefighters laid him on a countertop, removed his hood, and opened his coat. Two other firefighters arrived and the four removed the injured captain from the structure.

The 50-year-old suffered a neck injury, pulmonary embolism, and cardiomyopathy. He was hospitalized for several days and has retired from the fire service.

Fire Suppression

Four firefighters were injured while battling a fire in a single-family dwelling. The fire originated in the basement near the furnace. The fire spread throughout the wooden balloon frame construction, breaking out onto the second story where three firefighters were searching for fire. The intense heat forced the three to retreat.

The stairwell leading down to the first story collapsed. One firefighter decided to jump from the second story landing to the first story landing and sprained his ankle. He was wearing his protective ensemble properly and returned to work after being treated at the hospital.

Two firefighters exhausted their air supply while searching for a way out of the building. They found a window and exited onto a ground ladder. The first firefighter climbed down the ladder to the ground. He returned to full duty after being treated and released from the hospital. The second firefighter climbed out of the window and stepped onto the rung of the same ground ladder. He missed the rung and fell two stories, landing on his back. Because he was wearing a full protective ensemble, he did not receive any burns but he did land on his self-contained breathing apparatus, causing severe injuries to his back and spine.

At this time, he is undergoing rehabilitation and does not have any sensation from the waist down.

A fourth member suffered smoke inhalation while rescuing a firefighter from a second story window. He was on the tip of aerial ladder trying to pull and assist the victim when he inhaled a large quantity of smoke. He missed several days of work. The firefighters he helped from the window did not suffer any injuries.

Cardiac

Firefighters responded to a reported “odor of something burning” at a single-family dwelling. After a thorough investigation, the origin was located and an overheated blower motor in the furnace was identified as the cause. A half an hour after the incident, while finishing the incident report, the chief suddenly began to feel some discomfort in his chest. His firefighters transported him to the hospital where he was diagnosed with blockage of three coronary arteries causing a myocardial infarction.

After surgery to implant three stents, the 51-year-old chief was hospitalized for three days and medically cleared to resume activities as fire chief a week later.

Apparatus Incident

A 35-year-old company officer received a severe foot injury at a structure fire. The officer dismounted the apparatus and was donning his self contained breathing apparatus when the driver of the truck tried to reposition the aerial apparatus, running over and crushing his officer’s right foot.

He suffered an extreme injury to his right foot and has not returned to fire duty a year and a half after the incident.

Extrication

A fire fighter crushed his fingers in the arms of the “jaws of life” while on scene of a motor vehicle crash. The firefighter was in standby mode while paramedics stabilized the crash victims. He placed his left hand on the handle of the tool and unknowingly placed his right hand on one of the arms of the spreaders. He then knelt down and inadvertently pushed on the butterfly switch, closing the tool onto his hand.

Three other firefighters heard his scream and released the tool from his gloved hand. He was transported to the hospital where he remained for 10 days to undergo four surgeries. He was able to return to full duty. The 26-year-old victim states he was wearing protective gloves and that not being focused on scene safety was a factor in losing two fingers.

Responding/Returning

Three firefighters were seriously injured when their apparatus collided at an intersection while responding to a reported structure fire. Three firefighters riding on a 1993 engine company were shaken up and returned to full duty within 48 hours. They were all sitting in approved riding positions and wearing seatbelts.

The three firefighters riding in the 2004 rescue/pumper were severely injured. The 31-year-old unbelted apparatus operator suffered a head injury and returned to full duty three months later. The company officer returned to full duty within two weeks after suffering musculoskeletal injuries; it was not reported if he was wearing his seatbelt.

Responding/Returning (continued)

An unbelted firefighter sitting in the crew area of the truck was sitting facing forward. He received facial injuries after being slammed into a compartment door. He returned to work two months after the incident but is still undergoing corrective procedures. The department states that seatbelt use may have prevented or reduced the severity of the injuries.

Both apparatus suffered extensive damage and were placed out of service. The engine will have to be replaced. The rescue pumper is getting a new chassis and bodywork and will soon be back in service. The incident the companies were responding to turned out to be a false alarm.

Responding/Returning

A 40-year-old firefighter received disabling injuries after the apparatus he was operating collided with a fuel tanker. The victim was driving a 1994 heavy rescue and approaching a controlled intersection when an empty 18-wheel fuel truck pulled out in front of the apparatus. The rescue pumper struck the side of the fuel tank, crushing the cab inward, trapping and entangling the operator in the wreckage.

A second firefighter on the truck was not injured and called for help then attempted to remove his injured colleague with the tools on their own truck. After 30 minutes, he was extricated from the wreckage and transported to the hospital.

The victim underwent several surgeries to repair his fractured left leg. Unfortunately, his leg had to be amputated and he left the fire service. Neither occupant on the apparatus was wearing a seatbelt.

The incident is still in litigation and details regarding the status of the traffic control light are unavailable at this time.

Training

Two firefighter recruits suffered from minor burns during a training evolution when a live car fire prop flashed back. The firefighters were advancing a charged 1¾" handline towards the LP gas fired prop when it flashed engulfing the two in a ball of fire. Neither firefighter was hospitalized and received only minor burns. Their complete protective ensembles were credited with preventing injuries that could have been more serious. They returned to work the following day after new sets of protective clothing were issued.

An internal department report states there were several violations of the state and county's training regulations. These documents reference NFPA 1403, *Live Fire Training Evolutions*. These violations included inadequate student/instructor ratio, vague description of safety officer during the evolution, and use of students to ignite the training fires.

Training (continued)

External factors included a lack of familiarization of training prop by training staff; methods of extinguishment used by trainees, and repeated evolutions on a prop with questionable integrity. The department investigation was to identify any corrective measures necessary to prevent the potential for reoccurrence.

Firefighters struck by vehicle

Firefighters were operating at the scene of two previous motor vehicle crashes when a third vehicle struck them. The original crashes were down an embankment 70 feet (21 meters) from the roadway when the third vehicle traveling at nearly 70 miles (112 kilometers) per hour on the snowy road careened out of control and rolled over the two victims.

The first victim, a company officer acting as the incident commander, was struck by the car and suffered head injuries, fractured cervical vertebrae, broken ribs, and collapsed lung. He was hospitalized for 10 days and recovered a year later. He returned to full duty at an estimated expense of \$108,000.

The second victim, a chief officer, was struck and pinned under the vehicle. He suffered from a knee injury and returned to full duty 6 months after the incident.

A third firefighter assisting on the scene was sprayed with battery acid but did not receive any injuries. The department credits his use of his protective clothing in limiting his injuries.

Fire Suppression

Two firefighters were injured while combating a structure fire in a furniture manufacturing company. The fire department responded to a fire alarm activation originating in the ductwork of the plant's dust collection system. Company personnel located the smoldering fire and informed the fire department that the dust collection system was shut down and they could proceed with the operation.

Two firefighters on a scissor lift were equipped with a 1¾-inch hose line and appropriate tools to open the ductwork and gain access to the fire. A third firefighter was placed in a cage and lifted by a forklift to assist the other two firefighters working 10 feet (3 meters) above grade.

Upon opening the ductwork, firefighters realized the dust collection was still on and the influx of air created a dust explosion. The force of the blast forced dust and flames on the three firefighters operating on the ductwork. The explosion also caused debris and smoldering fires to spread through out the area as a second dust collection system sucked up flaming debris becoming involved in fire.

Fire Suppression (continued)

The firefighter in the cage was wearing a protective ensemble without his self-contained breathing apparatus or facial protection in place. He suffered first and second degree burns to his face and made a full recovery.

The two firefighters on the scissor lift both suffered from burns on their faces and heads. Both were wearing a complete protective ensemble with an integrated PASS device that activated. However, the force of the explosion dislodged one member's SCBA face piece and he received third degree burns on his face and head. He was able to recover and return to duty two months after the incident. The other firefighter was treated and released at the emergency room and returned to duty.

Fire Suppression

Two firefighters were injured while battling a fire in a single-family dwelling. While attempting an aggressive attack on a well-involved fire, the two members were advancing a hand line onto the porch when it collapsed. The two firefighters became trapped for several minutes until pulled from the rubble by fellow firefighters.

A 26-year-old firefighter suffered a minor left ankle injury and returned to duty. His partner, a 39-year-old firefighter, suffered from shoulder, back and rib injuries. He underwent surgery and returned to restricted duty 15 months after the incident. His physician has not cleared him to perform full fire suppression duty.

Both members were wearing full protective ensembles and manually activated their PASS devices. Their air supply from the self-contained breathing apparatus remained intact while under the burning debris, preventing further injury.

APPENDIX A

FIREFIGHTER INJURIES BY TYPE OF DUTY

Year	Total	Firefighting, fireground		Responding, returning		On scene at non-fire calls		Training		Other on-duty	
1981	103,340	67,510	(65.3%)	4,945	(4.8%)	9,600	(9.3%)	7,090	(6.9%)	14,195	(13.7%)
1982	98,150	61,370	(62.5%)	5,320	(5.4%)	9,385	(9.6%)	6,125	(6.2%)	15,950	(16.3%)
1983	103,150	61,740	(59.9%)	5,865	(5.7%)	11,105	(10.8%)	6,755	(6.5%)	17,685	(17.1%)
1984	102,300	62,700	(61.3%)	5,845	(5.7%)	10,630	(10.4%)	6,840	(6.7%)	16,285	(15.9%)
1985	100,900	61,255	(60.7%)	5,280	(5.2%)	12,500	(12.4%)	6,050	(6.0%)	15,815	(15.7%)
1986	96,450	55,990	(58.1%)	4,665	(4.8%)	12,545	(13.0%)	6,395	(6.6%)	16,855	(17.5%)
1987	102,600	57,755	(56.3%)	5,075	(4.9%)	13,940	(13.6%)	6,075	(5.9%)	19,755	(19.3%)
1988	102,900	61,790	(60.0%)	5,080	(4.9%)	12,325	(12.0%)	5,840	(5.7%)	17,865	(17.4%)
1989	100,700	58,250	(57.8%)	6,000	(6.0%)	12,580	(12.5%)	6,010	(6.0%)	17,860	(17.7%)
1990	100,300	57,100	(56.9%)	6,115	(6.1%)	14,200	(14.2%)	6,630	(6.6%)	16,255	(16.2%)
1991	103,300	55,830	(54.0%)	5,355	(5.2%)	15,065	(14.6%)	6,600	(6.4%)	20,450	(19.8%)
1992	97,700	52,290	(53.5%)	5,580	(5.7%)	14,645	(15.0%)	7,045	(7.2%)	18,140	(18.6%)
1993	101,500	52,885	(52.1%)	5,595	(5.5%)	16,675	(16.4%)	6,545	(6.5%)	19,800	(19.5%)
1994	95,400	52,875	(55.4%)	5,930	(6.2%)	11,810	(12.4%)	6,780	(7.1%)	18,005	(18.9%)
1995	94,500	50,640	(53.6%)	5,230	(5.5%)	13,500	(14.3%)	7,275	(7.7%)	17,855	(18.9%)
1996	87,150	45,725	(52.5%)	6,315	(7.2%)	12,630	(14.5%)	6,200	(7.1%)	16,280	(18.7%)
1997	85,400	40,920	(47.9%)	5,410	(6.3%)	14,880	(17.4%)	6,510	(7.6%)	17,680	(20.7%)
1998	87,500	43,080	(49.2%)	7,070	(8.1%)	13,960	(16.0%)	7,055	(8.1%)	16,335	(18.7%)
1999	88,500	45,550	(51.5%)	5,890	(6.7%)	13,565	(15.5%)	7,705	(8.7%)	15,790	(17.8%)
2000	84,500	43,065	(51.0%)	4,700	(5.6%)	13,660	(16.2%)	7,400	(8.8%)	15,725	(18.6%)
2001	82,250	41,395	(50.3%)	4,640	(5.6%)	14,140	(17.2%)	6,915	(8.4%)	15,160	(18.4%)
2002	80,800	37,860	(46.9%)	5,805	(7.2%)	15,095	(18.7%)	7,600	(9.4%)	14,440	(17.9%)
2003	78,750	38,045	(48.3%)	5,200	(6.6%)	13,855	(17.6%)	7,100	(9.0%)	14,550	(18.5%)
2004	75,840	36,880	(48.6%)	4,840	(6.4%)	13,150	(17.3%)	6,720	(8.9%)	14,250	(18.8%)

Prior to 1981, the categories were somewhat different. These figures are based on NFPA's annual National Fire Experience Survey.

FIREFIGHTER FIREGROUND INJURIES BY NATURE OF INJURY

Year	Total	Strain, sprain	Wound, cut, dislocation, fracture	Smoke, Gas Injuries			Burns and Smoke inhalation	Fire or chemical burns	Heart attack, stroke	Thermal stress	Other
				Smoke, gas Inhalation or respiratory distress (other)	Eye irritation						
1981	67,510	16,530	20,455	12,485	5,315		7,545	300	N/A	4,880	
1982	61,370	14,955	16,450	10,880	6,155		5,990	315	N/A	6,625	
1983	61,740	15,415	17,470	11,470	5,025		6,470	370	N/A	5,520	
1984	62,700	16,870	16,295	10,105	4,205		6,640	430	3,990	4,165	
1985	61,255	16,545	15,435	9,625	4,580		6,215	230	4,520	4,105	
1986	55,990	15,455	15,200	8,090	3,985		6,270	360	3,260	3,370	
1987	57,755	16,565	14,770	8,040	4,905		5,770	240	4,260	3,205	
1988	61,790	20,695	14,205	7,400	3,825		6,475	260	4,955	3,975	
1989	58,250	22,360	13,625	7,220	4,025		4,815	255	3,040	2,910	
1990	57,100	20,885	13,120	7,095	4,025		5,180	235	3,505	3,055	
1991	55,830	19,655	11,285	7,525	3,645		4,960	325	4,630	3,805	
1992	52,290	19,020	11,920	6,335	3,805		5,105	335	2,775	2,995	
1993	52,885	18,810	11,910	5,540	3,145		5,990	295	3,430	3,765	
1994	52,875	18,855	12,275	6,175	3,115		5,470	330	3,160	3,495	
1995	50,640	19,280	11,680	5,700	3,140		4,890	345	2,935	2,670	
1996	45,725	17,455	9,865	5,400	2,735		4,360	300	2,720	2,890	
1997	40,920	15,590	9,710	3,820	2,265		3,755	205	2,840	2,735	
1998	43,080	18,735	9,010	3,745	2,215		4,040	300	2,760	2,275	
1999	45,550	17,925	9,880	4,435	2,615		4,060	395	3,570	2,670	
2000	43,065	19,500	8,695	3,725	2,220		3,850	250	2,175	2,650	
2001	41,395	16,410	10,355	3,925	n/a	1,190	3,255	310	2,315	3,635	
2002	37,860	15,735	9,200	2,790	n/a	975	3,205	345	2,415	3,195	
2003	38,045	16,830	9,195	2,890	n/a	980	2,765	235	2,145	3,005	
2004	36,880	17,890	7,370	2,915	n/a	585	2,860	290	1,875	3,095	

Prior to 1981, somewhat different categories were used. Wound, cut also includes bleeding, bruises. Dislocations and fractures can be provided separately from wounds and cuts. From 2001 onward, the category eye irritation was dropped and the category burns and smoke inhalation was added.