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Fatalities Among Volunteer and Career Firefighters—United States, 1994-2004

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2 figures, 1 table omitted

APPROXIMATELY 800,000 FIREFIGHTERS in the United States are volunteer firefighters and 300,000 are career firefighters.[1] Volunteer firefighters primarily serve communities with fewer than 25,000 inhabitants, whereas most career firefighters serve communities of more than 25,000 persons.[1] To characterize fatalities among volunteer and career firefighters, CDC analyzed data from the U.S. Fire Administration (USFA). This report summarizes the results of that analysis and, to illustrate the most common types of volunteer and career firefighter fatalities, describes two cases investigated by the National Institute for Occupational Safety and Health (NIOSH) Firefighter Fatality Investigation and Prevention Program.* Fifty-three percent (610 of 1,141†) of U.S. firefighters who died while on duty during 1994-2004 were volunteers, and 32% (368) were career firefighters. The remaining 15% (163) of deaths were among other firefighters (e.g., wildland, paid on-call, and part-time paid firefighters). Among volunteer firefighters, sudden cardiac death (e.g., from myocardial infarction or arrhythmia) and motor vehicle (MV) crashes during emergency response were the leading causes of fatality. Among career firefighters, sudden cardiac death and asphyxiation were leading causes of death. Adoption and enforcement of existing fire-service recommendations regarding fitness standards, mandatory medical evaluations with appropriate work restrictions, and emergency vehicle response protocols are needed to prevent these fatalities among firefighters.

Case Reports

Case 1: volunteer fatality. On July 28, 2003, at approximately 5:30 p.m., two members (aged 19 and 23 years) of a volunteer fire department responded to a trailer fire. With emergency lights on, traveling in a privately owned vehicle on a two-lane asphalt state road at an estimated 80 mph in a 55-mph zone, the driver drifted off the pavement and lost control of the vehicle. The vehicle overturned several times, struck a wooden utility pole, and ejected both unrestrained firefighters. The driver was killed, and the passenger was seriously injured. No adverse weather or road conditions were reported. The fire department's written protocol required that firefighters obey state and local traffic laws when responding in privately owned vehicles, including using seat belts.

Case 2: career fatality. On December 5, 2002, a male career captain aged 51 years responded to a fire in the attic of a two-story dwelling. After assisting with fire suppression on the second floor for approximately 5 minutes, he collapsed suddenly, and resuscitation efforts were unsuccessful. The autopsy revealed atherosclerotic and hypertensive cardiovascular disease with more than 85% narrowing of three coronary arteries. Thirteen years before his death, the captain had a myocardial infarction and subsequent angioplasty of his right coronary artery. The captain also had the following risk factors for coronary artery disease (CAD): age ≥45 years, male sex, family history of CAD, high cholesterol, high blood pressure, and overweight. Follow-up consisted of annual visits to his cardiologist, resting electrocardiograms, thallium-imaging exercise stress tests, and estimates of left ventricular function (e.g., left ventricular ejection fraction). These evaluations were consistently normal. However, 6 months before his death, new test results indicated new cardiac ischemia and a marked reduction of left ventricular function. No work restrictions were recommended by the cardiologist. Under these circumstances, the captain should have been issued work restrictions in accordance with National Fire Protection Association (NFPA) recommendations.[2]

Firefighter Fatalities

USFA maintains a database of all on-duty firefighter deaths. On-duty death is defined as the death of any firefighter who died while on duty or after recently completing a call (within 24 hours) for an organized fire department.‡ Using death certificates and fire department interviews, USFA determines firefighter demographics and the circumstances and causes of each fatality and classifies them accordingly. Firefighters are classified as career, volunteer, paid on-call, part-time paid, or wildland firefighters. For this study, only deaths among firefighters classified as career or volunteer were included. Cases of sudden cardiac death (e.g., myocardial infarction or arrhythmia) were recorded in the database as "heart attacks." To determine which trauma cases were MV-related and to identify the type of vehicle involved, the narratives of the USFA database were reviewed. MV-related traumatic death was defined as a fatality associated with a vehicle (e.g., a vehicle collision, being struck or crushed by a vehicle, or a fall from a vehicle).

During 1994-2004, a total of 610 volunteer and 368 career firefighters died while on duty. Half of the deaths among volunteers were caused by heart attacks and 26% by MV-related trauma. For career firefighters, 39% were caused by heart attacks, 29% by other causes (e.g., burns, cerebral vascular accident [CVA], or drowning), and 20% by asphyxiation. For both volunteer and

career firefighters, 97% of the decedents were male. The median age was 47 years (range: 15-81 years) for volunteers and 44 years (range: 20-67 years) for career firefighters. For both volunteer and career firefighters, most heart attack deaths occurred among persons aged 45-54 years. The majority of heart attack deaths were attributed to stress and overexertion in both volunteer (98%) and career (97%) firefighters.

For career firefighters, being caught/trapped accounted for 76% of asphyxiation fatalities and 30% of other fatalities (e.g., burns, CVA, or drowning). MV-related trauma was the second most common type of fatality for volunteers. Seventy-three percent of MV-related traumatic deaths of volunteer firefighters were caused by vehicle collisions/crashes. The greatest proportion of crashes (30%) involved privately owned vehicles. Tankers accounted for 26% of crashes. Eighty percent of the vehicle crashes occurred while firefighters were en route to calls, whereas 5% occurred during returns from calls.

Reported by: S Proudfoot, MS, T Hales, MD, TW Struttmann, MSPH, C Guglielmo, MS, Div of Safety Research, National Institute for Occupational Safety and Health; ML Ridenour, MPH, RS Noe, MPH, EIS officers, CDC.

CDC Editorial Note: The findings in this report indicate that 610 volunteer and 368 career firefighters died while on duty during 1994-2004 and that heart attacks were the leading cause of fatality for both volunteer and career firefighters. Firefighting is physically demanding work requiring high levels of aerobic capacity.[3] Therefore, fire departments are encouraged to require preplacement and annual medical evaluations in accordance with NFPA guidelines. NFPA 1582, *Standards on Comprehensive Occupational Medical Program for Fire Departments*, recommends exercise stress testing for asymptomatic firefighters who have two or more risk factors§ for CAD.[2] Both volunteer and career firefighter organizations have developed fitness and wellness programs to prevent atherosclerotic heart disease.[4,5] NFPA 1583, *Standard on Health-Related Fitness Programs for Firefighters*, outlines a complete health-related fitness program designed for fire departments.[6]

The second leading cause of volunteer firefighter deaths was MV-related trauma, most often related to a crash in a privately owned vehicle en route to a call. Fire departments should enact and enforce policies requiring seat belt use, prohibiting speeding en route to calls, and requiring adherence to all traffic laws. Driver training should be provided to all drivers at least twice a year to meet the requirements of NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*.[7] USFA's *Emergency Vehicle Safety Initiative* provides best-practice guidelines for MV operations for firefighters.[8] Community officials should encourage local fire departments to comply with these guidelines. Information on proper operation of privately owned vehicles by emergency service workers is available at http://www.vfis.com/risk/risk_pov.htm. In addition, states should continue to work toward enacting primary seat belt laws,‖ which have been demonstrated to increase seat belt use.[9]

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, contains the minimum requirements for a fire-service–related occupational safety and health program.[10] NFPA 1500 provides guidance to prevent firefighters from dying as a result of being caught/trapped during fire suppression in a structure (e.g., personnel accountability programs to ensure that incident commanders know where their crews are at all times while at the scene).

The findings in this report are subject to at least four limitations. First, because volunteer hours served are not reported to USFA consistently by volunteer fire departments, fatality rates could not be computed. Second, USFA might not capture data on all on-duty deaths; however, because benefits awards¶ for firefighters depend on reporting to USFA, reporting rates are probably high. Third, the definition of on-duty heart attack death was not consistent throughout the study period. Before December 2003, a heart attack death was considered an on-duty death if the person became symptomatic at the fire scene and died within 24 hours; however, since December 2003, a death within 24 hours after a response to a call, whether symptoms began at the scene, has been considered an on-duty death. Finally, the definition of "heart attack" used in the USFA database is broad, describing all events instead of specific cardiac events; prevention recommendations are different for myocardial infarction and arrhythmia.

To reduce the risk factors for cardiovascular disease, fire departments should consider mandating that all firefighters have an annual fitness and medical examination and participate in a department-based fitness program. NFPA 1583 provides the minimum requirements for health-related programs for firefighters.[6] Physicians performing fitness exams should be knowledgeable about NFPA 1582[2] and the physical demands of firefighting. Moreover, seat belt use and safe-driving practices or defensive-driving skills by firefighters are critical interventions to decrease MV fatalities. Fire departments should continue to promote a culture of safety for all as the foundation for effective response to the community.

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*Case reports are available from the NIOSH Firefighter Fatality Investigation and Prevention Program at http://www.cdc.gov/niosh/fire.
†Excludes the 343 career firefighters who died at the World Trade Center after the September 11, 2001, terrorist attack.
‡Affiliated with a city, state, or territory, the federal government, or an industrial brigade.
§Risk factors are family history of a premature (age <60 years) myocardial infarction in a first degree relative, hypertension (defined as systolic blood pressure >140 mmHg or diastolic blood pressure >90 mmHg), diabetes mellitus, cigarette smoking, and hypercholesterolemia (defined as total cholesterol >240 mg/dL or high density lipoprotein <35 mg/dL).
‖Laws that allow a law enforcement officer to stop a vehicle and issue a citation when the officer observes a driver or passenger not wearing a safety belt; no other traffic offense is required to stop the vehicle.
¶A benefit award is a one-time financial payment to the eligible survivors of public safety officers whose deaths are the direct and proximate result of a traumatic injury sustained in the line of duty.

Update: Guillain-Barré Syndrome Among Recipients of Menactra® Meningococcal Conjugate Vaccine—United States, October 2005–February 2006

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In October 2005, a possible association between Guillain-Barré Syndrome (GBS) and receipt of meningococcal conjugate vaccine (i.e., meningococcal polysaccharide diphtheria toxoid conjugate vaccine [Menactra®])* (MCV4) was reported.[1] GBS is a serious neurologic disorder involving inflammatory demyelination of the peripheral nerves. At the time of the first report, five confirmed cases of GBS after receipt of MCV4 had been reported to the Vaccine Adverse Events Reporting System (VAERS). During the 4 months since, three additional confirmed cases of GBS have been reported. This report describes two of these recent cases and provides additional data collected through February 2006. Because available evidence neither proves nor disproves a causal relation between MCV4 and GBS, further monitoring and studies are ongoing within VAERS and the Vaccine Safety Datalink (VSD). CDC continues to recommend use of MCV4 for persons for whom vaccination is indicated[1]; the additional reported cases have not resulted in any change to that recommendation.

Case Reports

Brief clinical and epidemiologic descriptions of two of the newly reported cases follow. The third case is undergoing detailed clinical investigation but meets the provisional case definition for GBS.†

Case 1. On August 8, 2005, a male aged 19 years from Arizona was vaccinated with MCV4. Approximately 25 days later, he experienced numbness and tingling in his hands and feet, followed by weakness in his legs, difficulty running, and decreased dexterity in his hands. In the month before neurologic symptom onset, he had no defined episode of respiratory or gastrointestinal illness. He had traveled to Mexico twice during the preceding 3 months. Electrophysiology studies revealed a diffuse neuropathic process with both demyelinating and axonal features, consistent with GBS. Testing for Epstein-Barr virus capsid IgG and IgM antibodies was negative. Testing for cytomegalovirus IgG and IgM antibodies also was negative, as were serologic studies for hepatitis A, B, and C to rule out other probable causes of GBS. The patient was treated with intravenous immunoglobulin. At follow-up examination 8 weeks after onset, he had fully recovered.

Case 2. On November 4, 2005, a male aged 17 years from Ohio received MCV4. Eleven days later, he experienced numbness and tingling in his right foot, followed by the same symptoms in the left foot, which progressed proximally during the next 5 days. He also described a neck hyperextension injury sustained while playing sports 2 days before the start of sensory symptoms and sore throat and congestion 1 day before sensory symptoms. He had no gastrointestinal illness during the 6 weeks before hospital admission, which occurred 6 days after symptom onset. Cervical spine radiographs revealed no fractures; magnetic resonance imaging (MRI) of the spine revealed mild enhancement along the surface of distal cord and lumbar nerve roots, consistent with GBS. Nerve conduction studies also were consistent with GBS. Polymerase chain reaction (PCR) assays for enterovirus were negative, as were tests for *Mycoplasma pneumoniae* IgG and IgM. The patient was treated with intravenous immunoglobulin. At follow-up examination 2 weeks after admission, he had completely recovered.

In the two cases described in this report, the period from MCV4 vaccination to symptom onset was less than 6 weeks. This is the time window of elevated risk noted for GBS after administration of certain other vaccines.[2]

To determine whether the reporting rate of GBS after MCV4 vaccination was higher than the expected incidence rate of GBS for the appropriate age group population, the reporting rate was calculated by dividing the eight confirmed GBS cases with onset within 6 weeks of vaccination by the number of vaccine doses distributed as provided by the manufacturer (approximately 3.77 million doses of MCV4 were distributed during March 2005–February 2006). The eight cases were divided by the 3.77 million distributed doses to provide the reporting rate for GBS after MCV4. The expected incidence rate of GBS was estimated from

