

LINE OF DUTY DEATH REPORT

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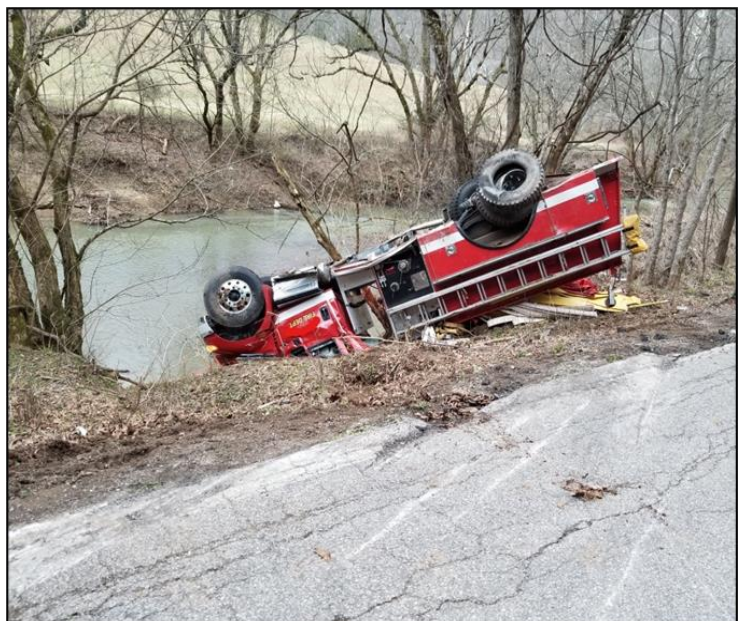
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51-Year-Old Firefighter Suffers a Sudden Cardiac Event and Crashes Engine While Responding to a Residential Structure Fire - West Virginia

Executive Summary

On January 11, 2020, a 51-year-old male volunteer firefighter died while responding to a mutual aid call for a residential structure fire. While driving the department's engine to the fire scene, the firefighter suffered a sudden cardiac event causing him to lose control of the apparatus approximately ½ mile from the structure fire. At approximately 1524 hours, the engine left the roadway and began to roll down an embankment. A hillside tree prevented the engine from rolling all the way down the hill into a creek. The engine came to rest on its roof in a very unstable position.

A firefighter from a neighboring fire department, also responding to the mutual aid call, came upon the crash site and notified dispatch at 1526 hours. Over the next 15 minutes, multiple emergency responders, including two members of the victim's fire department working the structure fire, responded to the crash scene. They found the firefighter unconscious, trapped inside the cab. The firefighter was wearing his shoulder and lap belt and had donned all his turnout gear except for his helmet. A Lieutenant (LT) from the firefighter's department and an advanced life support (ALS) unit from the neighboring department climbed into the engine's cab to take the firefighter's vital signs. The firefighter was unresponsive, did not have a pulse, and was not breathing. Due to firefighter's grave condition and the engine's unstable position, no



Fire engine balancing on its roof after leaving the roadway and rolling down a hill.
(Photo courtesy of the Fire Department)

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cardiopulmonary resuscitation (CPR) was administered, and no immediate attempt was made to extricate the firefighter.

The wrecker crew arrived on-scene approximately 45 to 60 minutes after the crash. It took a significant amount of time to stabilize the engine which was then righted onto the roadway. The roof of the engine's cab had to be cut way to extricate the firefighter. The Medical Examiner was called to the scene and pronounced the firefighter deceased at 1636 hours. The Chief Medical Examiner for the State of West Virginia performed the autopsy and completed the death certificate. "Sudden death" was listed as the immediate cause of death, caused by a "likely dysrhythmia," due to years of "hypertensive cardiovascular disease." "Positional asphyxia" could not be excluded as "contributory."

Contributing Factors

- *Lack of fire department medical evaluations to screen firefighters for risk factors for cardiovascular (CV) disease*
- *Lack of exercise stress tests (ESTs) for firefighters at increased risk for CV disease*
- *Lack of annual medical clearance for unrestricted firefighting duties, including operations of fire department apparatus*
- *Stress of responding to a fire emergency.*

Key Recommendations

- *Fire departments should ensure pre-placement and annual medical evaluations are provided to all firefighters*
- *Fire department physicians should ensure ESTs are provided to firefighters at increased risk of CV disease*
- *Fire department medical programs should be under the direction of a physician knowledgeable about the physical demands of firefighting, the personal protective equipment used by firefighters, and the medical guidance provided by the National Fire Protection Association (NFPA) 1582*
- *Fire department physicians should use the information from the annual medical evaluation to make final medical recommendations regarding medical clearance for unrestricted firefighting duties and tasks such as driving fire department apparatus.*

The National Institute for Occupational Safety and Health (NIOSH), an institute within the Centers for Disease Control and Prevention (CDC), is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. In 1998, Congress appropriated funds to NIOSH to conduct a firefighter initiative that resulted in the NIOSH Firefighter Fatality Investigation and Prevention Program, which examines line-of-duty deaths or on-duty deaths of firefighters to assist fire departments, firefighters, the fire service, and others to prevent similar firefighter deaths in the future. The agency does not enforce compliance with state or federal occupational safety and health standards and does not determine fault or assign blame. Participation of fire departments and individuals in NIOSH investigations is voluntary. Under its program, NIOSH investigators interview persons with knowledge of the incident who agree to be interviewed and review available records to develop a description of the conditions and circumstances leading to the death(s). Interviewees are not asked to sign sworn statements and interviews are not recorded. The agency's reports do not name the victim, the fire department, or those interviewed. The NIOSH report's summary of the conditions and circumstances surrounding the fatality is intended to provide context to the agency's recommendations and is not intended to be definitive for purposes of determining any claim or benefit.

For further information, visit the program website at www.cdc.gov/niosh/fire or call toll free 1-800-CDC-INFO (1-800-232-4636).



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Introduction

On January 11, 2020, a 51-year-old volunteer West Virginia firefighter suffered a sudden cardiac event while driving his department's engine to a mutual aid call for a residential structure fire. The firefighter lost control of the engine which veered off the roadway, rolled, and landed on its roof.

The National Institute for Occupational Safety and Health's (NIOSH) Fatality Investigation Prevention Program (FFFIPP) was notified about this incident by the United States Fire Administration on January 13, 2020. On January 27, 2020, a NIOSH FFFIPP investigator and an occupational medicine resident rotating through NIOSH visited the fire department to initiate the investigation. They conducted interviews with the affected fire department (fire chief, his assistant, a lieutenant, and a captain), and reviewed the following documents:

- membership requirements
- training requirements
- maintenance records of department apparatus
- fire department's standard operating procedures
- death certificate.

The NIOSH team visited the scene of the crash, took photographs, and inspected the damaged engine at the storage garage. The NIOSH team also reviewed the West Virginia uniform traffic crash report for this incident. While the death certificate completed by the medical examiner was available to NIOSH, the dispatch records and the medical examiner's autopsy report were not available to NIOSH at the time of this report.

Fire Department

The department involved is a volunteer fire department, one of six departments in the county. The department is staffed with 20 active firefighters and 5 probationary firefighters working out of one station. The department serves 754 people and 232 homes in a first due response area of 17.9 square miles. The response area expands to 25.1 square miles when mutual aid areas are included. The department responds to approximately 40 to 45 calls per year, consisting mostly of motor vehicle

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crashes. The department does not provide emergency medical team services, although they do have a paramedic on staff.

Hiring Process, Training and Experience

Membership in this fire department begins with an application completed by the prospective member. The fire department board and fire department members review the application. After a vote is made to accept the applicant, a 90-day probation period begins. After the 90 days, the board votes whether to accept the probationary firefighter as an active full member.

During the probationary period, the new member is required to become Firefighter 1 certified [NPFA 1001, 2019]. After completing Firefighter 1, new members must become first aid and CPR certified, and complete a hazmat awareness course. During their probationary period and after becoming an active firefighter, new members are paired with experienced firefighters in the department during emergency responses.

The department requires biweekly training for all active members. The department provides motor vehicle crash training conducted with the assistance of a local towing company to ensure firefighters can respond appropriately to various vehicle crash scenarios. Additional training is available at the West Virginia Fire Schools in Sissonville and Granville. For a member to drive fire department apparatus, the member must have a current WV driver's license and received a completion certificate from the West Virginia State Emergency Vehicle Operations Course (EVOC).

The FD does not require a candidate pre-placement medical evaluation nor periodic medical evaluations or medical clearance for members. The fire department provides numerous opportunities for exercise at the fire station, including the use of extensive gym equipment available at the fire station.

The driver involved in this incident was a 20-year firefighting veteran who worked in this fire department as a paramedic and a firefighter. He started his firefighting career in the state of Nebraska in 2000. In January 2002, he earned a certificate of training in confined space rescue and attained Firefighter II certification in October 2009. He also earned an Instructor I certificate (NFPA 1041, 2019) in April 2011. He successfully completed the Emergency Vehicle Operations Course (EVOC) at the West Virginia Department of Education through the West Virginia State Fire Commission in 2017. In 2019 he joined the fire department and completed the department's apparatus driver training and was an active participant in the department's various training sessions. According to the traffic crash report prepared by the county sheriff's, the driver had a valid driving license with no history of driving violations.

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Fire Department Apparatus

The department's fleet of vehicles at the time of the incident was comprised of:

- 2018 International Fire Engine (Engine 22) which had a 1000-gallon pump and a 750-gallon tank. This engine was involved in the crash (Photo 1 and 2, post-crash)
- 2018 Kiota Mechron (Utility 21)
- 2001 Ford Explorer (Squad 21)
- 1994 Freightliner FL80 (Rescue 21) which had a 1000-gallon pump and a 750-gallon tank
- 1991 GMC Tanker with a 500-gallon power take-off (PTO) pump and a 1500-gallon tank

Minor fleet maintenance is performed by the members of the department who also complete monthly apparatus maintenance checklists on each apparatus. Other apparatus maintenance is conducted by a garage with certified heavy-equipment mechanics. Engine 22 was last serviced in July 2019.



Photo 1. Damage to the front of Engine 22 stored at the wrecking/salvage yard.
(NIOSH photo)



Photo 2. Damage to the rear of Engine 22 stored at the wrecking/salvage yard.
(NIOSH photo)

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Weather and Road Conditions

The incident occurred on a dry, level, two-lane asphalt road divided by a double yellow line. Where the crash occurred, the roadway had a slight left curve and had a width of approximately 18 feet. At the time of this incident (about 1524 hours), the weather was clear with a high of 80 degrees Fahrenheit with no precipitation [Weather Underground 2022]. The roadway was dry, however, rains over the previous days made the shoulder soft. During recovery efforts (approximately 1630 to 1730 hours), rain began to fall (Photo 3).



Photo 3. Engine 22 righted onto the roadway after the deceased firefighter was removed. Rain was falling at the time of this photograph, about 2 to 3 hours after the crash.
(Photo courtesy of the Fire Department)

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Investigation

On January 11, 2020, a 51-year-old male volunteer firefighter reported to his fire station to drive Engine 22 to a residential structure fire. Approximately 18 miles from the station and ½ mile from the reported structure fire, the rear passenger side tires went off the pavement onto a soft shoulder/berm. The engine travelled approximately 70 feet with the right rear passenger tires on the shoulder/berm when the right rear tires hit a large boulder. The boulder was located about 3 feet off the roadway. The impact dislodged Engine 22's rear axle causing the driver to lose control of the engine. Tire skid marks show the vehicle returned to the roadway and crossed the double yellow line as it rotated 180 degrees. Approximately 120 feet from the initial impact of the boulder, Engine 22 exited the left side of the roadway (Photo 4). At this point the engine began to roll on its longitudinal axis down an embankment landing on its roof (Photo 5). The engine was dangerously balancing on a tree that prevented it from cascading farther down the hill to the creek below (Photo 5).



Photo 4. Gouges in the asphalt where the engine left the shoulder of the roadway.
(NIOSH photo)

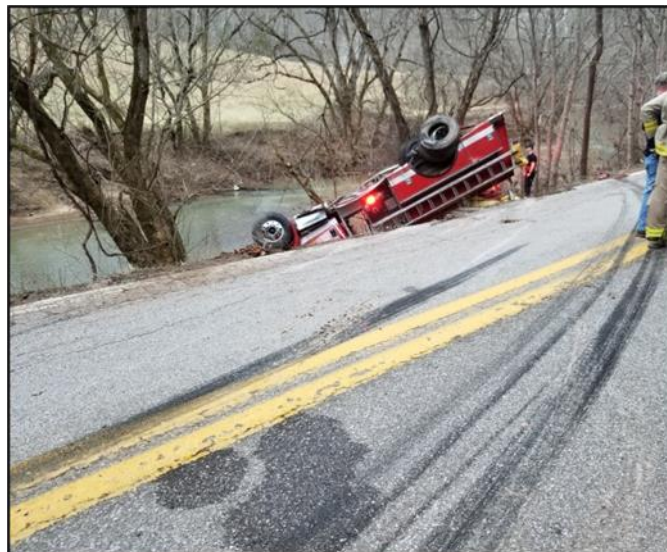


Photo 5. Overturned Engine 22 with tire skid marks on the roadway where the driver lost control of the engine.
(Photo courtesy of the Fire Department)

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The firefighter was driving the engine alone. He was wearing his turnout gear (jacket, bunker pants, rubber boots) and was buckled in with his shoulder and lap seatbelt when the crash occurred. The crash/rollover was not witnessed. There were no other injuries or fatalities caused by this crash.

The driver of a tanker from a neighboring fire department, also responding to the mutual aid call for the structure fire, came upon the crash scene approximately ½ mile from the location of the structure fire. The driver exited the tanker and surveyed the crash scene. While standing below the overturned engine, he could see the victim. The victim was unable to speak but was able to wave his arm out the driver side window. The tanker driver told the victim that he was going to get help. The driver climbed back up the embankment to his tanker and called dispatch at 1526 hours. In addition to requesting emergency responders, he told dispatch to notify a local wrecker/recovery operator.

Over the next 15 minutes, several emergency response units responded to the crash scene. This included three members of the local sheriff's office, an ALS unit from a neighboring fire department, two members of the State Fire Marshal's office, and two members of the victim's fire department. The two members of the victim's fire department (the assistant chief and a lieutenant) left the structure fire to assist with the rescue operation. All units found Engine 22 overturned, dangerously balancing on a tree with the firefighter unconscious, pinned to the driver's seat of the cab.

The lieutenant and the paramedic from the neighboring department's ALS unit climbed into the engine's cab to take the firefighter's vital signs. The firefighter, still belted in with his shoulder and lap belt, was unresponsive, did not have a pulse, and was not breathing. This information was passed onto the crash scene's incident commander from a neighboring fire department. Due to engine's unstable position and the poor prognosis of the victim, a decision was made to not perform cardiopulmonary resuscitation (CPR). Efforts to remove the firefighter from the cab would need to wait until the engine was stabilized by the wrecking crew. This information was passed to on-scene officers with the county sheriff's office and the State Fire Marshal Office who shifted their focus from rescue to recovery.

Officers from the county sheriff's office and State Fire Marshal's office collected crash scene data for the West Virginia uniform traffic crash report. Upon arrival of the wrecker and completion of data collection, the engine was righted onto the roadway (Photo 3). The deceased firefighter was extricated by cutting the roof off the engine's cab (Photo 3). The medical examiner was called, arrived on-scene, and pronounced the firefighter deceased at 1636 hours.

According to those present at the scene, the deceased firefighter had a small head laceration and a small indentation on the back of his head suggestive of him being pinned to the seat. There was no significant bleeding visible inside the cab. He was transported to the Office of the Chief Medical Examiner for an autopsy. The crash scene was cleared about 2330 hours. According to the traffic crash report, there was no evidence that Engine 22 was speeding, and there was no evidence of alcohol or other drug use by the driver.

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Cause of Death

The death certificate was completed by the state’s chief medical officer after conducting the autopsy. The immediate cause of death was “sudden death” caused by a “likely dysrhythmia” due to years of “hypertensive cardiovascular disease.” Since the firefighter was trapped and pinned inside the apparatus, “positional asphyxia,” could not be excluded as “contributory.” At the time of this report, NIOSH was unable to access the autopsy report performed by the chief medical officer in the West Virginia Office of the Medical Examiner.

The firefighter was not reported to have any medical problems, and NIOSH was also unable to locate any personal medical records of the deceased firefighter. Therefore, NIOSH was unable to determine if the firefighter had any known cardiac conditions or cardiac risk factors, other than the evidence of long-standing high blood pressure (hypertension) found at autopsy and listed on the death certificate.

Discussion

Sudden Cardiovascular (CV) Events

Sudden CV events (heart attacks, sudden cardiac death, and strokes) are the leading cause of on-the-job deaths among firefighters, constituting approximately 40%–45% of all duty-related fatalities [Fahy and Petrillo 2021]. Coronary heart disease (CHD) and cardiomyopathies are the most common underlying medical conditions for sudden CV events in the general population and in firefighters [Farioli et al. 2015; Myerburg and Junttila 2012]. Many individuals are unaware of these underlying medical conditions and the sudden CV event is frequently the first sign of their underlying disease [Myerburg and Junttila 2012]. According to the cause of death certificate completed by the chief medical officer of the West Virginia Office of the Medical Examiner, the firefighter had hypertensive CV disease. Hypertensive CV disease is the result of longstanding high blood pressure (hypertension). It is unclear if the firefighter was aware of his high blood pressure and its potential for adverse health outcomes.

Medical evaluations (medical history, physical examination, medical tests) can help identify individuals at risk for a sudden CV event. The well-established personal risk factors for CHD include both non-modifiable and modifiable risk factors. The non-modifiable risk factors include male sex, older age (males >45, females >55), race, and family history of premature heart disease or sudden cardiac death [AHA 2016]. The firefighter had two of these risk factors (age and male sex). The modifiable risk factors include hypertension, hyperlipidemia, smoking, diabetes, overweight/obesity, and physical inactivity [AHA 2016]. Based on the firefighter’s autopsy and death certificate, the firefighter had long standing hypertension, but NIOSH has no information about any of the other modifiable risk factors.

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The American Heart Association/American College of Cardiology (AHA/ACC) developed an on-line calculator to estimate the risk of future CV events [AHA/ACC 2020]. Using the following 12 risk factors (age, sex, race, total cholesterol, LDL cholesterol, HDL cholesterol, use of statins to control cholesterol, systolic blood pressure (BP), BP lowering medication use, diabetes mellitus status, smoking status, and aspirin therapy), the AHA/ACC's CV risk calculator estimates an individual's 10-year risk of developing atherosclerotic CV disease [AHA/ACC 2020]. NIOSH was unable to estimate the firefighter's 10-year CV disease risk due to the lack of personal risk factor information.

Physical Activity and Sudden Cardiovascular (CV) Events

Strenuous physical activity has been shown to “trigger” heart attacks and sudden death in susceptible individuals (e.g., those with underlying CV disease or CHD) [Thompson et al. 2007; Mittleman and Mostofsky 2011]. Since firefighting tasks require heavy physical exertion, this association is also found in firefighters [Hales et al. 2007; Hales 2016; Haller and Smith 2019; Kales et al. 2007; Smith et al. 2016]. While the task of driving the fire engine to a fire emergency is not strenuous physical activity, it can be stressful. It is possible the stress of responding to the fire emergency triggered his sudden CV event.

Occupational Medical Standards for Structural Firefighters

To reduce the risk of sudden CV events or other incapacitating conditions among firefighters, NFPA developed 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments* [NFPA 1582, 2021]. This voluntary consensus-based standard outlines the specific medical evaluation (medical history, physical examination, medical tests) recommended assessing a firefighter's medical ability to perform their duties safely and effectively. The standard also provides specific medical criteria used to determine fitness-for-duty for certain diseases or conditions. While the 2021 edition of NFPA 1582 is now available, the 2018 edition was in effect at the time of this investigation [NFPA 1582, 2018 and 2021]. The death certificate identified that the firefighter had one health issue addressed in NFPA 1582: hypertension.

Hypertension

The 2018 edition of NFPA 1582 recommended referral of firefighters with Stage 1 hypertension (systolic BP 140–159 millimeter of mercury (mmHg) or diastolic 90–99 mmHg) to their primary care provider for BP control and to “consider” screening for end-organ damage (cardiac findings, nephropathy, retinopathy, etc.). Given the medical examiner's conclusion that the firefighter had hypertensive cardiovascular disease, this suggests the firefighter had a long history of hypertension, suggesting that screening for these complications was indicated. According to NFPA 1582, these screening tests would include [NFPA 1582, 2018]:

- medical history for possible symptoms of heart failure
- dilated eye examination for possible retinopathy
- blood creatinine for possible nephropathy

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- an electrocardiogram (EKG) or echocardiogram for possible left ventricular hypertrophy.

Contributing Factors

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. NIOSH investigators identified the following items as key contributing factors in this incident that ultimately led to the fatality:

- *Lack of fire department medical evaluations to screen firefighters for risk factors for cardiovascular (CV) disease*
- *Lack of exercise stress tests (ESTs) for firefighters at increased risk for CV disease*
- *Lack of annual medical clearance for unrestricted firefighting duties, including operations of fire department apparatus*
- *Stress of responding to a fire emergency.*

Recommendations

Recommendation #1: Fire departments should ensure pre-placement and annual medical evaluations are provided to all firefighters.

Discussion: NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*, requires pre-placement and annual medical evaluations for firefighters. The standard also provides guidance on the components of the evaluations (e.g., laboratory tests) [NFPA 1582, 2021]. Regular medical evaluations help determine a firefighter's medical ability to perform duties without undue risk to the safety and health of self or others. Although fire departments are not legally obligated to follow NFPA 1582, annual/periodic medical evaluations are strongly encouraged by fire service organizations. To help smaller volunteer departments, the United States Fire Administration (USFA) published the *Health and Wellness Guide for the Voluntary Fire and Emergency Services*, and the National Volunteer Fire Council (NVFC) published the *Fit for Duty, Fit for Life: Firefighter Physicals and the Volunteer Fire Service*, and *Health and Wellness Tips* to help address these important medical issues [NVFC 2015; NVFC 2021a; USFA 2009].

Applying this recommendation involves funding and may be particularly difficult for small volunteer fire departments, such as the one fire department involved in this incident, to implement. To overcome these financial obstacles, volunteer fire departments could urge current members to get annual medical clearances from their private physicians. Another option is having the annual medical evaluations completed by paramedics and emergency medical technicians (EMTs) from the local emergency medical service (vital signs, height, weight, visual acuity, and EKG). This information could then be

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provided to a community physician (perhaps volunteering his or her time), who could review the data and provide medical clearance (or further evaluation, if needed). The more extensive portions of the medical evaluations could be performed by a private physician at the firefighter's expense (personal or through insurance), provided by a physician volunteer, or paid for by the fire department. Sharing the financial responsibility for these evaluations between firefighters, the fire department, and physician volunteers may reduce the negative financial impact on recruiting and retaining needed firefighters.

Recommendation #2: Fire department physicians should ensure symptom-limiting exercise stress tests (ESTs) are provided to firefighters at increased risk of CV disease.

Discussion: NFPA 1582 requires all firefighters 40 years and older be assessed for asymptomatic atherosclerotic CV disease [NFPA 1582, 2021]. As mentioned in the discussion section of this report, this assessment includes a 10-year cardiac risk estimate from the American College of Cardiology/American Heart Association, and/or a 2-year cardiac risk estimate from the Framingham Heart Study [AHA/ACC 2020; D'Agostino 2000]. According to NFPA 1582, firefighters with a 10-year risk between 10%–19.9%, or a 2-year risk between 2 to 4%, shall be further evaluated with a symptom limiting EST to at least 12 metabolic equivalents (METS) with negative tests repeated every 2 to 5 years or when clinically indicated [NFPA 1582, 2021]. Given the lack of CV risk factor information available for the firefighter involved in this incident, it is unclear whether the firefighter should have been referred for an EST. It is important to point out that the AHA/ACC does not recommend ESTs for young adults (<40 years old) due to validity issues. Finally, some fire departments use the EST to assess a firefighter's aerobic capacity rather than as a screening test for CV disease. This represents an unnecessary expense for the department because one's aerobic capacity can be easily determined in a non-medical setting (e.g., the Cooper test) [Cooper HK 1968; The Cooper Institute 2006].

Recommendation #3: Fire department medical programs should be under the direction of a physician knowledgeable about the physical demands of firefighting, the personal protective equipment (PPE) used by firefighters, and the medical guidance provided by NFPA 1582.

Discussion: NFPA 1582 requires fire departments designate a physician responsible for guiding, directing, and advising the members about their health, fitness, and suitability for duty [NFPA 1582, 2021]. This physician should be familiar with the essential job tasks of firefighting, the physical demands and environmental conditions under which firefighters must perform, the PPE required during various emergency operations, and the medical guidance provided by NFPA 1582. Additional guidance is available from the [Healthcare Provider's Guide to Firefighter Physicals](#) prepared by the International Association of Fire Chiefs [IAFC 2016].

Recommendation #4: Fire department physicians should use the information from the annual medical evaluation to make final medical recommendations regarding medical clearance for unrestricted firefighting duties and tasks such as driving fire department apparatus.

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Discussion: In addition to outlining the components of a medical evaluation, NFPA 1582 also provides guidance on when certain medical conditions might require restrictions from full duty [NFPA 1582, 2021]. This not only includes medical clearance for firefighting duties, but also the driving of fire department apparatus during emergency responses.

Implementing this recommendation (the recruitment and retention of medically qualified firefighters) may be particularly difficult for small, rural, volunteer fire departments. Several individuals and organizations have addressed the broader issue of recruiting and retaining volunteer firefighters [Aitken 2020; Carter 2005; Decremer 2018; Maruca 2021; NVFC 2021b; USFA 2007; Wilson 2002].

The USFA, in partnership with the NVFC, has traced some of the recruitment and retention problems to [USFA 2007, page 2]:

- “more demands on people’s time in a hectic modern society
- more stringent training requirements
- population shifts from smaller towns to urban centers
- changes in the nature of small-town industry and farming
- internal leadership problems, and
- a decline in the sense of civic responsibility.”

The USFA and NVFC believe individuals are still willing to give their time to volunteer emergency services organizations provided the following [USFA 2007, page v]:

- “the experience is rewarding and worth their time
- the training requirements are not excessive
- the time demands are adaptable and manageable
- they are rewarded with a personal sense of value
- there is good leadership minimizing conflict, and
- there is ample support for the organization.”

The USFA and NVFC document not only identifies the challenges of recruitment and retention but provides several categories of potential solutions including leadership, department image, consolidation, risk, cohesiveness, emotional support, training requirements, time demands, recognition, fun factors, and recruitment strategies [USFA 2007]. The [NVFC website](#) also provides 46 resources specifically on the recruitment and retention of volunteer firefighters. In addition, by searching on the term “recruitment and retention,” the [NVFC website](#) provides information on recent and upcoming meetings and webinars on the topic.

NIOSH recommends that small, volunteer fire departments review the documents and websites cited above for ideas and suggestions relevant to their department to help recruit and retain medically qualified volunteer firefighters.

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Recommendations #5, 6, and 7 would not have prevented this firefighter's death, however they are included to address general health and safety issues for this fire department.

Recommendation #5: Fire departments should consider phasing in a mandatory comprehensive wellness-fitness program for all firefighters to reduce CV disease risk factors and improve cardiovascular capacity.

Discussion: NFPA 1583, *Standard on Health-Related Fitness Programs for Fire Department Members*, allows firefighters to build and maintain a level of health and fitness which reduce their risk of illness, injury, and premature death [NFPA 1583, 2022]. Fire service health promotion programs have been shown to improve fitness, reduce CHD risk factors, reduce absenteeism, reduce work-related injuries, reduce lost workdays, and reduce worker compensation claims, reduce medical costs, and have a favorable return on investment with mandatory programs showing the most benefit [Blevins et al. 2006; Dempsey et al. 2002; Griffin et al. 2016; Kuehl et al. 2013; Poston et al. 2013; Sokoloski et al. 2020]. The fire department involved in this incident encouraged physical fitness and wellness but did not require participation in a mandatory comprehensive wellness-fitness program.

Recommendation #6: Fire departments should follow applicable NFPA apparatus standards to reduce the risk of firefighters becoming injured or dying in fire department apparatus crashes.

Discussion: In 2020, fire department vehicles were involved in an estimated 18,775 collisions while responding to or returning from incidents resulting in 600 injuries and 16 deaths [Campbell and Everts 2022]. While fire department vehicle collisions, injuries, and fatalities have been steadily decreasing over the past 20 years, they still represent a significant number of firefighter fatalities and warrant continued prevention efforts [Vatter 2021].

At least three NFPA standards are relevant to reducing the number and severity of firefighter injuries related to vehicle crashes. These standards have focused on:

- Improving the training and certification of the apparatus operator, and
- Improving the maintenance of the apparatus.

NFPA 1451: Standard for a Fire and Emergency Service Vehicle Operations Training Program.

This standard provides for the development of a written vehicle operations training program, including the organizational procedures for training, vehicle maintenance, and identifying equipment deficiencies [NFPA 1451, 2018]. The firefighter and driver of the engine in this incident had completed the West Virginia State Emergency Vehicle Operations Course (EVOC) and had been cleared to drive the engine per the department's apparatus standard operating procedure (SOP).

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NFPA 1002, Standard on Fire Apparatus Driver/Operator Professional Qualifications.

This standard identifies the minimum job performance requirements for firefighters who drive and operate fire apparatus in both emergency and nonemergency situations [NFPA 1002, 2017]. The standard also provides guidance on conducting annual proficiency evaluations. The fire department involved in this incident provided formal and informal apparatus driving training. NIOSH encourages the fire department to review all components of its apparatus training procedures to ensure compliance with NFPA 1002.

NFPA 1911, Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus.

This standard details a program to ensure that fire apparatus are serviced and maintained in safe operating condition [NFPA 1911, 2017]. This department performs minor maintenance of their apparatus in house. More extensive maintenance is provided by a local garage employing certified heavy equipment mechanics. While a mechanical failure was not responsible for this incident, NIOSH encourages the fire department to review all components of this maintenance procedure to ensure compliance with NFPA 1911.

Recommendation #7: Fire departments should ensure members have access to critical incident stress counseling services.

Discussion: During the NIOSH interviews, firefighters voiced concerns that their emotional needs surrounding this incident were not met. Losing a firefighter is a very emotionally and stressful event for all members of the fire department. The fire service recognizes the importance of making available counseling sessions for grieving firefighters. Typically, this is administered by a department's behavioral health or employee assistance programs. Unfortunately, most small, rural, volunteer FD do not have the resources to provide these programs.

The NVFC recognizes this service gap and has developed a [first responder helpline](#). This confidential line is available 24/7 to help responders cope with a variety of behavioral health issues and work-life stresses. The helpline is staffed by master's level clinicians with an average of five years of experience specially trained in assisting and supporting first responder groups. For volunteer departments that are not members of the NVFC, it costs \$21 to join NVFC and have access the First Responder Helpline. Alternatively, a department can sign up for a complimentary membership for access to the Helpline along with all the NVFC member benefits [NVFC 2022].

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The field investigation was conducted by Karis Kline-Field, a Safety and Occupational Health Specialist with the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research, located in Morgantown, WV. She was assisted in the field by Dr. Cletus Oppong, MD, MPH from the West Virginia University School of Public Health. Ms. Kline-Field and Dr. Oppong drafted the report. The final report was written by Dr. Thomas Hales, MD, MPH, with the NIOSH Fire Fighter Fatality Investigation and Prevention Program, Division of Safety Research located in Morgantown, WV.

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