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31-year-old Firefighter Cadet Collapses During Academy Training Exercise and Dies - Alabama

Executive Summary

On July 25, 2022, at 0718 a 31-year-old, male Cadet was participating in Academy training which included an (air) Consumption Course. While attempting the course for the first time, the Cadet was unable to complete it complaining of dizziness, shortness of breath, and cramping; He was reported to have "nearly passed out". An on-site Paramedic assessed the Cadet's condition immediately and determined he needed further observation and evaluation. The Cadet's PPE was doffed, and he was hooked up to a cardiac monitor to assess his vitals. At approximately 0750, the Cadet was moved indoors to an airconditioned classroom and advised to drink 1 liter of water. At 0803 the Cadet vomited the water he had consumed, and the Paramedic determined the Cadet's vitals were abnormal and the Captain on scene (Captain 1) called for EMS transport to the Emergency Department. After several hours of observation in the Emergency Department, the Cadet was admitted to the hospital, and then released the following evening. This incident was preceded by another event on July 11, 2022 where the Cadet experienced similar, but less serious symptoms and did not result in hospital referral.

The Cadet received clearance from his physician to return to Academy activities on July 28, 2022. The same day (July 28, 2022), at 0930, the Cadet attempts the Consumption Course again, this time accompanied by Captain 2. During the course, Captain 2 notes that the Cadet's breathing was not good, but the Cadet states he is fine and finishes the course. The Cadet promptly collapses just outside of the building where the on-site Paramedic assesses him and documents he is awake, alert and oriented. The Cadet initially denies any medical complaints other than experiencing dyspnea (shortness of breath), but moments later, complains of hamstring and back pain. The Cadet was doffed out of structure fire PPE and moved into an airconditioned classroom where he began to experience severe respiratory distress.

The Cadet was hooked up to cardiac and oxygen monitors which revealed sinus tachycardia and hyperventilation. At approximately 0955, EMS transport was arranged via phone. At 1001, the Cadet was moved from a chair to the floor. Approximately 10 seconds after being moved to the floor, pulseless electrical activity (PEA) was shown on the cardiac monitor with a rate of 23 BPM, and no carotid pulse

Please note that although NFPA standards are updated periodically, it is our practice to cite the version in effect at the time of the fatality. In 2025, the NFPA consolidated standards 1581–1584 that we cite in this report into a single 1580
standard.

could be found so cardiopulmonary resuscitation (CPR) was initiated. Following 30-60 seconds of CPR, the carotid pulse was palpable, and he was breathing independently but remained unresponsive. Multiple intravenous lines (IVs) were attempted but line placement was unsuccessful.

Upon arrival of EMS, a care report was given to the arriving Paramedic who attempted to place an IV but was also unsuccessful. The original on-site Paramedic simultaneously attempted to perform an endotracheal tube (ETT) placement but was unsuccessful.

The Cadet was transferred from the ED to the Intensive Care Unit (ICU) where lifesaving efforts continued. Unfortunately, his clinical condition continued to decline rapidly, and he died later that day.

Key Recommendations

NIOSH offers the following recommendations to reduce the risk of heat-related injury and death among firefighters at this and other fire departments across the country.

- *Key Recommendation #1: Review policy on return-to-work medical evaluations as the candidate had 2 prior incidents within the previous 17 days that required medical attention.*
- *Key Recommendation #2: Ensure that medical evaluations for Members and Cadets be performed by a provider familiar with the physical and psychological demands of firefighting and the components of NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments.*
- *Key Recommendation #3: Consider feasible options for exertional heat illness monitoring during training including temperature assessment and rapid cooling utilizing NFPA 1584: Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises, and the National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses.*
- *Key Recommendation #4: Have onsite staff (e.g., paramedics) assess Cadet's risk for heat-related illness prior to strenuous training, to include any training in full turnout gear; consider use of a checklist or other screening tool.*

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Introduction

On July 28, 2022, a 31-year-old Firefighter Cadet collapsed while participating in the Fire Academy's Consumption Course and died shortly after arriving at the local hospital. The U.S. Fire Administration notified the National Institute for Occupational Safety and Health (NIOSH) of this fatality through its firefighter fatality email notification service. NIOSH contacted the affected fire department (FD) to gather additional information and initiate the investigation.

A medical officer and a firefighter safety specialist with the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) conducted the investigation. NIOSH staff conducted a site visit October 24-27, 2022.

During the investigation, the NIOSH investigator interviewed the following people:

- *Chief*
- *Deputy Chief*
- *Training Chief*
- *EMS Coordinator*
- *Union President*
- *Union Representative*
- *On-Site Paramedic*
- *Academy Instructors (5)*
- *Academy Cadets -at time of incident (8)*

The NIOSH investigator reviewed the following documents:

- *FD Application for Employment*
- *FD Incident Report*
- *Fire College Physical Statement*
- *Fire College Course Application*
- *Fire College Recruit School Handbook*

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- *Fire Department Fitness for Duty Medical Certification*
- *SCBA Certification of Analysis*
- *SCBA Functional Test Results*
- *Cadet Class Schedule*
- *FD Hiring Schedule*
- *Death Certificate*
- *Autopsy Documentation*
- *Hospital Medical Records*

Fire Department

At the time of the incident, the Cadet was enrolled in the FD's Training Division (the Academy), an affiliate with the State Fire College. The FD employs 395 personnel who staff and operate 20 engine companies, 5 ladder trucks, 4 rescue trucks, and a Special Operations Division including, Hazardous Materials Units, Technical Rescue Units, and several specialized support units. The FD covers 220 square miles and responds to approximately 23,500 calls per year.

Membership and Training

The selection process for becoming an employee begins with an online application process. Applicants must possess a high school diploma or GED, be at least 18 years of age, and possess and maintain a valid drivers license. Secondarily, applicants must attend a mandatory Candidate Physical Ability Test (CPAT) orientation, following which, the applicants will be given approximately 6 weeks to prepare for their 1st of 3 attempts to pass the CPAT. Applicants must take and pass a written exam with a minimum score of 70%. Following a successful written exam, applicants are eligible to take the CPAT. Applicants may be selected to participate in an oral interview, and if selected, will receive a conditional job offer.

New Cadets will attend the FD's Academy for approximately 6 months. Required certifications include Firefighter I and II, CPR, Emergency Medical Technician, Rope I, Rapid Intervention Crews and Hazardous Materials Awareness and Operations.

At the time of this incident, the 31-year-old Cadet had completed approximately 19 weeks of training in the Academy.

Preplacement/Periodic/Return to Work Medical Evaluations

Each recruit is required to complete a Health Questionnaire Form prior to the first day of training. Information disclosed on the form which may preclude a recruit from safely participating is forwarded from the Course Coordinator to the fire college. The Cadet completed this form on March 25, 2022, and did not indicate any medical diagnoses, medications, or allergies.

If a recruit is referred for acute care during training, the Recruit School Handbook specifies that the recruit must obtain full release from a medical doctor prior to readmission into training. After medical

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release is obtained, the FD determines whether the recruit should continue with training, or if the recruit will be dismissed from the program.

Wellness/Fitness Programs

The fire Academy includes a fitness plan with organized workouts. Cadets perform the Marine Special Operations Short Card workout (MARSOC) as a baseline assessment of their overall fitness at the start of the Academy. The MARSOC workouts are self-paced and performed in regular physical activity gear. Other fitness activities performed in the Academy are a variety of prescribed circuits, equipment carry and wilderness rescue activities, bodyweight/calisthenics, and others as assigned.

Investigation

On July 11, 2022, during an indoor afternoon physical training session at the Academy, the Cadet complained of difficulty breathing, lightheadedness, and claimed his "lungs felt like they were cramping". The Cadet laid down on the ground and his classmates assisted with doffing of his Personal Protective Equipment (PPE). Although the Cadet was alert and oriented, he continued to complain of cramping. A fellow classmate took his pulse and reported it to be 170 beats per minute (BPM). A paramedic in the building at the time assessed the Cadet and recorded his blood pressure (BP) to be 150/110mmHg and a pulse of 133-140 BPM with 96% SpO2 on room air. The Paramedic advised the Cadet to sit with ice packs on his body while his blood pressure continued to be monitored every 10-15 minutes. Approximately 45 minutes later, the Cadet's BP fell to 133/88 mmHg and he was cleared to resume his class in cleaning up for the day.

Photo 1. Indoor gymnasium, physical activity area. Photo by NIOSH.

On July 25, 2022, at 0718 the Cadet was participating in Academy training which included an (air) Consumption Course. Weather conditions at the time of training were 75° Fahrenheit (F), with a heat index of 78° F. The course took place both inside and outside. While attempting the course for the first time, the Cadet was unable to complete it complaining of dizziness, shortness of breath, and cramping; He was reported to have "nearly passed out". Per FD policy, there was an on-site Advanced Life Support Certified (ALS) Paramedic who assessed the Cadet's condition immediately (approximately 0735), while he was still on the course and determined he needed further observation and evaluation. The Cadet's PPE was doffed, and he was hooked up to a cardiac monitor to assess his vitals. At

approximately 0750, the Cadet was moved indoors to an airconditioned classroom and advised to drink 1 liter of water. At 0803 the Cadet vomited the water he had consumed, the Paramedic determined the Cadet's vitals were abnormal, and the Captain on scene (Captain 1) called for EMS transport to the Emergency Department (ED). At 0825 the Paramedic administered intravenous (IV) fluids and Zofran. EMS arrived on scene at 0830 and took over care of the Cadet while transporting to the local ED.

Captain 1 met the Cadet at the hospital and remained with him while he received care. Captain 1 assured the Cadet that they would accommodate him if he was unable to complete the Consumption Course that week. After several hours of observation, the Cadet was admitted to the hospital. Captain 1 obtained Fit for Duty paperwork from the FD Chief and provided it to the Cadet, explaining the paperwork would need to be completed and signed off on by a physician prior to returning to the Academy in any capacity. The Cadet was released from the hospital on the evening of July 26, 2022.

Photos 2-3. Exterior tower and interior props used for drills. Photos by NIOSH.

The Cadet reported back to the Academy on July 27, 2022, but was held from all physical activity; the discharge instructions from the hospital prohibited physical exertion until he was cleared by a primary care physician. The Cadet's physician signed off on his return to activity on July 28, 2022. After speaking with the FD human resource office, it was determined that everything was in order for the Cadet to resume full Academy activities.

The same day, (July 28, 2022) at 0930, the Cadet attempts the Consumption Course again, this time accompanied by Captain 2. The weather was clear with a temperature of 86° F, and a heat index of 92°

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F. During the course, Captain 2 notes that the Cadet's breathing was not good, but the Cadet states he is fine and finishes the course. The Cadet promptly collapses just outside of the building where the on-site Paramedic approaches him sitting on the ground accompanied by training staff and fellow classmates. The Paramedic assesses the Cadet and documents he was awake, alert and oriented, with a Glasgow Coma Scale score of 15 (highest score possible meaning you are fully awake and responsive). He further notes that the Cadet's lungs are clear, there is delayed capillary refill, skin is dry, hot, and pale, and breathing is labored and increased. The Cadet initially denied any medical complaints other than experiencing dyspnea (shortness of breath), but moments later, complains of hamstring and back pain. The Cadet was doffed out of structure fire PPE with assistance from fellow classmates for further assessment and cooling.

Photos 3-4. Partial outdoor Consumption Course stations. Photos by NIOSH.

The Cadet, with assistance of 2 other people, was moved to an airconditioned classroom where he began to experience severe respiratory distress and was unable to answer any further assessment questions. The Cadet was hooked up to cardiac and oxygen monitors which revealed sinus tachycardia and hyperventilation. At approximately 0955, EMS transport was arranged via phone. The Cadet was provided oxygen therapy (15 L/M) via a non-rebreather mask but no improvement was noted and agonal respirations followed. At 1001, the Cadet was moved from a chair to the floor. Approximately 10 seconds after being moved to the floor, pulseless electrical activity (PEA) was shown on the cardiac monitor with a rate of 23 BPM, and no carotid pulse could be found so cardiopulmonary resuscitation (CPR) was initiated. Following 30-60 seconds of CPR, the carotid pulse was palpable, and he was breathing independently but remained unresponsive. A 12-lead electrocardiogram (ECG) was obtained showing sinus tachycardia with no ST changes. Multiple IVs were attempted but unsuccessful.

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Upon arrival of EMS, a care report was given to the arriving Paramedic who attempted to place an IV but was also unsuccessful. The original on-site Paramedic simultaneously attempted to perform an endotracheal tube (ETT) placement but was unsuccessful due to the Cadet biting down on the laryngoscope blade. The Cadet was moved via scoop stretch and placed on a cot, where he was then secured and loaded into the ambulance. Post-cardiac arrest protocol care was continued with an intraosseous (IO) line established in the Cadet's shoulder and 700mL of saline was infused en route to the emergency department.

The Cadet was transferred from the ED to the Intensive Care Unit (ICU) where lifesaving efforts continued. Unfortunately, his clinical condition continued to decline rapidly, and he died later that day.

The FD provided complete self-contained breathing apparatus (SCBA) documentation, showing compliance with NFPA 1989 *Standard on Breathing Air Quality for Emergency Services Respiratory Protection* requirements (NFPA, 2019). The SCBA in use during this incident was certified and passed all analytic tests.

Medical Findings

The Cadet's death certificate reported his cause of death as cardiac arrhythmia due to acute kidney injury, with the kidney damage due to rhabdomyolysis, or breakdown of muscle, into byproducts damaging to the kidneys. Review of ICU records showed very high serum potassium levels (hyperkalemia) immediately before his death, as his kidneys became unable to regulate and excrete potassium. Peaked T waves and a widening QRS complex, both heart rhythm findings on ECG characteristic of hyperkalemia, were reportedly present in the hours to minutes before he died. However, the cause of his rhabdomyolysis was not as conclusive.

On arrival to the ED at 1102, his triage vital signs showed a core temperature of 37.6°C (99.7°F), blood pressure of 122/45 mmHg, heart rate of 136 BPM, respiratory rate of 21 breaths per minute, and an oxygen saturation of 96% on 15 liters/minute of supplemental oxygen. His height was 178 cm (5 ft 10 in), and weight 90.0 kg (200 lbs), with a BMI of 28.7 kg/m2. His Glasgow Coma Scale score, a measure to assess level of consciousness, was 3, indicating complete unresponsiveness.

Physical exam was most notable for severe muscle rigidity, with a clenched jaw and extremities. He was intubated for airway protection and was noted to be difficult to intubate because of the rigidity. He also had skin warmth and diaphoresis (sweating).

Labs showed a creatine kinase (CK) level of 12,049 U/L (normal range 38-174 U/L) indicating muscle breakdown. His kidney function was impaired, with an initial serum creatinine of 2.8 mg/dL (normal range 0.7-1.2 mg/dL). His serum potassium level on admission was 5.3 mEq/L (normal range 3.5-5.0 mEq/L). An ECG in the ED showed sinus tachycardia.

He was admitted to the ICU and was given intravenous fluids. However, subsequent lab testing showed that his kidney function was worsening, and his CK and potassium levels continued to rise. He developed dark-colored urine, a sign of rhabdomyolysis.

ICU staff suspected a diagnosis of malignant hyperthermia and called the Malignant Hyperthermia Association of the United States (MHAUS) hotline. MHAUS recommended treatment with dantrolene and lorazepam, and those medications were administered. Simultaneously, the neurology team was

consulted to evaluate for seizure as the cause of his muscle rigidity. An electroencephalogram was performed and did not show evidence of seizure.

Hyperkalemia can lead to cardiac arrhythmia, and the Cadet's serum potassium continued to rise to 9.1 mEq/L. The nephrology team was consulted for emergent dialysis to lower his potassium level. However, before dialysis could begin, he suffered cardiac arrest. Resuscitation efforts continued for approximately 1 hour before he was pronounced dead at 1755.

An autopsy was performed the following day, July 29th. The pathologist noted vascular congestion within many internal organs, but no evidence of myocardial infarction (heart attack), myocarditis, aortic dissection, pulmonary embolism, or other causes of sudden death.

Return to Work Medical Evaluation Findings

After his second episode of lightheadedness, cramping, and difficulty breathing during training, which resulted in a hospital admission from July 25th-26th, the Cadet visited a primary care provider for evaluation of his readiness to return to work. At that visit, which took place on July 28th, 2022, the Cadet appeared well and had normal vital signs. He reported that he felt back to his physical baseline. Diagnoses noted at that visit were pre-syncope and dehydration, and the recommended treatment plan was consistent hydration during future strenuous activities.

At this visit, his physician signed a Return to Work Fitness for Duty Medical Certification form indicating that he could resume "full-time duties, no restrictions on essential duties".

Discussion

Malignant Hyperthermia

A definitive diagnosis was not established during his brief hospitalization, but several factors in the Cadet's history and clinical presentation are suggestive of malignant hyperthermia (MH). MH is a disorder of skeletal muscle, caused by genetic abnormalities leading to calcium dysregulation in the muscle tissue. It is a rare disorder, with an incidence between 1:10,000 and 1:250,000 per year [Kaur 2019].

Symptomatic MH is classically incited by exposure to volatile anesthetic agents or the muscle relaxant succinylcholine, but it has also been reported after strenuous exertion [Rosenberg 2007] [Ogletree 1996]. The Cadet had been participating in a rigorous training exercise at the time of illness onset.

The Cadet's marked muscle rigidity was noted by all providers, including EMS personnel, the ED physician, and ICU staff. This is consistent with MH and its effects on skeletal muscle contraction. Heat-related injury or heat stroke alone do not result in pronounced muscle rigidity. Rhabdomyolysis, while often accompanied by muscle pain, also does not cause rigidity.

Additionally, he had two prior episodes of similar illness before his death, with recovery in between. There are several reports describing patients diagnosed with malignant hyperthermia susceptibility after recurrent episodes of exercise intolerance with exertional rhabdomyolysis [Sambuughin 2009] [Kraeva 2017]. These first two episodes might have been sentinel events indicating an underlying predisposition, rather than illnesses caused by a one-time extreme circumstance, though the Cadet was never able to undergo genetic or other testing for MH susceptibility.

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The Cadet's core temperature on arrival at the ED was 37.6°C, or 99.7°F. This temperature does not reflect hyperthermia, but it is likely that EMS had taken steps to cool him prior to his arrival in the ED, and extreme hyperthermia is not observed in every case of MH [Larach 2006].

Malignant hyperthermia, rhabdomyolysis, and exertional heat stroke are independent clinical syndromes, but their causative mechanisms are complex and can be intertwined. Though MH was quickly suspected, the Cadet's illness onset during firefighting training required consideration of exertional rhabdomyolysis and exertional heat stroke, as these are known occupational risks to firefighters.

Rhabdomyolysis

Rhabdomyolysis is breakdown and necrosis of muscle fibers. This breakdown releases cellular products into the bloodstream and is responsible for the classic signs of rhabdomyolysis, including muscle pain, weakness, and dark-colored urine. Though rhabdomyolysis has many potential causes, most common is direct muscle injury, either through trauma or overuse. Close patient monitoring and hydration are critical in preventing kidney injury and other complications of rhabdomyolysis [Cervellin 2010].

Prior work by NIOSH has demonstrated an increased risk of rhabdomyolysis in firefighter cadets and instructors [NIOSH 2019]. Per the CDC's Rhabdomyolysis and Work fact sheet, both heat exposure and physical exertion are risk factors for development of rhabdomyolysis. [CDC 2024]. These risk factors are commonly present in firefighting work. While most sources of information on this topic note that the connection between these conditions is poorly understood and requires more study, there is a growing body of evidence that some individuals with prior episodes of exertional rhabdomyolysis are at risk of developing MH.

Exertional Heat Stroke

Both exertional heat stroke (EHS) and MH involve elevated body temperature, with the heat load generated by the contraction of skeletal muscle, but they have fundamentally different causes. MH is caused by abnormal calcium regulation in skeletal muscle leading to uncontrolled contraction and heat generation, and EHS is caused by physical exertion insufficiently offset by the body's normal cooling mechanisms. The Cadet in this case was at risk for EHS due to his strenuous exertion while wearing heavy gear that prevented heat dissipation; this is a well-recognized occupational hazard in firefighting work [NIOSH 2006] [NIOSH 2018] [NIOSH 2020a] [NIOSH 2020b]. Heat stroke alone, however, does not explain all of his clinical findings, and this caused his medical team to suspect MH.

It is increasingly recognized that certain people are predisposed to development of malignant hyperthermia when experiencing heat stress during strenuous exertion, blurring the line between these two conditions [MHAUS 2025]. This is of particular concern in firefighting work as strenuous activity in heat-trapping gear, potentially in proximity to an active heat source, is inherent. Authors of a 2002 paper on EHS and MH suggested that any individual with an EHS history should undergo MH screening [Grogan 2002]. While this may identify individuals at risk of further EHS or MH episodes, this screening would be very resource-intensive and is generally not performed. Strategies for preventing heat-related illness in firefighters, like encouraging sufficient hydration, gradual acclimatization to temperature and level of exertion when possible, and rapid identification of early heat stroke signs so cooling can be initiated, are critical to maintaining firefighter safety.

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Consumption Course

Consumption Courses are a commonly utilized drill in firefighter training. The purpose of this type of course is to identify and understand a FF's individual breathing limitations and air consumption through simulated fire ground activities. These types of drills allow FF's to further judge their levels of confidence and competence with their SCBA and ability to regulate breathing during physically strenuous activities. In this particular incident, the FD Training Academy had a judicious protocol in place requiring a paramedic to be on-site during these drills as this type of training can be both physically and psychologically demanding (Wilkinson, 2019).

Recommendations

Recommendation #1: Review policy on return-to-work medical evaluations as the candidate had 2 prior incidents within the previous 17 days that required medical attention.

Discussion: Due to the physically demanding activities required by FF training and FF activities, it is recommended that the FD review return-to-work policies and consider a light duty or an extended break period for personnel who have received medical care. Since the Cadet in this event had prior incidents with similar complaints, it would be prudent for a longer rest period to be explored for future situations that may arise.

Recommendation #2: Medical evaluations for Members and Cadets should be performed by a provider familiar with the physical and psychological demands of firefighting and the components of NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments.

Discussion: According to NFPA 1582, fire departments, or responsible agencies, should require that physicians be familiar with the physical demands of firefighting and the risks that firefighters encounter and should guide, direct, and advise members regarding their health, fitness, and suitability for duty [NFPA 2022]. The physician should review job descriptions and essential job tasks required for all fire department positions to understand the physiological and psychological demands of firefighting and the environmental conditions under which firefighters perform, as well as the personal protective equipment they must wear during various types of emergency operations and training. A focused medical assessment of heat related injury risk factors may be prudent.

FF training activities have been shown to be just as, and in some cases, more strenuous than actual fire suppression work (Wilkinson, 2019). By nature, firefighting work can be strenuous and unpredictable, but also carries a unique physiologic burden due to the weight of PPE and breathing workload due to SCBA use.

Although the Cadet in this incident did receive physician clearance as required, and FD leadership did approve it with their human resource department, it is unclear if the authorizing physician had an understanding of the unique physiologic burdens associated with FF training. It is recommended that firefighters and cadets seek care from providers with a thorough understanding of the occupation; if this option is not feasible, consider encouraging the distribution of a Providers Guide to Medical Evaluations where common risk factors and conditions are outlined.

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Recommendation #3: Consider feasible options for exertional heat illness monitoring during training including temperature assessment and rapid cooling utilizing NFPA 1584: Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises and the National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses.

Discussion: Heat stress is a known occupational hazard for the fire service. Structural firefighting PPE is fully encapsulating and can reduce the body's natural mechanisms for cooling. PPE also increases the physiologic burden or physical effort that a FF exerts due to the extra weight and can lead to an expedited increase in core temperature (NIOSH, 2024). Dehydration and prior heat illness are also independently predisposing risk factors for future heat related illnesses (NIOSH, 2018); In this case, the Cadet was diagnosed with dehydration two days prior to the event and had experienced similar, yet less severe, symptoms earlier in the month that although undiagnosed formally, may have also been an episode of dehydration or heat illness.

There are multiple shared signs and symptoms between MH and EHS such as high body temperature, muscle cramping//spasms and rapid diagnosis for the proper treatment is essential for survival in both conditions (Poussel, 2015). MH is a rare diagnosis, and most who are affected aren't aware of their underlying genetic susceptibility. EHS is much more common, and it is preventable. All on-scene first responders should understand EHS risk factors and emergency management, and it should be recognized and treated quickly to prevent firefighter morbidity and mortality.

It is recommended that the FD educate all members and providers on *NFPA 1584: Standard on the Rehabilitation Process for Members During Emergency Operations and Training Exercises.* NFPA 1584 outlines best practices for active and passive cooling. Although the Cadet in this incident was assessed promptly by on-site paramedics, it does not appear that aggressive and active cooling techniques were fully utilized. Accurate temperature monitoring in the field or training settings provide great logistical challenges, although may have been beneficial to expedite the decision to transport the Cadet.

Although caution was taken to move the Cadet into an air-conditioned room, it would be prudent to implement a manner to monitor temperatures and rapidly cool personnel. Logistics of accurately measuring core temperature are a significant barrier for the fire service, however the importance of this vital information provides key indicators for diagnosis and immediate action plans.

Review best practices for exertional heat from the National Athletic Trainers' Association Position Statement; this statement provides the currently accepted best practices for assessing and providing care for exertional heat illnesses.

Recommendation #4: Have onsite staff (e.g., paramedics) assess each Cadet's risk for heat-related illness prior to strenuous training, to include any training in full turnout gear; consider use of a checklist or other screening tool.

Discussion: A systematic pre-participation assessment can assist onsite staff to better assess each Cadet's suitability for training and identify any recent issues (illness, injury, medications, sleep deprivation, etc.) or ongoing factors (obesity, chronic disease, a tendency to be stoic, etc.) that may require closer monitoring throughout the training. Existing resources are available that could be used or modified for Academy use such as "Heat-Illness Screening Instrument" used by athletic trainers

[Eberman and Cleary 2011], or the ”Risk Assessment Worksheet” used by the U.S. Army [TRADOC 2016]. Both tools are used to determine readiness for strenuous activity.

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31-year-old Firefighter Cadet Collapses During Academy Training Exercise and Dies - Alabama

Investigator Information

This incident was investigated by the NIOSH Fire Fighter Fatality Investigation and Prevention Program's Medical Team based in the Division of Field Studies and Engineering in Cincinnati, Ohio. This investigation was conducted by Judith Eisenberg, MD, MS; Rob Saunders; and this report was coauthored by Judith Eisenberg, MD, MS, Andrea Wilkinson, MS, ATC/LAT, and Alexandra Barger, MD, MPH. Dr. Eisenberg is a board certified Emergency Medicine physician, Mr. Saunders is a former NIOSH Technical Information Specialist, Ms. Wilkinson is a Health Scientist, and Dr. Barger is a board-certified Internal Medicine physician. Mr. Saunders retired after 31 years with the Pike Township Fire Department, Indianapolis, Indiana. In addition to having served as a firefighter, paramedic, heavy rescue technician, and rescue diver, he has held the positions of Company Officer, Division Chief of Emergency Medical Services, Deputy Chief of Operations, and Fire Chief. Ms. Wilkinson is a fire service researcher and exercise physiologist. She is also an honorary Lieutenant for the Hanover Park Fire Department in Illinois.

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Appendix A

Consumption Course Drills

The training center has a 4-story training tower with interior and exterior stairwells. The consumption course consists of 10 skill stations. The stations are set up around the tower in a loop pattern. The stair climb uses the exterior stairwell, and the tire pull apparatus is attached to an exterior wall of the tower. The student is to complete 2 loops, doing each station twice. The student has 2 bottles of air to use and once both bottles are exhausted, the student will disengage the Mask-Mounted Regulator (MMR) and complete the evolution. The stations are as follows:

Station 1: Rafter Crawl The student will crawl across a set of rafters placed on the ground. The rafter prop will consist of 10 rafters placed on 2' centers.

Station 2: Wood Chop Using an 8-pound sledgehammer, the student will strike a 6 x 6-inch piece of wood for 2 minutes using a stopwatch to keep time.

Station 3: 2½ inch Hose Roll The student will unroll then roll a 2½ inch hose straight roll.

Station 4: Tire Pull Using ½ inch static kernmantle rope attached to a 4-inch pulley, the student will hoist a tire 22 feet into the air then control the decent back to the ground. The student will complete 1 set of 3 pulls. The tire will weigh 50 pounds.

Station 5: Stair Climb With a 2½ inch section of hose draped over the student's shoulder, the student will ascend and descend stairs until the student has met the required 71 steps ascending and 71 steps descending.

Station 6: Tire Drag Using an 18-wheeler tire and an 8 ft 1¾ inch piece of hose attached for dragging the tire, the student will drag the tire a distance of 100 ft.

Station 7: SCBA Bottle Carry The student will carry 2 SCBA bottles 50 ft, around a cone, then back 50 ft. The SCBA bottles will be filled with sand to weigh 40 lbs. each.

Station 8: Pipe Crawl The student will crawl through a 36-inch diameter pipe for a length of 20 ft.

Station 9: Ladder Shift Using a 14 ft roof ladder set at the proper angle for climbing, the student will shift the ladder a distance of 30 feet and reset the ladder at the proper climbing angle.

Station 10: Dummy Drag The student will drag a 115-pound dummy a total of 100 ft.