Cardiovascular Risk Factors Among Career Firefighters

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North American firefighters are predominately males who are relatively young (53.7% are 20 to 39 years old, 41.3% are 40 to 59 years old, and 5% are older than 60 years) (U.S. Fire Administration, 2007). Many retire between 50 and 55 years of age due to the extreme physical demands of firefighting, but are also encouraged by incentives for early retirement. The public has significant expectations of these servants, the most basic of which are that firefighters will focus on safety for themselves, their colleagues, and the community.

Between 1994 and 2004, 368 on-duty firefighters died (excluding those who died at the World Trade Center) among 316,950 career firefighters in the United States (Centers for Disease Control and Prevention [CDC], 2006). The “cost” of these deaths includes the emotional toll on families and colleagues, work force deficit, loss of knowledge, and direct financial impact on the community and families. Of these deaths, 39% were heart attacks, 29% other causes (e.g., burns, cerebral vascular accident, or drowning), 20% asphyxiation, and 12% motor vehicle-related trauma (CDC). Given the significant number of firefighter deaths related to cardiovascular disease (CVD), it is necessary to identify risk factors and develop intervention programs to prevent or reduce fatalities through early detection and treatment. The purpose of this study was to identify CVD risk factors among firefighters through an extensive literature review. Specifically, this review answers three questions:

1. What are the energy demands imposed by firefighting?
U.S. firefighters do not appear to benefit from the healthy worker effect, may be part of the national obesity epidemic, and have cardiovascular risk profiles similar to the general population. Demanding work, heavy gear, and occlusive clothing, combined with the emergent nature of fire and rescue situations, may place firefighters at increased risk for cardiovascular events, especially if undiagnosed or undertreated cardiovascular disease exists. Hypertension and hypercholesterolemia are significantly undertreated in this population. Occupational health nurses can be the education and communication facilitators for firefighters and primary care providers who may not be aware of the increased cardiovascular risks potentially associated with firefighting demands. Occupational health nurses are uniquely positioned to assess cardiovascular risks and implement programs to reduce these risks among career firefighters.

METHOD
An extensive literature review (2006 to 2009) was conducted using several library databases, including PubMed and the Cumulative Index of Nursing and Allied Health Literature (CINAHL). Keywords used included firefighter, male, sudden cardiac death, mortality, cardiovascular, obesity, hypertension, lipids, aging, fitness, and occupational health. This review was limited to peer-reviewed studies published in English and excluded female career firefighters.

A consideration when discussing firefighter mortality is the impact of the “healthy worker effect” (HWE). The HWE is “an observed decrease in mortality in workers when compared to the general population” (Choi, 1992, p. 980). Standardized mortality ratio (SMR) is an indirect age adjustment statistic used to compare death rates due to a specific cause between an occupational group and the general population (Gordis, 2004). An SMR of 100 is equal risk between groups; less than 100 indicates fewer deaths than expected; and more than 100 indicates more deaths than expected (Gordis). The HWE generally accounts for a 20% to 30% reduction in mortality in SMRs (Choi).

FINDINGS
Findings of the literature review are organized to answer the three questions.

1. **What are the energy demands imposed by firefighting?**
   Efforts to define work energy demands of firefighting have focused on determining the metabolic equivalent (MET) levels required to safely perform fire suppression duties. A MET is a multiple of the resting metabolic rate and is commonly estimated using standardized equations (Froelicher & Myers, 2006). The range of METs suggested or observed in the literature is from 9.6 (Sothmann, Saupe, Jasenof, & Blaney, 1992) to 14 (Malley et al., 1999). Ten METs is roughly equivalent to jogging a 10-minute mile; 14 METs is similar to extended activities such as running or rowing competitively, or bicycle racing at a high level (Fletcher, Froelicher, Hartley, Haskell, & Pollock, 1990).

   A comparison of heart rates, with varying weights of self-contained breathing apparatus during simulated fire drills, found that heart rate increased to 70% to 80% of maximum predicted within the first minute of the exercise, regardless of type or weight of breathing gear. Heart rate continued to increase to 90% to 100% of predicted maximum and remained there until the fire was extinguished (Manning & Griggs, 1983).

   Maximum heart rate and VO$_2$max were compared for firefighters who performed maximal work on a stair-climbing machine versus a treadmill. VO$_2$max is the maximum volume of oxygen that an individual can process with aerobic metabolism. VO$_2$max, also known as peak VO$_2$, is an objective, clinical measure that defines the limits of cardiopulmonary function. Peak VO$_2$ directly reflects individuals’ ability to increase their heart rate and stroke volume and redirect oxygenated blood to muscles for work on demand. Exercising at a level beyond which the cardiopulmonary system can adequately supply oxygen (commonly termed the anaerobic or ventilatory threshold, or VT) involves a greater degree of oxygen-independent muscle metabolism, which is dramatically less efficient than aerobic metabolism, and can compromise cardiovascular function (Froelicher & Myers, 2006). The stair-climbing machine resulted in significantly lower VO$_2$max and maximum heart rate without wearing personal protective equipment (PPE) (Ben-Ezra & Verstraete, 1988). Similarly, 10 firefighters completed submaximal treadmill tests with VO$_2$max measurements; they then completed a set of simulated tasks in PPE (Sothmann et al., 1991). Although heart rate with suppression tasks was not significantly different from heart rate at exhaustion on the treadmill, VO$_2$max with simulated suppression tasks was significantly less than predicted by the treadmill (Sothmann et al.).

   Researchers and firefighters collectively determined the most strenuous tasks in firefighting (reported in order of difficulty) as (1) carrying equipment up stairs in a high-rise building; (2) advancing charged hoses; (3) breaking down doors, walls, ceilings, and roofs; (4) raising ladders; (5) working overhead; and (6) rescuing victims (Gledhill & Jamnik, 1992). The most difficult tasks (i.e., numbers 1 and 2) required 11.9 METs, representing 85% of VO$_2$max (Gledhill & Jamnik). The less arduous tasks (i.e., numbers 5 and 6) required 6.6 METs, which represented 50% of VO$_2$max (Gledhill & Jamnik).

   Another study compared task simulations in three uniforms to a baseline maximum stress treadmill and ac-
tual VO$_{2 \text{max}}$ measured in workout clothes (Malley et al., 1999). Each firefighter repeated a treadmill test to exhaustion on three separate occasions, wearing three separate uniforms (traditional, modern, and modified modern), including PPE. Regardless of uniform type, each firefighter surpassed his anaerobic threshold at 1 minute, 70% of his VO$_{2 \text{max}}$ by 3 minutes, and 90% of his VO$_{2 \text{max}}$ by the end of the exercise and reached his maximum heart rate (Malley et al.). This study showed a negative relationship between age and VO$_{2 \text{max}}$, and that uniform type influenced exercise time significantly.

In contrast to objective measurements, self-perception of fitness and measured aerobic capacity did not demonstrate a relationship (Peate, Lundergan, & Johnson, 2002). A total of 92 firefighters completed a self-assessment of their fitness level and had VO$_{2 \text{max}}$ estimated from two tests (5-minute step test and submaximal stress treadmill). No association was found between the firefighters’ self-perception of fitness and estimated aerobic capacity (Peate et al.).

Twelve firefighters randomly exercised on graded treadmills to exhaustion in workout clothes, and then in full PPE. VO$_{2 \text{max}}$ was 17.3% lower in the PPE than in the workout clothes (Dreger, Jones, & Petersen, 2006).

All of these studies reinforce the concept that the energy demands of firefighting are significant. Studies of the accuracy of firefighters’ self-perceptions of effort remain inconclusive.

2. What is the CVD risk profile of firefighters?

Overall Firefighter Cardiovascular Risk Profiles. The RISKO cardiac index (Michigan Heart Association, 1967) was calculated for 4,066 Los Angeles County safety personnel, of whom 1,825 were firefighters. Compared to lifeguards, marshals, and sheriffs, firefighters had the second lowest risk score despite being the oldest cohort (Thomas, Cady, O’Connell, Bischoff, & Kershnan, 1979).

In 1982, firefighters were matched to veterans enrolled in the Normative Aging Study in Boston and monitored for 10 years (Dibbs, Thomas, Weiss, & Sparrow, 1982). The firefighters were at lower risk for developing CVD than the comparative population of veterans (Dibbs et al.).

Of the 43 on-duty firefighter deaths in North Carolina between 1972 and 1985, 23 were due to CVD (Fort & Griggs, 1987). Only 6 of the 23 victims had a history of CVD, highlighting the need for early identification and intervention.

In a study by Licciardone et al. (1989), 452 firefighters in Dallas, Texas, with ages ranging from 18 to 59 years, completed physical examinations, serum chemistry and lipid profiles, resting and exercise stress electrocardiograms (ECCGs), and body fat assessment. Hypercholesteremia and obesity were commonly found, but Framingham Risk Equations (National Institutes of Health, National Heart, Lung and Blood Institute, 2005) of the cohort did not differ from those of age-matched men in the general population (Licciardone et al.).

Between 1984 and 1992, 806 Cincinnati firefighters participated in comprehensive periodic examinations, including a thallium treadmill (Glueck et al., 1996). This study found that firefighting was not associated with an increase in cardiovascular event rates. CVD was related to modifiable risk factors (i.e., blood pressure, cholesterol, and cigarette smoking). No relationship was found between smoke inhalation during fire suppression and cardiovascular death.

The most-studied firefighter cohort to date is from Massachusetts. There, the relationship between cardiovascular risk factors and fitness for duty was explored among Hazardous Material (HazMat) firefighters (Kales, Aldrich, et al., 1999). The study found that lower predicted aerobic capacity (VO$_{2 \text{max}}$) and lower spirometric function, combined with an increase in age, cholesterol, and weight, resulted in increased cardiovascular risk. More important, the findings underscore that not one indicator but often multiple factors predispose firefighters to CVD.

In a 2003 case-control study using national data, 52 cardiovascular on-duty deaths were compared to 51 non-cardiovascular on-duty deaths between 1996 and 2002 among the male subjects of the HazMat cohort from Massachusetts (n = 310) (Kales, Soteriades, Christoudias, & Christiani, 2003). An important finding was the time of cardiovascular death: firefighters most often had cardiac death between noon and midnight, whereas the general population most frequently dies of cardiovascular events between 6 a.m. and 12 p.m., regardless of work shift pattern. The time of firefighter death corresponds to the period of high-intensity emergency dispatches in most fire departments. The second significant finding was the increased odds of firefighter cardiac death being associated with suppression activities (Kales et al.). Traditional risk factors (i.e., age, smoking, diabetes, and hypertension) were found more frequently among the victims of cardiovascular death than the controls.

Firefighter Framingham risk equation scores (based on a one-time physical examination and laboratory evaluation) were compared to Framingham risk equation scores of an age-matched “healthy” group (same age, optimal blood pressure, total cholesterol between 160 and 199 mg/dl, high density lipoprotein [HDL] ≥ 45 mg/dl, no diabetes, and no history of smoking). The percentage of firefighters exceeding the “low coronary heart disease risk category” for each factor ranged from 40% to 87% (Byczek, Walton, Conrad, Reichelt, & Samo, 2004). As a group, firefighters had a higher prevalence of obesity, lower HDL, higher low-density lipoprotein (LDL), and higher total cholesterol than the healthy group (Byczek et al.).

Comparing 362 Massachusetts firefighters, members of the Massachusetts HazMat cohort who qualified for “heart presumption retirements,” a compensable workers’ compensation injury or illness, between 1997 and 2004, researchers concluded that of the retirement group, 42% of the retirements were related to on-duty events (Holder, Stallings, Peoples, Burress, & Kales, 2006). Retiree cardiovascular risk factors (i.e., age, current cigarette smoking, diabetes, or prior arterial occlusive disease) were
all independent significant predictors of heart disease presumptive retirement, with age being the strongest predictor. This analysis also determined that the risk of an on-duty event was highest during fire suppression activity (odds ratio [OR] = 51; 95% confidence interval [CI] = 12, 223) (Holder et al.).

When the relationship between firefighter activity and risk of a cardiac event is examined, only 1% to 5% of firefighters’ time on task is spent on actual fire suppression, although the majority of cardiac events occur during suppression activities. Cardiovascular line-of-duty death (LODD) was associated with fire suppression (32%); responding to an alarm (13.4%); returning from an alarm (17.4%); engaging in physical training (12.5%); attending non-fire emergencies (9.4%); and performing non-emergency duties (15.4%) (Kales, Soteriades, Christophi, & Christiani, 2007).

The seasonality of firefighter cardiovascular LODD does not appear to match the seasonality of cardiovascular death in the U.S. population for spring and summer but does for winter (Mbanu et al., 2007). When type of duty preceding death was included in the analysis over time of year of death, the risk of fire suppression-related on-duty death is highest in winter (32%), lowest in spring (15%), spikes to 30% in summer, and is 23% in fall.

Eighty-seven acute on-duty cardiovascular deaths occurred among all firefighters between 1996 and 2006 (National Institute for Occupational Safety and Health, 2007). The cardiovascular risk profile of this group was compared to 113 firefighters who experienced a non-fat, on-duty, career-ending cardiovascular event in Massachusetts between 1997 and 2004 to determine any specific predictors of a fatal cardiovascular event. Current smoking, hypertension, and previous diagnoses of CVD, carotid stenosis, or peripheral arterial disease were significant predictors of a fatal outcome in on-duty events (Geibe et al., 2008).

Obesity. A commonly used formula for determining obesity is the body mass index (BMI) (body weight in kilograms divided by height in meters squared) (McPhee & Pignone, 2005). The majority (87%) of the Massachusetts HazMat cohort had a BMI over 25, with 34% over 30 (Kales, Polyhronopoulos, Aldrich, Lettao, & Christiani, 1999). The mean BMI was 28.9, which is above the 85th percentile for men based on the National Health and Nutritional Examination Survey II data (NHANES II; Van Itallie, 1985). Given the limitation of BMI to distinguish between fat and muscle mass (Jette & Sidney, 1990), this percentage seems to indicate that a higher proportion of firefighters are obese than the general population (Kales, Polyhronopoulos, et al.).

Analysis of Texas firefighters yielded similar results (Clark, Rene, Theurer, & Marshall, 2002). On the basis of BMI criteria proposed by the World Health Organization (2008), 80% of the sample was classified as being overweight to obese (BMI ≥ 25). With the “standard” criteria of Kales, Polyhronopoulos, et al. (1999), 60% were classified as obese. Allowing a BMI of 25 to 26.9 to represent increased muscle mass, the majority of these firefighters (mean BMI = 28.8) remain above the 85th percentile of the general population (Kales, Polyhronopoulos, et al.).

At baseline, the average BMI of the HazMat cohort was 28.9 (± 4.1) (Kales, Polyhronopoulos et al., 1999); after 5 years, it increased by 0.8 to 29.7 (± 4.3) (Soteriades et al., 2005). The prevalence of obesity (BMI > 30) increased significantly during the study period, from 34.9% in 1996 to 1997 to 39.7% in 2001; more important, extreme obesity (BMI > 40) increased fourfold during the same period (Soteriades et al.). Cardiovascular risk factors (i.e., age, smoking, hypertension, increased total cholesterol or LDL, decreased HDL, and increased fasting glucose) were also associated with weight increase.

Analysis of obesity and job disability in the HazMat cohort demonstrated that for every unit increase in BMI, an associated 5% increase in risk of job disability occurred (Soteriades, Hauser, Kawachi, Christiani, & Kales, 2008). Obesity has previously been linked to cardiovascular events at work; it may also place firefighters in danger of acquiring non-cardiac, career-ending disabilities.

The national obesity epidemic is reflected in firefighter and emergency medical response recruits. Of 370 firefighter (n = 210) and ambulance (n = 160) recruits (age range of 18 to 34 years) examined in Massachuetts between 2004 and 2007, 43.8% were overweight (BMI = 25 to 29.9) and 33% were obese (BMI > 30) (Tsismenakis et al., 2009). Of equal concern is the significant association between increased BMI and increased blood pressure, higher total cholesterol, and decreased exercise tolerance (Tsismenakis et al.).

Hypertension. The first of three hypertension studies of the HazMat cohort showed that 10% of the study population had blood pressures higher than 140/90 mmHg (Stage I hypertension according to the 6th Joint National Committee on the Prevention, Detection, Evaluation and Treatment of Hypertension guidelines [JNC6]) (Kales et al., 1998; National Institutes of Health, National Heart, Lung and Blood Institute, 1997). The second study showed that firefighters with Stage II hypertension (JNC6, > 160/100 mmHg) who were not receiving treatment were two to three times more likely to experience adverse employment events or outcomes (i.e., retirement, termination, injury, or illness) when compared to the normotensive, or treated hypertension groups (Kales et al., 2002). Both groups were adjusted for age, BMI, smoking, cholesterol, and medication. Those with Stage II hypertension were also found to be older and more obese than those with Stage I and those who were normotensive (Kales et al., 2002).

The third study directly addressed untreated Stage I hypertension (> 140/90 mmHg) (Soteriades, Kales, Li- arokapis, & Christiani, 2003). At baseline (1996), the prevalence of Stage I or higher hypertension in this cohort was 20%; in 1998 and 2000, it was 23%. During each examination period, only 17% (1996), 25% (1998), and 23% (2000) of those diagnosed were taking antihypertensive medication. Approximately 74% of the cohort with identified hypertension were untreated, or inadequately controlled, after 4 years of monitoring (Soteriades et al.). A recent recommendation is for emergency responders (including firefighters) to be subject to duty limitations, similar to those found in Department of Transportation
licensing, for untreated or uncontrolled hypertension. Based on the level of hypertension, firefighter assignments would range from full to modified duty with a prescribed time period to bring the hypertension under control (Kales, Tsismenakis, Zhang, & Soteriades, 2009).

**Lipids.** The average cholesterol level of the HazMat cohort declined from 224 mg/dl at baseline to 214 mg/dl at follow-up, and the percentage of hypercholesteremic career firefighters who were being treated increased from 3% at baseline to 12% at second screening (Soteriades et al., 2002). However, the percentage of hypercholesteremic career firefighters at baseline and second screening who were untreated remained high (78%) (Soteriades et al.).

**Age.** Age, particularly for men older than 65 years, is the most significant risk factor for CVD (Libby, 2005). Cardiopulmonary fitness, as measured by heart rate, VO₂max (aerobic capacity), and stroke volume, decreases with advancing age (Britton et al., 2007; Hollenberg, Ngo, Turner, & Tager, 1998). The “early retirement” of firefighters seems to reduce their potential acquisition of CVD while actively employed as firefighters. However, this may not be of benefit, as the average age at cardiac-related, on-duty death is 44 years (CDC, 2006).

Age may be a bona-fide occupational criterion for firefighting, particularly as it relates to cardiopulmonary fitness, most notably VO₂max (Sothmann, Landy, & Saupe, 1992). The first described range of VO₂max deemed necessary to perform fire suppression activities was 25 to 35 ml/kg⁻¹ x min⁻¹ (Sothmann et al., 1991). Review of subsequent literature recommended that firefighters, regardless of age, have a VO₂max of 33.6 to 42 ml/kg⁻¹ x min⁻¹, which would allow for reserve above the observed work demand (Malley et al., 1999; Sothmann, Saupe, Jasenof, & Blaney, 1992).

The effect of aging on firefighters was observed over 17 years in a California suburban department (Davis, Jankovitz, & Rein, 2002). Comparing physical fitness results of younger (20 to 29 years) and older (50 to 59 years) firefighters, VO₂max decreased 27.7%; push-ups decreased 45.6%; sit-ups decreased 40%; flexibility decreased 9.6%; and body fat increased from 13.3% to 22.4% (Davis et al.). However, firefighters were more fit than the general population in all age groups (Davis et al.). Although firefighters appeared to maintain better than average levels of fitness, the overall decline with time, especially in aerobic capacity, is of concern.

Findings for cardiovascular risk factors indicated that firefighters were closely aligned with their age-matched NHANES comparison group (U.S. Department of Health and Human Services, 1996). However, during the 17 years of observation, the percentage of firefighters who acquired cardiovascular risk factors was considerable. Comparing younger (20 to 29 years old) to older (50 to 59 years old) firefighters, the presence of hypercholesteremia increased from 21.7% to 73.7%; LDL (> 130 mg/dl) increased from 18.8% to 78.9%; total cholesterol to HDL ratios over 5 increased from 16.7% to 31.6%; and hypertension increased from 12% to 31.6% (Davis et al., 2002).
No association between cardiovascular mortality and occupation was found in Boston (Musk et al., 1982), Connecticut (Sardinias et al., 1986), New Jersey (Feuer & Rosenman, 1986), Buffalo (Vena & Fiedler, 1987), San Francisco (Beaumont et al., 1991), Seattle, Tacoma, and Portland (Demers et al., 1992), Edmonton/Calgary (Guidotti, 1993), Toronto (Aronson et al., 1994), or Florida (Ma et al., 2005). When Seattle was studied independently, those firefighters with more than 30 years of employment had a cardiovascular SMR of 103 (Heyer et al., 1990); and in Philadelphia, the cardiovascular SMR of 109 was statistically significant (Baris et al., 2001).

The literature indicates that firefighters, regardless of where they work, do not appear to be at increased risk for cardiovascular death, with some exceptions for career spans that preceded the use of sophisticated PPE. Of concern are the variable time periods of the cohorts and the latency associated with CVD. The overall data do not suggest that firefighters are at increased risk for CVD, and most studies demonstrate cardiovascular SMRs below 100.

**DISCUSSION**

This review is limited by studies that have small sample sizes with significant self-selection bias. Much of the published work has been limited to groups that do not represent the geographic or age diversity of most firefighters. Early research is focused on whether firefighting increases cardiovascular risk, whereas more contemporary work is focused on the energy demands of firefighting.

The impact of demanding work with heavy gear is repeatedly established in the literature. When the demands of work in a stressful environment, with extreme temperatures, space and time constraints, smoke, noise, and dust and chemical exposures, are considered, it is reasonable to assume that cardiac stress might be significant. Based on the previously discussed findings of Peate et al. (2002), inaccurate self-perception of fitness could lead to inappropriate judgment regarding one’s ability to complete a task under duress.

The cardiovascular risk profile consists of nonmodifiable risk factors (i.e., age > 65 years; male; positive family history of CVD in a first-degree relative; and ethnicity) and modifiable risk factors (i.e., obesity; physical inactivity; diet; smoking; hypertension; diabetes; hyperlipidemia; and possibly stress and alcohol use) (National Institutes of Health, National Heart, Lung and Blood Institute, 2005). Male firefighters have at least one nonmodifiable risk factor (gender) and may have family history and ethnicity factors (age > 65 years is unlikely). Based on this review of three modifiable risk factors (obesity, hypertension, and hyperlipidemia), it appears that firefighters have risk profiles similar to the general population. They may be overweight and have hypertension and hypercholesterolemia, often undetected or undertreated.

Firefighters may have had a greater occupational risk for CVD prior to the widespread use of PPE, but currently no evidence exists that firefighters have an increased risk of all-cause mortality, or cardiovascular mortality, when compared to the general population. In general, firefighters have slightly lower levels of cardiovascular mortality than the general population, but not as much as would be expected in a population that is initially selected for its fitness and lack of evident preexisting disease. The loss of the HWE over time may be due, in part, to the stress and extreme work demands of firefighting. The primary problem, however, appears to be that firefighters may succumb to the same epidemic of obesity and untreated hypertension and hyperlipidemia as in the general population, and those morbidities may be negatively affecting the HWE as well.

**CONCLUSION**

It would appear that firefighters in North America do not have HWE protection. This may be due, in part, to the obesity epidemic, untreated hypertension and hyperlipidemia, and increased risks associated with age. Firefighters have extreme energy demands from their work. All of these factors may contribute to the incidence of cardiac-related on-duty death.

Occupational health nurses and nurse practitioners have many opportunities to intervene with this population and reduce modifiable risk. Areas of prime influence are nutrition and cardiovascular status, including education, access to healthy foods, and healthy weight goals (International Association of Fire Fighters, 1999), and continued focus on heart-healthy behaviors, including appropriate use of PPE, smoking cessation, and exercise. Occupational health nurses and nurse practitioners are uniquely positioned to counsel firefighters directly, as well as to design programs within fire departments to assess risk, develop and implement various interventions, evaluate the effects of interventions, and perhaps, most important, convey the unique demands and risks of firefighting to community providers. Given the major risk factors among firefighters, an argument can be made that early detection of risk, as well as ongoing surveillance of firefighters who are identified as having cardiovascular risk factors, is justified and deserves evaluation. This review illustrates the effectiveness of health surveillance, as well as the frustration of being unable to rectify health problems without the support and assistance of primary care providers. It is unknown if the “disconnect” between diagnosis and treatment is related to firefighter communication or primary care providers not understanding the unique requirements of firefighting and its potential toll on the cardiovascular system. Occupational health nurses and nurse practitioners can intervene to assist firefighters and primary care providers to better understand the risks associated with untreated cardiovascular risk factors in firefighters and the need for aggressive evidence-based risk reduction interventions (Soteriades et al., 2003).
The aim of prevention is to monitor cardiovascular risk status, encourage healthy behaviors, and implement timely and appropriate interventions to reduce morbidity and mortality in firefighters. These efforts will be beneficial to firefighters, their families, the fire service, and the communities served.

REFERENCES


Cardiovascular Risk Factors Among Career Firefighters

This issue of the AAoHN JOURNAL contains a Continuing Nursing Education Module on “Cardiovascular Risk Factors Among Career Firefighters.” 1.0 contact hour of continuing nursing education credit will be awarded by AAoHN upon successful completion of the posttest and evaluation.

A certificate will be awarded and the scored test will be returned when the following requirements are met by the participant: (1) The completed answer sheet is received at AAoHN on or before September 30, 2010; (2) A score of 70% (7 correct answers) is achieved by the participant; (3) The answer sheet is accompanied by a check or money order for $15.00 ($20.00 non-members), or purchase online for $10.00 ($15.00 non-members) at www.aaohn.org. Expect up to 4 weeks for delivery of the certificate.

Upon completion of this lesson, the occupational health nurse will be able to:
1. Describe the energy demands of firefighting.
2. Discuss the cardiovascular disease risk profile of firefighters.
3. Discuss firefighters’ risk for all-cause or cardiovascular mortality.
AAoHN is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center’s Commission on Accreditation. AAoHN is additionally approved as a provider by the California Board of Registered Nursing (#CEP9283) and the Louisiana State Board of Nursing (#LSBN3).

Contact hour credits received for successful completion of the posttest and evaluation may be used for renewal, certification, or re-certification.

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Directions: Circle the letter of the best answer on the answer sheet provided. (Note: You may submit a photocopy for processing.)

1. According to the Centers for Disease Control and Prevention (2006), 39% of firefighter deaths were due to:
   A. Burns.
   B. Heart attacks.
   C. Cardiovascular events.
   D. Asphyxiation.

2. A standardized mortality ratio of ____ indicates an equal risk of deaths between an occupational group and the general population.
   A. 80.
   B. 90.
   C. 100.
   D. 110.

3. Which of the following is the most strenuous task in firefighting (Gledhill & Jamnik, 1992)?
   A. rescuing victims.
   B. Advancing charged hoses.
   C. Raising ladders.
   D. Carrying equipment up stairs in a high-rise building.

4. In the Gledhill and Jamnik study (1992), the most difficult task required how many metabolic equivalents?
   A. 13.6.
   B. 11.9.
   C. 8.4.
   D. 6.6.

5. Which of the following is a finding in the Kales et al. (2003) study?
   A. Firefighter cardiac death was associated with fire suppression activities.
   B. Work shift patterns had a significant effect on firefighter cardiac deaths.
   C. Traditional risk factors were found most frequently in the controls.
   D. Firefighters most often had cardiovascular death between 6 a.m. and 12 p.m.

6. In the study by Byczek et al. (2004), firefighters as a group had:
   A. Higher high-density lipoproteins.
   B. Higher prevalence of obesity.
   C. Lower low-density lipoproteins.
   D. Lower total cholesterol.

7. According to Mbanu et al. (2007), when type of duty preceding death was included in the analysis over time of year of death, the risk of fire suppression-related on-duty death was highest in the:
   A. Summer.
   B. Fall.
   C. Winter.
   D. Spring.

8. In the study by Clark et al. (2002), ____% of the sample was classified as being overweight to obese (body mass index > 25).
   A. 50.
   B. 60.
   C. 70.
   D. 80.

9. What is the most significant risk factor for cardiovascular disease?
   A. Age.
   B. Hypertension.
   C. Hypercholesteremia.
   D. Smoking.

10. Which of the following is true in relation to firefighters and all-cause mortality?
    A. Firefighters have all-cause mortality rates generally greater than the general population.
    B. Firefighters have healthy worker effect protection.
    C. Most studies demonstrate cardiovascular standardized mortality ratios below 100.
    D. Study findings show an association between cardiovascular mortality and occupation.
Cardiovascular Risk Factors Among Career Firefighters
October 2009

(Goal: To gain ideas and strategies to enhance personal and professional growth in occupational health nursing.)

Mark one answer only!
(You may submit a photocopy of the answer sheet for processing.)

1. A B C D
2. A B C D
3. A B C D
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5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D

EVALUATION (must be completed to obtain credit)
Please use the scale below to evaluate this continuing education module.

1. As a result of completing this module, I am able to:
   A. Describe the energy demands of firefighting.
   B. Discuss the cardiovascular disease risk profile of firefighters.
   C. Discuss firefighters’ risk for all-cause or cardiovascular mortality.
2. The objectives were relevant to the overall goal of this independent study module.
3. The teaching/learning resources were effective for the content.
4. How much time (in minutes) was required to read this module and take the test?

Please print or type: (this information will be used to prepare your certificate of completion for the module).
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