

PHYSICAL FITNESS INITIATIVES IN THE FIRE SERVICE—BARRIERS AND BENEFITS

INTRODUCTION

Firefighters across the United States may be not meeting the recommended fitness levels based on the cardiovascular and metabolic demands of the occupation (7,21,33). Recent statistics indicate that firefighters are at an increased risk of cardiovascular incidents or injury (10,17), which may stem from the strenuous nature of the profession combined with a high prevalence of firefighters being overweight or obese (33). Although recruits are required to undergo extensive training programs, many departments fail to uphold fitness standards among incumbent firefighters. As individuals settle into firehouse culture, unhealthy behaviors (e.g., lack of physical activity, poor sleep habits, and unhealthy diet) may arise and leave firefighters physically unprepared for duty (16). While many of the governing bodies of the United States Fire Service (e.g., National Fire Protection Association (NFPA), International Association of Fire Chiefs (IACF), and International Association of Firefighters (IAFF) encourage mandatory annual health screenings and on-duty exercise, only an estimated 27% of United States departments actually provide such resources (12). Therefore, the purpose of this article is to identify and discuss some barriers and benefits of training initiatives among professional firefighters.

BARRIERS

INTRAPERSONAL

Barriers to physical training may occur at the individual or departmental level. A qualitative study analyzing the perception of training initiatives identified that firefighters may avoid working out while on shift for fear that it could interfere with response to an emergency call (22). For instance, it was reported that training on-duty was avoided so as to not arrive at a scene fatigued. While this is a major concern for firefighters, a study by Dennison et al. sought to examine the effects of exercise on occupational performance (9). To represent a worst-case scenario, participants engaged in simulated fireground tasks (i.e., stair-climb, hose drag, equipment carry, ladder raise, forcible entry, and search and rescue) 10 min following a fatiguing circuit training exercise protocol. Results indicated that while exhaustive exercise hindered fireground performance, physically trained firefighters outperformed their untrained and non-fatigued counterparts, even in a fatigued state. Even so, it has been recommended to avoid exhaustive exercise (e.g., near-max efforts, rating of perceived exertion 9 – 10) while on-duty or to exercise during low call volume times to ensure peak performance (1).

Another potential barrier may be that many firefighters are unaware of their current health status. Baur et al. reported that, of 768 professional firefighters, approximately 68% underestimated their respective BMI classification (4). Moreover, firefighters

self-perceived fitness levels did not align with actual fitness measured by aerobic capacity (31). Due to this lack of personal awareness, the perceived need to improve health may be diminished (36). Through the provision of mandatory, non-punitive health screenings and appropriate consultations, firefighters can potentially identify these weaknesses and begin improving upon poorer components of health (36).

INTERPERSONAL

Similar to the general population, lack of self-motivation and ambivalence can be highly influenced by social groups (e.g., firehouse culture), and are frequently reported deterrents to exercise among firefighters (6). One recent study noted the negative impact food cultural (i.e., snacking, grazing, and eating out) can have on exercise routines in the firehouse (24).

Interpersonal relationships can, however, have a positive influence on firefighter fitness. Competition and camaraderie appear to be particularly strong motivators among this profession (22,23). It is possible that the initiation of group-based exercise sessions may improve exercise adherence, shift cohesion, and create a sense of accountability. Additionally, firefighters can become qualified to lead such sessions with certifications such as the Tactical Strength and Conditioning Facilitator® (TSAC-F®) through the National Strength and Conditioning Association (NSCA) or Peer Fitness Trainer certification through the American Council on Exercise (ACE).

INSTITUTIONAL

One prominent barrier from the departmental level is a lack of funding, especially among many smaller communities (12). However, a lack of space or equipment should not be considered an impediment to exercise. Although supplying each station with fitness equipment may be unfeasible, recommended alternatives include incorporating one centralized location, involving a contracted fitness center, or utilizing available outdoor space (18). Moreover, body weight exercises and plyometrics can sufficiently improve strength and force production (8), with the addition of firehouse equipment (e.g., stairs, hoses, chains) to be used as external weight when appropriate (30). Grants, such as the Assistance to Firefighters Grant programs, are also available for the promotion of health initiatives.

BENEFITS

PHYSICAL HEALTH

Firefighters have been shown to demonstrate multiple impaired health metrics, including increased levels of adiposity, hypertension, and dyslipidemia (7,13). This is of concern, as each is considered a risk factor for cardiovascular disease. Of

particular importance, high blood pressure has been shown as a strong predictor of fatal cardiovascular incidents (13). Fortunately, lifestyle changes, such as increased physical activity and improved diet, can help promote favorable body composition and blood panels. Additionally, more fit firefighters have shown fewer cardiac abnormalities during stress testing (5) and fewer injuries (32) than their less fit counterparts.

Many previous studies have evaluated the efficacy of training initiatives among the fire service. For example, a study by Poston and colleagues sought to determine the benefits of health promotion programs within the fire service (34). In this study, researchers compared 10 departments that complied with multiple crucial components of the IAFC and IAFFs' Wellness Fitness Initiative (WFI) to 10 departments that did not. Results indicated that the departments that provided employees with annual health screenings, a health and fitness coordinator, peer fitness trainers, and time to exercise while on-duty tended to demonstrate more desirable physical, behavioral, and mental health. More specifically, WFI compliant departments were 42% less likely to be obese and more likely to be cognizant of current weight status. Additionally, these firefighters reported more physical activity, greater estimated aerobic capacity (VO_{2max}), job satisfaction, and lower incidence of hypertension.

Likewise, a recently published meta-analysis by Andrews et al. calculated that exercise interventions among firefighters were capable of eliciting significant moderate-to-large improvements in body fat percentage (-7.73%), aerobic capacity (+8.7%), endurance (+17.61%), strength (+8.83%), and power (+5.28%) (3). Controls, in contrast, demonstrated a <1% mean change in the same metrics, with the exception of strength (+2.48%). Furthermore, the authors concluded that a program structured around resistance training may be the most efficacious among firefighters, as those studies in particular observed the greatest number of improvements. It may be worth noting that while exercise interventions elicited improvements in four of the five components of physical fitness, non-significant improvements were reported for flexibility. These results may suggest that emphasizing flexibility training may be necessary for improving flexibility or mobility.

JOB PERFORMANCE

Departments may also benefit from health promotion programs as it applies to improved job performance. Occupational tasks can require high amounts of aerobic fitness ($\geq 44 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) and muscular strength ($\geq 68 \text{ kg}$) for extended periods of time (14). Adding strain caused by the environment (e.g., heat, anxiety, dehydration), these tasks are performed in protective gear weighing at least 23 kg (28). If a firefighter is physically unable to execute these tasks in harsh conditions, the safety of the public, engine, and self are placed at risk.

Considering the physical demands associated with the job, it is apparent that more fit individuals are more likely to better execute physical job tasks. To further support this, an abundance of previous literature has reported associations between fitness and job performance (25,26,29,35). For instance, Michaelides et al. found that upper-body and abdominal strength, upper-body endurance, and anaerobic power all contributed to enhanced performance on time to completion of a simulated fireground test (i.e., stair climb, rolled hose lift and move, Keiser sled, hose pull and hydrant hookup, mannequin drag, charged hose advance) (25). Conversely, performance decreased with increased resting heart rate, body mass index, body fat percentage, age, and waist circumference. This is in agreement with the findings of Rhea and associates (35), which indicated that upper-body strength and endurance, lower-body endurance, and sprint time were associated with time to completion of a similar test (i.e., hose pull, victim drag, stair climb, equipment hoist). These results lend support to the notion that physical training is essential for peak physical job performance (36).

ECONOMIC

Training programs may also appeal to departments from an economic standpoint. Seven years post implementation, the WFI reports indicate that despite a 5% increase in total injury claims, the average cost per claim decreased by 23% (18). In comparison, non-WFI compliant departments observed a 22% increase in claims and a 35% increase in average cost per claim (18). Moreover, engaged departments demonstrated fewer missed days and less of an increase in total incurred costs than those not. While a study by Poston and colleagues surprisingly found that departments complying with multiple components of the WFI reported higher workers compensation claims than non-compliant departments, the authors note that these claims may be a result of more physical activity or that these firefighters were more comfortable reporting injuries (34). In addition, Jahnke and associates found that although the risk of exercise-induced injury was greater in those that habitually exercised while on-duty, the incidence rate of non-exercise injury was significantly lower (20).

In agreement with these findings, another study by Poston et al. identified that the number of missed workdays due to injury was proportional to increasing weight status/body mass index (33). Subsequent costs associated with these absences ranged from -\$5,076 for healthy weight firefighters to -\$25,271 for those that were class I or II obese. There were, however, no differences in the prevalence or type of injury between healthy and overweight or obese firefighters. Additionally, poor physical fitness has been reported as one of the leading causes of on-duty injury (27).

CONSIDERATIONS

While implementing fitness programs for the fire service is essential to increasing health and wellness measures, several considerations are warranted prior to their adoption. For instance,

a needs assessment should be performed to determine available resources. Additionally, fitness assessments should be performed to identify weaknesses in physical capabilities (e.g., cardiovascular health, muscular strength). Though, based on recommendations through the NFPA, results should not be used for punitive purposes. Laboratory and occupational assessments, along with annual physician health screenings, may also educate firefighters who are at high risk for disease, and clear employees for physical activity before beginning a program. As normative values for firefighters continue to be established regarding physical health and occupational performance, data collected from individual departments can further provide information regarding strengths and weaknesses, and available funds may be allocated where deemed most necessary. While simply adopting an assessment program has the potential for behavioral change, multiple variables (e.g., consultation with local government or an audit) may be needed prior to a warranted increase in departmental procedures and funding.

Other considerations should be made in terms of optimal training styles. As previously discussed, resistance training should account for a large proportion of regimens among this population (3). Tactical personnel, though, may find functional or circuit training modalities appealing, as they stress both the aerobic and anaerobic systems and transfer well to job specific requirements (2,15). Furthermore, they also require less time commitment, less costs, and can be modified for varying skill levels (15). To evaluate the physiological responses to circuit training compared to actual fireground tasks, Abel et al. monitored blood lactate and heart rate before and following an extensive training circuit (2). Participants completed two rotations of the following exercises interspersed with 30 s of rest: cable pulldown, seated row, leg press, shoulder press, deadlift, step-up, wood chop, single-arm cable pull, step-up, push-up, and abdominal crunch. While heart rate was comparable to performing smoke-diving tasks, it did not elicit a heart rate response similar to fire suppression tasks. Therefore, these results imply that circuit training may be an appropriate training stimulus for some firefighter tasks but not all. As such, and based on the metabolic demands of the occupation, this form of exercise should be periodized with an additional emphasis on higher-intensity cardiovascular exercise (14).

While exercise has been shown to be beneficial, it is important that individuals also learn fundamental movement patterns. Strain, sprain, and muscular pains caused by overexertion are consistently among the leading causes of injury within the service (17). These musculoskeletal injuries are often accompanied by poor mobility or flexibility (19). Frost et al. emphasized the role of corrective exercise techniques in a study comparing the movement patterns of firefighters while completing typical movements associated with the occupation (i.e., lifting from floor to waist height, squat, lunge, push, pull) (11). Participants were categorized into either a standard exercise group, with emphasis on promoting

performance and peak fitness; a movement-guided training group, with emphasis on execution of key movement patterns (e.g., spinal control); or a control group. Following 12 weeks of training, both exercise groups demonstrated improvements in body composition, aerobic capacity, grip strength, upper-body endurance, lower-body power, and flexibility. The movement-guided group, though, exhibited less spine and frontal plane knee motion during occupational-related tasks. It is within reason to speculate that these adaptations could result in fewer injuries. Given this information, training initiatives should strive to teach proper form and the avoidance of potentially harmful movement patterns.

PRACTICAL APPLICATIONS

Noting the aforementioned benefits of physical training programs, it is apparent that fire departments should implement, and actively support, exercise initiatives. Barriers of physical health initiatives can often be overcome, and the benefits can occur in health, performance, and economic domains. Baseline health screenings are encouraged to identify weaknesses and contraindications to exercise, although results should not be used for punitive purposes. Furthermore, functional or circuit style training modalities may be particularly efficacious among this population, given the reduced cost and time commitment, as well as the transfer to job-specific tasks. Finally, programs should ideally be under supervision of experienced personnel who emphasize the importance of correct movement patterns. Therefore, departments interested in implementing wellness programs may find success in partnering with strength and conditioning facilities or local universities.

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