

**DEVELOPMENT OF A PERFORMANCE BASED PHYSICAL ABILITY PROGRAM IN
THE CITY OF FAIRFAX FIRE AND RESCUE SERVICE**

Executive Leadership

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ABSTRACT

Many departments are faced with the challenges of ensuring firefighter fitness. Can the firefighters really perform the essential tasks associated with the job? Development of a program that fairly, equitably and comprehensively evaluates these personnel and their ability to do the job is critical to the organization, its members and the public they serve.

The problem with the existing program of assessing firefighter fitness to perform, was that it differentiated between men and women; varied based upon age of the firefighter; and was subject to legal repercussions if challenged in court.

The purpose of this applied research project was to develop a process that would identify the essential tasks of a firefighter, and to ensure optimal fitness through a comprehensive, skills-based work performance evaluation (WPE). This WPE would enable the organization to assess the levels of firefighter fitness, and then apply them to both applicants and incumbents into the organization, regardless of gender or age.

This research project utilized a descriptive methodology to examine the current practice of assessing firefighter fitness. In addition, an evaluative methodology was applied in examining the results of the four sessions of WPE's performed on the department's firefighters. Action research was then applied to develop an operational procedure to be implemented within the department.

The following research questions were developed to facilitate this process:

1. What skill related tasks are essential to the job of firefighting?
2. What is the relevance of these fitness tasks to the job of firefighting?
3. What is the minimum acceptable level of fitness for a firefighter?
4. Do the firefighters in the department have an acceptable level of fitness?

This project used a focus group of members within the department to develop this process and answer these questions. This work group identified the essential tasks, developed a means to assess the performance of these tasks, and developed an internal operating procedure. The group then administered the WPE to all members of the department and evaluated the data.

The result was the development of the WPE as a continual method of assessing the physical abilities of a firefighter to do the job.

The key to the success of this process is the continual assessment of the firefighters to ensure optimal physical ability. The organization should continue to embrace this tool, and should follow through with the recommendations identified, such as the creation of specific exercises to assist members in the various physical tasks of the WPE.

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INTRODUCTION

The City of Fairfax Department of Fire and Rescue Services (Department) began a program of physical fitness in the mid-1980s after a series of permanently disabling work-related injuries. These injuries resulted in several members of the department experiencing earlier than expected disability retirements, and worker's compensation claims were at an all-time high.

This initial program of health and fitness was designed to increase the cardio-respiratory efficiency, muscular strength, lean body mass and flexibility of firefighters. The variety of exercises that were used to evaluate this level of fitness were the typical, for that time, exercises found in most fitness evaluation programs, namely the 1 1/2 mile run, sit-ups, pull-ups, bench press, flexibility assessment and lean body mass measurements. In addition to this annual measurement, point values were assigned to the performance of each exercise; with a cumulative total of 200 points required in order to successfully complete the testing.

The problem with this fitness program was that it differentiated between levels of fitness between our male and female firefighters, and provided variations in point values as our firefighters aged. An additional problem was that the fitness program was punitive in nature, as disciplinary action was administered for failure to pass the test.

The purpose of this applied research project was to develop a performance based physical fitness assessment program that did not discriminate between genders, that was not punitive, that was based upon actual job skills, and to evaluate and validate the results of the implementation of this program. This physical fitness program, or work performance evaluation (WPE), would assess a firefighters level of fitness and physical ability, as well as establish minimal department expectations, regardless of gender or age.

This research project utilized a descriptive methodology in examining the current practice of assessing firefighter fitness. In addition, an evaluative methodology was applied in examining the results of the four sessions of WPE performed on the department's firefighters. Action research was then applied to develop an operational procedure to be implemented within the department. To fully determine what the essential elements of an effective performance based physical ability program should be, the following research questions were developed:

1. What skill related tasks are essential to the job of firefighting?
2. What is the relevance of these fitness tasks to the job of firefighting?
3. What is the minimum acceptable level of fitness for a firefighter?
4. Do the firefighters in the department have an acceptable level of fitness?

This research project intended to analyze these questions and develop a comprehensive means to assess a firefighter's level of fitness. This research project resulted in a skills-based, work performance evaluation that assessed the levels of fitness of a firefighter, and clearly defined the expectation of fitness levels that would be applied to applicants into the department and incumbent firefighters, regardless of gender or age.

BACKGROUND AND SIGNIFICANCE

The City of Fairfax Department of Fire and Rescue Services (department) is a combination career and volunteer municipal based system of dual role, cross trained personnel. The department was created in early 1978 after the City of Fairfax (City) concluded its contract with the surrounding Fairfax County to provide personnel. In the department's earliest developmental stages, personnel were recruited from across the country to staff the operational units. Currently, the department consists of 62 career and approximately 30 active volunteer personnel. Currently, four of the career staff are females, or 6% of the career population. The personnel staff two engine companies, one truck company, two Advanced Life Support (ALS) units and a duty battalion chief. Three people staff the engine and truck companies, while two people staff the ALS units. One person covers the position and function of the duty battalion chief for the shift. Career personnel are assigned to one of three rotating shifts, working a 56 hour week. Volunteer personnel are utilized to augment existing staffing. Volunteers are recalled to cover for leave and are used in minimum staffing positions on all operational units. Approximately eight volunteers are female, or 26%. This number fluctuates based upon current membership enrollment. This staffing phenomenon creates an operational situation where all personnel, whether career or volunteer, must meet the same physical demands of firefighting.

In the initial formation of the department, the only form of physical fitness assessment was the applicant hiring process, which consisted of a timed 1 1/2 mile run, sit-ups, push-ups and bench press. After the initial hiring process, no other form of physical fitness was encouraged or required. After several disability retirements due to work related injuries significantly affected the department, an effort was finally made to explore a fitness program.

In the early stages of the department's physical fitness program, personnel participated in a voluntary fashion. There was no formal structure to the program, although an exercise physiologist from a local university assisted in the early development of a more structured program. This voluntary program created some problems if one person wanted to work out, and others assigned to the tactical unit did not. However, with time, peer pressure affected a more uniform participation. As the program gained acceptance, both from the administration and the operational personnel, a more structured, mandatory program was developed. Personnel were permitted to work out on duty, and were allowed up to two hours to perform their physical fitness training. All career personnel were then tested each year to assess their level of fitness.

This initial program of health and fitness was designed to increase the cardio-respiratory efficiency, muscular strength, lean body mass and flexibility of firefighters. This was intended to serve several purposes. First, it was intended to reduce the number and severity of work related injuries, thereby hopefully having the affect of reducing work related disability retirements. Second, it was felt that a more physically fit firefighter would be able to perform the tasks of a firefighter in a more effective manner. Lastly, a more physically fit firefighter would generally be a healthier employee, and reductions of sick leave use would reduce overtime compensation.

The variety of exercises that were used to evaluate this level of fitness were the typical, for that period of time in the fire service, and found in most fitness evaluation programs, namely the 1 1/2 mile run, sit-ups, pull-ups, bench press, flexibility assessment and lean body mass measurements.

The problem with this initial fitness program was that it differentiated between levels of fitness between our male and female firefighters, and provided variations in point values as our

firefighters aged. An additional problem was that the fitness program was punitive in nature. Disciplinary action could be taken if a firefighter failed to pass the annual test.

The fitness program, or testing, consisted of an accumulation of point values, dependant upon the age and sex of the firefighter and the number of specific "items" that the firefighter performed. An example would be a male firefighter age 40, performing 40 sit-ups in the allotted one minute time frame would be assigned 28 points. In contrast however, the same 40 year old firefighter, although now a female, performing the same 40 sit-ups, would be assigned only 25 points. The point values were also on a sliding scale based upon age. The older one got, the "easier" it was to receive points, as compared to the younger firefighters.

The point values accumulated over the various physical exercises were then added together. To successfully pass the annual fitness test, a firefighter had to accumulate at least 200 points. Failure to successfully pass the fitness test resulted in possible disciplinary action. This disciplinary action could consist of written documentation, required retesting of the physical fitness program, documentation in the individual's annual performance evaluation, and potentially termination.

Since lean body mass was also assessed, persons exceeding the mandatory body fat of 22% for men and 26% for women were automatically placed into a mandatory weight loss reduction program.

Many department members felt that a firefighter should have the same level of firefighter fitness, and should be able to effectively perform all tasks of firefighting, regardless of gender or age. The tasks and physical demands placed on a firefighter did not vary just because a person happened to be older or a female. Additionally, some of the female members of the department expressed concern over the appearance of special treatment in the physical fitness tests. In

addition, the punitive nature of the program did not provide an atmosphere of support and wellness from the administration to the firefighters.

About this time, many departments were also experiencing legal action due to this perception of gender and age bias. In addition, the validity of testing skills that were not seen as directly related to the job tasks of firefighting were also being challenged in the courts. A commonly heard analogy was "how many times does a firefighter have to do sit-ups on the fire ground?"

A method was needed that could provide a supportive, non-punitive assessment of a firefighter's physical ability, while at the same time being fairly applied to all members of the department, whether they are career or volunteer, male or female, young or old.

In addition, a method was needed to evaluate future candidates in the department. The applicant hiring process needed a component of physical ability assessment that was job and task related. This initial assessment would assist in the identification of candidates that could reasonably be expected to perform the tasks of a firefighter.

The author, serving in the position of the department's administrative battalion chief, was instrumental in the development and implementation of this new program. The skills and lessons learned in the National Fire Academy's Executive Fire Officer Program, Executive Leadership course, were critical to the success of this process, specifically the units on influencing and persuasion. For this program to be successful, funding had to be appropriated, career personnel had to be influenced on the need to participate in this new program, volunteer personnel had to be persuaded to participate in a completely new program, and it all had to be accomplished in a supportive, non-punitive nature.

LITERATURE REVIEW

There is an abundance of literature regarding the need for firefighters to be physically fit. Firefighting continues to be a strenuous, demanding occupation, and the need for firefighters to be physically fit is well established. “Not everyone is capable of being a firefighter and those that hold this position of public trust have both a duty and responsibility to be able to do the job” (Davis, 1996). In addition to the physical demands inherent with the occupation of firefighting, the physiological response places additional stress on the body. “Firefighting often subjects its personnel to sudden, strenuous exercise without warm-up” (Ostrow, 1997). “Firefighting, by definition, description, design and practice is a hazardous occupation. The atmosphere in which interior fire suppression takes place is hostile and without life support equipment, uninhabitable” (Davis, 1996). “Each year, IAFF Death and Injury Surveys demonstrate that firefighting remains one of the most dangerous occupations in the United States. Research has repeatedly shown the need for high levels of fitness to perform safely in the fire service” (Fire Service Joint Labor Management Wellness-Fitness Initiative [FSJLMWFI], 1997). The very nature of the tasks associated within the occupation of firefighting place firefighters in a unique work environment. “Unlike most of work-a-day America where the job is designed around the capacities of the workforce, firefighters must respond to an ever-changing set of circumstances” (Davis, 1996). These specific, challenging sets of work environment circumstances are applicable to anyone who chooses to be a firefighter. “Fire is indiscriminate, uncompromising and no respecter of gender, age or race; it is a true “equal opportunity” dynamic that destroys with impunity and without hesitation whatever is in its path” (Davis, 1996). “High levels of stress, intense physical demands, and long term exposure to chemicals and infectious disease contribute to heart disease,

lung disease and cancer - the three leading causes of death and occupational disease disability” (FSJLMWFI, 1997).

Firefighter fitness has a direct impact on the ability, or inability, of a firefighter to perform the tasks associated with fire ground operations, both in form, function and physical ability.

“Thus, the individual with the greatest physical work capacity has the best probability of successfully completing the task. And, conversely, less fit individuals, incapable of performing such tasks as climbing stairs under load, or wielding an axe for more than a few swings have their work-effort curtailed because of the build-up of lactate in the blood stream” (Davis, 1996).

The departments that support such programs can also see additional benefits of firefighter fitness. In addition to improved fire ground performance, reductions in worker’s compensation and on-the-job injuries can have a significant cost benefit. “Several fire departments have documented that improved fitness results in significant cost savings through reduced incidence and severity of on-the-job injuries. Of particular note are reductions in back injuries and improvement in heart disease risk factors” (Pearson, Hayford, Royer, 1995).

It is incumbent upon the department to develop a clearly defined standard of physical fitness or performance for the firefighter. “The purpose of adopting physical fitness standards is to ensure that firefighters possess and maintain the physical ability to perform their jobs without undue risk to themselves or others” (Davis, 1996). Davis goes on to explain “A department without clearly defined fitness standards cannot know if its members are truly capable of meeting the arduous demands of fire combat” (1996).

In addition to the moral and ethical obligation of the department to ensure that their firefighters are fit and prepared to perform the job, there are industry standards that also have a significant implication on fire departments. Building upon the essential tenets of the National Fire Protection Association (NFPA) Standards, NFPA 1500 requires that fire departments establish fitness programs for incumbents and also requires applicants and incumbents to pass physical performance tests in order to demonstrate the ability to safely perform emergency operations (1997). An even stronger case is made for firefighter fitness when evaluating the Occupational Safety and Health Administration (OSHA) laws. OSHA, and the Virginia equivalent VOSH, requires in the respirator protection standard that firefighters be assigned duties that require the use of self-contained breathing apparatus (SCBA) only after determining that they are physically fit to perform the work and use the equipment (1998). The NFPA 1582 standard on medical requirements for firefighters covers the medical necessity, and the physical ability, to perform firefighting tasks. The draft NFPA standard 1583 on firefighter fitness is directed to the programmatic aspects of fitness, and is intended to prevent the use of fitness tests that can lead to litigation.

The challenge is determining an appropriate level, or performance standard, for a firefighter. Court cases and litigation have directly affected the ability of a department to establish these minimal criteria. “In today’s litigate-happy environment, assigning employee’s duties that they are not capable of performing sets the stage for a catastrophe that can have both legal and mortal consequences” (Davis, 1996). In an article addressing validation of physical ability testing for fire departments, Arvey, Nutting and Landon comment: “Another observation we have, however, is that there is an acceleration of litigation and legal scrutiny regarding the use of physical ability tests over the past few years” (1992). “Although the need for strength and

endurance appears to be self-evident, federal Equal Employment Opportunity laws and Americans With Disabilities Act (ADA) of 1990 place a burden upon the employer to positively demonstrate job necessity and relevance” (Smith, 1993).

Through the proliferation of court cases, it is essential that departments determine exactly the essential skills necessary to perform the tasks of firefighting. “Given the language of the law, the direction of future hiring tests lies in replicating the essential functions of the job, rather than using tests that approximate the underlying physical skills needed on the job” (Davis, 1995). “In St. Paul, Minnesota, a case involved the challenge of a set of physical ability tests sued [*sic*] in hiring firefighters (*State of Minnesota v. City of St. Paul, 1990*). Similar cases are unfolding or have been litigated in the cities of San Francisco, New York and St. Louis” (Arvey, et al., 1992).

These laws may even be applied to departments that are a combination of career and volunteer members. In an article on this issue, Davis writes:

In federal court, Alexandria stated its case that volunteers who are expected to perform the same tasks as career personnel should, in the interest of safety, be able to demonstrate that they are fit enough to perform these same tasks. The court ruled in favor of the city, and the upshot of the decision was a two-tiered system that distinguished between volunteers qualified to perform interior operations and those whose duties were outside the building (1994).

Federal laws have been enacted that impact the ability of a department to hire or fire members based upon their level of fitness. The ADA is one such federal law. “The ADA requires hiring tests to correlate with the job’s ‘essential functions’, those activities that are necessary to the job and virtually define the reason for hiring an employee” (Davis, 1995).

The Civil Rights Act of 1964 bestowed new rights and legal protection to religious, national and racial minorities and to females. “Title VII of the 1964 law specifically addressed employment testing. While aimed at paper and pencil selection and promotional examinations, the principles have always been held by the courts to apply to physical ability tests and performance ratings of existing employees” (Carmean, Padgett, 1989).

While these laws are important considerations to organizations developing physical performance standards, “Federal law does not require employers to hire people who are incapable of performing the duties of the job” (Davis, 1993). Davis goes on to describe the parameters of the law:

What the law does require is that employment decisions be made based on ability. U.S. Supreme Court Justice John Paul Stevens commented that ‘the 14th Amendment guarantees equal opportunity, not equal results’. A test must have some power of discrimination, because a test everyone passes is not particularly useful. However, tests that are shown to adversely affect protected workers or women, must be validated (1993).

Such legal considerations, and the institution of physical performance programs within a department, may seem a daunting task to most departments, and may lead to serious legal implications if not researched sufficiently.

Leaving aside the obvious issues of managing organizational change and maintaining morale and sound employee relations, the legal constraints involved in testing the ability of current firefighters to perform their jobs deserve serious attention before such a program is designed, developed or implemented (Carmean, et al., 1989).

There continues to be court cases, however, that in fact back up the requirements by fire departments to have fitness standards. In a case in the City of Dallas Fire Department, the courts upheld the department's requirement that a firefighter meet certain height and weight standards or risk termination. "This case illustrates a couple of things. The first is the right of the employer to discipline and ultimately discharge an employee for failure to comply with a physical fitness plan" (Stittleburg, 1994).

However, validating a test, or a set of performance standards, does not require a department to experience a lawsuit. "There is a core of essential tasks that are common to nearly every fire department" (Davis, 1993).

It is important to understand the fitness test and the components that are being evaluated. "A fitness test is health-based, and a performance test is job-based" (Davis, 1995). Davis continues:

People may be classified as unfit because they are overweight, hypertensive or exhibit other negative health factors that may affect performance, yet pass the performance test. Conversely, a person may be highly fit and fail the performance test, because the test is designed to determine if one can perform the necessary essential functions, not to establish a fitness level (1995).

It is the relationship between the job tasks and the performance of those job tasks, that determine fitness to perform. "In the scientific community, validity is defined as demonstrating a relationship between a criteria (the job) and performance indicators (the test)" (Davis, 1996). Some would say that the tasks of firefighting are a team effort, and certainly to an extent, that is true. "Firefighting is a team effort, with considerable emphasis on shared work responsibilities.

However, the team is only as strong as its weakest member” (Davis, 1996). There are many tasks that can only be handled by one individual. “For example, only one person can work an axe or carry a high-rise pack” (Davis, 1996).

So what are the essential elements necessary to determine if a firefighter is fit to perform?

The most frequently identified physical requirement is good cardiovascular fitness.

Other traits include low body fat, good pulmonary function, grip strength, endurance, balance, coordination, upper body strength, manual dexterity, and leg strength. All of these have been selected based upon examination of firefighting functions and identification of critical abilities needed to meet the various demands (Smith, 1993).

These essential job tasks, or functions, define the minimum requirements to be a firefighter. “Said another way, if you cannot perform these evolutions, you cannot fulfill the essential functions of the job” (Davis, 1994). At one time, fire departments, as well as police agencies, utilized general height and weight requirements as standards for selection. Because the use of these variables had an adverse impact, especially against females and Hispanics, agencies were asked to produce evidence for the job relatedness of such standards. “After almost uniformly failing to show the job relatedness of these standards, agencies turned to the use of physical ability testing procedures” (Arvey, et al., 1992). These physical ability testing procedures typically included such activities as “climbing a ladder, pushing and pulling a ceiling hook, dragging a dummy a set period, running up stairs carrying hose bundles, walking on a balance beam” (Arvey, et al., 1992).

A text on firefighter wellness describes the various components of fitness, and divides them into four separate components: flexibility, cardiovascular fitness, muscular fitness and body composition. Muscular fitness is further divided into muscular strength, endurance and power (Pearson, et al., 1995). Directly relating these components of fitness into a more specific and job/task relation is the challenge to departments looking at developing a performance based fitness assessment. “For fire and rescue work, studies have shown that fitness is directly related to performance” (Pearson, et al., 1995). Fit personnel are able to perform the tasks more quickly and with fewer injuries than non-fit personnel. These measures of fitness, however, do not necessarily measure an individual’s ability to perform firefighting or rescue tasks. “That process, usually called a physical performance assessment, typically involves the simulation of essential job tasks and the establishment of minimum standards for gauging individual capabilities” (Pearson, et al., 1995).

Clearly, there are a number of considerations that must be taken into account when developing a comprehensive, job and task related physical performance assessment for firefighters. Past court cases, the essential elements of fitness, industry standards, and state and federal laws all must be reviewed and understood if one is to develop a system of fitness and/or performance standards that will stand the test of law, firefighter scrutiny and ensure optimum performance of firefighters on the fire ground.

PROCEDURES

The development of a task based, job performance assessment for physical ability encompassed many facets of the organization. The intent was to identify a set of tasks that, when completed by the firefighter, would indicated a sufficient level of fitness to do the job. Early development and discussion included the firefighter's union president, as well as the author serving in the role of the administrative battalion chief, whose duties included the oversight of the department's physicals and physical fitness programs.

It was essential to the buy in of the membership that early discussions included a broad representation of the organization. A committee was convened that included administrative representation, as well as labor. Interested individuals were sought that would serve on such a committee. The initial interest was overwhelming, as all members wanted a process that was fair, equitable, comprehensive and provided a realistic assessment of firefighter fitness and performance.

This committee met over the course of many months, reviewing the current literature, assessing other department programs in the region, and consulting with exercise specialists from the local university. Key to their discussion was an assessment of the essential tasks of the job of a firefighter. As each member was briefed, they returned to their respective shifts to discuss the committee work, progress and thoughts. It was essential that all members continued to be involved throughout all phases of the process in order to achieve optimal support and buy-in to the finished product. Also critical to the eventual success was that the committee included members from our volunteer component of the organization. Since the organization utilizes its volunteers in minimum staffing positions, the career members felt that all personnel should meet the same physical requirements, regardless of whether they were paid or volunteer.

Through a series of discussions with the members of the organization, a process was developed to identify the essential tasks that are most frequently used, or potentially used, by a firefighter in the course of their job. These tasks were physically demanding, and would be expected to be performed by a firefighter. As these tasks were brought back to the committee, they were evaluated for frequency of use, applicability to the job tasks, and whether they were easily assessed. The culmination of these discussions resulted in the following list of essential job tasks: carrying a ladder, forcible entry skills, carrying a high-rise pack up stairs, handling a charged hose line, pulling ceilings, carrying equipment, chopping skills to open a roof, and rescuing a victim. All members of the group were in consensus that these skills should be evaluated in full personal protective equipment (PPE) and wearing of SCBA.

This final list of essential skills was then re-introduced to the shifts and volunteer members for evaluation. The clear consensus was that these skills appropriately represented the essential tasks of a firefighter and would be an acceptable assessment of firefighter performance.

At the same time that this department was working on the job/task analysis, another department in the region was integrally involved in the 10-city effort that was coordinated jointly through the International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC). Fairfax County, Virginia had been working on developing a performance based physical ability program for its own department. Many discussions were held with representatives from that department to gain insight into their research, and to compare their work with that of this process. The two departments respond in a very similar manner, and the firefighters perform essentially the same skills and work under the same operational procedures. The work environment is similar, and the two departments are dispatched from the same public safety communications center (PSCC). The response algorithms include companies from each

department based upon physical or geographical location, and are not dependant upon political boundaries or jurisdictions. With that in mind, it was felt by the committee that since the job tasks were the same for the firefighters in both jurisdictions, the physical demands and measurement of the physical ability of the firefighters should be the same, or very similar. This is in great contrast to other departments in the region who have different staffing levels, different work shifts, a more diverse composition of career/volunteer staffing patterns, and geographical area.

As the various tasks were identified and evaluated, a system was developed to structure them into a process whereby they could be measured. The committee felt strongly that this assessment should also take into account the cardiovascular component of fitness, and therefore, these tasks should be structured into a course where the tasks were done concurrently. While each individual task is a true representation of a skill necessary to be performed on the fire ground, the grouping of these tasks into a simultaneous course would allow assessment of the stamina, endurance and overall cardiovascular fitness of the firefighter.

The diagram shown as Appendix A represents an initial attempt at this structured course. Each of the identified tasks was placed sequentially into the course design. Through this initial assessment period, all members of the department were asked to participate in the evaluation and data collection process. This evaluation was presented to the department in specific shift meetings where all were present. An overall introduction into the course was presented, with each task station being described and demonstrated in detail. The stations, or tasks, represented those skills that had been identified as being essential to the job of a firefighter. They included: the use and wear of the full protective clothing ensemble, carrying a ladder, forcible entry, carrying a high-rise pack up a set of stairs, handling a charged hose line, simulating pulling

ceilings with a pike pole, carrying equipment, performing ventilation on a roof and rescuing a victim.

Each station was developed to simulate, as realistically as possible, those skills or job tasks that were critical to fire ground performance. Using the actual equipment that the department carried on the fire apparatus was felt to be more job specific and assist with the validation process.

Station # 1 consisted of the use and wear of the full protective clothing ensemble. Each member was required to wear all of the personal protective equipment (PPE) that they would be expected to wear into a fire. Complete turnout clothing, including nomex hood and firefighting gloves, completed the ensemble. Since it was critical that the course be performed in a safe manner, this station was not timed. Each member would be allowed to don all of the required equipment, making sure that it was fully buttoned up, all pieces were properly worn, and the SCBA was comfortably worn.

Station # 2, which started the timed process of the WPE, was the ladder carry. The firefighter would be expected to lift and carry a 24' ladder a distance of 75 feet, place the ladder against the building, raise it a total of three rungs, and place it into the proper climbing angle with the fly section out. The 24' ladder was chosen since it was the ground ladder typically used and was able to be carried by one firefighter. A ladder of greater length would typically be handled by two firefighters. This evolution assessed the ability of the firefighter to handle, and place into service, a ground ladder.

Station # 3 was the forcible entry table. Utilizing a table, built to accommodate a weighted tire, the firefighter would pick up a sledgehammer and drive the weighted tire, over the table, the distance of 8'. This table was built to a height to simulate the approximate height of a

doorknob. This distance was developed to simulate the approximate times a door might have to be struck in order to force entry. The weighted tire simulated the strength necessary to force entry into a reinforced door. The entire scenario assessed the firefighters' ability to use the tools available to them and force entry through a door.

Station # 4 was the high-rise pack event. Traveling a distance of 75', the firefighter would then pick up a high-rise pack, carry it to a step-box, and using both feet, step up onto the box, and down again, a total of 30 steps. The step-box process had been evaluated as a safe and realistic assessment of the firefighter's ability to lift and carry a high-rise pack up three flights of stairs. A high-rise pack is typically used in high-rise emergencies. An actual replica of the high-rise pack in use by the department was created to provide an exact representation of the equipment that would be used in a high-rise incident. This pack consisted of 150 feet of 1 3/4" Handline, a gated wye connection, and held together by reinforced straps. After completing the 30 steps on the step-box, the firefighter would return to the origination point of this event and place the high-rise pack on the ground.

Station # 5 and # 6 consisted of the hand line. In station # 5, the firefighter would walk the distance of 75', grasp a charged 1 3/4" hose and nozzle, and drag it a distance of 75'. Upon completing this phase, the firefighter would then get on their hands and knees and crawl back along the hand line to the coupling, a distance of 50 feet. Upon reaching the location of the coupling (Station # 6), they would then grasp the hand line, and using a hand-over-hand motion, pull the hand line back until they reached the nozzle. This would complete this evolution. This station would assess the firefighter's ability to handle a charged hose line, both advancing and retrieving the line, and their ability to crawl along the hand line in an effort to exit a structure.

Station # 7 consisted of the pike pole evolution. Walking to the location of the pike pole, the firefighter would pick up a weighted pike pole, carry it to a designated location, and using a hand-over-hand motion, lift the pike pole above their head a total of 30 times. The firefighter would be expected to raise their arms to a fully extended position over their head, simulating the ability to pull a ceiling. The weighted pike pole, encompassing 12 pounds of lead taped to the head of the pike pole, would represent the energy and workload associated with the lifting and pulling of a pike pole to remove a drywall ceiling. This skill is a necessary component of firefighting and overhaul operations.

Station # 8 consisted of the equipment carry. Typical equipment used, and often needed on the fire ground, is an exhaust fan and cord reel. The firefighter would be expected to lift and carry an exhaust fan a distance of 75', where they would then set that down and pick up a cord reel and light. Carrying that equipment back 75', they would place it down on the ground. This evolution would assess the ability of the firefighter to lift and carry equipment on the fire ground.

Station # 9 consisted of the ventilation or Keiser sled station. Using a piece of equipment commonly used in the Combat Challenge, the Keiser sled assesses the ability of a firefighter to chop a hole in a roof. The firefighter would pick up the specialized mallet, and drive the sled a distance of three feet. This event would assess the ability of the firefighter to cut a hole in a roof to provide vertical ventilation.

Station # 10, the last station in the WPE, consisted of the rescue dummy drag. Walking a distance of 75', the firefighter would then be expected to drag a 165-pound rescue dummy back a distance of 75'. This event simulated the ability of the firefighter to rescue a person from a

building fire. As the firefighter completed the evolution by dragging the dummy across the finish line, the time would stop. This would then complete the entire WPE process.

In order to familiarize the department members with the content and context of the entire WPE process, a member of the committee participated in the WPE and was video taped. This videotape allowed all members of the department an opportunity to see the WPE in its entirety, and to see a clear representation of the time taken to complete the series of events.

The next step in the implementation was to provide an opportunity for all members of the department to complete the WPE. The course was set up at the fire station, and all members were expected to participate. The initial opportunities were presented as practice sessions, and there would not be an expectation of a pass/fail result. These initial sessions were provided to familiarize each member with the work demand, process and skills necessary to complete the WPE, while also gathering essential data, such as times and vital signs. A data collection tool was developed to collect information such as individual characteristics (name, age, sex, shift, rank, vital signs) as well as air consumption and overall time to complete the WPE (Appendix B). As the firefighter participated in these early sessions, critical data was collected prior to, during and after the performance. Firefighters were counseled regarding proper hydration, stretching, and test evaluators accompanied the candidates throughout the process to ensure that they paced themselves, did not risk an injury and to evaluate technique. Baseline vital signs were taken to determine the capability of the firefighter to initially participate in the WPE, in addition to an assessment of the cardiovascular wellness and physiological response during the physical activity. Additionally, a heart rate monitor was applied to each firefighter during the WPE so that the evaluator could monitor the heart rate of each candidate. This piece of

information could be used to determine overall fitness, as well as providing a safety measure in case the candidate began to exceed the safe levels of their target heart rate.

Upon completion of the WPE, each firefighter was assisted in the removal of their PPE and SCBA in order to begin to cooling-off process. Firefighters were reminded to hydrate to replace body fluids, and a second set of vital signs was taken.

Immediately upon completing this process of rehabilitation, each firefighter was asked to complete a survey (Appendix C). The firefighters were asked to provide an assessment of the relevance of each task to their perception of the tasks associated with firefighting. This data was collected to assist in the internal validation of the overall WPE process. Only 2 surveys were completed due to the overwhelming support and perceived validation of the process as a measure of the tasks required of a firefighter.

As each firefighter participated in the WPE, it became clear that repetition brought a certain level of familiarity to the process, which in turn enabled the firefighter to reduce their overall time to complete the WPE. In addition, since the department was relatively small in size and number of firefighters, the WPE was administered every six months for a total of two years to gather critical data. This data collection would assist the department in establishing the maximum acceptable time to perform the WPE.

The next task before the committee involved the revision to the department's operating procedure for physical fitness evaluation. The initial process and procedures included the earlier mentioned testing of basic strength, such as sit-ups, pull-ups, bench press, body mass index and a cardiovascular assessment by either a mile and one-half timed run or a three-mile timed walk. While these certainly are a measure of fitness, the committee desired to develop a more job-related performance assessment. Critical to the eventual and continued success was a clearly

defined operating procedure that not only outlined the parameters of fitness training, but also the process used to evaluate firefighter performance. Equally important was the clear message that this process was to be supportive, and not punitive. Hence, it was also important to clearly define what would happen to the firefighter if they did not pass the assessment. After several revisions, the department issued a comprehensive procedure that defined the parameters of physical fitness training and performance evaluation (Appendix D).

It should be noted that before the department established the maximum acceptable time for the completion of this process, a full two years of bi-annual sessions of the WPE were provided for all members of the department. Since this was a completely new process, and change, in general, is sometimes difficult, these early sessions were provided to allow for a familiarization process, as well as to accumulate critical data. These sessions were advertised as practice sessions only, and were not to be considered as pass/fail. Since the department had not yet established the maximum acceptable time, there was not a benchmark to base a decision of whether or not the firefighter was successful, other than the completion of all components of the performance assessment.

RESULTS

The results of the development of the WPE have been well received by all members of the department, career and volunteer alike. The comments and reactions have been positive, and personnel actually prefer to participate in the WPE rather than the old testing of physical fitness.

The efforts of the committee that worked on the development of this process resulted in a clearly defined, task related set of physical performance skills that are directly related to the job of a firefighter. These tasks, or skills, when demonstrated in a manner that indicate the firefighters ability to perform the job, indicate a direct relationship to the ability to perform as a

firefighter. These essential skills served to answer research question # 1: “What skill related tasks are essential to the job of firefighting”? These skills include:

1. Use of personal protective equipment and self-contained breathing apparatus
2. Ability to lift and carry a ladder
3. Ability to perform forcible entry
4. Ability to lift and carry a high-rise pack and climb stairs
5. Ability to handle a charged hand line
6. Ability to use a pike pole and pull ceilings
7. Ability to lift and carry equipment
8. Ability to chop and open a roof
9. Ability to rescue a victim from a building

Each of the above-listed essential skills were further developed into a comprehensive evaluation process that served to assess each person’s ability to not only perform these tasks, but also to assess other parameters of fitness, namely cardiovascular endurance, stamina and upper and lower body strength.

In assessing the relevance of these tasks to the actual job of firefighting, a survey was developed that sought to assess each firefighters’ perception of the task as it related to the job. The results of this survey, when administered over two different opportunities to perform the WPE, indicate the perception of relevance to the job of firefighting, by the firefighters who completed the WPE. As each individual task was evaluated, a score was assigned by the firefighter completing the form. A scoring system was developed, ranging from a score of “1”, meaning no relevance to the job of firefighting, to a score of “5”, meaning highly relevant to the job of firefighting. Each person completing the WPE was required to fill out a survey, thereby

ensuring 100% compliance and evaluation. Upon completion of the WPE by all personnel, the scores were tabulated. The results of these scores can be seen in Appendix E. In the first application of the WPE to personnel in the department, held in October of 1998, the overall survey results indicated a relevance factor of 4.63 out of a possible 5. This score indicated a high relevance to the job of firefighting.

Further breakdown of the survey scoring indicated the following:

1. The overall relevance of the use of PPE to the job was 4.80 out of a possible 5, with a range being between a score of 2 and 5.
2. The overall relevance of the ladder evolution to the job was 4.60 out of a possible 5, with a range being between a score of 3 and 5.
3. The overall relevance of the forcible entry evolution to the job was 4.46 out of a possible 5, with a range being between a score of 2 and 5.
4. The overall relevance of the high-rise pack evolution to the job was 4.34 out of a possible 5, with a range being between a score of 2 and 5.
5. The overall relevance of the hand-line advancement evolution to the job was 4.51 out of a possible 5, with a range being between a score of 2 and 5.
6. The overall relevance of the hand-line withdrawal evolution to the job was 4.46 out of a possible 5, with a range being between a score of 2 and 5.
7. The overall relevance of the pike pole evolution to the job was 4.26 out of a possible 5, with a range being between a score of 2 and 5.
8. The overall relevance of the equipment carry evolution to the job was 4.71 out of a possible 5, with a range being between a score of 3 and 5.

9. The overall relevance of the ventilation evolution (using the Keiser sled) to the job was 4.34 out of a possible 5, with a range being between a score of 2 and 5.
10. The overall relevance of the rescue dummy evolution to the job was 4.54, with a range being between a score of 2 and 5.
11. Overall, the cumulative relevance of the WPE to the job of a firefighter was 4.63 out of a possible 5, with an overall range being between a score of 2 and 5.

In the March of 1999 session of the WPE, the results were fairly consistent with those of the October 1998 session. In the second application of the WPE to personnel in the department, the overall survey results indicated a relevance factor of 4.76 out of a possible score of 5. This score indicated an even higher relevance to the job of firefighting.

Further breakdown of the survey scoring indicated the following:

1. The overall relevance of the use of PPE to the job was 4.88 out of a possible 5, with the range being between a score of 4 and 5 (compared with the fall score of 4.80).
2. The overall relevance of the ladder evolution to the job was 4.79 out of a possible 5, with a range being between a score of 4 and 5 (compared with the fall score of 4.60).
3. The overall relevance of the forcible entry evolution to the job was 4.76 out of a possible 5, with a range being between a score of 4 and 5 (compared with the fall score of 4.46).
4. The overall relevance of the high-rise pack evolution to the job was 4.69 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.34).

5. The overall relevance of the hand-line advancement evolution to the job was 4.88 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.51).
6. The overall relevance of the hand-line withdrawal evolution to the job was 4.60 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.46).
7. The overall relevance of the pike pole evolution to the job was 4.67 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.26).
8. The overall relevance of the equipment carry evolution to the job was 4.69 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.71).
9. The overall relevance of the ventilation evolution (using the Keiser sled) to the job was 4.60 out of a possible 5, with a range being between a score of 2 and 5 (compared with the fall score of 4.34).
10. The overall relevance of the rescue dummy evolution to the job was 4.76, with a range being between a score of 3 and 5 (compared with the fall score of 4.54).
11. Overall, the cumulative relevance of the WPE to the job of a firefighter was 4.76 out of a possible 5, with an overall range being between a score of 3 and 5 (compared with the fall overall score of 4.63).

This data served to answer research question # 2: “What is the relevance of these fitness tasks to the job of firefighting”?

In establishing the minimum level of fitness for a firefighter within the department, several items needed to be accomplished before this could be done. First, a total for four sessions of the WPE were performed by firefighters within the department. This served to provide optimal familiarity to the WPE by all personnel, as well as providing sufficient data with which to establish the maximum performance time. This maximum performance time would be the term applied to the maximum amount of time that the WPE could be performed in, or in other words, if a firefighter performed the WPE within this time parameter, or less, they would be able to perform the skills necessary, in a physical ability sense, to be a firefighter.

After the multiple opportunities to perform the WPE, time data was evaluated. In addition to the various personal indicators both pre-WPE and post-WPE, such as vital signs and air consumption, the time data was evaluated within the context of acceptable levels of performance. Using such indicators as the ease with which each of the skills was performed, the ability of the firefighter to complete all of the necessary skills, and the ability of the firefighter to recover from the WPE, a maximum acceptable time of 10:47 was established. Personnel able to perform all of the requisite skills in the WPE within this time frame were determined to be minimally able to perform the tasks associated with firefighting. Appendix D, the Operating Procedure for the department, reflects this time requirement.

The establishment of this maximum acceptable time served to answer research question # 3: “What is the minimum acceptable level of fitness for a firefighter”? In other words, firefighters able to complete the WPE within the time frame of 10:47 were in at least a minimum acceptable level of fitness to perform as a firefighter within the department. As the time to complete the WPE was reduced, and if the air consumption was within the specified amount of one bottle, and the firefighter was able to recover quicker from the performance of the WPE,

they would be viewed as holding a higher level of fitness, and a higher ability to perform the physical tasks of a firefighter.

The operating procedure was developed to provide a comprehensive physical fitness program and measure firefighter fitness. Integral to the success of the program was the clearly defined expectations of firefighter fitness, especially the process to be used should a firefighter fail to meet the minimum level of fitness expectations. This operating procedure also served to provide a framework of department expectations as to the minimum acceptable level of fitness for a firefighter.

After completion of the multiple sessions of the WPE, analysis of the results indicated a progression of successful completion of the WPE. In the fall of 1998 session of the WPE, a total of 48 people participated in the process. Recognizing that the maximal time of 10:47 had not been established, but looking in a retrospective fashion, a total of 6 people (12.5%) “failed” the WPE, or exceeded the time. The spring of 1999 session reflects 48 people participating in the WPE, with 4 people (8%) failing to meet the time criteria. The fall of 1999 session reflects 48 people participating in the WPE, with 1 person (2%) failing to meet the time criteria. These three sessions were all held as “practice” sessions, with the goal of having the spring 2000 session as the first one to actually count, meaning that the expectation would be to have all firefighters meet the maximum acceptable time of 10:47. The spring 2000 session reflects a total of 49 people participating in the WPE, with all persons (100%) passing the acceptable time of 10:47. This data can be found in a more comprehensive manner in Appendix F. Specific identifiers, such as name, have removed in order to provide confidentiality to the participants.

Additional statistics from the spring 2000 session of the WPE are reflected as follows:

Average age of participant:	37.7 years
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Average Pre-WPE resting heart rate: 74.7 bpm

Average Pre-WPE respirations: 15.7

Average Pre-WPE blood pressure: 127/77 mmHg

Average Post-WPE heart rate: 112.5 bpm

Average Post-WPE respirations: 21.3

Average Post-WPE blood pressure: 133/72 mmHg

Average air consumption: 2000 psi

Average time to complete WPE: 7 minutes 34 seconds

When comparing these results to the first session of the WPE held in October 1998, the following comparison can be shown:

	<u>October 1998</u>	<u>March 2000</u>
Average age:	38.2	37.7
Pre-WPE heart rate:	74.8	74.7
Pre-WPE respiration:	16.6	15.7
Pre-WPE blood pressure:	130/78	127/77
Post-WPE heart rate:	121.4	112.5
Post-WPE respiration:	25.2	21.3
Post-WPE blood pressure:	147/75	133/72
Average air consumption:	2029	2000
Average time:	8.30	7.34

Analysis of this data would indicate that the ability of the firefighter to complete the WPE, and the physiological response (heart rate, respirations, blood pressure, air consumption) improved over the course of the implementation of the WPE. Of note should be that the average age of the firefighter decreased. This was due to retirements within the work force, and younger firefighters were hired over the period of WPE assessment. To an extent, the decreases shown in the physiological responses, from 1998 to 2000, may be somewhat attributed to the average age of the firefighter decreasing, however, significant decreases in blood pressure readings, heart

rates, respiratory rates, air consumption and overall time to complete the WPE were demonstrated as well. A decrease in performance time alone reflects a one minute decrease in time to complete the WPE, or an over 12.5% reduction. This decrease in time actually represents an increase in overall performance of the WPE. This data would indicate that the firefighters in the department do have an acceptable level of fitness, and are therefore able to perform the tasks associated with the job of firefighting. This data served to answer research question # 4: “Do the firefighters in the department have an acceptable level of fitness”?

DISCUSSION

In analyzing the results of this developmental process, it became clear early on that the firefighters within the department preferred the new WPE process to the older process of true physical fitness testing. Most, if not all, of the firefighters saw the true correlation of the tasks included in the WPE to the job tasks that they perform every day. Some of the firefighters tended to be very linear in their thinking, and even though both forms of assessment measured the various aspects of fitness, the pure job tasks (i.e., hose pulling, ladder carry, forcible entry, etc.) were met with much greater acceptance.

When comparing these results with the literature, this was not a surprising result. More and more of the fire department testing or evaluation is geared toward specific job tasks. The Fire Service Joint Wellness Initiative (1997), and the concurrent Candidate Physical Ability Test (CPAT, 1999) base their assessment of firefighter fitness on job-related tasks.

Davis describes the key differences in physical fitness testing and the newer performance evaluations, specifically as it pertains to fire departments, by saying “the use of traditional health and fitness assessments (sometimes called fitness tests) is now illegal” (1995).

This closer evaluation by the courts in the arena of firefighter testing would indicate that fire departments must re-evaluate their process of testing to determine either applicant or incumbent fitness to perform the job.

Do fire departments need to have physically fit firefighters? The answer appears clear. Ostrow describes the work performance factors, or ability to work safely, associated with firefighter fitness,

For example, an unfit firefighter must perform at a much higher percentage of his or her maximum capacity than a fit firefighter doing the same work. The implication is the unfit firefighter is at a much higher risk for injury than the fit firefighter (1997).

Repetition of the tasks included in the WPE also demonstrated an improvement in performance. Some of this improvement, specifically the time factor alone, may be, in part, due to the familiarity with the various tasks. However, that alone does not explain the physiological factors. Since the WPE was held every six months, firefighters were more apt to maintain or improve their physical conditioning in an effort to improve their overall time, as well as the competition factor between others, other shifts, and a desire to improve individual performance. Of significance, however, were other factors that were improved. While the time criteria established whether or not the firefighter “passed” the WPE, the overall air consumption was reduced. This directly translates to more work time, or more time a firefighter can spend inside a structure performing essential firefighting functions. The ability of the firefighter’s body to tolerate, or recover, from the physical and physiological stress of heavy work demands was also improved. Resting heart rates were lowered over the course of the two years of WPE implementation. Blood pressures were lowered, indicating less stress and work by the heart. Even after completing the strenuous WPE, firefighter heart rates, respirations and blood pressure

were not noticeably elevated. This would indicate that the firefighters were in an improved level of physical conditioning and would also recover more quickly.

This new measure of firefighter fitness also indicated an improvement in the conditioning of the department's female firefighters. Initially, all four female firefighters "failed" the WPE. This was based upon the retrospective application of the maximum acceptable pass time to perform the WPE of 10:47. After 1½ years of preparation and conditioning, all female firefighters passed the WPE in the spring of 2000. While the females indicate that it is more difficult to perform some of the tasks of the WPE, they all indicate their unanimous acceptance of the newer testing and evaluation. The female firefighters are supportive of this new evaluation since it does not discriminate, or provide altered scoring as compared to their male counterparts. In an article on validation strategies, Arvin, et al. notes the importance of having a sound, validated assessment tool: "Physical ability tests typically show an adverse effect against females such that a much higher percentage of women applicants get screened out with ensuing law suits resulting" (1992).

The implications to the organization, specifically any fire department, are quite clear. Efforts should be made to assess the current practice of incumbent and applicant testing. A comprehensive process must be incorporated into the organization, involving all levels within the department in the conceptualization and program development. This effort will reap many benefits, including improved acceptance by the work force, as well as support for the implementation of the program.

Additionally, the development of a specific task based performance evaluation, based upon the duties that can reasonably be expected to be performed by a firefighter, can reduce or eliminate the legal repercussions to the organization. By having a process that assesses the

physical abilities of a firefighter to perform the tasks associated with the job of firefighting, organizations are more apt to hire physically fit personnel, as well as maintain or improve the overall level of fitness to the members of the organization.

Davis sums it up quite nicely.

Without overstating the obvious, firefighting is hard, dirty and sometimes dangerous work. The fire doesn't care who's making the attack. Whether young or old, male or female, the laws of physics will apply without regard to issues of equal employment. The critical issue is one of safety. Individuals who volunteer to go in harm's way should be capable of delivering the service without compromising themselves or the other members of their team (1994).

Fitness is, and should be, an essential element of any fire department or public safety agency. Ensuring that the level of fitness is maintained is certainly a personal obligation and commitment. The organization, however, shares in that duty and responsibility. Opportunities must be made for personnel to work out, both to ensure and improve cardiovascular fitness, as well as strength and flexibility conditioning. Ensuring optimum firefighter fitness will not only provide a safer work place, but it improves overall morale. If the almighty dollar is any consideration, fit firefighters will show a decrease in lost work time and numbers of days off due to injury and illness (Pearson, et al., 1995).

RECOMMENDATIONS

Clearly, the development of the work performance evaluation as a measure of fitness and ability to perform the essential functions of the job of a firefighter has been a resounding success in the City of Fairfax. Department personnel, inclusive of both career and volunteer members have shown a remarkable level of support for this new process. The tasks that are assessed are clearly related to the skills performed by a firefighter. Optimal performance of those skills, due to a high level of fitness, improves the overall success of the mission of the department.

Continuing with this process will enable the organization to ensure firefighter fitness and ability to perform the job. Using this process, as an applicant tool, will continue to ensure that the department obtains fit personnel. Continuing the six-month frequency of physical fitness assessment, through the use of the WPE, will ensure that the firefighters in the department maintain their overall level of fitness.

Critical to the continued success of the program will be the development of a user's guide to physical fitness exercises. Since the department cannot afford to have full-time physical fitness experts on staff, members must rely upon the resources of local gyms or their own knowledge. The department has begun to expand upon those resources by the purchase of passes to local gyms. On-duty members are encouraged to use these facilities to perform the physical fitness activities. While these facilities do have staff on hand to assist with the various equipment and exercises, experience has shown that having those resources right at hand also enables the firefighter to improve upon their personal workout regimen. Efforts should be made to identify specific exercises that will assist the firefighter in the successful accomplishment of the WPE. If the individual lacks upper body strength, there should be a convenient resource that

describes exercises that can improve upper body strength. The firefighter can then tailor their workout program to their needs.

Lastly, it is critical that management lead the way by setting the proper example. How important is firefighter fitness if the leadership of the organization fails to set the example by themselves participating in physical fitness training?

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