The Fire Service Joint Labor Management

Wellness-Fitness Initiative

FOURTH EDITION

WFI

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4th Edition

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Task Force Cities

FOREWORD

Harold A. Schaitberger
IAFF General President

Thomas Jenkins
IAFC President

The International Association of Fire Fighters and the International Association of Fire Chiefs have continued to work together in an unprecedented endeavor. We have gathered and maintained for over 12 years some of North America's finest fire departments to build a stronger fire service by strengthening our foundation — the fire fighter and EMS responder. Meeting the challenges of tomorrow's fire service requires that we keep our uniformed personnel fit and healthy today.

The ***Fire Service Joint Labor Management Wellness-Fitness Initiative*** has been an exciting challenge for everyone involved in this very positive endeavor. In this document and throughout the process of its development, enhancement and revision, we have addressed the needs of the total individual in a program designed to build and maintain fit and healthy uniformed personnel. Fitness — physical, mental, and emotional — requires an effective wellness program that is made available to recruits, incumbents, and retirees. Components of the Wellness-Fitness Initiative include medical evaluation, fitness, rehabilitation and injury prevention, behavioral health, and data collection.

It is no secret that, historically, the fire service has placed a great deal of its focus on maintaining apparatus and equipment rather than the uniformed personnel who provide emergency services and use such equipment. Fire fighters and EMS responders respond to emergency incidents that require extreme physical exertion and often result in adverse physiological and psychological outcomes. Over time, these adverse outcomes impact the overall wellness of the fire fighting and emergency response system. Often, past attempts to address personnel fitness have been piecemeal, such as recent trends to unilaterally implement timed, task-based performance tests. Such piecemeal approaches have failed to produce universally acceptable and productive results.

Fire chiefs and IAFF local union presidents participating in the Fire Service Joint Labor Management Wellness-Fitness Initiative have contributed to developing an overall wellness-fitness system with a holistic, positive, rehabilitating and educational focus. All participants have committed themselves to overcoming the historic fire service punitive approaches to physical fitness and wellness issues. They have committed to moving beyond negative timed, task-based performance testing to progressive wellness improvement. Moreover, in a joint endeavor all labor and management representatives have committed themselves to the implementation of an individualized wellness-fitness program that is based on the recommendations located in this document.

The ultimate goal of the comprehensive ***Fire Service Joint Labor Management Wellness-Fitness Initiative*** is to improve the quality of life of all uniformed personnel. The project seeks to demonstrate the value of investing wellness resources for the duration of uniformed personnel's careers in order to maintain fit, healthy, and capable fire fighters and EMS responders. An effective program will minimize the expenditures on lost work time, workers compensation, and disability. In addition, through data collection and analysis, participating departments will create an invaluable database which can be utilized throughout the fire service.

This comprehensive project on physical fitness and wellness issues involved the creation and now 12 years later, the continuation of a network of geographically diverse fire departments with excellent union/management relations. Each of the fire departments selected was represented by the fire chief and the IAFF local union president, Additionally, significant input from technical experts from each department was given. As participants, the fire department and IAFF local union officials detailed their physical fitness programs and needs. They provided feedback to help assist in creating and implementing a practical fire service program, and were committed to sharing new knowledge with the consortium. The IAFF has facilitated this effort and provided the necessary resources to complete this project. The IAFC, as an organization, participated in all phases of this WFI revision.

For the past twelve years, numerous task force meetings and technical committee meetings were held as part of this Initiative. The task force, consisting of the IAFF, the IAFC and the fire department chiefs and IAFF local union presidents, directed the content of the document. Each department was represented on the technical committee by exercise physiologists, fitness coordinators, department physicians, behavioral health professionals, and information management personnel. Expert advisors were utilized throughout the process to assist with meeting proceedings. Facilitating and coordinating the work of the task force and technical committees was completed by the IAFF Division of Health, Safety and Medicine.

ACKNOWLEDGMENTS

The Fire Service Joint Labor Management Wellness-Fitness Initiative is now a complete medical, physical fitness and wellness program package. Since the initial distribution of this manual, the IAFF, the IAFC, the Task Force, and technical committee members have continued to address each of the Initiative's components. The fourth revision of this manual reflects our commitment to keep this project current and seek its full implementation in all career fire departments.

The IAFF Department of Occupational Health and Safety would like to lend its appreciation and gratitude to those individuals who contributed their talent, knowledge and expertise towards the development and completion of the Fire Service Joint Labor Management Wellness-Fitness Initiative.

Foremost to the leadership of the IAFF and the IAFC for their joint commitment on behalf of labor and management in meeting the challenge to design and implement an unprecedented program to save fire fighters' and EMS responders' lives. The foresight of IAFF General President Harold Schaitberger and IAFC President Thomas Jenkins drove this historic labor/management effort to its success and created a future model to address mutually important labor and management issues. The organizational commitments allowed this project to be completed with unanimity in all issues before an extremely diverse group.

Special acknowledgment is given to the IAFF Division of Occupational Health, Safety and Medicine staff responsible for coordinating the Initiative process and manual for their persistence in completing the directed research as well as the manual writing and organization of the project, including Jim Brinkley, Director of Occupational Health and Safety, Lawrence Petrick Jr., Deputy Director Occupational Health and Safety, and IAFF Health and Safety Assistants Jason Atkins, Courtney Benedict, Ron McGraw, Racquel Segall, Lauren Kosc, and Bill Bussing. The Division's administrative staff, especially Teri Byrnes and Joyce Vanlandingham, were responsible for the preparation of all meeting materials and meeting aids. Assistance in editing and final document design and layout was done by the IAFF's Communications Department, Jane Blume Director and Kristin Hazlett, Production Assistant. Video production was provided by E18 Media – Marty Sonnenberg and Erin Hart. In addition, Dr. Virginia Weaver, Dr. Aisha Rivera, and the IAFF Occupational Medicine Fellows from Johns Hopkins School of Hygiene and Public Health provided valuable assistance with the development and review of all medical related issues. Further assistance was provided by Dr. Thomas Hales, NIOSH, Dr. David Frost, University of Toronto, Dr. Stefanos Kales, Harvard School of Medicine, and Dr. Kerry Kuehl, Oregon Health and Science University. We were also assisted by a number of fire department physicians, who served as technical representatives, and worked on this document, especially Dr. Don Stewart, Fairfax County Fire And Rescue, Dr. Paul Parrish, Austin Fire Department, Dr. Steve Moffatt, Indianapolis Fire Department, Dr. David Prezant, FDNY, Dr. Frank Pratt, Los Angeles County Fire Department and Dr. Tony Lynch, Calgary Fire Department.

We gratefully recognize the IAFC officials and staff who participated in the project, including IAFC President Chief Thomas Jenkins, Mark Light, Chief Executive Director and John Woulfe, Program Director.

We are indebted to the Fire Service Joint Labor Management Wellness-Fitness Initiative Task Force, including the IAFF, the IAFC, the ten fire departments and IAFF local unions and their technical, medical and operations staff for the commitment of time and resources, and for their thoughtful direction and insight to the final program's implementation. Each department and IAFF local union, regardless of the numbers of personnel committed to the project participated equally in a balance with the IAFF and IAFC that assured the Initiative's success.

International Association of Fire Fighters
Harold A. Schaitberger, General President
Patrick J. Morrison, Assistant to the General President
James E. Brinkley, Director of Occupational Health & Safety
Lawrence Petrick Jr., Deputy Director of Occupational Health & Safety

International Association of Fire Chiefs
Thomas Jenkins, President
Mark Light, Executive Director
John Woulfe, Program Manager

Austin, Texas Fire Department
Rhoda Mae Kerr, Fire Chief
Bob Nicks, President, IAFF Local 975

Calgary, Alberta Fire Department
Steve Dongworth, Fire Chief
Mark Faires, President, IAFF Local 255

Charlotte, North Carolina Fire Department
Pete Key, Fire Chief
Tom Brewer, President, IAFF Local 660

Fairfax County, Virginia Fire and Rescue Department
Richard Bowers, Fire Chief
John Niemiec, President, IAFF Local 2068

Indianapolis, Indiana Fire Department
Ernest Malone, Fire Chief
Henry Harris, President, IAFF Local 416

Los Angeles County, California Fire Department
Daryl Osby, Fire Chief
David Gillotte, President, IAFF Local 1014

Miami Dade, Florida Fire Rescue Department
Dave Downey, Fire Chief
Omar Blanco, President, IAFF Local 1403

City of New York, New York Fire Department
Daniel Nigro, Fire Commissioner
Gerard Fitzgerald, President, IAFF Local 94
James LeMonda, President, IAFF Local 854
Phoenix, Arizona Fire Department
Kara Kalkbrenner, Fire Chief
Steve Beuerline, President, IAFF Local 493

Seattle, Washington Fire Department
Harold Scoggins, Fire Chief
Kenneth Stuart, President, IAFF Local 27

Literally, hundreds of members of the above departments and locals participated over the past 19 years. However, we must recognize the efforts of members of our PFT Oversight Committee, who continually assisted in the revision process, especially Ian Crosby, IAFF Local 255 — Calgary; Michael Cacciola, IAFF Local 854 — New York; Andy Arredondo, IAFF Local 493, Phoenix; Jill Craig, IAFF Local 975 — Austin; George Cruz, Derek Alkonis IAFF Local 1014 —Los Angeles County, Melissa Kennedy, IAFF local 27 – Seattle; Sue Shepard IAFF Local 416 — Indianapolis..

Finally, we also wish to recognize the special experts we utilized during the process: Joanna Gaitens PhD, MPH, and Melissa McDiarmid, MD, MPH, both Associate Professors of Medicine, University of Maryland; Julie Collier, Physical Therapist, Fairfax County Fire & Rescue Department; Dr. Suzy Bird Gulliver, Clinical Psychologist, Texas A&M University; Frank Leto, FDNY Counseling Services Unit Local 854; Willie Ostiguy, Boston FD EAP Coordinator, Local 718.
The completion of this project could not have been possible without the professionalism and commitment of everyone involved. We recognize and applaud every member of this group for all the hard work they have done throughout the past two years. Our organizations will remain committed to continue developing programs to improve the quality of life of all fire fighters and emergency medical personnel.

Patrick J. Morrison
Assistant to the General President
Occupational Health, Safety and Medicine

International Association of Fire Fighters, AFL-CIO, CLC
Department of Occupational Health and Safety
1750 New York Avenue, NW
Washington, DC 20006
(202) 824-1571

MISSION STATEMENT

Every fire department in cooperation with its local IAFF affiliate must develop an overall wellness/fitness system to maintain uniformed personnel physical and mental capabilities. While such a program may be mandatory agreement to initiate it must be mutual between the administration and its members represented by the local union. Any program of physical fitness must be positive and not punitive in design; require participation by all uniformed personnel in the department once implemented; allow for age, gender, and position in the department; allow for on-duty-time participation utilizing facilities and equipment provided or arranged by the department; provide for rehabilitation and remedial support for those in need; contain training and education components, and, be reasonable and equitable to all participants. The program must address the following key points.

- Confidentiality of behavioral, medical, and fitness evaluations
- Physical fitness and wellness programs that are educational and rehabilitative, and not punitive
- Performance testing that promotes progressive wellness improvement
- Commitment by labor and management to a positive individualized fitness/wellness program
- Develop a holistic wellness approach that includes:
- Medical evaluation
- Fitness
- Rehabilitation
- Behavioral health
- The program should be long term, and, where possible, be made available to retirees.

CHAPTER 1 — Introduction

THE FIRE SERVICE JOINT LABOR MANAGEMENT WELLNESS-FITNESS INITIATIVE

This chapter highlights the following:

- **The Initiative**
- **What is Wellness?**
- **Uniformed Personnel and Wellness**
- **The Union and Wellness**
- **Fire Chiefs and Wellness**
- **Community Support for Wellness**
- **Financial and Administrative Commitment**
- **Overview of Document Content**

THE INITIATIVE

The Fire Service Joint Labor Management Wellness-Fitness Initiative (WFI) is a historic partnership between the IAFF and the IAFC as a way to improve the wellness of fire department uniformed personnel. Ten public professional fire departments from the United States and Canada participated. Each of these departments committed themselves to this Wellness-Fitness Initiative by requiring mandatory participation of all of their uniformed personnel in this program. This intrepid move to commit labor and management to the wellness of their uniformed personnel will carry the fire service into the 21st century.

The Fire Service Joint Labor Management Wellness-Fitness Initiative is a non-punitive program.

The brand and logo for the WFI was established in 2007. All WFI products, including the Initiative, the Candidate Physical Ability Test (CPAT) and the Peer Fitness Trainer (PFT) Certification bear this name and logo.

The intention of the WFI is that its implementation should be a positive individualized program that is non-punitive. All component results are measured against the individual's previous examinations and assessments not against any standard or norm. However, medical practice standards may be used when results indicate that life saving intervention is required.

Confidentiality of medical information is the most critical aspect of the WFI. The unauthorized release of personal details which may be recorded as part of a medical evaluation causes legal, ethical, and personal problems for the employee, employer and examining physician. All information obtained from medical and physical evaluations should be considered confidential. The employer will only have access to information regarding fitness for duty, necessary work restrictions, and if needed, appropriate accommodations. Also, all medical information must be maintained in separate files from all other personnel information.

WHAT IS WELLNESS?

Wellness is a term that refers to an individual's state of mind as well as their physical state, balancing between health and physical, mental, emotional and spiritual fitness. The concept of wellness also entails having access to rehabilitation, when indicated. Moreover, wellness should be an interactive process where an individual becomes aware of and practices healthy choices to establish a balanced lifestyle.

In fire departments wellness programs are intended to strengthen uniformed personnel so that their mental, physical, and emotional capabilities are resilient enough to withstand the stresses and strains of life and the workplace.

A wellness program should not be perceived as just another program, but rather as a complete commitment to the

- health, safety and longevity of all uniformed personnel;
- productivity and performance of all fire crews; and
- cost effectiveness and welfare of the fire department.

The Initiative is considered a total program, where all components must be implemented for the benefit of both the individual and department.

UNIFORMED PERSONNEL AND WELLNESS

Fire fighting continues to be one of the most dangerous occupations in the United States and Canada. Research reveals the need for high levels of physical fitness to safely perform the necessary duties of the fire service. The long hours, shift work, sporadic high intensity work, strong emotional involvement, and exposure to human suffering places fire fighting among the most stressful occupations in the world. High levels of stress, intense physical demands, arduous work and short and long-term exposure to chemicals and infectious disease contribute to heart disease, lung disease and cancer, which are the three leading causes of death and occupational disease disability.

Wellness is important concept for all uniformed personnel. In many departments, some individuals may gravitate to job tasks other than fire fighting due to personal necessity or interest and can include: EMS activities; rescue; hazardous materials response; or fire investigations. However, all tasks include significant physical and emotional stresses.

Wellness is a personal commitment that all uniformed personnel must make to survive and to sustain a successful career in the professional fire service. When uniformed personnel are ill or injured, malnourished or overweight, over stressed or out of balance, it affects their ability to effectively do their job.

There are many benefits of wellness for uniformed personnel. Some of these include:

- greater strength and stamina;
- weight reduction and/or maintenance;
- lower cholesterol and blood pressure levels;
- decreased risk of death, injury, or disability from disease;
- improved job performance and work satisfaction;
- improved physical performance;
- better posture and joint functioning;
- reduced anxiety, stress, tension, and depression;
- increased energy, general vitality, and mental sharpness;
- enhanced self-esteem and self-image;
- improved sleep patterns;
- enhanced capacity to recover from strenuous and exhaustive work;
- increased homeostasis ability;
- improved mobility, balance, and coordination.

THE UNION AND WELLNESS

In implementing wellness-fitness programs unions must assume a leadership role for their members. Traditionally, safety in fire fighting entailed purchasing the latest equipment, such as new apparatus, protective clothing, or the latest technology. Yet, the most important component in responding to emergencies is the fire fighter and EMS provider. The definition for safety in fire fighting must expand to include a wellness-physical fitness program for uniformed personnel. Unions must work to ensure that uniformed personnel have the opportunity to attain and maintain a healthy body and mind so they can perform their work duties to the best of their abilities.

The responsibility for a wellness-fitness program is not simply the responsibility of management, but should have union input and cooperation in the process. Without union participation in establishing such a program there will be limited or no member "buy in" to the program. A wellness-fitness program must be collaborative between labor and management and is educational and rehabilitative and not punitive in nature.

Fire fighter unions work hard to improve the economic status of their members. A quality wellness-fitness program will help all members perform their duties, while allowing them to enjoy the fruits of their labor when they retire.

FIRE CHIEFS AND WELLNESS

As previously stated, wellness is a commitment that all uniformed personnel must make to meet the demands and rigors of the job. It is the fire chief's job to ensure that excellent customer service is delivered to the community by healthy uniformed personnel. In order to achieve such a workplace uniformed personnel can enhance their performance in an environment where workplace safety, regulatory compliance, and positive attitudes exist.

Fire chiefs must support their commitment to wellness with actions and policies that improve the overall quality of life of uniformed personnel. Fire chiefs should take the long view with their commitment to wellness, considering how best to enable the wellness of their members throughout careers and into retirement. Implementation of an evidenced based wellness program will facilitate compliance with workplace regulations and improve the responsiveness of fire chiefs to directives from governing political bodies.

Finally, in most departments, a fire chief is not only an administrator but also an active fire fighter, subject to the same stresses and other occupational hazards. Thus, a fire chief's commitment to wellness serves both personal and professional interests.

COMMUNITY SUPPORT FOR WELLNESS

Every fire incident or response within a community is unique. The ability of uniformed personnel to effectively respond is improved by their level of physical and mental preparedness. A wellness program is a cost effective measure for the community in that injury rates and sick leave usage are reduced. This enables controlling the overtime costs that are associated with filling vacant positions or utilizing other agencies for response. Wellness programs can facilitate fire department compliance with federal, state, and local laws related to issues such as infectious disease training and testing, as well as breathing apparatus certification. Utilizing a wellness program to address such issues will eliminate using costly outside consulting agencies, thus reducing costs while achieving uniformed personnel wellness. Fire departments with members who are medically, physically, and mentally fit provide better service to their communities while realizing reductions in disability retirements by their uniformed personnel.

FINANCIAL AND ADMINISTRATIVE COMMITMENT

The implementation of a wellness program is not free. However, there may be significant cost benefits to initiating or expanding a wellness program. Wellness programs have repeatedly been shown to provide long-term savings.

Fire department wellness programs make economic sense and by adopting and implementing an occupational wellness program, such as the WFI, fire departments can reduce occupational claims and costs while simultaneously improving the quality and longevity of a fire fighter's life; Other benefits include:

- Prevention, early detection and reduction of premature fire fighter musculoskeletal injuries, cardiovascular disease , and cancer through a comprehensive health risk screening;
- Avoiding passive impacts to reduce off-duty injury/illness costs through health promotion programs.
- Behavioral health programs that will further enhance, complement and improve the cost savings of a comprehensive wellness program.

The fire service's greatest asset is not equipment, apparatus or stations, but rather its personnel. It is through personnel that fire departments are able to serve the public, accomplish their missions, and able to make a difference in the community. A commitment and investment in a wellness program helps to gain the members' trust, which in turn benefits every program and each call answered by the fire department. Therefore, placing a high priority on wellness makes sense for everyone including fire service personnel, tax payers, and the public served.

OVERVIEW OF DOCUMENT CONTENT

The Fire Service Joint Labor Management Wellness-Fitness Initiative has five main components. Each component is significant to the implementation of a wellness-fitness program and lends itself to achieving a holistic approach. The The five components are:

1. Medical evaluations
2. Physical fitness;
3. Medical/fitness/injury rehabilitation;
4. Behavioral health;
5. Data collection and reporting.

Structure of Manual

Each of the components is presented as a separate chapter. Each chapter begins with an introduction which explains the need of that component within the context of the WFI. The introduction is followed by a description of the necessary services that should be included to meet the objective of the larger component. Applicable protocols or detailed programs are included or referenced in the document, where appropriate.

National Fire Protection Association Standard 1582 and the WFI

The IAFF worked directly with the National Fire Protection Association (NFPA), as well as the Technical Committee responsible for NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*, to ensure consistency in both documents. IAFF provided copyrighted materials to NFPA, with the provision that the incumbent evaluations mirror the Wellness-Fitness Initiative.

The current 2018 edition of NFPA 1582 document includes a stringent standard for candidate fire fighters, as well as a flexible guide for incumbent fire fighters medical determinations, which are based upon the specifics of their condition, as well as the duties and functions of their job. Job tasks are addressed in Chapter 9, with an explanation of medical conditions that can potentially interfere with a member's ability to safely perform essential job task. The key word here is potentially.

Most importantly, presence of one or more of the conditions listed in Chapter 9 for incumbent fire department members does not indicate a blanket prohibition for the incumbent member from continuing to perform essential job tasks, nor does it require automatic retirement or separation from the fire department. However, it does provide the Fire Department Physicians guidance to determine a member's ability to medically and physically function using an individual medical assessment for the conditions listed in the chapter.

Conversely, the standard does provide specific requirements for candidates. Unlike the guidance provided for incumbents, the standard provides specific medical conditions that can affect a candidate's ability to safely perform essential job tasks. Candidates with Category A medical conditions are not to be certified as having met the medical requirements of this standard. Candidates with Category B medical conditions can be certified as having met the medical requirements of this standard, only if they can perform the essential job tasks without posing a significant safety and health risk to themselves, other members, or civilians.

The fire department must also document, through job analysis, the essential job functions that are performed in a local jurisdiction and must also determine if that incumbent is expected to perform those tasks, based on assignment and even rank. **Again, there are no blanket prohibitions for incumbent fire fighters.**

Upon conducting an individual medical assessment, it is the responsibility of the physician to state if a member, because of a specific condition, cannot safely perform his/her job, as well as specific tasks that the individual cannot perform. The fire chief must then determine if there are positions within his/her department that the individual can perform, based on that fire departments job analysis for that position.

It is essential to recognize that this Standard was fundamentally developed for and intended for physician guidance. The Standard is to provide physicians with advice for an association or relationship between essential job functions of a fire fighter as an individual and his/her medical condition(s). This guidance should be utilized for the best approach towards an individual's risk assessment and management with respect to their medical issue(s) and particular job. Therefore, especially with incumbent fire fighters, it is always important to consider what exactly the fire fighter does while on the job and how those particular tasks will affect his/her performance on an individual basis. ■

CHAPTER 2 — Medical

Management and labor shall support the provision of the comprehensive mandatory annual medical exams as a component of the Wellness-Fitness Initiative (WFI) Program

This chapter highlights the following:

- **Introduction**
- **Physical Examination**
- **Body Composition**
- **Laboratory Analyses**
- **Vision Evaluation**
- **Hearing Evaluation**
- **Pulmonary Evaluation**
- **Aerobic/Cardiovascular Evaluation**
- **Cancer Screening**
- **Sleep Disturbance**
- **Immunizations**
- **Infectious Disease Screening**
- **Occupational Stress Awareness Consultation**
- **Referrals to Health Care Practitioners**
- **Written Feedback**
- **Data Collection and Reporting**

INTRODUCTION

The WFI is a progressive model for delivering a preventive and occupational health care services program for today's fire fighters and emergency medical workers (collectively referred to as "uniformed personnel"). The purpose of the WFI is to ensure that uniformed personnel are healthy enough to work safely and effectively during their careers and maintain good health during their retirement. The need for this type of program is based on the unique risks and adverse working environments that uniformed personnel face daily. The intent of the program is that it is implemented as a mandatory, non-punitive program where all uniformed personnel work to improve his or her health or wellness, competing only with themselves.

Due to the physical demands of the job, it is essential that all uniformed personnel maintain a high level of fitness-wellness. In addition, these individual's face unique psychosocial stressors that are a result of the constant exposure to tragic events and suffering. Therefore, the creation of a comprehensive health and wellness program is essential to provide the medical and psychological support needed for uniformed personnel.

Properly implemented, the clinical program outlined in this chapter will allow for an appropriate medical assessment, early detection of diseases and illnesses, as well as implementation of health promotional programs. The annual medical examination is an integral element that provides invaluable health status assessments of both the individual and the department. Moreover, collecting unidentifiable aggregated data during such exams allows for long-term analysis and the implementation of improved preventive programs.

Medical Evaluation and Assessment

The medical evaluation outlined in this chapter is intended to accomplish the following:

1. Identify whether an individual is physically and mentally able to perform essential job duties without undue risk of harm to self or others
2. Monitor the acute and long-term effects of the working environment on uniformed personnel, including exposure to chemical and biological agents and the effects of physical and psychosocial stressors in the fire department
3. Detect patterns of disease in the fire department that might indicate underlying work-related health concerns
4. Provide quantifiable medical information on the entire fire department
5. Inform uniformed personnel of their occupational hazards and health status
6. Provide a cost-effective investment in health promotion and disease prevention in the fire department
7. Comply with federal, state, provincial and local health and safety requirements

A comprehensive medical assessment shall be conducted annually. Individuals may use any designated fire department physician, or other providers, to conduct the medical assessment. Uniformed personnel may elect to have certain components of the medical evaluation (i.e. invasive genitourinary examinations) completed by their primary care physician. If this option is chosen, the exam must still be done within the prescribed schedule and the results reviewed by the fire department-designated medical provider and recorded in the member's confidential fire department medical record. Since many medical providers are not familiar with the increased health risks associated with uniformed personnel, the WFI recommends providing them with the "Fire Fighter Medical Examination" outlined in Appendix B. All medical assessment results, regardless of where they were obtained or performed, shall remain confidential.

Recently, there have been some varying recommendations on the intervals of medical assessments usually based on an individual's age. However, the value of providing annual medical assessments for uniformed personnel within a high-risk occupation has been determined by the WFI Task Force to be medically significant. It is a cost-effective program, based on a history of saving

members' lives through early intervention. The National Fire Protection Association (NFPA), within its health, safety, medical and fitness standards for fire departments has also recognized and specifically requires annual medical assessments.

While the WFI Medical Committee relied extensively on the U.S. Preventive Services Task Force (USPSTF), American Heart Association (AHA) and American Cancer Society (ACS) general population recommendations on health screening, it is important to note that these organizations do not routinely consider occupational risk in their recommendations. Therefore, to specifically address known occupational risks in fire fighters, such as cardiac events during fire suppression and certain cancers, the WFI Medical Committee made recommendations beyond the general population guidelines of these authoritative organizations.

Medical History Questionnaire

An initial pre-employment history questionnaire for establishing a medical baseline and a periodic medical history to provide follow-up information and to identify changes in health status must be completed during each medical assessment.

The Genetic Information Nondiscrimination Act (GINA) prohibits discrimination on the basis of genetic information (including family medical history). The definition of genetic information includes information about an employee's genetic tests, the genetic tests of an employee's family members, and the employee's family medical history. According to the Equal Employment Opportunity Commission (EEOC), family medical history is included in this definition because it is often used to determine whether an employee has an increased risk of getting a disease, disorder, or health condition in the future.

GINA prohibits employers from requesting, requiring, or purchasing genetic information with respect to an employee, subject to several exceptions. The EEOC's regulations state that this prohibition on requesting genetic information from employees applies to medical examinations related to employment, such as periodic or fit-for-duty exams. In order to avoid violating GINA, an employer could require participation in a mandatory wellness program with a mandatory medical exam that does not request family medical history or any other genetic information.

The EEOC has stated that collection of genetic information is only permitted in very limited circumstances, including "voluntary" wellness programs and then, only with prior, knowing, voluntary, and written authorization. Voluntary means that participation is not required and that employees may not be penalized for non-participation in providing genetic information and in the program itself.

Although a fire fighter may not be required to provide family medical history under this law, it may prove to be very useful to medical providers screening for potential medical conditions. Nevertheless, family medical history, when collected, must only be utilized as part of a voluntary wellness and fitness program. In cases where such history is collected, the employee must sign a statement confirming prior to any such disclosure that the information is being voluntarily disclosed. Additionally, the health care provider must maintain the individual's confidentiality and may only report such information to the employer in aggregate terms so that it cannot be tracked back to individual employees. Genetic information cannot be used by employers in making employment decisions.

Health Care Provider Responsibilities

The department will designate all examining physicians approved to evaluate patients for the WFI. This continuum of care includes:

- Candidate medical evaluations
- Annual medical/fitness evaluations
- Injury/illness care and rehabilitation
- Pre-retirement medical evaluations (post-retirement exams where provided)
- Return to work evaluations.

The physician must have a thorough understanding of the positions in the fire department, including:

- Essential job tasks
- Physical demands
- Psychosocial stressors
- Chemical, biological, and physical exposures
- The effects of medical conditions on essential job tasks.

It is important that the physician understand and participate as a member of a multidisciplinary WFI Team. The physician is a vital advisor/consultant to both labor and management on all medical issues.

Physicians must maintain complete adherence to medical confidentiality. Specific information regarding the medical examination, evaluation, laboratory results and medical diagnosis shall not be released unless written permission is obtained from the individual. Employees need to feel assured that the information provided to the physician will not be shared unless consent is granted.

Finally, the fire department physician must have knowledge of local, state, provincial, and federal laws related to health and safety.

WFI PHYSICIAN SELECTION

The physician plays a central role in all medical aspects of the WFI. The following parameters should be considered in selecting a physician for this program. Ensure that the provider:

1. Has experience in occupational medicine including wellness and fitness health components related to firefighting.
2. Is board eligible or certified in a relevant specialty such as emergency, family, internal, or occupational medicine.
3. Has experience coordinating referrals to a variety of medical specialties for care of occupational injuries, cardiac and pulmonary issues, cancer, behavioral and other health issues affecting firefighters.
4. Is familiar with data collection, risk management and environmental conditions relevant to Labor/Management Wellness Fitness Initiatives.

NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Departments, contains several options that fire departments can implement to increase physician knowledge regarding fire fighter occupational hazards and their management. These include:

- Providing the physician with an overview of all fire fighter essential job tasks and current job descriptions as well as an outline of the types and levels of service provided by the department.
- Assisting the physician to understand the physiological and psychological demands of fire fighters, their work conditions/environment, and their personal protective equipment (PPE) requirements. Options to increase knowledge in this regard include participating in ride-alongs and being present at fire and emergency scenes. This may be more difficult if the position is contracted out to a health care company.
- Ensuring that the physician has a thorough working knowledge of the NFPA 1582 and is actively engaged in the health and safety, behavioral health, rehabilitation, and wellness and fitness programs in their fire department. In addition, ensuring that the physician remains current in the medical literature pertaining to the fire service and consensus clinical practice with relevant CME.

PHYSICAL EXAMINATION

■ Vital Signs

A physical examination begins with the assessment of height, weight, blood pressure, temperature, heart rate, and respiratory rate. Blood pressure shall be a part of the baseline and annual examination, with any necessary follow-up as medically indicated. Uniformed personnel with known elevated blood pressure must be educated about the long-term health effects of ignoring this condition, including the possibility of stroke and coronary artery disease. They must be counseled to obtain treatment from their primary care provider.

■ Head, Eyes, Ears, Nose, and Throat (HEENT)

This examination offers an opportunity for the examiner to assess each person's ability to wear head protection, a respirator face piece, and other respiratory protection. The examiner should also review the importance of an uncompromised airway while wearing a respirator. Moreover, it allows for identification of possible chronic exposures that may place the individual at risk for long-term illnesses. The HEENT exam should emphasize early identification of treatable disease and prevention strategies through education. It is also important to note that the examiner has an opportunity to discuss the health hazards of tobacco use, including cancer, cardiovascular disease, lung diseases and premature aging. This is also an opportunity to discuss tobacco cessation strategies.

The HEENT exam includes a thorough evaluation of the:

- **Head —** Evaluate the shape of a member's face looking for evidence of previous trauma or other gross abnormality that may interfere with the use of self-contained breathing apparatus (SCBA) or other PPE
- **Eyes —** Assess extra ocular movements, pupillary light reflex and accommodation, conduct fundi/retinal exam, assess visual acuity, peripheral vision, and color vision
- **Ears —** Visualize the external ear canal and tympanic membrane, inspect the external ear helix particularly for evidence of sun damage or cancerous lesions. An audiometric exam, performed per standard procedures, is also required.
- **Nose —** Inspect for patency of nares, septal cartilage deviation, evidence of polyps (usually secondary to chronic inflammation), other mucosal changes (e.g., erythematous patches in smokers), and evidence of tenderness over the paranasal sinuses
- **Throat —** Evaluate the oropharyngeal cavity, gums, teeth, palate (hard and soft), tongue (dorsum and undersurface), tonsils and posterior pharyngeal wall, also direct observation for pre-cancerous changes (e.g., color changes-leukoplakia, plaques, nodules, and asymmetry) is important.

■ Neck

The exam should include evaluation of major vessels, lymph nodes, endocrine structures (salivary and thyroid glands), physiologic functioning (e.g., swallowing, saliva production), assess for abnormal masses, gland enlargement, or suspicious skin lesions. Range of motion of the cervical spine should also be noted.

Cardiovascular (CV)

The CV exam must include the following components:

- Assessments of pulse (rate, regularity, and volume)
- Seated blood pressure (with the patient's feet on the floor and the proper sized BP cuff)
- Auscultation of the heart (for heart sounds, extra sounds, clicks, and murmurs) and major arteries (carotid, abdominal aorta, femoral for bruits)
- If clinically indicated, examination for signs of decompensating heart function (CHF) such as jugular venous pulse and peripheral (ankle) edema.

In addition, a medical CV assessment must include a thorough history and physical exam. It is imperative to inquire if there are any recent changes in the patient's aerobic capacity, which could indicate pulmonary or cardiac disease. Typically, uniformed personnel suffering from early lung or heart disease will deny being more fatigued while fighting fires. More common is the complaint that during the past year or two the individual's tolerance for exercise has diminished.

The examiner must identify modifiable cardiac risk factors including:

- Smoking
- Dyslipidemias, including: high total cholesterol/HDL-cholesterol ratio, high LDL-C, high triglycerides, and low HDL-C
- Hypertension
- Diabetes
- Chronic kidney disease
- Metabolic (insulin resistance) syndrome
- Sedentary lifestyle and/or obesity
- Nutritional concerns and/or deficiencies.

Non-modifiable cardiac risk factors should also be noted. These include:

- Male gender
- Advanced age
- Positive family history of premature cardiovascular diseases or risks. Individuals with a family history of premature CAD in a first-degree relative are at an increased risk of cardiovascular events.

Pulmonary

A pertinent history includes any complaints of exercise intolerance, cough, symptoms of bronchospasm, and exposures (chemical or biological). The respiratory exam should include:

- Inspection for respiratory rate and effort
- Presence of coughing or sneezing
- Skin color and any clubbing of the digits (indicative of respiratory diseases)
- Auscultation for breath sounds and any abnormal sounds (expiratory wheezing, inspiratory crackles, or stridor). If clinically indicated, more specific exams for areas of consolidation or dullness (pneumonia, pleural effusions, etc.).

Spirometry is an effective screening and surveillance exam for pulmonary disease and shall be included in the exam. Any changes in the spirometric indices, such as reductions in the vital capacity and/or forced expiratory volumes should be subject to further evaluation by more formal pulmonary function testing and/or evaluation by a pulmonologist.

Gastrointestinal

Gastrointestinal exam shall include inspection, palpation, percussion, and auscultation. Abdominal obesity has been shown to be associated with increased inflammation in the body and concomitant increased risk for several chronic diseases. Palpation for tenderness, organ enlargement, other masses (tumors or hernias), and femoral lymph node enlargement is appropriate. Percussion and palpation of major arteries for bruits and pulse volume (specifically abdominal aortic aneurysms, or weak pulses indicative of arterial atherosclerosis) should also be performed. Generally, the right upper quadrant is palpated for evidence of liver, colon or gall bladder disease; and the left upper quadrant is palpated for spleen or colon pathology. Palpating the right and left lower quadrants is helpful for evaluation of colon disease.

Genitourinary

- *For Men* — this examination includes testicular, penis, and inguinal hernia evaluations, as well as previously mentioned palpation of femoral pulses and for lymphadenopathy. This part of the examination provides an opportunity for the examiner to discuss the merits of testicular and prostate cancer screening, and techniques for self-examination of the testicles. This exam may be deferred if the patient prefers to obtain these exams from his own primary care physician.

- *For Women* — this examination includes vaginal and bimanual pelvic exams, the Pap smear, breast exam, and mammography. This part of the examination provides an opportunity for the examiner to discuss the merits of breast and cervical cancer screening and techniques for self-examination of the breasts. This exam may be deferred if the patient prefers to obtain these exams from her own primary care physician or women's health care facility.

Lymph Nodes

An examination of the lymph nodes for enlargement, tenderness, and mobility in the cervical, supraclavicular, inguinal, and the axillary regions is to be conducted.

Neurological

The neurological examination for uniformed personnel shall include a general assessment of:

- Mental status
- Cranial nerve function
- Motor system
- Sensory system
- Cerebellar function/coordination (balance and gait)
- Reflexes

- ***Mental Status Exam*** — A general mental status exam focuses on orientation, memory (short and long term), and judgment. If clinically indicated, refer for psychiatric and/or psychological evaluation for additional assessment.

A focused cranial nerve examination includes an emphasis on the senses. The cranial nerve exam includes:

CN1 — smell (often omitted unless history of head trauma or toxic inhalation)

CN2 — vision

CN3 – pupillary constriction; elevation of the eyelid; extra ocular eye movements

CN4 – extraocular eye movement

CN5 – jaw movement

CN6 – extraocular eye movements

CN7 – muscles of the face

CN8 – hearing and balance

CN9 – taste and pharynx movements

CN10 – movement and sensation in the oropharynx

CN11 – movement of the neck muscles

CN12 – tongue movement. A more thorough evaluation may be necessary if clinically indicated (e.g., headaches, dizziness/vertigo, or syncope).

- ***Peripheral Nerve Exam*** — peripheral nerve function is assessed in the motor and sensory portions of the neurological exam. Decreases and imbalances in muscular power can predispose uniformed personnel to musculoskeletal injuries. Thus, a general (motor assessment as measured by a 0 to 5 subjective rating of power) is important as it pertains to safe and injury-free work performance. The peripheral neurological examination is usually continuous with the cranial nerve evaluation. However, such peripheral motor, sensory, and reflex examinations may be conducted in conjunction with the musculoskeletal exam.

  Motor — gait, heel-to-toe, and Rhomberg (feet together, arms outstretched, palms up and eyes closed) screening examinations for cerebellar function must be conducted. Muscle strength is tested in all major muscle groups. Because of the physical demands on fire fighters, any evidence of decreased muscle strength (as measured on the standard 0-5 scale) raises significant concerns regarding work performance and must be addressed.

  Sensory — the examination includes pain, thermal sensation, light touch, position, two point discrimination, and vibratory sensation testing. Thermal evaluations are generally omitted if the pain examination is normal.

  Reflexes — this examination includes the standard evaluation of reflexes on a 0-4+ scale, including the ankle, knee, bicep, tricep, and brachioradialis.

Musculoskeletal

In addition to the motor assessment, the examiner must inspect and palpate for the following conditions:

- Structural asymmetries (e.g. areas of muscular imbalance and atrophy)
- Active range of motion of all major joints (including the back)
- Sensation of pain with any of the above
- A complete joint specific examination where clinically indicated.

Any musculoskeletal limitations or areas of pain are important to note, not only for the timely provision of physical therapy, but to record those injuries that may be relevant to future workers' compensation, pension, or disability claims.

Skin

The examiner shall inspect the skin for color, vascularity, lesions, and edema. Careful examination of the skin for abnormal/atypical nevi (moles) or other suspicious lesions that could be cancerous (non-melanoma or melanoma types) is critical. The clinician should have a low threshold for referring a patient to a dermatologist when suspicious or atypical changes are present. Also note any rashes, scars, tattoos, or obvious evidence of trauma/injury (bruising, excoriations, scraps, cuts, swelling, erythema, warmth, or tenderness).

BODY COMPOSITION

Body composition differentiates between the relative amounts of adipose tissue (fat) and lean body mass. Lean body mass consists of muscle, bone, organs, nervous tissue, and skin. Historically, body fat was thought of as a passive tissue that served to insulate and protect the body and its organs and act as a reservoir for energy storage. Although some body fat is considered essential, excess body fat increases the workload and amplifies heat stress by preventing the efficient dissipation of heat when a person exercises. In addition, added body fat elevates the energy cost of weight-dependent tasks such as climbing ladders and walking up stairs, contributing to injuries and an increased risk of many chronic diseases. Obesity is overtaking smoking as the number one cause of preventable deaths and is associated with an increase in almost every chronic disease including but not limited to:

- Cardiovascular disease
- Hypertension
- Dyslipidemia
- Heart failure
- Diabetes
- Several types of cancer
- Asthma and chronic lung diseases
- Obstructive sleep apnea
- Dementia
- Arthritis
- Gastroesophageal reflux disease

■ Evaluation of Body Composition

Methods for evaluating body composition include:

- Circumferential measurements
- Hydrostatic weighing
- Bod Pod
- Bioelectrical impedance analysis (BIA)
- Skinfold measurement
- Body Mass Index (BMI)

The accuracy, reliability and practicality of these methods vary. There is ongoing research on the most accurate and consistent method for evaluating body composition. However, the WFI has selected the hip to waist circumference ratio as the preferred method of estimating body composition.

■ Distribution of Body Fat

Recent scientific research suggests that the distribution of body fat is an important predictor of negative health outcomes. Individuals with more intra-abdominal/visceral fat, which is fat around abdominal organs, are at an increased risk of hypertension, type 2 diabetes, dyslipidemia, coronary artery disease, and premature death. This visceral adipose tissue is metabolically different than subcutaneous fat. Excessive abdominal fat, as revealed by waist circumference measures, creates increased inflammation in the body. This occurs because fat cells release pro-inflammatory cytokines, cell signaling molecules that activate the immune system, which 'turns on' an inflammatory cascade at genetic and cellular levels, ultimately affecting the entire body. This is important because current scientific research links chronically increased inflammation to several chronic disease states such as cardiovascular disease, pre-diabetes/diabetes, cancer, and dementia, and others.

Thus, abdominal fat is no longer thought of as just a passive or inert reservoir for storing energy; it is an active endocrine organ, secreting many factors capable of increasing systemic inflammation within the body. Expert consensus indicates that a waist circumference measurement, measured at the level of the iliac crests, that is greater than 102cm (40 inches) in men, and 88cm (35 inches) in women imparts a significant increase in the risk of chronic disease, including cardiovascular disease. Obesity, and in particular abdominal obesity, is a health risk that must be managed aggressively.

LABORATORY ANALYSES

Blood and urine testing should be conducted at baseline and at a minimum of every three (3) years to the age of 40 and annually thereafter. Prior to age 40, this testing should be performed more frequently as a function of age, disease, risk factors and specific occupational exposures. Follow-up abnormal lab results as clinically appropriate.

Prior to reporting to a physician for an annual medical examination, uniformed personnel may have their blood drawn and urine sampled and analyzed at a designated laboratory site. Having the lab results available at the time of the physical exam will assist physicians in providing a more thorough examination and allow physicians to address any concerns based on the laboratory results. If blood is drawn and urine sampled during the annual examination, results are provided to physicians for a follow-up and/or addressed in the Health Risk Appraisal.

■ Blood Analysis

The following are components of the blood analysis. At a minimum, laboratory services must provide these components in their automated chemistry panel (CMP) and complete blood count (CBC) protocols. If laboratory tests are not done prior to the scheduled physical examination, laboratory tests will be drawn at the time of the medical examination.

Blood drawn for medical analysis *will not* be used for drug screening at any time.

The minimum blood analysis includes:

- White blood cell count (with differential)
- Platelet count
- Red blood cell count (hemoglobin and hematocrit)
- Liver enzymes and function tests (AST, ALT, LDH, alkaline phosphatase, bilirubin, albumin)
- Fasting glucose
- Creatinine and estimated glomerular filtration rate (eGFR)
- Blood urea nitrogen; sodium; potassium; carbon dioxide; total protein; calcium; lipids (cholesterol and triglycerides) – fasting

- ***White Blood Cell Count***
  White blood cells (WBC) are an important part of the body's immunologic system. The role of white blood cells is to help the body defend itself against infection.

  An elevated WBC count may suggest an acute bacterial or viral infection, various types of leukemia, acute blood loss, renal failure, pregnancy, or an inflammatory disorder (such as inflammatory bowel disease). It may also indicate the effects of acute severe emotional/physiological stress (e.g. burns, trauma) on an individual.

  Situations where the WBC count is low can include: chronic viral or bacterial infection, acute leukemias, immunosuppressive disorders (e.g., HIV), autoimmune diseases (e.g., lupus), chemical and heavy metal toxicities, drug effects (e.g. some antibiotics and analgesic medications), and perhaps chronic emotional stress (which could be construed as 'normal' depending on the circumstances of the individual). The WBC differential helps to determine the significance of an abnormal WBC count.

- ***WBC Differential***
  The WBC differential identifies relative amounts of different types of white blood cells and helps to identify different clinical problems. For instance, a high neutrophil count might indicate: an acute bacterial infection; presence of immature neutrophils (bands) could mean acute leukemia; excess eosinophils may indicate a parasitic infection or allergic reaction; or an increase in lymphocytes may indicate a chronic inflammatory condition, infection or chronic type of leukemia.

- ***Red Blood Cell Count***
  The purpose of red blood cells is to carry oxygen to the body's tissues. The routine measures of the blood's oxygen carrying capacity are hemoglobin and hematocrit. An increase in the number of RBC's may indicate dehydration, a myeloproliferative disorder called polycythemia, or conditions of hypoxia such as emphysema and smoking**.** Decreased levels may indicate anemia, acute blood loss, or hemodilution.

- ***Platelet Count***
  Platelets are essential to the bloods ability to properly clot. Abnormally low platelet counts, known as thrombocytopenia, may be caused by a decrease in production possibly stemming from bone marrow suppression, clumping or destruction of platelets from sequestration in the tiny capillaries of the spleen. High platelet counts are associated with myeloproliferative disorders such as polycythemia, essential thrombocytosis, or chronic myelogenous leukemia.

- ***Liver Enzymes and Function Tests***
  The following liver assessment tests are used primarily to detect and monitor liver disease. These tests measure either liver injury (enzymes, also referred to as liver transaminases) or liver function. An increasingly common cause of elevated liver enzymes is fatty infiltration of the liver, due to obesity, referred to as 'non-alcoholic fatty liver disease.' Abnormal results are caused by many other medical conditions or medical treatments.

  Aspartate aminotransferase (AST) — is distributed through many tissue types with high concentrations in liver, heart, skeletal muscle, and kidney. It is elevated in liver conditions of infection (hepatitis), obstruction (e.g., gall bladder stones), cirrhosis, fatty infiltration, myocardial stress (acute MI, infection, heart failure), skeletal muscle trauma or vigorous exercise, medication use (e.g., acetaminophen or isoniazid), or alcoholism. Low levels are due to vitamin B6 deficiency, renal failure, or protein deficiency/malabsorption.

  Alanine aminotransferase (ALT) — is typically elevated in liver disease, although there are small amounts of this enzyme in heart, kidney, and muscle tissues. It is more liver specific than is AST. Typically alcoholism, hepatitis, obstructive jaundice, liver cancers, cirrhosis, acute MI, trauma to skeletal muscle, and salicylate (ASA) toxicity can cause ALT elevation.
  Lactate dehydrogenase (LDH) — is an enzyme present in all cell types and is released when they are damaged. It is elevated in liver disease, malignancy, hemolytic anemia (rupture of red blood cells), pulmonary infarct, muscular or myocardial injury, or trauma.

  Alkaline phosphatase (Alk Phos) — is present in high concentrations in growing bone and in bile. It

is elevated in diseases involving the liver, especially any disease process that impairs bile formation or flow (e.g., hepatic duct blockage with stones, metastatic carcinoma of liver), thus it is a liver 'function' test. Diseases of the bone (e.g., bone metastases, Paget's disease, osteomalacia, rickets, hyperparathyroidism, healing fracture, or myositis ossificans) also increase this enzyme. Decreased levels might indicate hypothyroidism, very low fat/low protein diets, zinc deficiency, excessive vitamin D intake, or blood type A.

Bilirubin — is formed when RBC's break down and release their bilirubin (heme metabolism), which is then conjugated in the liver for excretion in the bile. High levels of bilirubin in the blood may be due to abnormalities of formation, transport, metabolism, and excretion. This makes bilirubin a liver 'function' test. Jaundice results from high bilirubin concentrations in the serum. Elevated bilirubin levels are classified as unconjugated or conjugated hyperbilirubinemias. Unconjugated (indirect) hyperbilirubinemias are caused by: increased bilirubin production (e.g., hemolytic anemias or reactions); impaired bilirubin uptake by the liver (due to certain drugs); or impaired conjugation (Gilbert's disease is a common cause of elevated bilirubin which is caused by a decreased level of a conjugation enzyme). Conjugated (direct) hyperbilirubinemias result from: impaired excretion of bilirubin from the liver due to hepatocellular disease (hepatitis, cirrhosis); intrahepatic cholestasis (blockages within the liver) from drugs, sepsis, and hereditary cholestatic syndromes; or extrahepatic biliary obstruction.

Albumin — is a protein made by the liver, thus it is a liver 'function' test. Decreased levels of albumin can be the result of: liver disease or dysfunction (e.g., hepatitis, cirrhosis, necrosis, fatty liver); malnutrition; malabsorption; alcoholism; some chemical and heavy metal toxicities; systemic infections; chronic inflammation; insulin resistance; obesity; autoimmune diseases; renal diseases (nephrotic syndrome, glomerulonephritis); congestive heart failure; overhydration; leukemia; or pregnancy. Albumin may be high with dehydration, shock, and prolonged tourniquet use during venipuncture, and with steroid therapy.

- ***Glucose***

  Adequate levels of glucose are essential for all normal body functions. Cells use glucose as a fuel substrate to produce adenosine triphosphate (ATP), the basic source of energy used in all metabolic reactions, both anabolic (synthetic reactions that convert simple molecules into larger more complex molecules) and catabolic (reactions that breakdown or degrade larger molecules into simpler ones). Insulin is a hormone that regulates glucose metabolism. Diabetes results from a lack of insulin, a lack of sensitivity to insulin or both. Blood glucose may be tested in a multi-step process to determine if one has diabetes or is at risk of developing diabetes. Fasting blood glucose levels are easier to interpret than are random levels although both measurements may be useful in the diagnosis of diabetes.

- ***Creatinine (Cr)***

  This is a measure of renal function. It is a product of muscle metabolism that is produced in the blood stream at a relatively constant rate and cleared by renal excretion. The kidney filters blood through millions of sieves, glomeruli, which retain essential components of the blood in the body followed by selectively reabsorbing anything that was missed by the glomeruli in the renal tubules. Creatinine is freely filtered by the kidney and not reabsorbed by the renal tubules. It is not a perfect indicator of renal function as other factors can alter serum creatinine measurement. Conditions causing elevation of creatinine include use of drugs, such as aspirin, cimetidinetrimethoprim, cephalothin, and cefoxitin, ketoacidosis, and increased protein intake or muscle mass. Conditions causing decrease of creatinine include advanced age due to physiological decrease in muscle mass; cachexia, due to pathological decrease in muscle mass caused by cancer and malnutrition; and liver disease, due to a decrease in hepatic creatinine synthesis and cachexia.

- ***Glomerular Filtration Rate (GFR)***

  This is the best index of overall kidney function and is a more sensitive, and early, indicator of kidney dysfunction than creatinine alone. Creatinine clearance, done with 24 hours of urine collection, is the usual means of estimating GFR. Urine collection for a full 24 hours is impractical for patients and prone to error. Many laboratories now estimate GFR using the modified MDRD GFR equation which uses the patient's age, gender, race, and measured serum creatinine level. This estimate of GFR is often included with the serum creatinine on the laboratory results chart.

- ***Blood Urea Nitrogen (BUN)***

  Urea is another useful index of renal function. It is synthesized mainly in the liver and is the end product of protein catabolism. The kidney excretes this nitrogenous waste product of protein catabolism. Kidney damage reduces its excretion and is a marker of renal failure and disease.

  Urea is freely filtered by the kidney with approximately 30 to 70 percent being reabsorbed in the renal tubules, but is dependent upon the hydration status of the individual. The reabsorption of urea may be decreased in well-hydrated individuals, causing a low BUN level. Whereas, dehydration causes increased reabsorption causing a higher BUN level, as is often seen after a prolonged fast with little water intake.

A normal BUN creatinine ratio is 10:1. With dehydration, the ratio can increase to 20:1 or higher. There are conditions other than renal disease that affect BUN independently of GFR. Circumstances which could increase BUN include:

- Conditions that reduce the effective circulating blood volume (e.g. dehydration, congestive heart failure, or acute blood loss/shock)
- Catabolic states (e.g. gastrointestinal bleeding or corticosteroid use)
- High protein diets
- Drugs such as tetracycline, analgesics, or NSAIDs.

Circumstances which could decrease BUN include:

- Liver disease
- Malnutrition
- Low protein diet
- Cachexia
- Overhydration

- ***Sodium***

Sodium is an important electrolyte in the body. Abnormal serum sodium does not necessarily mean a problem with the sodium ion balance, but is most often due to abnormal water balance, generally associated with abnormal serum osmolality and shifts of water across the cell membrane.

The most common and complicated disturbance of sodium is hyponatremia, a low sodium concentration. Generally, it results from water imbalance, not sodium imbalance. Its differential diagnosis starts with measurement of the patient's serum osmolality as low, normal, or high, then determination of their extracellular fluid volume as low, normal, or high. The most common reasons for hyponatremia can include situations where the patient's serum osmolality is low and their volume status is low or normal. If their volume status is low, known as hypovolemia, it may be the result of: dehydration, vomiting, or diarrhea which causes extrarenal salt losses; certain medications such as diuretics and ACE inhibitors; or aldosterone deficiencies. If volume status is normal, hyponatremia is usually due to the syndrome of inappropriate antidiuretic hormone secretion (SIADH). Patients who are hypervolemic, in edematous states, with hyponatremia may have congestive heart failure, liver disease, nephritic/nephrotic syndrome, or advanced renal failure.

Hypernatremia, high sodium concentration, occurs most commonly when free water intake has been inadequate. This is not an exhaustive list of causes for hypo/hypernatremia and specialist consultation may be appropriate.

- ***Potassium***

Potassium is another important electrolyte in the body. Ninety-five (95) percent of potassium resides inside cells. The plasma potassium concentration is maintained in a narrow range through two main regulating mechanisms: potassium shift between intracellular and extracellular compartments and modulation of renal potassium excretion. Elevated potassium levels (hyperkalemia) may occur in patients taking certain medications that inhibit potassium excretion, including ACE inhibitors, angiotensin receptor blockers, potassium sparring diuretics, or a combination of them. Other medications that can cause hyperkalemia include NSAIDs, trimethoprim, tacrolimus and heparin. Otherwise, the causes of hyperkalemia involve clinical situations where there is decreased excretion of potassium, shift of potassium out of cell, spurious causes or if there is excessive intake of potassium.

Low potassium levels (hypokalemia) occur in situations where there is:

- Decreased potassium intake
- Potassium shift into the cell (alkalosis, excess insulin, or trauma)
- Renal potassium loss (aldosterone deficiency
- Therapy with diuretics, such as furosemide and thiazides
- Hypomagnesemia
- Renal tubular acidosis)
- Extrarenal potassium loss (vomiting, diarrhea, or laxative abuse).

This is not an exhaustive list of causes for hyper/hypokalemia and specialist consultation may be necessary.

- ***Carbon Dioxide (Bicarbonate)***

Carbon dioxide levels are an indicator of the acid-base status of the patient. The measurement of venous carbon dioxide is actually a direct determination of the bicarbonate anion concentration. Therefore, for clinical purposes the total carbon dioxide content is equivalent to the bicarbonate anion concentration. Disturbances in acid-base balance can be caused by a variety of primary metabolic and respiratory disorders (more acute situations), or they can be due to a combination of the two (in more chronic situations where there has been compensation for the primary disorder). Primary respiratory disorders affect blood acidity by causing changes in the arterial partial pressure of carbon dioxide, and primary metabolic disorders are indicated by changes in the bicarbonate anion concentration. The medical workup of the patient with an acid-base disorder is complicated and may require specialist consultation.

- ***Total Protein***

  Total protein is a measure of the total proteins in the serum (albumin and globulins). Plasma also contains fibrinogen protein so if the lab result is high, ensure that the serum was measured and not the plasma. Total protein levels can be elevated in:

  - Chronic infection
  - Chronic liver disease
  - Alcoholism
  - Dehydration
  - Multiple myeloma
  - Lymphoma
  - Some autoimmune diseases.

  Levels are low in malabsorption, malnutrition, severe liver disease, chronic renal failure, nephrotic syndrome, over-hydration, and protein losing states.

- ***Calcium***

  Calcium is measured in the serum or plasma and is required for normal muscle contraction and nerve function. It is the ionized calcium in blood that is usually measured, and any variation from the normal range is usually highly significant. Calcium is usually elevated, known as hypercalcemia, due to primary hyperparathyroidism or a malignancy (e.g., multiple myeloma, lymphoma, or tumors that secrete PTH). These two (2) reasons account for 90 percent of all cases of high calcium. Other causes of hypercalcemia include increased intake or absorption of antacids or excess vitamin D or A or other endocrine diseases such as adrenal insufficiency, or pheochromocytoma, sarcoidosis, Paget's disease of the bone, drugs such as thiazide diuretics or lithium, and conditions leading to immobilization.

  Ionized calcium may be low, referred to as hypocalcemia, in conditions where there is insufficient action of PTH (e.g., hypoparathyroidism) or active vitamin D. The most common cause for low total calcium is low albumin states. Correction, by the lab or with a formula, of the serum calcium concentration is needed to accurately reflect the ionized calcium concentration. The most common cause of hypocalcemia is renal failure due to decreased production of vitamin D. Other important causes include decreased intake from malabsorption or vitamin D deficit, increased loss resulting from diuretics or alcoholism, hyperphosphatemia, and sepsis. The medical workup of the patient with hyper/hypocalcemia can be complicated and may require specialist consultation.

- ***Lipid Tests***

  A full lipid panel is a critical component of the laboratory testing profile for the WFI. In the general population, a positive correlation between plasma cholesterol and coronary risk has been well documented. Fire fighters are at an even higher risk of cardiovascular events during their duty, especially during fire suppression. Almost half of fire fighter line-of-duty deaths can be attributed to cardiovascular events. Hypercholesterolemia is one of the major modifiable risk factors in efforts to prevent coronary artery disease and cardiovascular events.

  - *Total Cholesterol* — Cholesterol belongs to a larger family of biological chemicals called lipids (fats). Because it is such a critically important substance, a complex carrier system has developed to move cholesterol through the entire body. This system consists of several proteins that bind to cholesterol and transport it to where it is needed. Cholesterol, a lipid, when bound together with one of these carrier proteins, is called a lipoprotein. Both total cholesterol and carrier proteins can be measured in blood samples. When looking at total serum cholesterol levels, the risk of developing atherosclerotic coronary vascular disease increases as the total cholesterol level increases.

  - *Low Density Lipoprotein (LDL-C) level* — LDL-C is 45 percent cholesterol by weight and is the major carrier of cholesterol to the body's tissues. Since LDL-C can deliver too much cholesterol to the wrong places (like the heart arteries) resulting in cholesterol plaque build-up, people often refer to this as a bad cholesterol.

  - *High Density Lipoprotein (HDL-C) level* — HDL-C is 30 percent cholesterol by weight and is involved in reverse transport of cholesterol away from body tissues and out of the body. HDL-C cholesterol removes excess cholesterol from the arteries, helping to prevent the build-up of cholesterol plaques. Because this lipoprotein appears to remove excess cholesterol, it is often referred to as the good cholesterol.

  - *Total Cholesterol/HDL-C Ratio* — TC/HDL-C ratio gauges relative risk of cardiovascular disease. The importance of the protective effect of HDL cholesterol is emphasized by this ratio. The total cholesterol level may be within a normal range but combined with low HDL-C cholesterol level, the ratio indicates the individual is at a higher risk than someone with normal total cholesterol and a normal HDL-C level.

  - *Triglycerides* — Triglycerides are a type of lipid made by the body when calories from food are not immediately needed. Triglycerides are stored in fat cells and released later as needed for energy between meals. A high triglyceride level combined with low HDL or high LDL cholesterol is associated with plaques in artery walls that increase the risk for heart attack and stroke.

  While cholesterol tests are part of the medical examination, the WFI strongly recommends that a fasting lipid profile be conducted at least once every five

(5) years. Further, a non-fasting total cholesterol > 200 or HDL cholesterol < 40 indicates the need for a fasting lipid profile.

Risk factors for cardiovascular disease that need to be considered in the interpretation of results and in further determining additional fasting lipid profile testing include age > 45 years for males and > 55 years for women, current cigarette smoking, hypertension, HDL-C cholesterol below 40 and a family history of premature coronary heart disease defined by a definite myocardial infarction or sudden death before age 55 years in a male first-degree relative and before age 65 in a female first-degree relative. A desirable LDL-C level in individuals without identifiable coronary heart disease is < 160 mg/dl with zero risk factors and < 130 mg/dl for two or more risk factors. The desirable LDL-C cholesterol level for those individuals with known coronary artery disease or risk equivalents including symptomatic carotid artery disease, peripheral arterial disease, abdominal aortic aneurysm, and diabetes mellitus is < 70 mg/dl.

Given the increased risk for cardiovascular events in fire fighters during fire suppression activities and the increased physiological demand imposed by the fire service, cholesterol lowering therapy including lifestyle modification and medication when necessary is recommended for the achievement and maintenance of desired cholesterol levels.

Additionally, if a member's cholesterol level is elevated on multiple exams, the WFI health care provider should discuss these longitudinal results and their health implications with the member. The member should be encouraged to provide a copy of the results to his or her personal health care provider and seek treatment. Referral for nutritional counseling or other intervention as clinically indicated is recommended.

Metabolic Syndrome

Individuals with metabolic syndrome (also referred as syndrome X, insulin resistance syndrome, and pre-diabetes) are at increased risk for the development of coronary heart disease and other diseases related to plaque buildup in artery walls, such as stroke and peripheral vascular disease, as well as Type 2 diabetes mellitus.

Therefore, it is important to identify those with metabolic syndrome and refer for treatment. The metabolic syndrome is identified by the presence of three (3) or more of the following components:

- Abdominal obesity defined as a waist circumference >102 cm (>40 in) in men or >88cm (>35 in) in women
- Triglycerides ≥150 mg/dL; HDL cholesterol <40 mg/dL for men or <50 mg/dL for women
- Blood pressure: systolic ≥130 or diastolic ≥85 mmHg; and fasting glucose ≥110 mg/dL

Heavy Metal and Special Exposure Screening

Baseline testing for heavy metals and special exposures may be performed under special circumstances, such as hazardous materials exposures, recurrent exposures, other known exposures, or where under federal, state, or provincial regulations requires it, such as OSHA standards.

The following screenings may be utilized:

- Urine screening assesses exposure to arsenic, mercury and cadmium
- Blood screening for lead and zinc protoporphyrin assesses exposure to lead
- Testing and screening for specific exposures or other heavy metal screens may include aluminum, antimony, bismuth, chromium, copper, nickel and zinc
- Special blood testing may be ordered for organophosphates, plasma and/or RBC cholinesterase, or other toxic exposures such as blood screening for exposure to PCBs.

Urinalysis

Urinalysis will include both dip stick and/or laboratory microscopic evaluations. The urine sample received for this analysis is not intended to be and will not be used for drug or alcohol use screening at any time.
Dip Stick Urinalysis analyzes the following:

- pH — Is the relative acidic or basic state of the urine can be an indication of infection or chemical exposure.
- Glucose — Excess glucose is seen in diabetes and renal tubule disease.
- Ketones — Are abnormally elevated in uncontrolled diabetes, alcoholism, starvation, dehydration, and with some weight reducing diets.
- Protein — Protein levels in urine can be elevated in kidney or urinary tract diseases including cancers. The clinical significance of elevated protein on dipstick can be determined by performing a 24-hour urine test.
- Blood — Dip sticks detect hemoglobin, from lysed red blood cells, and myoglobin. Levels can be elevated with hemolytic anemias, infections, kidney stones, tumors, dehydration, muscle breakdown, and renal disease due to tuberculosis, trauma, glomerulonephritis, or cancer.
- Bilirubin — Dip sticks may be positive for bilirubin in liver disease, the breakdown of red blood cells, and gallbladder obstruction.

Microscopic urinalysis includes evaluation for white blood cells (WBC), red blood cells (RBC), WBC casts, RBC casts, and crystals. This testing helps to differentiate various kidney and urinary tract diseases or trauma.

VISION EVALUATION

Assessment of vision must include evaluation of distance, near, peripheral, and color vision. Near visual loss, known as presbyopia, is common in adults and increases in prevalence with increasing age usually from the mid to late 40s on. Common visual disorders affecting adults include cataracts, macular degeneration, glaucoma, and diabetic retinopathy.
The visual evaluation must include:

- Visual acuity screening for both far vision acuity and near vision acuity. Each eye must to be tested separately.
- Vision testing to determine both uncorrected and corrected visual acuity
- Color vision testing must be assessed using color plates, such as Ishihara plates

When peripheral vision evaluations are indicated, protocols specific to the test apparatus, not objects in the field, must be utilized.

HEARING EVALUATION

By nature of their occupation, uniformed personnel are at an increased risk for noise-induced hearing impairment at an earlier age than the public. Baseline and annual audiograms must be performed on all uniformed personnel. To establish trends in hearing acuity, the current audiogram must be compared with all previous audiograms, including the baseline. Testing must be done in an ANSI-approved soundproof booth. Pure tones are presented at various intensities until a threshold is established. For the purposes of database collection, the following frequencies are tested: 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz.

In addition, pure tone threshold testing must be performed separately in both ears and participants must not use hearing aids during testing.

PULMONARY EVALUATION

■ Spirometry

A baseline spirometry must be established in all uniformed personnel who may be required to wear breathing apparatus. A baseline is useful in individuals who have a history of respiratory health problems to use for later comparison. Baselines can also be used in individuals without respiratory disease who later develop respiratory impairment again for comparison purposes. Since maximum effort is required, results can vary depending on the patient's effort and coaching proficiency of the test administrator. Please note the technician performing this test must be certified through NIOSH-approved courses in the testing procedure. The member's age, height, gender, and race/ethnicity is used by the technician to optimally calculate and interpret spirometry results. Significant deterioration, greater than 15 percent from the previous year's test, indicates further evaluations.

• ***Spirogram***

Only a spirogram that is technically acceptable and demonstrates the best effort by an individual should be used to calculate Forced Vital Capacity (FVC) or Forced Expiratory Volume (FEV_1).

Guidelines from the American Thoracic Society and the European Respiratory Society (ATS/ERS Task Force: Standardisation of Lung Function Testing: Standardisation of Spirometry http://www.thoracic.org/statements/resources/pft/PFT2.pdf) and the American College of Occupational and Environmental Medicine (Mary C. Townsend, DrPH, and the Occupational and Environmental Lung Disorders Committee, Spirometry in the Occupational Health Setting – 2011 Update; http://www.acoem.org/Guidelines.aspx) provide information on criteria for spirometry acceptability and reproducibility.

Interpretation of spirometry results is based on ATS/ERS Task Force: Standardisation of Lung Function Testing: Standardisation of Spirometry http://www.thoracic.org/statements/resources/pft/PFT5.pdf and UpToDate, Office Spirometry –

- FVC less than 80 percent of predicted (or below the 5th percentile of the predicted value [lower limit of normal]) in the presence of normal FEV1 and FEV1/FVC may indicate restrictive lung disease and should be followed up with lung volume testing.
- FEV1/FVC below the 5th percentile of the predicted value with an FEV1 < 70 percent of predicted (or below the 5th percentile of the predicted value) and a normal FVC indicates obstructive lung disease.
- FEV1/FVC below the 5th percentile of the predicted value with an FEV1 < 70 percent of predicted (or below the 5th percentile of the predicted value) and an FVC less than 80 percent of predicted (or below the 5th percentile of the predicted value) suggests combined obstructive and restrictive lung disease.

Longitudinal spirometry is the most effective screening test for the early identification of pulmonary dysfunction. The following respiratory tests are used when indicated to further evaluate suspected abnormal conditions; some may be performed in specialized laboratories.

• ***Peak Expiratory Flow Rate***

A low PEFR may indicate obstructive lung disease entities such as asthma or chronic obstructive pulmonary disease (COPD), but is most useful as a simple measurement to monitor asthmatic response to therapy. PEFR can be used at home or work to objectively document a patient's symptomatic complaints.

• ***Pre/Post Bronchodilator***
Obstructive disease and mixed obstructive/restrictive disease usually, but not always, respond to a bronchodilator. Restrictive diseases typically do not respond to a bronchodilator. Repeat spirometry after bronchodilator treatment may provide useful information, but is not required for data collection purposes.

• ***D_LCO***
A measurement of diffusing capacity of carbon monoxide. Low DLCO, less than 80 percent (or below the 5th percentile of the predicted value), is seen in interstitial restrictive lung diseases (e.g., asbestosis and sarcoidosis), chronic CO intoxication, and obstructive lung diseases such as emphysema. DLCO is not reduced in bronchitis or asthma.

• ***Lung Volumes***
Lung volumes are low in restrictive diseases, interstitial or chest wall, and are high in obstructive diseases especially with emphysema.

■ Chest X-Ray
A baseline chest X-ray is required. This baseline is useful for individuals with a history of respiratory problems or symptoms and for subsequent comparison in healthy individuals in whom symptoms, changes in spirometry, or pulmonary disease later develops. Since the routine use of chest x-rays in surveillance activities in the absence of significant exposures, symptoms, or medical findings has not been found to reduce respiratory or other health problems, chest X-rays as part of regular medical surveillance examinations are not indicated. Repeat chest X-rays should be obtained as clinically indicated i.e. when evaluating a symptomatic fire fighter or when there are changes in pulmonary function testing (PFT), as a recent chest x-ray for comparison is useful. Among uniformed personnel, chest X- ray abnormality may indicate pneumonia, tuberculosis, lung cancer, or other occupational lung disease.

AEROBIC/CARDIOVASCULAR EVALUATION

■ Resting ECG
A resting 12-lead ECG should be performed at baseline for all ages, annually starting at the age of 40, and when clinically indicated (e.g early development of risk factors or symptoms). It can be useful to diagnose disturbances in rhythm, presence of conduction defects (e.g. heart blocks), or indications of ischemic heart disease (e.g. ST segment depression or elevation, T-wave inversions, or Q-waves). Further investigation may be necessary if any abnormality is seen, or if there is a significant change in the ECG from the previous year(s).

Before the age of 40, annual resting ECG testing for coronary artery disease and other cardiovascular diseases is of limited value (AHA & USPSTF guidelines); however, when testing a symptomatic fire fighter, a recent ECG for comparison is useful.

■ Aerobic/Cardiopulmonary Testing
Asymptomatic fire fighters younger than 40 years of age known to be at high risk for ASCVD shall be assessed for coronary artery disease. Asymptomatic uniformed personnel > 40 years of age with no atherosclerotic cardiovascular disease (ASCVD) shall be assessed annually for both their 2-year and 10-year risks of ASCVD, defined as coronary death, nonfatal myocardial infarction, or fatal or nonfatal stroke.

The 10-year Heart Risk Calculator created by the American College of Cardiology/American Heart Association (ACC/AHA) (http://tools.acc.org/ascvd-risk-estimator/) is used to generate a 10-year risk of ASCVD, taking into consideration the individual's age, sex, race, total cholesterol, high density lipoprotein (HDL) cholesterol, systolic blood pressure, blood pressure lowering medication use, diabetes status, and smoking status.

Those uniformed personnel assessed as being at high risk defined as ≥ 20 percent risk of ASCVD over the next 10 years should be referred to a cardiologist for further evaluation and treatment. Those personnel assessed as having intermediate risk defined as 10 to < 20% risks of ASCVD over the next 10 years should be evaluated with symptom-limiting exercise stress testing with or without imaging.

Cardiac exercise stress testing should be done to achieve 12 METS and a validated 12 MET exercise testing protocol must be used. Cardiopulmonary testing should be performed in a medical facility with proper monitoring by a physician and available resuscitation equipment. Testing may be done with or without imaging as determined by the physician. When selecting imaging options, physicians should be aware of the large prevalence of left ventricular hypertrophy in fire fighters who experience on-duty cardiovascular deaths (Yang, Teehan Farioli et al. Sudden Cardiac death among firefighters ≤ 45 years of age in the United States Am J Cardiol, 2013) Given that left ventricular hypertrophy is of greater concern in younger fire fighters and ischemic heart disease is of greater concern in older fire fighters, when stress imaging is ordered, consideration should be given to echocardiography stress testing in younger fire fighters and nuclear stress testing in older fire fighters. Uniformed personnel with positive stress tests shall be referred to a cardiologist for further evaluation and treatment.

Uniformed personnel whose stress test results are negative but who are unable to meet the 12 MET criteria should be referred to a fitness program, counseled on risk factor modification, and retested in 6 months. Uniformed personnel with negative stress tests reaching the 12 MET criteria should be retested after two (2) to five (5) years or as indicated depending on clinical assessment and risk factors.

The 2-year Framingham Heart Risk Calculator (https://www.framinghamheartstudy.org/risk-functions/coronary-heart-disease/2-year-risk.php) will be used annually to generate a 2-year risk of ASCVD taking into consideration the individual's age, sex, total cholesterol, high density lipoprotein (HDL) cholesterol, systolic blood pressure, blood pressure lowering medication use, diabetes status, and smoking status. The 2-year risk assessment will not consider race as a factor for consideration. Those assessed as being at intermediate risk defined as 2 to < 4 percent risk of ASCVD over the next 2 years, shall be further evaluated using symptom-limiting exercise stress testing (EST) with or without imaging to at least 12 METs. This is the same recommendation as the 10yr risk of ASCVD.

Those assessed as being at high risk defined as ≥4 percent risk of ASCVD over the next 2 years, shall be referred to a cardiologist for further evaluation and treatment. This is the same recommendation as for individuals with a high 10-year risk of ASCVD (Table 2.1).

Table 2.1 Annual ASCVD Risk Assessment Levels

Annual ASCVD Risk Assessment	Low	Intermediate	High
2yr-ASCVD Risk	No action needed	2-<4% risk requires a stress test with or without imaging to 12 METs	> 4% requires cardiologist for further evaluation and treatment
10yr-ASCVD Risk	No action needed	10-<20% risk requires stress test with or without imaging to 12 METs	> 20% requires cardiologist for further evaluation and treatment

CANCER SCREENING

While the WFI Medical Committee relied extensively on the U.S. Preventive Services Task Force (USPSTF) recommendations on general population health screening, it is important to note that the USPSTF did not consider occupational risk in their recommendations. Given the known occupational risk of exposure to carcinogens and the excess number of certain cancers in the fire service, the WFI Medical Committee, in some cases, made recommendations beyond those made for the general population. Examples here include lowering the age at which screening begins or repeating screening more frequently than would be done for the general, non-occupationally exposed population.

Appropriate screening examinations of the lungs, skin, breast, cervix, testes, prostate, thyroid, oral mucosa, bladder and colon must be conducted with the annual examination or as indicated below. When such examinations are carried out on a member of the opposite sex or if the member requests, a second health care worker/chaperone should be in the room for patient support and medico-legal reasons. Uniformed personnel may, however, choose to have such exams performed by an outside physician. When uniformed personnel use their own physicians for cancer screening examinations, results need to be forwarded to the fire department physician for inclusion in the fire department confidential medical file.

■ Lung Cancer

The USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults ages 55 to 80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

■ Skin Cancer

Some studies have found elevated risk of both melanoma and non-melanoma skin cancers in fire fighters. Skin cancer must be diagnosed in a timely manner to ensure successful treatment and maximize cure rates. Comprehensive inspection of the skin, especially in sun-exposed areas, is recommended. Inform the patient that taking a photograph of their own skin (especially their back) can help when comparing specific nevi (moles) or assessing for new or atypical lesions over time. Any suspicious lesions shall be referred for dermatological assessment.

■ Breast Cancer

Breast cancer is the most common type of cancer in women and the second leading cause of cancer death in women, after lung cancer. Breast cancer incidence and mortality rates increase with age. An annual clinical breast examination is required. Self-examination should be encouraged, and educational information should be made available to interested patients.

Mammography screening shall be performed on all women uniformed personnel beginning at age 40 and continue every other year until age 50, at which point annual mammography is indicated. Annual mammography should be obtained before age 50 if clinically indicated. Uniformed women personnel with a family history of breast cancer or other personal risks shall be referred for appropriate individualized recommendations for breast cancer screening, such as genetic screening or breast MRI. Uniformed women personnel may wish to have an ongoing clinical association with a women's health provider.

Cervical Cancer

The WFI technical representatives recommend using the USPSTF guidelines, now pending further research, on female fire fighters. The USPSTF recommends screening for cervical cancer in women ages 21 to 65 years with cytology (Pap smear) every three (3) years or, for women ages 30 to 65 years who want to lengthen the screening interval, screening with a combination of cytology and human papillomavirus (HPV) testing every five (5) years.

Testicular Cancer

Testicular cancer represents one (1) percent of all cancers in men. It remains the most common cancer in Caucasian men 20 to 34 years old. In general, an excellent prognosis exists with early detection and treatment. A baseline examination by a healthcare provider followed by routine self-examination is recommended, and educational materials should be made available to interested patients.

Prostate Cancer

Prostate cancer is the second most common type of cancer in men, after skin cancer. In addition, some studies have observed an elevated risk of prostate cancer in fire fighters. The prostate-specific antigen (PSA) test is a blood test that has been used for prostate cancer screening. However, recommendations for its use have been recently changed to a recommendation that medical providers discuss the benefits and risks of PSA testing to allow patients to decide whether they want PSA testing.

Uniformed male personnel shall be offered a discussion regarding PSA testing at age 50 and annually thereafter. Uniformed male personnel who are considered to be at an increased risk for prostate cancer, such as those who have a family history of prostate cancer or are of African-American heritage shall be offered a discussion regarding PSA testing starting at age 40 and annually thereafter.

After this discussion, those men who want to be screened should be tested with the PSA blood test. The digital rectal exam (DRE) may also be done as a part of the screening. Several non-cancerous conditions might result in elevated PSA levels including benign prostatic hypertrophy (BPH) and inflammation, or recent prostate gland stimulation resulting from a DRE or ejaculation. Current consensus also highlights the importance of measuring and comparing PSA results over time, known as PSA velocity. Where an increase over time would indicate higher risk for prostate cancer, the magnitude of this increased risk should be in accordance with current national urological association guidelines.

Digital Rectal Examination (DRE)

The DRE is no longer the preferred method of screening for prostate or colorectal cancer, however, if PSA is obtained, DRE can be performed as well.

Colorectal Cancer Screening

Uniformed personnel are exposed to a variety of particulate materials, chemicals and asbestos which can increase the risk for colon cancer. Current research suggests that fire fighters are at increased risk of colorectal cancer. WFI recommends that health care providers discuss the possible increased risk of colorectal cancer resulting from occupational exposures along with the risks and benefits of initiating screening at age 40 in fire fighters. If the fire fighter decides to start screening at age 40, fecal occult blood testing (FOBT) is the method recommended for use as it has the lowest risk for adverse patient events and is the most cost effective.

The USPSTF recommended screening methods for colorectal cancer include fecal occult blood testing, sigmoidoscopy, or colonoscopy beginning at age 50 and continuing until age 75. The risks and benefits of these screening methods vary. The USPSTF concludes that there is insufficient evidence to assess the benefits and harms of computed tomographic colonography and fecal DNA testing as screening modalities for colorectal cancer.

The USPSTF concluded that screening programs incorporating fecal occult blood testing, sigmoidoscopy, or colonoscopy will all be effective in reducing mortality using any of the following 3 regimens, assuming 100% adherence to the same regimen for that period:

- Annual screening with high-sensitivity fecal occult blood testing
- Sigmoidoscopy every five (5) years, with high-sensitivity fecal occult blood testing every three (3) years
- Screening colonoscopy every ten (10) years

Fecal occult blood testing uses stool specimens applied to guaiac cards by the patient at home that are sent to a laboratory for later analysis. Multiple different stool samples, usually three (3), from different days can increase the sensitivity of this colorectal cancer screening test. Diet restrictions apply to this test.

A colonoscopy is used to examine the full lining of the colon and rectum. During the colonoscopy, polyp removal or excising a small piece of tissue for biopsy may be performed if indicated. Colonoscopy should start at an earlier age (40 years) and/or be conducted more frequently if clinically indicated. A colonoscopy shall also be performed, regardless of age or schedule, when FOBT results are positive or when there is a consistent change in bowel habits.

Bladder Cancer Test

As the body absorbs cancer-causing chemicals, they are transferred to the blood, filtered out by the kidneys, and expelled from the body in urine. High concentrations of

chemicals in urine can damage the endothelial lining of the bladder and increase the risk of cancer. Because fire fighters are regularly exposed to smoke and chemical fumes, they may be at an increased risk for bladder cancer. Urine shall be evaluated for blood (hematuria) during scheduled wellness examinations. Positive dipstick for hematuria requires follow-up and referral may involve upper tract imaging, cystoscopy and/or urine cytology.

■ Oral Cancer Screening

Regular dental checkups that include an exam of the entire mouth are important in finding oral and oropharyngeal cancers and pre-cancers early. The American Cancer Society recommends that doctors examine the mouth and throat as part of a routine cancer-related checkup.

■ Thyroid Cancer Screening

A physical exam for palpable nodules should be part of the routine exam.

■ Ovarian Cancer Screening

There are currently no approved screening modalities for this cancer.

■ Uterine Cancer Screening

There are currently no approved screening modalities for this cancer.

■ Brain Cancer Screening

There are currently no approved screening modalities for this cancer.

SLEEP DISTURBANCE

There are significant and emerging concerns regarding the health and behavioral consequences related to sleep disturbance. Several contemporary reports in the medical literature have suggested that night-shift or swing-shift work may negatively impact situational awareness, decision making, hypertension, cardiovascular disease and malignancies (i.e. breast and ovarian cancers). The extent to which these findings may apply to the sleep disruption that occurs in the fire service is uncertain at this time. Furthermore, multiple studies of fire fighters have shown biochemical evidence of a stress response to the disruptions of circadian rhythms that occur in some fire stations. Insomnia may be a symptom of depression, anxiety, or another mental health disorder. Excessive daytime somnolence may indicate sleep disruptions. Adverse health effects may result in cases of sleep apnea where it is undiagnosed and untreated.

It is important to include screening for sleep disorders in the fire fighters' annual medical evaluation using a validated questionnaire such as the Berlin sleep questionnaire, Epworth Sleepiness Scale or BMI. Fire fighters with a high index of suspicion should be referred to a specialist for diagnostic sleep studies.

IMMUNIZATIONS

Uniformed personnel must receive, or provide documentation of having received the following vaccinations (http://www.cdc.gov/vaccines/adults/rec-vac/hcw.html):

- Hepatitis A
- Hepatitis B
- Tetanus/Diphtheria
- Pertussis
- Influenza
- MMR
- Polio
- Varicella (if not already immune)
- Human Papillomavirus (HPV)
- Pneumovax should be considered for individuals with appropriate risk factors.

■ Hepatitis A Virus (HAV)

Formalin inactivated vaccines made from attenuated HAV strains have been shown to be immunogenic, safe, and highly effective in preventing Hepatitis A. Previous recommendations were consistent with CDC guidelines and only included vaccinations for "high risk" uniformed personnel (e.g. Haz Mat, USAR, and SCUBA personnel) and those uniformed personnel who are Hepatitis C positive or have exposure to contaminated water. However, since all uniformed personnel are potentially exposed to contaminated water via floods or accumulated water from fire suppression, all uniformed personnel shall be vaccinated. The vaccine is 99-100 percent effective, so serum titers after vaccination are not recommended.

A combined Hepatitis A and B vaccination is now available. Immune globulin (IG) contains anti-HAV antibody concentration sufficient to be protective. It is to be administered to uniformed personnel who have not been previously vaccinated before exposure or during the early incubation period. Immune globulin may not prevent infection, but will weaken the effects and may render the infection unapparent.

Appropriate post exposure prophylaxis is the responsibility of the department and should be in accordance with current CDC guidelines for healthcare providers.

■ Hepatitis B Virus (HBV)

Uniformed personnel, by the nature of their occupation, are considered high risk and are therefore required to have this vaccine. The vaccine is effective in preventing HBV infection. Among the greater than 90 percent who develop adequate antibody levels after the third dose, vaccine effectiveness is virtually 100 percent. Laboratory

confirmation of immunity shall be done for all public safety workers and first responders one (1) to two (2) months after completion of the three (3) dose vaccination series. Although antibody levels decrease with time, people with normal immune systems continue to be protected from infection and do not require a periodic booster dose.

If initial vaccine doses do not result in immunity, up to three (3) additional doses can be administered. The following factors — male, over 40 years old, smoker and obesity — are associated with difficulty in HBV antibody conversion following vaccination.

Appropriate post exposure prophylaxis is the responsibility of the department and should be in accordance with current CDC guidelines for healthcare providers.

■ Tetanus/Diphtheria

Tetanus and diphtheria occur almost entirely in unimmunized or incompletely immunized persons. Case fatality rates for tetanus are as high as 30 percent and as high as 5 to 10 percent for diphtheria. Immunization records of prior vaccinations are required. Uniformed personnel shall be given tetanus/diphtheria (Td) boosters every ten (10) years. For certain high risk wounds, a booster shall be given if five (5) years have elapsed since the last vaccine. Epidemiological studies have indicated that adult immunity to pertussis, whooping cough, is waning. A convenient way to prevent outbreaks of pertussis is to administer a combination Tetanus/Diphtheria/Pertussis vaccine (TDAP) which can be given once to replace the 10-year Td booster or the 5-year wound management Td dose. Tdap should not be administered less than two (2) years following a Td vaccine dose.

■ Influenza

The influenza vaccine is 30 to 40 percent effective in preventing clinical illness and 80 percent effective in preventing death in older adults. Uniformed personnel are in close contact with the public and live in close quarters while on duty. Therefore, the vaccine is required for all uniformed personnel, unless contraindicated, and must be administered annually, early fall through early winter.

■ Measles, Mumps, Rubella (MMR)

Measles remains a significant health problem with recent outbreaks attributed to vaccine failure, waning immunity, and erroneous documentation of previous vaccination. Mumps has been increasing in incidence. Use of the rubella vaccine has led to a significant decrease in the incidence of rubella. Rubella is usually a mild illness. However, in pregnant women particularly in the first trimester, it can lead to miscarriage, stillbirth, and congenital rubella syndrome (CRS).

The MMR vaccine is required for all uniformed personnel if there is no medical contraindication and no laboratory evidence of immunity. Two (2) doses of the MMR vaccine shall be administered per current immunization guidelines. Women who receive the vaccine should not become pregnant for three (3) months after the vaccination is administered.

■ Polio

The polio vaccine has dramatically reduced the annual number of reported cases of paralytic poliomyelitis. The vaccine series is usually given in childhood. It shall be given to uniformed personnel if the vaccination or disease is not documented and there is no medical contraindication for use.

■ Human Papillomavirus (HPV)

The quadrivalent HPV vaccine shall be provided to all uniformed personnel up to 26 years old, if previous vaccination is not documented.

■ Varicella

Varicella disease, or chickenpox, is a highly contagious childhood disease caused by varicella virus (VZV). A vaccine is now available. As recommended by the American Committee on Immunization Practices (ACIP), susceptible persons 13 years old and older who encounter those at high risk for serious complications from VZV disease (e.g., health care workers and those in contact with immunocompromised individuals) should be vaccinated with two (2) doses at least one (1) month apart. Uniformed personnel who have not had varicella are considered high risk due to their occupational exposures.

Uniformed personnel shall be screened for immunity levels and vaccine shall be administered to all non-immune personnel. If immunity to VZV is not documented and a member is exposed, then the vaccination series shall be initiated. If vaccination is contraindicated and the member is at increased risk for severe disease i.e. pregnant or immune compromised, then gamma globulin shall be used after exposure.

■ Vaccination Adverse Event Reporting

All adverse reactions to vaccine administration shall be recorded in the member's medical record and reported to the Vaccine Adverse Events Reporting System (VAERS) at https://vaers.hhs.gov. Their phone contact is 800-822-7967.

INFECTIOUS DISEASE SCREENING

■ Hepatitis C Virus

Hepatitis C is a major health concern for employees in the fire service. It is very important to screen for the antibody to the Hepatitis C virus because it can be clinically silent for decades while causing ongoing damage to the liver. Historically, the clear majority of Hepatitis C infections were caused by blood transfusions or IV drug use.

The prevalence of Hepatitis C infections in the fire service has varied considerably where it has been measured. Medical studies have suggested that new infection

(seroconversion) with HCV in fire service employees is almost always caused by percutaneous injury events such as with contaminated needle sticks. Baseline antibody tests shall be done on all uniformed personnel to check for previous infection or to establish the absence of infection. Be aware that false positive and false negative results may occur. If conversion from negative to positive occurs, additional testing to verify infection and expert consultation for specialized treatment protocols is required.

■ Tuberculosis (TB)

Tuberculosis (TB) control depends upon screening high-risk populations and providing preventive therapy to those most likely to develop active disease. Uniformed personnel, by nature of their occupation, are at increased risk and an annual PPD is required. A measles, mumps, rubella (MMR) vaccination may depress tuberculin skin sensitivity so PPD testing should be done prior to, simultaneously with, or four (4) to six (6) weeks after MMR vaccination dosing. A serum test (IGRA, interferon-gamma release assay) is available and may be considered as an alternative to PPD particularly if the member has had prior BCG vaccine or is not able to return for a read of the PPD result in 48 to 72 hours.

Tuberculosis (TB) screening, by either tuberculin skin testing using the tuberculin purified protein derivative (PPD) or the tuberculin blood test (interferon gamma release assay); shall be performed at baseline.

Subsequent tuberculosis screening shall to be performed annually or at a frequency according to CDC guidelines unless the member has a history of positive tuberculin screening test, in which case CDC guidelines for management and subsequent chest radiographic surveillance shall be followed.

If annual conversion rates are high in a given work group, then testing is recommended every six (6) months. A conversion indicates recent exposure to or infection by mycobacterium tuberculosis. These personnel will require appropriate follow-up and contact investigation as medically indicated. Chest X-rays and isoniazid prophylaxis may be needed as recommended by the American Thoracic Society and Centers for Disease Control and Prevention.

■ Human Immune Deficiency Virus (HIV)

Human immune deficiency virus (HIV) testing is not a part of baseline or annual physicals. However, the test should be offered on a confidential basis as part of post-exposure protocols and as requested by a physician and patient. All results from HIV tests are provided directly to the patient and will not be maintained in any local or international database.

OCCUPATIONAL STRESS AWARENESS CONSULTATION

As fire fighters face more disturbing and devastating incidents, their job-related stress and the potential for behavioral health issues have increased. Left unaddressed, these issues can interfere with day-to-day life and affect work, sleep, and relationships; ultimately, they can develop into diagnosable mental illnesses, such as post-traumatic stress disorder, major depressive disorder, generalized anxiety disorder, and substance use disorders.

Fire fighters should be assessed for the heightened risks of stress associated with occupational exposures related to fire fighting and emergency medical services work. It is important for the physician conducting the fire fighter's annual medical evaluation to use a validated questionnaire to assess for occupational stress such as the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) for post-traumatic stress, the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD PHQ2 and PHQ 9) for depressive disorders, and the CAGE-AID questionnaire to capture symptoms of potential alcohol and substance abuse. Fire fighters with a high index of suspicion must be referred to a licensed behavioral health specialist trained to recognize and treat stress-related and/or behavioral health disorders in fire fighters and first responders as indicated.

REFERRAL TO HEALTH CARE PRACTITIONERS

The following situations/conditions warrant referrals to health care practitioners:

- Abnormal findings on the annual medical exam must be addressed by a medical practitioner follow-up or referral
- Revaccination or intervention following exposures must be managed by a medical practitioner follow-up or referral
- Managed care or other provider referrals as appropriate for non-work related medical issues

Follow-up on findings from annual examinations must be reviewed by the fire department physician and return to work determinations require clearance by the fire department physician in conjunction with other specialty evaluations, as needed. The fire department physician will normally function as the "gatekeeper" for medical certification, retaining final authority for return to work/fitness for duty decisions.

WRITTEN FEEDBACK

Written feedback to uniformed personnel concerning health risks and health status is required following the annual examination. Reporting findings and risks and suggesting plans for modifying risks improves the physician-patient relationship and helps uniformed personnel claim ownership of their health.

■ Individualized Health Risk Appraisal

Individualized health risk appraisals must also include questions that attempt to accurately measure the uniformed personnel's perception of their health. Health perception can be a useful indicator of potential problems.

DATE COLLECTION AND REPORTING

Comprehensive, confidential, aggregated medical and health information will be collected for the purposes of this initiative. The complete data protocol is found in Chapter Seven of this report. The following is an overview of the different categories of data to be compiled:

- Demographics
- Employment status
- Illness and injury experience
- Tobacco and alcohol use
- Current health status
- Cancer screening
- Physical activity
- Physical measurements
- Lab data
- Immunizations
- Fitness testing

■ Occupational Exposure

An integrated exposure database that provides the fire department physician timely information on uniformed personnel aids in tracking diseases in individuals and risks in the population. The physician must educate uniformed personnel on the importance of documenting exposures and follow-up care to ensure that the employee gets necessary medical care. The central departmental database on uniformed personnel must include the following:

- Chemical exposures
- Physical exposures
- Biological exposures
- All safety and health related incidents

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CHAPTER 3 — Fitness

Management and Labor shall work together to provide a comprehensive fitness and injury prevention program. This program should include access to resources supporting on-duty exercise in order to prepare members to meet the demands on and off the job.

This chapter highlights the following:

- **Introduction**
- **Medical Clearance**
- **On-Duty Time for Exercise**
- **Equipment and Facilities**
- **Models of Access to Equipment**
- **Exercise Specialists and Peer Fitness Trainers**
- **Incorporating Fitness Throughout the Fire Service**
- **Fitness Assessment**
- **Exercise Programs**
- **Nutrition**
- **Summary**
- **Endnotes**

INTRODUCTION

Throughout the history of the fire service, the proper implementation of fitness programs in fire departments has been extensively debated. The risk of coronary heart disease events during fire suppression may be increased because many firefighters lack adequate physical fitness, the presence of cardiovascular risk factors, and existing medical conditions.[1] Research has demonstrated the need for high levels of aerobic capacity, power, muscular strength and endurance, mobility and flexibility, and favorable body composition in order to perform safely and effectively in the fire service. Physical fitness is critical to maintaining the wellness of our uniformed personnel. Fitness must be incorporated into the overall fire service philosophy.

To be prepared for life's demands, on and off the job, physical fitness and quality movement patterns are critical to maintaining wellness. Both must be incorporated into the overall fire service philosophy.

While assessing uniformed personnel's current fitness level is an important part of developing an individualized fitness program, assessment is not, in itself, a fitness program. An effective physical fitness program also requires access to equipment and facilities, and guidance from certified exercise professionals (e.g. Peer Fitness Trainers). The elements necessary for a successful and comprehensive physical fitness program are discussed throughout this chapter. Specific recommendations for the fitness assessment protocols are described in Appendix A.

MEDICAL CLEARANCE

All exercise carries some risk of sudden cardiac events, especially in individuals who are unaccustomed to exercise, therefore, prior to involvement in any exercise regimen, including the WFI fitness assessment, all uniformed personnel must be medically cleared in order to participate.

ON-DUTY TIME FOR EXERCISE

It is necessary to provide dedicated on-duty time for exercise to assist in promoting physical fitness. While scheduling on-duty time may vary due to emergency calls, training, and other duties, it is recommended that 60-90 minutes be allotted during every shift. Uniformed personnel working administrative shifts, 40-hours or otherwise, shall also be provided the opportunity to exercise. The health, fitness, and wellness of all uniformed personnel must be viewed as a priority. The Wellness-Fitness Initiative holds forth the idea that labor and management should work together to ensure full participation by all uniformed personnel.

EQUIPMENT/FACILITIES

Many models exist to guide departments through the process of providing access to and/or maintaining exercise equipment, whether in every fire station or in regional fitness centers. The following steps detail strategies that have proven successful to secure equipment for departments:

- ***Step 1***

Evaluate equipment for utilization, reliability, durability, available space, safety, and cost. This evaluation should be conducted by personnel who will be using the equipment and the Peer Fitness Trainers who will instruct the membership on its correct use.

- ***Step 2***

Allocate funds to purchase the equipment in the budget process. Other sources are also available to raise funds independent of the traditional budget process, such as FEMA's Assistance to Fire Fighters Grant (AFG) program, and other federal, state or provincial grants. Several locals have bargained for a matching system in which each employee contributes a dollar every month and the city or county matches it on a one-to-one or one-to-two ratio. This encourages ownership of the fitness program by both labor and management.

- ***Step 3***

Initiate the bid process to purchase the selected equipment. If possible, small orders should be avoided because larger orders usually provide a reduced cost per unit. Requests

for Proposals (RFPs) must be written specifically for the equipment that was chosen by the above process. Ideally, the same equipment is available in all work locations. When purchasing cardio equipment consider purchasing the same equipment as that used to conduct the fitness assessment.

MODELS OF PROVIDING ACCESS TO EQUIPMENT

Traditionally, equipment access has been provided in one of the following ways: exercise equipment placed directly into each fire station; centralized fire department locations where personnel can exercise; contracted fitness center locations where personnel can exercise; and use of outdoor facilities such as track, high school, park or local college/university.

The following section summarizes the benefits and considerations of these four models:

Equipment in every station

- ***Benefits***
  1. Personnel can use equipment at their convenience, between emergency calls.
  2. Personnel are in quarters where they are strategically located within their first due response area.
  3. Personnel can use equipment at various times during the shift.

- ***Considerations***
  1. Initial investment in equipment.
  2. Equipment maintenance.
  3. Number of Peer Fitness Trainers to support exercise program instruction.

Centralized fire department fitness center

- ***Benefits***
  1. Personnel can use equipment any time.
  2. Lower equipment expense.
  3. Availability of Peer Fitness Trainers on site.

- ***Considerations***
  1. Designated workout times.
  2. Crews may have to leave first-due response area.
  3. Crews responding to emergency calls may be less likely to return to their workout.
  4. Limits the time that personnel have access to Peer Fitness Trainers for individual attention.

Contracted fitness center

- ***Benefits***
  1. Outfitted with a greater selection of equipment.
  2. Fitness professionals on site.
  3. Can accommodate large groups.

- ***Considerations***
  1. Designated workout times.
  2. Crews may have to leave first-due response area.
  3. Crews responding to emergency calls may be less likely to return to their workout.
  4. Recurring membership cost.
  5. Possible public perception of fire fighters recreating instead of working.

Outdoor Space (park, track)

- ***Benefits***
  1. Low cost.
  2. Readily available.

- ***Considerations***
  1. Inclement weather.
  2. Lack of equipment.
  3. Proximity of personnel to apparatus.

Maintenance of Equipment

Equipment must be maintained as recommended by the equipment manufacturer. Poorly maintained equipment is unsafe and less likely to be used. Frequent inventories and inspections must be done so that equipment can be accounted for, maintained, repaired, and replaced when necessary. Designate personnel to ensure that all fitness equipment is maintained.

Types of Equipment

There are two basic types of fitness equipment that are necessary for an effective fitness program:

- ***Resistance Equipment***
  This can include the following:
  - Cage/squat rack with pull-up bar
  - Olympic bar(s) and an assortment of weight plates (it is recommended that there is a minimum of 300 pounds),
  - Medicine Balls
  - Adjustable pulley machine,
  - Adjustable bench,
  - Dumbbells (pairs from 5 pounds to 80 pounds are recommended),

- Kettlebells (pairs from 25 pounds to 50 pounds are recommended)
- Floor mats for mobility and flexibility training,
- Burst-resistant stability ball(s),
- Assortment of resistance bands (various band tensions)

• ***Cardiovascular Equipment***

This can include the following:

- Treadmill,
- Stationary bike (upright or recumbent),
- StepMill,
- Elliptical cross trainer,
- Rowing ergometer.

EXERCISE SPECIALIST, PEER FITNESS TRAINERS, and REFERRAL NETWORK

A broad-based Fitness Committee involving labor, management, a fire department physician, and an exercise specialist should be established. An exercise specialist and the Peer Fitness Trainers can disseminate the work of the Fitness Committee, while guiding the fitness efforts of all uniformed personnel. Peer Fitness Trainers should reflect the demographics of the department.

■ Qualifications of the Exercise Specialist

The exercise specialist should be chosen with care. They may come from inside or outside the department. Ideally they should have a degree in exercise physiology, kinesiology, or a related field. A thorough knowledge of the job of firefighting is essential. If the exercise specialist comes from outside the department, the individual must be able to ride along, conduct job analyses, and remain current on literature pertaining to fitness and firefighting. The individual's ability to conduct ongoing research related to personal fitness and injury is another desirable asset. In addition, excellent communication and interpersonal skills are necessary.

■ Peer Fitness Trainers

The Peer Fitness Trainers (PFTs) should encourage safety and participation in the Wellness Fitness Initiative. An integrated multi-level approach is recommended, in which the exercise specialist and /or lead PFT trains and oversees multiple PFTs. All fire department PFTs should be certified through the IAFF/IAFC/ACE Peer Fitness Trainer certification program. They must maintain their certification through continuing education. In addition, they should be encouraged to supplement their professional certification with further advanced training.

Some recommended non-profit certification agencies that provide advanced training include:

- The International Association of Fire Fighters (IAFF) and the International Association of Fire Chiefs (IAFC)
- The American Council on Exercise (ACE)
- The National Strength and Conditioning Association (NSCA) and its accompanying Tactical Strength and Conditioning (TSAC) division
- The American College of Sports Medicine (ACSM)
- The National Academy of Sports Medicine (NASM)
- The Canadian Society of Exercise Physiology (CSEP).

Certified PFTs have the knowledge and skills required to design and implement fitness programs, and assist in the physical training of candidates, incumbents, and recruits. They should also be able to influence the broader community in achieving wellness and fitness. PFTs understand proper exercise techniques and have a broad scientific knowledge of exercise. The PFT Certification improves the credibility and effectiveness of departmental fitness programs. Certified PFTs can be utilized in many ways, including:

- Administering annual fitness assessments and movement screens
- Designing and implementing personalized exercise programs,
- Evaluating the utility of exercise sessions and the department's wellness and fitness initiative
- Conducting station visits and delivering wellness and fitness education to members regarding the application to work, life and play
- Implementing hands-on workshops to highlight the application of wellness to work, life and play
- Promoting wellness and fitness and helping to shape the wellness and fitness culture
- Assisting with healthy meal planning
- Maintaining fitness equipment,
- Candidate mentoring and orientation,
- CPAT administration and proctoring,
- Training recruits and new hires regarding the importance of wellness and fitness throughout their career and long into retirement.

■ Referral Network

It is important for health professionals in the referral network to understand the unique demands of the fire service (e.g. job tasks and shift work). This includes physical therapists, athletic trainers, and nutritionists/dieticians. Addressing the wellness and fitness needs of all members may require input from other specialists. A referral network is a good way to provide access to specialists.

- ***Physical Therapist (PT)***

PTs are licensed health care professionals that use various treatment techniques to rehabilitate injury, reduce pain, restore function, and prevent disability. PTs work in a variety of settings (e.g. in and outpatient hospital, private practices, sports/fitness facilities, etc.). They may have additional pertinent certifications in exercise training and ergonomics. A department may wish to consult, contract or hire a PT in order to better facilitate job-related neuromuscular and cardiopulmonary readiness of their members who are returning to work after an injury or medical condition, including neurologic, musculoskeletal, cardiac, postnatal and/or post cancer issues.

Hiring a PT who has an awareness of the tasks that fire service personnel perform provides additional benefits, including:

- The ability to educate other community-based PTs on the specific needs of fire fighters,
- Implementation of specific fire service injury prevention strategies,
- Collaboration with PFTs and recruit staff to provide evidence-based injury prevention fitness/wellness exercise strategies,
- Ergonomic education such as body mechanics for safe and efficient material and patient handling,
- Ergonomic consultation for equipment design, usage, and storage.

- ***Nutritionist/Dietician***

A nutrition counselor, dietitian, or sports nutritionist is a valuable asset to any wellness program. The field of nutrition is plagued with fads and misinformation. Members, company officers, and PFTs may wish to consult a qualified professional. Such experts can be hired, contracted, or involved as volunteers. Benefits of a qualified expert include:

- The development of weight management programs;
- Analysis of individual dietary logs; design of customized nutritional programs for specific conditions such as pregnancy, weight gain, or illness;
- Education of PFTs, company officers, members, and recruits;
- Discouraging potentially harmful dietary practices;
- Developing specialized menus for post-incident replenishment.

INCORPORATING FITNESS THROUGHOUT THE FIRE SERVICE

There are many pieces involved with incorporating fitness concepts and practices into the fire service. The following individuals have important roles in establishing a successful program in any fire service agency and throughout the fire service.

PFTs

The PFT can address the specific needs of uniformed personnel through personalized exercise program design and implementation. PFTs should conduct themselves as role models and ambassadors for the Wellness Fitness Initiative.

Responsibilities of a PFT may include:

- Administering annual fitness assessments and movement screens
- Designing and implementing personalized exercise programs,
- Evaluating the utility of exercise sessions and the department's wellness and fitness initiative
- Conducting station visits and delivering wellness and fitness education to members regarding the application to work, life and play
- Implementing hands-on workshops to highlight the application of wellness to work, life and play
- Promoting wellness and fitness and helping to shape the wellness and fitness culture
- Conducting special projects or serving on committees that pertain to the department's wellness and fitness initiative (e.g. helping to establish the vision with the Wellness Committee)
- Assisting with healthy meal planning
- Maintaining fitness equipment,

PFTs must also pursue additional continuing education each year to maintain certification.

Company Officers

The company officer is the formal leader responsible for the health, safety, and training of the crew. Their influence on the attitudes of the crew cannot be overstated. By seeking out wellness education, the officer can become an instrumental advocate for wellness within the department. Educating the company officer will ensure that he/she understands the purpose, scope, and components of the wellness program.

Chief Officers

Chief officers also play a vital role in the implementation of fitness initiatives into the fire department. First, they should serve as roles models and participate in the program themselves. This is an important aspect of being a leader. They should ensure that policies are in place that allow members to participate in fitness activities while they are on duty. They should also ensure that the necessary resources to conduct fitness training are obtained and maintained.

Recruits

PFTs assigned to the academy can help incorporate fitness into the culture of the fire department. They can design exercise programs based on the physical demands and workload of the training academy environment.

Responsibilities of PFTs at the academy can include the following:

- Overseeing and implementing a fitness program for recruits;
- Educating recruits on of the importance of maintaining wellness during their careers;
- Monitoring the recruits for signs of overtraining;
- Adapting training programs to prevent exercise-related injuries;
- Designing post-academy exercise programs for the recruits;
- Serving as a resource for the recruit training officers to improve poor performance that may be related to low levels of fitness.

Candidates

The Fire Service Joint Labor Management Wellness-Fitness Task Force has developed a comprehensive Candidate Physical Ability Test (CPAT) program that includes a physical ability preparation guide. This program will ensure that fire fighter candidates are more physically capable of performing the challenging job of a fire fighter, while making it possible to improve the diversity of the fire service. Peer Fitness Trainers can familiarize candidates with each task and test apparatus, and advise them about specific conditioning regimens and techniques to help prepare for the CPAT or specific CPAT events.

FITNESS ASSESSMENT

All uniformed personnel shall participate in a mandatory, annual, non-punitive, and confidential fitness assessment comprising the following components: body composition, aerobic capacity, power, muscular strength and endurance, and mobility and flexibility. Health screening and medical clearance must be obtained prior to participating in the fitness assessment.

Participants will be provided with the results of the fitness assessment. Personalized feedback should also be provided. This may include the individual's current fitness level, comparisons with previous assessment results, possible areas for improvement, and exercise recommendations. All data must be stored in a confidential database.

To ensure maximum safety, uniformed personnel must be screened for any medical contraindications and instructed in proper technique prior to performing any of the fitness assessment protocols. All department fitness assessments should be administered by trained exercise specialists to ensure that they are being conducted using the standardized protocols and with proper form.

As mentioned previously, the fitness assessment addresses five specific components:

- Body composition
- Aerobic capacity
- Power
- Muscular strength and endurance
- Mobility and flexibility

A detailed description of each assessment protocol is outlined in Appendix A. The fitness assessment recording forms are located in Appendix A1.

Body Composition

Obesity is associated with an elevated risk of many adverse health conditions including cardiovascular disease, hypertension, dyslipidemia, heart failure, diabetes, several types of cancer, asthma and chronic lung diseases, obstructive sleep apnea, dementia, arthritis, and gastro-esophageal reflux disease. The accumulation of fat specific to the abdominal area is also highly correlated with cardiac events.

- ***Evaluation of Body Composition***

The WFI recommends that waist and hip circumference be used to assess body composition. Each measurement is simple to collect, reliable, and can provide valuable insight for the exercise specialist/PFT and member regarding their specific needs. In contrast to skinfolds, the accuracy of each measurement will not depend on the magnitude of adipose tissue and the ability of the assessor to identify specific anatomical landmarks.

To reduce the risk of adverse health conditions, the World Health Organization recommends a waist circumference less than 102 cm and 88 cm for men and women respectively.[2] A waist to hip circumference ratio less than or equal to 0.90 for men and 0.85 for women has also been shown to reduce the risk of metabolic complications. The waist and hip circumference assessment is described in Appendix A.

Aerobic Capacity

Aerobic fitness is fundamental to the health, safety and performance of all uniformed personnel. Occupation-related heart and lung disease cause premature departures from the fire service. An exercise program comprising aerobic activity will reduce an individual's risk of heart and lung disease, improve cardiovascular fitness, and assist to maintain normal body composition, blood pressure, blood lipids, and blood sugar.[3]

Numerous studies have demonstrated the importance of having a moderate to high aerobic capacity to perform the duties of a firefighter. The heart rate response during normal firefighting tasks is consistently near maximal levels.[4] In addition, the oxygen requirements associated with live fire rescues and suppression typically fall within 60-80 percent of an individual's maximum aerobic capacity.[5] Several groups have confirmed that heart rates increase dramatically following the initial alarm and reach maximal or near-maximal predicted values during simulated or actual fire emergencies.[6]

• ***Evaluation of Aerobic Capacity***
Accurate estimates of VO2 max are needed to educate personnel on their current level of fitness as it relates to the demands of their job. This information can be used to assist with the design of an appropriate exercise program, and will help the exercise specialist, PFT, and member gauge its effectiveness. The WFI Treadmill Protocol and the WFI StepMill Protocol were adopted as submaximal field tests for fire service personnel. Details pertaining to both assessment protocols are outlined in Appendix A.

• ***Submaximal versus Maximal***
Aerobic capacity can be assessed with submaximal or maximal protocols. Well validated submaximal tests have been shown to accurately estimate aerobic capacity. These tests can be less expensive and easier to administer than maximal tests, and can be performed in a fitness setting by a qualified exercise specialist.

The submaximal aerobic assessments developed for the WFI (i.e. StepMill and Treadmill protocol) are based on the heart rate response to graded exercise. It is important to note that all submaximal tests use regression equations to estimate aerobic capacity and are, therefore, subject to error. Potential sources of error include:

- Age-predicted estimation of maximal heart rate;
- Resulting test termination heart rate; and
- Potential idiosyncratic heart rate responses due to dehydration, anxiety, and certain medications.

The magnitude and frequency of these prediction errors are reduced by using a well-validated sub-maximal test and appropriate medical prescreening.

Programs that have an on-site physician and ECG monitoring may choose to use a maximal aerobic capacity test; this will produce a more accurate estimate of VO2 max. The WFI Treadmill or StepMill protocol can be extended to the point of maximum effort. The test terminates at maximum volitional fatigue, which is consistent with the effort put forth in an arduous emergency situation or a competitive athletic event, rather than at a percentage of the age-predicted maximal heart rate.

Maximal testing must be conducted under medical supervision with ECG monitoring, and resuscitation and defibrillation equipment on site.

■ Power

Power reflects the ability to generate high forces while moving the body quickly through a range of motion. The ability to contract a muscle or group of muscles very quickly is a function of power. Job tasks such as a forcible entry require the speedy transfer of power from the body to a tool, as in swinging a sledgehammer.

• ***Evaluation of Power***
Lower body power is required for many essential emergency service tasks including lifting and carrying equipment, forcing entry, climbing ladders and stairs, pulling and operating hose lines, and lifting patients. The ability to generate power with the lower extremities, rather than the back, will improve performance and reduce the risk of injury. Lower body power will be evaluated with the vertical jump. Please refer to Appendix A for the vertical jump protocol.

■ Muscular Strength and Endurance

Muscular strength is defined as the maximal force that a specific muscle or group of muscles can generate. The demands of firefighting require above-average strength. Job task analyses have shown that the weight of equipment used by a single fire fighter on the job can be in excess of 100 pounds.[4,7] Further, these loads must often be carried for extended periods of time (i.e. submaximal strength and endurance). Insufficient muscular strength may contribute to the high incidence of sprains, strains and back injuries among uniformed personnel.

Muscular endurance reflects the ability of a specific muscle or group of muscles to contract repeatedly or continuously for an extended duration. Job analyses have shown a strong correlation between muscular endurance and the essential job tasks of first responders. [4]

Insufficient muscular endurance will limit the amount of time that a firefighter can continue to work effectively. Poor endurance can also precipitate injury, because fatigue causes movement patterns to degrade. The muscles of the trunk help to support the low back during sustained exertions, which implies that endurance of these muscles is critical. Because many back injuries occur when the spine is flexed, extended and/or rotated, the ability to resist these movements under load and over extended periods is also essential to the prevention of low back pain and injury.

• ***Evaluation of Muscular Strength and Endurance***
Although strength is sometimes evaluated using single repetition tests, whereby an attempt is made to lift the heaviest load possible (i.e. 1RM), these single maximal effort tests have an inherent risk of injury. Further, many essential emergency service tasks including lifting and carrying equipment, packaging and moving patients, holding and operating hose lines, raising extension ladders, and removing victims require that firefighters exhibit submaximal levels of strength over extended periods of time (strength and endurance). For this reason, three assessments are recommended to assess muscular strength and endurance.

The push-up assessment can be used to evaluate upper body pushing strength endurance and coordination and control of the trunk. The alternate grip push-up is an alternative assessment that may be better suited for individuals with a

history of hand, wrist or shoulder injuries. Please refer to Appendix A for the push-up protocol.

The horizontal pull-up assessment can be used to evaluate upper body pulling strength and endurance (including grip strength), and coordination and control of the trunk and hips. Please refer to Appendix A for the horizontal pull-up protocol.

The static side plank assessment can be used to evaluate firefighters' trunk muscle strength and endurance such as the ability to resist lateral flexion and rotation of the spine. Both right and left side assessments are performed so that potential asymmetries can be addressed through exercise interventions. Please refer to Appendix A for the static side plank protocol.

■ Mobility and Flexibility

The mobility of a joint and the flexibility of the muscles that cross that joint influence the range of motion that a firefighter could achieve. Range of motion of the hips and shoulders can influence firefighters' safety and effectiveness while performing many essential job tasks (e.g. lifting patients, raising ladders, operating hose lines). Range of motion restrictions can also influence the performance of many activities of daily living. When a joint lacks mobility and flexibility, the surrounding joints must compensate to perform essential tasks, which can result in cumulative "micro trauma" or a musculoskeletal injury over the long-term.

The leading types of on-duty injuries in the fire service are sprains and strains affecting the low back, shoulders and knees. In fact, the most prevalent injury leading to premature retirement from the fire service is back injury. Limited hip and shoulder mobility can contribute to the rate and severity of these injuries.

• ***Evaluation of Mobility and Flexibility***

Mobility and flexibility of the hips and shoulders will be evaluated with an active straight leg raise and shoulder flexion and extension assessments, respectively. Each assessment protocol is described in Appendix A.

■ Data Collection

The data collected from the fitness assessments will provide insight into members' body composition, aerobic capacity, power, muscular strength and endurance, and mobility and flexibility. This data can be used to examine changes in fitness levels of personnel over the course of their careers. This can include the strength, endurance, flexibility asymmetries or deficits in neuromuscular coordination and control that may predispose an individual to injury.

The data can also measure the effectiveness of the fitness/wellness program and identify possible factors related to musculoskeletal injuries within the fire department.

■ The WFI is not a Standard — Norms vs Standards

A *norm* is an informal guideline derived from the average or median performance of a large group. A *standard* is a definite rule, principle, formal guideline, or measure established by an authority. Norms are often used during fitness setting as a frame of reference to assist with the interpretation of personalized results, such as assisting individuals in understanding how their results compare to a population of similar age and gender. While fire departments may provide information regarding norms for their members, under no circumstances does the IAFF/IAFC Joint Labor Management WFI Task Force Committee endorse the use of norms to establish standards that, if not met, might result in punitive action. All uniformed personnel should understand that the goal of the WFI fitness assessment is solely to inform improvements in personal fitness. The Wellness-Fitness Initiative has set no standards. Every individual is expected to attain or maintain physical fitness through a personalized exercise program, education, and healthy lifestyle choices.

EXERCISE PROGRAMS

The development of an exercise program based on the specific needs of each individual is a major component of the Wellness-Fitness Initiative. The exercise program should be progressive and account for an individual's current level of fitness, job duties, time restrictions, physical capabilities, dietary habits, and self-improvement efforts. Although the specifics of exercise program design are beyond the scope of this document, it is important to highlight a few considerations.

■ Considerations for Designing Exercise Programs

Because the benefits of personalized fitness programs cannot be overstated, the customer service aspect of exercise programming is critical. The fitness assessment is only the first step in educating uniformed personnel regarding their fitness level, and in guiding them through the process of establishing personal goals. Assessments must be followed by a one-on-one consultation in which the firefighter can address concerns and learn about recommended exercises and equipment use.

Personalized exercise programs should consider the following individual characteristics: age, weight, motivation level, goals, current physical abilities (e.g. aerobic capacity, power, strength and endurance, mobility and flexibility, coordination and control), body awareness, exercise experience, physical work requirements, previous injuries, personal lifestyle, time constraints, available equipment, preferred activities and sociological preference (e.g. individual vs. group participation). These programs should identify and balance the fire fighter's work, life style, and recreational needs. Identifying these individual needs and developing an individualized exercise program stand to impact the lives of fire fighters in all aspects of life.

The program should focus on encouraging positive choices relating to nutrition, time management, health, and overall quality of life. The program should also be balanced to address the fitness components included in the WFI assessment (i.e. body composition, aerobic capacity, power, muscular strength and endurance, and mobility and flexibility).

In some cases, exercise programs centering on job task performance may be appropriate.

Exercise can be a form of stress. The body will adapt and respond as long as the stress is not too great. All exercise programs should be progressive in nature. Attention should be paid to allow time for the body to recover. Programs that advance too quickly over-stress the body and may lead to injury. Job specific allowances must be made for sleep deprivation, high stress shifts, and the intense workload associated with working fires, long incidents, heavy rescues, or high call volume.

NUTRITION

Few lifestyle factors have as strong of an influence on an individual's overall health and physical performance as included in their habitual eating pattern. The working environment of uniformed personnel presents unique challenges to the maintenance of healthy eating habits. Proper nutrition enhances the performance and quality of life of uniformed personnel.

Nutrition for Performance

Nutrition plays a significant role in exercise performance and recovery. Some benefits of a well-balanced diet include optimal energy delivery, enhanced recovery, and strengthened immune function.

Obesity increases an individual's risk for injury, reduces performance, and adversely affects the ability to dissipate heat while working. A well balanced diet, combined with a regular exercise program, is the best way to maintain a healthy body composition.

Nutrition for Health

The high levels of stress, extreme physical demands, long-term exposures to chemicals and disease, and poor dietary habits contribute to elevated risks of heart disease and cancer within the fire service.

- ***Heart disease***

Several risk factors for heart disease - including high cholesterol, obesity, hypertension, and diabetes — can be reduced by dietary intervention. A diet low in total fats, saturated fats, cholesterol and salt, but high in fruits, vegetables, and fiber has been shown to reduce the risk of heart disease.

- ***Cancer***

Poor diet has also been associated with the development of cancer. A diet high in animal fats, and obesity in general, have been linked to the colorectal, breast and prostate cancer. A diet high in fruits, vegetables, and high-fiber whole grains may have a protective effect against cancer.

A Balanced Diet

A well-balanced diet fuels the body for exercise, strenuous work, and resistance to disease. Paramount to the success of a department's wellness program is the promotion of healthy dietary habits. By educating company officers and making them a part of the wellness program, healthy eating should become an expectation within the fire station.

Most experts agree that a balanced and varied diet can meet all of the required daily nutrition needs. The exact quantity of protein, fats, and carbohydrates has long been subject for debate. The widely accepted contribution to the total daily caloric intake is as follows:

- carbohydrates should be 45-65 percent;
- proteins consist of 10-35 percent;
- fats should be 20-35 percent of the total daily intake.

In addition, the following USDA guidelines will help lead to a healthy diet:

- eat five or more servings of fruits and vegetables;
- reduce the amount of cholesterol, salt, and fats, particularly saturated fat;
- replace high fat meats with lean cuts;
- reduce the amount of processed foods, which are high in salt and hydrogenated oils;
- increase the amount of fiber;
- drink plenty of non-caffeinated and alcohol-free beverages.

Planning can reduce the potential for unhealthy eating behaviors.

Nutritional Counseling

A nutritional counselor, dietitian, or sports nutritionist is a valuable asset to any wellness program. The field of nutrition is plagued with fads and misinformation. Members, company officers, and Peer Fitness Trainers may wish to consult a qualified nutritionist. Such experts can be hired, contracted, or involved as volunteers. Benefits of a qualified nutritional expert include: development of weight loss management programs; analysis of individual dietary logs; custom nutritional programs for specific conditions such as pregnancy, weight gain, or illness; education of Peer Fitness Trainers, company officers, members, and recruits; discouragement of potentially harmful dietary practices; and development of specialized menus for post-incident replenishment.

■ Hydration

Working fire fighters can lose more than 2.6 liters of body fluid per hour. Sweat loss in excess of 2 percent of body weight can significantly impair performance, elevate body temperature and decrease cardiac output. It is critical to address proper hydration throughout the shift and during rehabilitation.

During prolonged work, the body loses water via perspiration and respiration. This produces a gradual decrease in stroke volume and the body's cooling capacity. The result is an elevated heart rate and the accumulation of body heat. These effects amplify the sense of exertion and accelerate the rate of fatigue. Dehydration and hyperthermia further predispose an individual to arrhythmias, myocardial infarction, and loss of consciousness, stroke, and sudden death. Adequate hydration helps prevent these ill effects, making it easier to sustain physical performance and enhance recovery. Uniformed personnel can improve their efficiency and capacity for evaporative cooling (sweating) by maintaining a high level of fitness, acclimatizing the body to working in a hot environment, decreasing body fat, and staying hydrated.

INJURY PREVENTION PROGRAM

An emphasis on injury prevention is needed to reduce risks in the fire service. Preventing injuries requires a comprehensive physical fitness program that begins with an assessment and appreciation for the needs and wants of the firefighter, a strong commitment to safety from both labor and management, a designated safety officer, and an understanding of the job demands, beginning in the fire academy and continuing throughout the entire career. Any injury prevention program should also have an educational component that addresses the fitness, wellness, and behavioral elements. Attempts to improve fitness or performance without consideration for the prevention of musculoskeletal injuries in the short- and long-term will leave any firefighter unprepared for the demands of the job, and could have a negative impact on overall quality of life.

■ Injury Prevention Committee

A comprehensive injury prevention program requires an injury prevention committee, as an extension of the safety and fitness committee. The committee should consist of an equal number of members from the fire department administration and the union. The injury prevention committee may also wish to consult with the department's physician, an industrial hygienist, an ergonomist, a physical or occupational therapist, and the departments PFTs. A near-miss program is another powerful tool in the prevention of injuries.

SUMMARY

In summary, this document provides a model for proper implementation of fitness programs in the fire service. Research has shown the need for high levels of aerobic capacity, power, muscular strength and endurance, mobility and flexibility, whole-body coordination and control, and favorable body composition to perform safely and effectively on the fire ground. High levels of physical capacity and body awareness are essential in maintaining the wellness of our uniformed personnel. Fitness must be incorporated into the overall fire service philosophy.

While assessing uniformed personnel's current fitness level is an important part of developing an individualized fitness program, assessment is not, in itself, a fitness program. An effective physical fitness program has several components. The elements necessary for a successful and comprehensive physical fitness program have been highlighted throughout this chapter. All recommended protocols are referenced in Appendix A. The fitness assessment recording forms are located in Appendix A1.

ENDNOTES

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CHAPTER 4 — Injury and Medical Rehabilitation

Management and Labor shall work together to provide a comprehensive individualized injury management /medical recovery and fitness program that ensures effective rehabilitation of any affected uniformed personnel to a safe return to full duty status.

This chapter highlights the following:

- **Definition of Rehabilitation**
- **The Need for Rehabilitation**
- **Components of a Comprehensive Rehabilitation Program**
- **The WFI Rehabilitation Continuum**
- **Stages of Rehabilitation**
  - **Early Healing/Recovery**
  - **Functional/Performance**
  - **PFT Involvement in Rehabilitation**

INTRODUCTION

As noted in Chapter 3, fitness programs have been incorporated numerous ways within the fire service. Peer fitness trainers have utilized various protocols to assess the specific functional fitness categories of aerobic conditioning, muscular strength and endurance, power, flexibility, and body composition in order to facilitate successful performance of job duties. Fitness and rehabilitation research continue to advance with a more recent fitness focus on functional skills needed for safe performance and more movement-based strategies to prevent injuries. It is then a natural progression to view rehabilitation as a continuum of a fire fighter's fitness program, now with the goal of assisting in the return to physical fitness/conditioning and performing quality movement patterns to prevent re-injury.

The diagram in Figure 4.1 outlines the continuum that exists between fitness and rehabilitation.

It is extremely important that rehabilitation providers for fire fighters take into consideration this unique continuity between fitness and rehabilitation. Communication between rehabilitation providers and peer fitness trainers is strongly encouraged. The different stages of rehabilitation with respective goals are described and components of collaborative and effective rehabilitation for fire fighters are presented in this chapter.

DEFINITION OF REHABILITATION

Rehabilitation is the sequence of services that restores a patient's physical function and wellness following an injury or medical condition. Rehabilitative care starts at the moment of injury or recovery from a medical condition and includes a continuum of services to restore the firefighter to full duty. Rehabilitation involves numerous professionals, including:

- The physician(s)
- Licensed healthcare professionals
- Physical or occupational therapists
- Exercise physiologists/specialists
- Fire department's peer fitness trainers
- Nurses
- Athletic Trainers

The successful rehabilitation of injured uniformed personnel, regardless of the cause or nature of the injury or medical condition, must address both physical and psychological factors which impact the recovery process. It is anticipated that there will be psychological needs associated with physical injuries.

THE NEED FOR REHABILITATION

Every year, statistics show that firefighting is one of the most dangerous occupations in the world. According to the National Fire Protection Association (NFPA), injuries are a problem and can place substantial strain on a department. In addition, when personnel are re-injured after inadequate rehabilitation of previous injury, the costs are even higher. Therefore, the comprehensive rehabilitation of our uniformed personnel must be a priority.

Figure 4.1 The Fitness/Rehabilitation Continuum.

COMPONENTS OF A COMPREHENSIVE REHABILITATION PROGRAM

The rehabilitation program should be comprehensive in scope to include medical treatment, rehabilitation, and fitness services. Medical treatment is provided by a treating physician (orthopedist or other specialty) and/or occupational health physician. The outpatient rehabilitation services are primarily provided by physical and/or occupational therapists (PT/OT), with some facilities providing additional health care providers, such as exercise physiologists, kinesiologists or athletic trainers (AT). Some fire departments provide in-house rehabilitation services and include AT and/or PT providers. Fitness assessments and/or training can be provided by rehabilitation or fitness professionals, including the individual fire department's peer fitness trainers (PFTs) or department ATs. In some instances, additional support from behavioral therapy and psychological support services may be indicated.

Rehabilitation programs must not be punitive in nature. The fire department must take the lead in ensuring that uniformed personnel are properly rehabilitated. The opportunity for light duty work during the rehabilitation process is encouraged. Light duty work should fall within the medical restrictions provided by the physician. This light duty work provides temporary, purposeful work to assist in the recovery process. It is a means to reduce injury costs and to keep the individual involved with the department by utilizing that individual's expertise. During rehabilitation, clinicians familiar with firefighting job requirements, or the essential job functions, should be the ones making the informed decisions regarding the functional capacities of uniformed personnel and their readiness to return to full duty upon recovery from an injury or medical condition. In short, the fire department must facilitate the process from beginning to end.

THE WFI REHABILITATION CONTINUUM

Rehabilitation is a critical component of the WFI. Figure 4.2 demonstrates the stages from point of injury/medical condition requiring medical evaluation/treatment, until return to full duty. If rehabilitation is recommended, additional medical re-evaluation(s), with changes in duty status, may occur as recovery progresses. It is recommended that the WFI fitness components are integrated into the rehabilitation process to facilitate firefighter performance readiness. WFI fitness components are integral in the post return to work stage, as well as the maintenance of firefighter fitness to reduce injuries/illnesses.

The department should use care when choosing medical and rehabilitation providers. It is highly recommended that these professionals review the individual's job tasks and the department's performance testing, if present. It is encouraged that medical and rehabilitation providers support behavioral/psychological interventions should a fire fighter's rehabilitation be impeded during this recovery period.

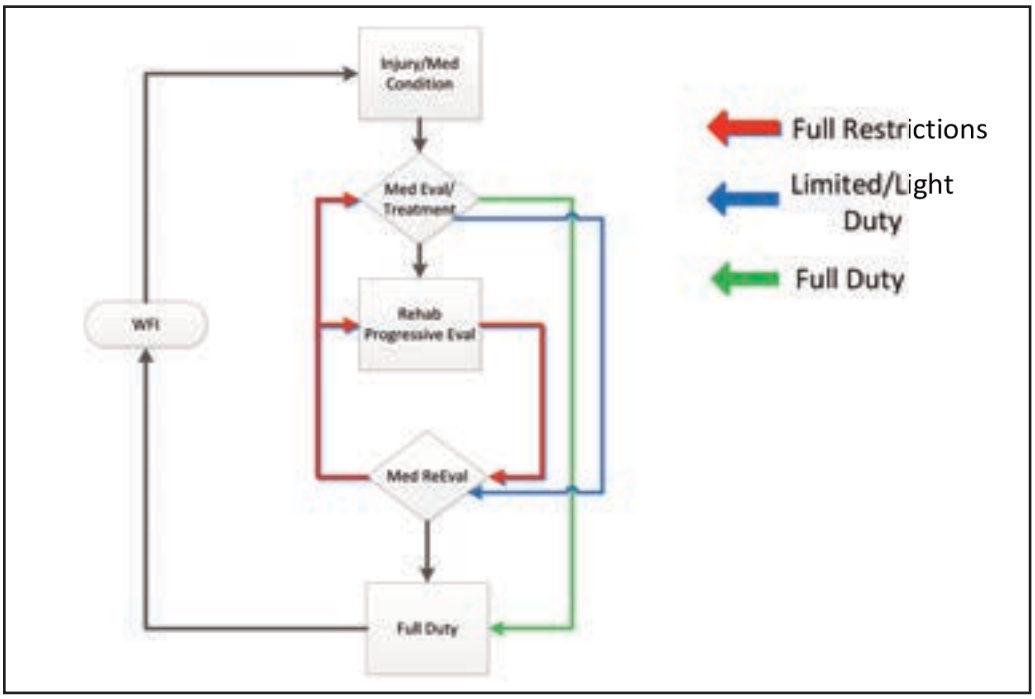

Figure 4.2 – The WFI Rehabilitation Continuum Diagram

Communication between medical professionals and the fire department is essential. However, Health Insurance Portability and Accountability Act (HIPPA) laws must be followed to maintain confidentiality. Rehabilitation providers relay the job readiness information and projected rehabilitation timelines to the physician. The physician makes the determination if personnel are on full restrictions, or are ready to be assigned to limited/light or full duty.

STAGES OF REHABILITATION

■ Medical Evaluation and Treatment

After an injury and after each medical appointment, the physician should provide the department with an update in work status (full restriction, light duty or full duty) and recommendations to the impaired person for recovery, which may include specific medical intervention or rehabilitation.

It is recommended that uniformed personnel on extended leave as a result of a medical condition for a continuous period, undergo a medical and fitness assessment. Extended leave status includes:

- alternate assignment
- leave of absence
- leave due to illness, injury, maternity
- other qualifying situations.

Such a policy will help identify loss of conditioning which may put uniformed personnel at risk for future injuries. The department physician or designated clinician shall evaluate individual for recommendation on re-entry into the workforce. See Chapter 2 for fire department physician guidelines.

■ Rehabilitation

Most commonly, rehabilitation services are provided in outside medical/rehabilitation facilities. However, it is recommended fire departments, in collaboration with Risk Management and/or the department's insurance provider, locate rehabilitation providers either outside of the department that provide quality services or consider bringing a rehabilitation provider into the department. This internal program could possibly be located within department's fitness setting and/or a location where there is access to firefighting equipment for progressive performance practice. There also may be facilities within the department's geographic region which provide advanced, functional skills for specific return to work needs. These "Industrial or Occupational Rehab Facilities" are designed, and the staff is likewise trained, to progressively simulate job tasks and demands so that a worker is prepared to return to his/her job. In addition, these facilities may have providers certified in ergonomics to address gear fit and function needs during the rehabilitation process, better preparing the fire fighter for return to full work demands.

Athletic trainers, Physical or occupational therapy providers should provide evidence-based services, making clinical decisions and choosing interventions which have a strong correlation with recovery and return to function. Clinicians should also base progression on physiologic indicators of readiness for increasing physical and functional demands.

- ***Early Healing/Recovery Stage of Rehabilitation***

Rehabilitation should start as soon as medically appropriate, as referred/directed by the physician. The early stages in the rehabilitation continuum facilitate tissue healing, prevent adverse impacts of the injury or medical condition, and facilitate the primary injured joint/tissue recovery. If possible, it is recommended that the rehabilitation provider guide the fire fighter on safe options for cardiopulmonary conditioning so that healing is facilitated and a base level of fitness is maintained. The goal of these early rehabilitation stages is individual joint recovery and tissue tolerance for everyday activities.

- ***Functional and Performance Readiness Stage of Rehabilitation***

Medical and rehabilitation providers need to coordinate the readiness for a fire fighter to advance his/her rehabilitation intensity. The progression to more demanding rehabilitation approach should begin once the tissue healing/recovery allows additional loading and demands to be placed on the fire fighter. The clinician should use an "industrial/tactical athlete" approach to rehabilitation and reconditioning during these stages.

Functional strength components and simulated job specific tasks should be incorporated into individual rehabilitation programs. Performance requirements including the aerobic and anaerobic needs for wearing progressive gear, handling progressive weights, demonstrating safe patterns of motion and demonstrating speed-related, impact tasks are encouraged. Cardiopulmonary demands should reach near, if not 100%, of a fire fighter's calculated maximum heart rate.[1]

Wearing the gear reduces the body's ability to sweat and will require a period of re-acclimatization to reduce the likelihood of heat stress. Depending on the time off full duty work, gear fit and function needs to be assessed making sure it allows functional joint motion to protect the injured area. The goal of these later rehabilitation stages is to prepare the total fire fighter for the physical, functional and cardiopulmonary demands of his/her job.

- ***Relationship Building – PFT Involvement in the Rehabilitation Process***

Early in the rehabilitation process, it is recommended that a department peer fitness trainer be assigned and communicate with the rehabilitation provider(s). The purpose of this communication is two-fold: it facilitates the rehabilitation provider's awareness of fitness and performance requirements for return to safe job performance and it supports the firefighter in their recovery process.

The WFI peer fitness trainers are trained to assess the following fitness components of fire fighter fitness (also see Chapter 3):

- Aerobic / Anaerobic Capabilities
- Muscular Strength and Endurance
- Flexibility
- Power
- Body Composition

It is these categories of expected performance that rehabilitation providers should be addressing, both from an individual joint/medical system perspective during the early stages of recovery and progressing to a total body readiness during the later stages in rehabilitation The earlier general fitness skills can be incorporated safely back into the rehabilitation process, the more prepared the firefighter will be to progress to more demanding stages of rehab and ultimately the high performance demands of the job. Additional balance, proprioception and sensory integration skills must be evaluated and retrained, as needed, by the rehabilitation provider.

It is strongly suggested that the department provide information to the rehabilitation provider that details a fire fighter's performance demands for full duty. They should also note the in-house fitness resources provided by peer fitness trainers. See Appendix C for information that can be forwarded to the rehabilitation provider. This should prompt the physical/occupational therapist to consider the broader needs of the fire fighter and to collaborate with the department's peer fitness trainers.

SUMMARY

A consistent approach to medical evaluation/intervention, light duty opportunities, rehabilitation services and peer fitness trainer involvement is encouraged in addressing the recovery and return to work of personnel following injury or medical condition. A high level of readiness for full duty requires a collaborative effort between medical professionals, rehabilitation providers and peer fitness trainers to help prepare the total body of a fire fighter for the full duty physiologic demands of firefighting.

END NOTES

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CHAPTER 5 — Behavioral Health

Management and Labor shall support the provision of a behavioral health plan, which may be delivered either through internal or external sources, based on specific elements.

INTRODUCTION

Wellness is defined as a balance between the various fitness modalities — medical, physical, emotional and behavioral. Traditionally, medical and physical fitness took precedence over emotional or behavioral fitness in the fire service. However, there's growing realization that imbalance in any of the fitness domains can impact a fire fighter's health and ability to perform the job. Uniformed personnel who are mentally and emotionally fit are essential building blocks that form the foundation of the fire service.

There is widening recognition that behavioral wellness must be prioritized and integrated into a department's overall fitness and safety culture. A successful behavioral health initiative is a non-punitive program that provides access to mental health services, builds awareness about behavioral health issues, educates, and works to dismantle the stigma associated with behavioral health and those who seek services. The most successful behavioral health programs are cooperative efforts between labor and management and often have a "champion." This behavioral health champion collaborates with others to implement the program, assess effectiveness, provide leadership and ensure sustainability.

This chapter provides a thorough overview of behavioral health within the fire service, including common stressors and behavioral health conditions. The chapter also provides guidance on how to implement a comprehensive behavioral health program that assists all uniformed personnel with maximizing their behavioral wellness.

Behavioral Wellness

Physical fitness is a balance between good health, strength, fitness and durability, while behavioral wellness involves a person's thoughts, feelings and behavior. Fighters who balance their physical, behavioral and emotional fitness tend to fare better in life. They are equipped to cope with life events (including transitions like retirement), achieve higher career satisfaction and look after their family's well-being. To perform at a high level on the job, uniformed personnel must balance the emotional, physical, and mental stresses of work and personal life and be able to cope effectively. Challenges such as substance abuse, death of a loved one, financial distress, marital and family problems affect personnel both on and off the job. If their ability to cope with these challenges is compromised, fire fighters and paramedics are less able to deal with these stresses and their mental and emotional health suffer. A comprehensive wellness program teaches individuals how to engage in daily practices that help them cope with the stressors within the fire service and while also maximizing their body and mind wellness.

Investment

Although departments invest heavily in fire service equipment, greater focus must be given to the individuals who operate the equipment. When departments invest in their members, they increase their capacity to provide high quality service to communities and enhance the quality of life of their employees.

Numerous cost-effectiveness studies have demonstrated that employers who have high-quality and well-utilized health promotion programs, such as an Employee Assistance Program (EAP), gain a meaningful return on their investment. One comprehensive study underscores that point. Dr. Pelletier[1] at the Stanford University School of Medicine launched a series of reviews on workplace health promotion programs, including EAPs. He concluded that the cost-offset for these programs made a solid case for their continued support. The Pelletier review indicated the return of dollars invested to dollars saved ranged from $1.81 to as high as $8.81 saved for every dollar spent. Another study found that the expected return on investment for EAPs was between $5.17 and $6.47 per dollar spent.[2] A post-hoc analysis of closed EAP cases from twenty US employers indicated that level of functioning at home and at work improved significantly when employees used EAP services.[3]

Without attention to and an investment in the behavioral health of their employees, the fire service and other employers risk having employees who are absent more often, less productive on the job, involved in more accidents, incur more injuries, utilize more sickness benefits, and poorly perform required duties.[4] Uniformed personnel run the risk of being a liability to the department, rather than an asset. In a profession that requires the utmost skill and reliability, an emotionally, physically, or medically unfit member may jeopardize not only their safety, but that of their co-workers.

In addition to helping their individual employees, departments that promote good communication and positive emotional interactions can enhance daily operations, teamwork and personnel satisfaction.[5] When behavioral health disorders are unaddressed, they can impact the work setting and contribute to low morale and higher turnover rate.[6] A behavioral health program can provide educational seminars and information on topics of interest to uniformed personnel and their families, such as: positive versus destructive coping strategies, shift work and sleep disturbances, balancing the stressors of emergency services work and families, weight control, nutrition, cholesterol control, tobacco use cessation, fitness, hypertension awareness, preventive medicine, infection control, substance abuse, retirement planning, career/vocational guidance, job associated grief counseling, and other specific work-related issues. These topics mirror and complement the themes found elsewhere in the Wellness-Fitness Initiative. Equally important, programs that promote behavioral health wellness help reduce the stigma associated with using behavioral health resources.

BEHAVIORAL HEALTH STRESSORS IN THE FIRE SERVICE

■ Stress

Stress is defined by the National Institute of Mental Health as the brain's response to any demand.[7] Events that trigger this response may be short-term, long-term and/or recurring stressors. Not all stress is bad – it can also be triggered by positive events - and some level of stress is a normal part of life. However, stress can also be triggered by negative experiences, like a serious illness, divorce, or exposure to traumatic events.

Chronic stress can have negative physiological and psychological consequences ranging from digestive symptoms, headaches, depressed mood, anger, and irritability. Stress can also exacerbate certain health conditions like high blood pressure and diabetes, as well as increase susceptibility to viral infections such as the common cold and flu virus. When a person's ability to cope with stressors is overwhelmed, it can result in diagnosable psychological conditions such as anxiety disorders, mood disorders, or post-traumatic stress disorder.[8]

The following section reviews the common stressors experienced by uniformed personnel – job-related stress, hazardous exposures and family relations – and suggests ways departments and individuals can manage that stress.

■ Job Stress

The work of fire service personnel is characterized by long hours, shift work, disruptions in sleep patterns, sporadic high intensity situations, strong emotional involvement, life and death decisions, and exposure to extreme human suffering. Eventually, this type of work can impose excessive stress upon an individual and his or her family. Uniformed personnel also experience small day-to-day stressors — old or lack of equipment, high call volume, condition of station living quarters, or disagreements with coworkers —– which can build up over time and result in unhealthy stress reactions.[9]

Disasters and other large-scale emergency responses are also a major source of job stress. Disasters affect whole neighborhoods, towns, cities and/or counties. An entire city's resources may be mobilized to help restore order and assist the hundreds or thousands of people affected. Without fail, uniformed personnel are on the frontline, the first to respond to any such disaster. Keep in mind, firefighters also live in the communities affected by national disasters, so they're coping with personal loss at the same time they are addressing increased job-related stress. If a lengthy recovery operation is necessary, uniformed personnel may stay on the scene of the disaster for days and even weeks, further elevating stress and leaving little time to recover. Spending hours and days on the scene of a disaster can have significant emotional consequences.

In the aftermath of a disaster, fire fighters often take shortcuts with sleep and nutrition and may be away from their families for a period of time. These shortcuts can short-circuit the individual's physical and psychological health. Uniformed personnel who work disaster scenes should take more time to care for themselves, not less, to make sure that they and their families are physically and emotionally safe.

■ Hazardous Exposures

Uniformed personnel risk exposure to a variety of hazards during their course of their jobs, and these exposures can become a significant source of stress. On the job, they interact with individuals who have been exposed to or have been infected with contagious diseases such as hepatitis B, tuberculosis, viral meningitis, meningococcal, pneumococcal diseases and HIV/AIDS.[10] Wearing proper personal protective equipment (PPE) can help prevent transmission and reduce stress.

While fighting a fire or in the fire station, uniformed personnel also can be exposed to high levels of hazardous chemicals, including known and suspected human carcinogens. Fire smoke contains many hazardous combustion byproducts such as benzene, formaldehyde, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), many of these are known to cause cancer in humans. Fire fighters can be exposed to these hazards when they do not wear their Self-Contained Breathing Apparatus (SCBA) and full protective gear during all phases of firefighting (including overhaul). Exposure can occur if protective gear is faulty,

does not fit properly, or if certain contaminants pass through turnout coats and are absorbed through the skin. At the fire station, uniformed personnel can also be exposed to diesel exhaust if source capture devices are not used or used incorrectly.

Several recent research studies show that fire fighters are at an increased risk of developing cancer and dying from cancer when compared to members of the public. Some of these cancers include mesothelioma, non-Hodgkin's lymphoma and cancers of the lung, colon and prostate.[11, 12]

Family Relations

The demands of the fire service can take their toll upon marriages and families. Extended shifts keep many uniformed personnel away from home for long periods of time, and work may cause them to miss holidays, birthdays, school functions and other family obligations. One study of fire service personnel found that more time at work plus less uninterrupted time at home were associated with higher work-family conflict and emotional exhaustion.[13] In addition, family members worry about the health and safety risks that their loved one faces on the job, which creates additional stress for the family.[14] Stress from family problems coupled with the job's high demands can intensify stress for uniformed personnel.

Managing Stress

At an individual-level, the negative effects of stress can be managed by adopting healthy behaviors. A varied and healthy diet, physical activity and exercise, consistent sleep schedule, and supportive social network of friends and family can help people cope with both acute and chronic stressors. Using alcohol or other substances to cope with stress is not a healthy coping behavior and can lead to dependence and addiction.

At the department-level, an effective stress management program can significantly enhance overall job performance. Stress management programs educate personnel on healthy methods for dealing with job-related and personal stressors and deliver information through written materials, educational workshops, peer-based programs, and/or behavioral health professionals. For example, a multi-faceted stress management program can help support fire fighters and their families if there is a hazardous exposure or someone is diagnosed with an occupational cancer or other illness. Programs also may want to target retirees who are dealing with the transition of retirement and no longer have regular contact with co-workers around the kitchen table and may struggle without that supportive network. Departments can establish these programs using external or internal behavioral health resources.

Finally, a stress management initiative should focus on prevention and use a proactive approach for recognizing, managing and reducing the effects of stress on fire fighters' emotional and physical health. A comprehensive behavioral health program might educate new hires about how to recognize reactions to stress during recruit training. Incumbent uniformed personnel could visit the academy to provide recruits with realistic insights on job-related stresses they can expect throughout their careers. These prevention efforts can be developed and delivered by the department's behavior health specialist, peers or community behavioral health providers.

Personnel training, promotional and/or paramedic training can incorporate information about stress and review stress management techniques. Stress prevention education activities could include highlighting how exercise is a tool to reduce stress; sharing assessment tools so personnel may self-monitor their own stress levels; and providing information on how to access support and resources. Examples of stress management programs and interventions can be found on the National Registry of Evidence-Based Programs and Practices available at https://nrepp-learning.samhsa.gov/.

Resiliency

Resiliency is the process of coping with stressful or challenging life events in a manner that provides the individual with additional protective and coping skills.[15]

One study found that career professional fire fighters cited acceptance, humor, religion and positive reframing as among their top coping strategies.[16] Resilient individuals learn from and integrate their experiences. They create a sense of meaning and eventually accept the "new normal" of their lives following a traumatic event.

Researchers increasingly view resilience not as a fixed attribute but as an alterable set of processes that can be fostered and cultivated.[17] When fire fighters increase their capacity to adapt and overcome traumatic events, they increase their resiliency. Key factors that enhance resiliency include caring and supportive relationships, a realistic plan of action for dealing with the event, and a positive sense of spirituality and mindfulness.[18, 19] Resilience increases when uniformed personnel are committed to their own behavioral health and well-being, and departments can reinforce that commitment by providing helpful wellness programs and resources.[20]

COMMON BEHAVIORAL HEALTH CONDITIONS

While there's been limited discussion about behavioral health within the fire service over the years, these conditions have long affected uniformed personnel. This section provides an overview of some of the behavioral health conditions that fire fighters and paramedics experience more frequently.

Substance Use Disorders

There are many reasons why individuals become dependent upon or abuse alcohol and drugs, including an attempt to reduce stress or escape traumatic memories. However, substance abuse poses significant risks to members' physical and emotional health. Problems that result from alcohol and drug abuse are not confined to the user; people closest to or dependent upon the individual (e.g., family, friends and coworkers) are also significantly impacted.

It is important that department policies reflect a strong commitment to a workforce that is free of substance abuse. Each department should establish a policy that explicitly states that neither the use of illegal substances nor the abuse of legal and/or controlled substances will be tolerated. The department's policy regarding substance abuse should be made clear to applicants for all positions within the department

While a strong policy against substance abuse is important, drug testing does not belong within the context of the Wellness-Fitness Initiative. Given the WFI's explicit non-punitive approach, drug testing should not be included in the annual medical examination or blood/urine tests. If drug testing was incorporated into the Wellness-Fitness Initiative, it would create resistance to medical evaluations and physical examinations.

Most departments have new-hire and for-cause drug testing policies, while others have a random, mandatory testing policy. When drug misuse is identified, either through reasonable suspicion or random testing, any follow-up action should include a referral to treatment. Treatment is most effective when it specialized and readily accessible. The Wellness-Fitness Initiative emphasizes rehabilitation of the affected individual, not termination. Rehabilitation is the most effective and compassionate means of retaining a valuable member of the department. The department should foster an environment in which fire fighters can come forward to request help and receive support when they enter and return from treatment. Confidentiality is paramount throughout the process of assisting individuals with substance use disorders.

Alcohol

Alcohol use is highly prevalent among fire personnel.[21] Alcoholism (now called Alcohol Use Disorder) has been recognized as a treatable disease by the American Medical Association since 1956. People who abuse alcohol frequently have a difficult time knowing when their use has crossed the line and becomes a health and safety risk. Alcohol Use Disorder may be diagnosed after 12-months or more use that interferes with job, family, school responsibilities; results in problems with family and friends; occurs despite being in hazardous situations; requires heavier drinking to achieve the same effect, and a few additional criteria.[22]

Alcohol Use Disorder is a progressive illness, and it may take time before a person performs poorly on the job and develops a chronic problem. Whenever possible, affected workers should receive early intervention and a referral to a credible substance abuse program. Early intervention benefits the member, the member's family, and the fire department. In addition, research has demonstrated that alcohol treatment programs reduce the long-term health care costs for patients.[23]

Tobacco

Tobacco is another commonly used substance within the fire service. Smoking is the number-one cause of premature death and a significant contributor to heart disease, lung disease and cancer. Smoking is also the leading cause of fires, including fires that have claimed the lives of IAFF members. Medical data clearly show that tobacco use is damaging to one's health and not compatible with healthy uniformed personnel. The use of tobacco, whether through smoking or smoke-free products, is contrary to the philosophy of the Wellness-Fitness Initiative and the goals of a comprehensive wellness program. Tobacco use also undermines the benefits secured by existing presumptive heart and lung laws.

The Wellness-Fitness Initiative includes the following Tobacco Cessation Policy:

- All new fire department candidates shall be tobacco free upon appointment and throughout their length of service to the department.
- Current fire department uniformed personnel shall not use tobacco products (cigarettes, cigars, and/or chewing tobacco) inside the worksite, within or on fire department apparatus, or inside training facilities.
- A fire department sanctioned tobacco cessation program shall be made available to incumbent tobacco users. Tobacco cessation programs must be non-punitive and must include both short and long term goals.

The IAFF and the pharmaceutical company Pfizer started a campaign to help the IAFF become the first smoke-free union in the North America. The program materials, found on the IAFF's Fit to Survive website, include information on the health risks of smoking, benefits of quitting, tips on how friends and family can help a smoker quit, and ideas on how to encourage health insurance plans to cover smoking cessation. The website can be accessed at http://www.iaff.org/smokefree/ \

Several tobacco cessation programs have been well-studied and found to be safe and effective. Success rates appear to improve when other tobacco users in the person's life -- family members, close friends, or co-workers -- stop smoking at the same time. Cessation programs may include the use of hypnosis, acupuncture, nicotine

chewing gum, nicotine patch, and medications such as clonidine and varenicline (Chantix). These programs are far more effective when coupled with counseling for behavioral modification. The best tobacco cessation programs represent a joint effort between the physician, other health care providers, trained counselors, and supportive family and friends.[24] All tobacco cessation programs should be coupled with formal nutrition and exercise programs using the same goals and protocols discussed in other WFI chapters.

■ Post-Traumatic Stress Disorder (PTSD)

Traumatic events -- unexpectedly gruesome sights, mass causalities or loss of friends or family during a call – are a daily reality for fire fighters and paramedics. These potentially traumatic events (PTEs) can be experienced directly, witnessed, or occur to someone that is very close to the individual.

While fire fighters are exposed to PTEs as a normal part of their job, they may respond to these incidents differently. Two people who experience the same traumatic event can have very different reactions to it. Certain calls may hit closer to home or have a greater impact on some responders.

Stress reactions can occur after exposure to a single potentially traumatic incident, or after cumulative incidents as the stress builds up over time. These stress reactions may include nightmares or intrusive thoughts (re-experiencing), avoidance or numbing (avoiding people or places associated with the event), and increased arousal (irritability, difficulty concentrating and sleeping). Individuals may experience some, but not all, of these symptoms. When these symptoms persist or intensify, or if there's a delayed stress reaction months or years after an event, fire fighters need to be concerned about whether Post-Traumatic Stress Disorder (PTSD) has developed.

PTSD is a psychiatric diagnosis made after an individual is exposed to a potentially traumatic event and experiences an array of symptoms that last more than a month and create distress or functional impairment. These symptoms include nightmares and flashbacks, avoidance behaviors, increased arousal and reactivity, and negative thoughts/feelings.[25] The prevalence of PTSD in uniformed personnel is higher because of the greater exposure to trauma and critical incidents they experience.[26] The risk for PTSD increases when there is longer critical incident duration; intensity, unpredictability, uncontrollability and real or perceived responsibility or betrayal associated with the potentially traumatic event; and perceived threat, terror or horror in reaction to the incident. On an individual-level, family history of psychiatric illness; ongoing stressful life events at the time of the event; lack of social support; and a social environment that promotes shame, guilt, stigmatization, or self-hatred can increase the risk for PTSD.

It's preferable to intervene before waiting for all of the PTSD symptoms to appear and progress into an illness. Individuals can minimize their own suffering and that of their family and co-workers by addressing symptoms during the early stages. At the same time, individuals who have suffered from PTSD for years, or even decades, can get relief and resolution with appropriate treatment. It is critical that fire personnel become better at understanding trauma and PTSD, recognizing and talking about the signs, and encouraging treatment.

■ Depression

Depression is a serious but common health condition. The World Health Organization reports that more than 300 million people suffer from depression around the world.[27] Feeling sad on occasion is a normal part of life, but depression is more than just sadness. Depression is associated with unrelenting feelings of helplessness, hopelessness, and worthlessness and interferes with day to day life, affecting work, sleep, recreation, and diet.

People who suffer from depression experience a variety of symptoms lasting for at least two weeks, including loss of interest and enjoyment in pleasurable activities; reduced energy levels; insomnia or oversleeping; appetite or weight changes; irritability; loss of energy; self-loathing; concentration problems; and physical aches and pains.[28] It is generally agreed that depression is the result of biological, psychological and social factors and can be triggered by a range of factors or events. Depression is related to other mental health issues like PTSD and substance use, and to physical health problems like diabetes and cardiovascular disease. At its worst, depression can lead to suicide.

In the fire service, recent studies suggest between 7%[29] and 11%[30] of fire fighters suffer from clinical levels of depressive symptoms. Depression levels seem to rise over the course of a career in fire service, with new recruits having the lowest levels of symptoms, and experienced fire fighters having the highest.[31] The good news is that effective treatments are available for depression. Effective treatments for mild depression include evidence-based psychotherapy like Cognitive Behavioral Therapy, Activation treatment and Interpersonal psychotherapy. Moderate to Severe depression responds to those psychological interventions, as well as antidepressant medications. Fire fighters suffering from depression, even moderate to severe depression, can engage in treatment (both psychological or talk therapy and medication treatment) with appropriate medical clearances.

■ Suicide

Suicide is the 10th leading cause of the death in the United States, accounting for 13 deaths for every 100,000. Over 44,000 Americans commit suicide each year.[32]

One must understand suicide's warning signs to identify at-risk fire fighters and paramedics in need of help. These signs include talking or writing about death; threatening to hurt or kill oneself; feeling rage or uncontrolled anger and hopelessness; withdrawing from friends and family; feeling anxious or agitated; experiencing significant changes in mood; and engaging in risky and reckless activities. A person's risk is higher if there's history of past suicide attempts, mental health disorders such as depression or PTSD, alcohol and substance abuse, access to firearms or other lethal means, and stressful life events like legal problems, abusive behaviors, and family conflicts.

If there is concern that a fellow fire fighter, family member or friend is in danger, the next step is to be direct and ask if they are considering suicide. Anyone who is planning to kill themselves should not be left alone and should be brought to the nearest hospital or emergency room for evaluation and treatment. For less acute situations, the individual will need assistance finding a knowledgeable mental health professional or reputable treatment facility.

While suicide may not always be avoidable, it is preventable. Research has shown that there are specific ways to improve the odds of preventing a suicide. These include 1) reducing the stigma around mental illness and help-seeking, 2) enhancing social support through social networks, 3) making help-seeking easier through departmental or policy changes, 4) screening for depression, substance abuse, and suicidal ideation or suicide attempts, 5) restriction of lethal means, and 6) media education.[33, 34, 35] A comprehensive behavioral health program can address many of these factors through education, programming and individualized support.

The unfortunate reality is that departments also should develop guidelines that outline protocol for the department following a suicide death. These SOPs can include notification procedures and guidelines for responding to family and department members. The IAFF web site has a model SOP for suicide postvention that can be reviewed and tailored. Departments also must provide resources and counseling to assist those coping with the suicide of a member.

COMPREHENSIVE BEHAVIORAL HEALTH PROGRAM

Few departments have a comprehensive behavioral health program. Most have a patchwork of ineffective services and often must scramble when behavioral health concerns arise. The current system is characterized by ineffective and underutilized EAPs; few protocol or resources for responding to behavioral health needs; and pervasive stigma that discourages discussion about behavioral health and hinders access to services. Fire departments that implement a comprehensive behavioral health program are able to move out of this reactionary mode and become more proactive and preventive.

Since behavioral health programs deal with sensitive issues, confidentiality must be the cornerstone of every fire department's program. Individuals who seek assessments and counseling must be assured that services are both non-punitive and confidential. Trust in the behavioral health program is essential for services to be utilized and effective.

A comprehensive behavioral health program could address the following issues through education and services: substance abuse issues; addictive behaviors; medical issues; occupational diseases; disabilities; veteran concerns; stress management; communication skills; marital concerns; family and child issues; domestic violence; anger management; legal and financial problems; critical incident stress (including post-traumatic stress disorder); cumulative stress; workplace violence; and death/grief counseling. Once these behavioral health topics are addressed, programs may evolve further to address career/vocational concerns; organizational problems; and lay off/suspension/termination.

A comprehensive behavioral health program can be configured in various ways, but typically encompasses a core set of services and supports. These components include an Employee Assistance Program; Behavioral Health Standing Committee; Behavioral Health Specialist; Periodic Behavioral Health Evaluations; Peer Support; Chaplain Services; Post-Incident Response; Family Support and Education. The following section describes these essential elements in more detail. A bulleted list of these fundamental components can be found in Appendix D.

■ Employee Assistance Programs

An Employee Assistance Program (EAP) -- or Labor/Employee Assistance Program (L/EAP) -- is a cost effective, humanitarian, job-based intervention to help individuals whose personal problems or occupational concerns impact their work performance.[36]

Fire fighters and paramedics need an EAP that can address their concerns specific to the fire service and promote total wellness. An effective EAP can restore uniformed personnel to a healthy and fully productive life, along with improving employee morale and increasing the productivity of the entire department. It can be an internal program within the department or union, sponsored by a jurisdiction and/or contracted to an outside organization. Regardless of how it's structured, it is helpful to periodically review EAP utilization and member satisfaction to ensure accountability.

Employees should have direct access to EAP services without going through departmental personnel. EAP providers must have a good understanding of how life in

the fire service can adversely affect a member's wellbeing and ability to perform their jobs safely and effectively. EAPs should refer individuals who require specialized or longer-term counseling to licensed mental health professionals who have experience with traumatic stress, use best practice evidenced-based treatment strategies, and have been vetted.

The guarantee of complete confidentiality is fundamental to any EAP, as well at the assurance that job security or future promotional opportunities is not jeopardized by the employee's need for or use of services.[37] If the perception is that confidentiality is not maintained or there's a conflict of interest, the EAP will not be utilized. Both employer and employee should be informed of and able to review relevant privacy rules, including federal regulations that govern privacy of health records and employee records. In addition, many states have specific laws that address provider-patient privilege for licensed health care providers.

■ Behavioral Health Standing Committee

Establishing and maintaining a comprehensive behavioral health program requires ongoing communication and collaboration. This is not a one-person job. A Behavioral Health Standing Committee should be created to provide leadership and address behavioral health concerns within the department. This joint labor-management Standing Committee ensures that all aspects of behavioral health are being discussed: What is the impact of SOPs (or lack thereof) on access to behavioral health treatment? Member privacy? What are the unmet needs? Committee members work collaboratively to systematically address gaps, identify behavioral health resources, and create a culture where behavioral health is viewed as a critical component of the Wellness-Fitness Initiative. A comprehensive behavioral health program is strengthened when the Committee obtains funding sources to improve the program.

■ Behavioral Health Specialist

Individual fire departments can hire or contract with a behavioral health specialist to help develop and coordinate a department's comprehensive behavioral health program. The behavioral health specialist also can provide direct short-term counseling, refer individuals to services in the community, and provide clinical guidance to a peer support team.

Ideally, the behavior health specialist should be a licensed mental health professional with a Ph.D. or Master's degree in the field of psychology or related and relevant fields (e.g., social work, nursing, counseling, mental health counseling, or psychiatry). Regardless of the professional field, it is essential that the behavioral health specialist is familiar with the unique stressors and culture of the fire service to be effective.

A behavioral health specialist should have (or obtain) training in: crisis intervention; general stress; group processes; human communication skills; direct intervention strategies; PTSD and depression; managing retiree transition; suicide awareness and postvention; addressing stigma; and understanding barriers to care. Additional training in substance abuse; family therapy and physiological basis of behavior is beneficial. The specialist must also have working relationships with behavioral health providers in the community – inpatient facilities, intensive outpatient programs and psychiatrists who evaluate and prescribe medication – and more general resources that fire fighters might need, such as financial counseling and/or debt consolidation; tobacco use cessation programs and parenting classes.

Another key role for the behavioral health specialist is coordination of services. Behavioral health services are typically provided through the individual's health insurance plan or through the department's EAP. The behavioral health specialist can facilitate access to treatment and provide follow-up support. If necessary, the specialist can work with management to ensure leave time is handled in the same manner as it would be with any medical problem or issue. Treating behavioral health care like other forms of health care is critical to reduce the stigma that persists in the fire service.

■ Periodic Behavioral Health Evaluations

The annual medical examination should include a confidential behavioral health evaluation. The confidential behavioral health evaluation should include questions that address stress management; alcohol use; financial and family problems; substance abuse; departmental problems; weight management; tobacco abuse; and assistance with any concerns about immediate family members. The department's behavioral health specialist should review each survey, and then meet individually with each participant to review their survey and offer specific resources or counseling for identified problems. This step is a preventive and proactive way to address problems before they progress into life-altering, career-ending behavior. As with the other components of a comprehensive behavioral health program, periodic evaluations are only effective if privacy is ensured.

■ The IAFF Center for Excellence in Behavioral Health Treatment and Recovery

Occasionally fire fighters and paramedics will experience acute behavioral health problems that cannot be addressed through outpatient services and will require inpatient or residential care for symptom stabilization. In such cases, departments are encouraged to seek treatment facilities that are equipped to deliver culturally competent and evidence-based care for the treatment of substance use disorders, PTSD, major depression and related behavioral health concerns. The importance of group cohesion, the

degree to which members feel positively bonded towards one another, is strongly correlated with positive treatment outcomes in psychotherapeutic settings. This has been demonstrated in the inpatient treatment of active duty military personnel coping with PTSD . Thus to enhance treatment efficacy, it is preferred that fire fighters and paramedics have an opportunity to seek treatment with other peers who understand the challenges and rewards of their occupation.

The IAFF Center for Excellence in Behavioral Health Treatment and Recovery is a 64-bed residential treatment facility located in Upper Marlboro, MD, designed specifically for members of the fire service. The Center for Excellence is dually licensed to treat substance use disorders and PTSD, as well as other cooccurring mental health disorders. Services are delivered through four levels of care including detox, inpatient, partial hospitalization, and intensive outpatient treatment, with continued aftercare support and monitoring, provide by multipdisclinplary treatment team of doctors, nurses, clinicians, and technicians that have received specialized training to work with members of the fire service. Program curricula are designed to stabilize symptoms, address underlying mental health problems, and equip the member with the necessary recovery tools for healthy occupational and social functioning after discharge.

Peer Support Programs

Peer support is an effective method for providing services and assistance in various occupational groups, including law enforcement,[39] military,[40] fire fighters,[41] and nurses.[42] Trained Peer Supporters provide education, individualized support, short-term crisis intervention and necessary referrals. The peer support program is not meant to replace professional assistance, but to provide short-term support and serve as a bridge to appropriate professionals. It is imperative that peers build a network of resources, including local offices of 24-hour hotlines, so they can provide the necessary referrals.
Trained Peer Supporters are trusted members of the fire service who are selected from all ranks and positions. Trained Peer Supporters must be trained in active listening skills, assessment, action planning and referrals to community resources. Newly trained peers who are developing their skills should be mentored by experienced peers. Finally, as confidentiality is the backbone of a peer support program, each peer team must develop its own policies and procedures to ensure member privacy.

Peer programs may be operated by the department or the union. A peer support program should have a coordinator to oversee training, organize deployment of peers, and act as a resource for fellow peers. The coordinator should have meaningful experience as a peer provider and regularly consult with a behavioral health professional for additional program support. The coordinator should stress the importance of self-care for the peer providers, encouraging them to take care of themselves so they can be a resource for others. Finally, it is up to each jurisdiction to determine compensation for peer team members.

Chaplain Services

Fire department chaplains are an important component of a comprehensive behavioral health program as they provide valuable guidance to individuals who need emotional or spiritual support. Effective chaplains use a non-denominational approach and promote a culture of religious tolerance and acceptance.

Fire department chaplains often assist fire service personnel and their families in times of crisis. The chaplain — a local clergy person or a retired fire fighter trained as a chaplain — handles emergency situations within the fire department, such as serious injury to fire department members; line of duty deaths; notification of family members for serious injuries or fatalities; and suicides involving fire department members and their families. The chaplain may comfort the bereaved, and visit and provide support to injured personnel. The services of a chaplain can greatly enhance an individual's or family's emotional response when a traumatic incident occurs.[43] Given their role, chaplains must be aware of signs of stress, effective coping methods for daily and life pressures, and available resources, including peer support services.

Post-Incident Response

A post-incident response is different than an after-action critique following a traumatic event. The former focuses on helping members deal with the potential emotional fall-out after an event, while the latter encourages personnel to review and analyze their actions with a goal of improving performance, policies and training.

Critical Incident Stress Management (CISM) is a widely-used model in the fire service to respond to traumatic events; however, there is disagreement on its effectiveness and some departments are beginning to move away from the CISM model.[44, 45] There is agreement in the literature that participation in any post-incident response should be voluntary and structured to meet the specific needs of the individual or group involved.

Response teams may provide pre-incident education and preparation; on-scene support services; large group interventions; small group intervention; individual crisis intervention; pastoral crisis intervention; family support services; organizational and staff consultation; post-incident education; and follow-up and referral. An effective crisis response program may include behavioral health professionals, peers, and chaplains who go through a rigorous process of selection, training, on-going evaluation, and continuing education.

Family Support

A comprehensive behavioral health program should provide support to spouses, children and other family members. Family support and education should start during the recruitment stage and continue through retirement. In addition, a comprehensive program can help uniformed personnel better handle their family relationships by providing educational material (such as how to deal with teenagers) and referrals to marriage counselors, elder care and other family supports.

Families also can be important allies when a member is struggling and needs support. They are often the first ones to notice symptoms such as mood changes, sleep disturbances, changes in diet, or increased use of alcohol. Spouses and other family members can help members realize they need treatment or support for their behavioral health issues.

Education

Behavioral health education should be integrated into a department's regular training schedule. By providing trainings and educational materials on behavioral health topics, departments can help reduce stigma and ultimately impact the overall safety culture. Electronic education can reach wide audiences and may take the form of email newsletters, website articles or web-based trainings. Web-based trainings can be as effective as in-person trainings, and can be completed at the user's convenience.[46, 47] IAFF has developed a self-paced online Behavioral Health Awareness course tailored for the fire service that is available on its website. (See www.iaff.org/bhonlinecourse.) In addition, the federal Substance Abuse and Mental Health Services Administration (SAMHSA) offers behavioral health training resources and can be accessed at https://www.samhsa.gov/dtac/education-training.

Awareness and Access

Regardless of the type of services offered through a comprehensive behavioral health program, the program is only successful if members are aware of the services and services are easily accessible.

To raise awareness and increase use of the behavioral health program, education activities should describe the program's components, availability, effectiveness and confidentiality policies. Information about the comprehensive behavioral health program should be shared throughout the members' career. Probationary members, active duty personnel, retirees and their family members should receive a comprehensive introduction to the behavioral health program, be encouraged to utilize the services and resources, and informed how to access each component. Regular notices, distribution of literature, social media, website resources, posters, and announcements at training academies can all be used to spread awareness. In addition, department supervisors should receive on-going training so they are fully knowledgeable about the program and how individuals can access services.

Finally, once people become aware of available services, they should not encounter barriers when they ask for help. Medical leave and alternate duty polices should facilitate – not hinder – access to behavioral health services, as they do for members seeking other types of medical treatment.

SUMMARY

A comprehensive behavioral health program is a vital part of the Wellness-Fitness Initiative should be integrated into a department's wellness efforts. Comprehensive wellness is only achieved through a holistic approach that includes the well-being of individuals' physical, medical, and behavioral health. Fire fighters and paramedics experience some of the most tragic aspects of life and have limited control over the events they witness. Exposure to potentially traumatic events can generate stress responses that trigger psychological and behavioral problems, which ultimately can contribute to negative job performance.

A comprehensive behavioral health program ensures that all uniformed personnel have access to resources to deal with the job's stressors. A successful program depends on labor-management cooperation and effective education, support, and treatment. Fire departments must view the investment in a comprehensive behavioral health program as more than its financial costs. The cost for NOT addressing behavioral health results in personnel suffering emotional or behavioral problems that negatively impact their life and the overall effectiveness of a department. An employee who is physically and emotionally fit is critical to the fire service and its ability to deliver the service that the public demands and deserves. A comprehensive behavioral health program summary outline is provided in Appendix D.

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CHAPTER 6 — Cost Justification

Management and labor shall work together to reduce injuries to uniformed personnel, and the associated costs, by fully implementing the Fire Service Joint Labor Management Wellness Fitness Initiative.

This chapter highlights the following:

- **Introduction**
- **Return on Investment**
- **WFI vs. Non-WFI Cost Justification Research**
- **2017 Research on Economic Impact and Cost Justification of the WFI**
- **Return on Investment of FD Wellness Programs**
- **Summary**

INTRODUCTION

As the world becomes increasingly "data-driven," being able to demonstrate the value of the Wellness-Fitness Initiative (WFI) often requires convincing decision makers to look past the initial cost of the program and to identify the economic value, along with the altruism, of keeping our population of firefighters healthier. While we dedicated Chapter 7 of this manual to data collection, this chapter focuses on data useful to justify WFI implementation costs.

Moreover, this chapter highlights some recent scientific studies that have captured the cost benefit relationship. It allows us to generalize their findings and support WFI with economics underpinning an investment in the WFI program. Summarily, they tell us what many have known for years: these programs save money and prevent firefighter injuries – and it doesn't take years to see the cost savings.

It's a fact of reality that today the public safety community must compete for funding, often when lean budgets compel other city departments to fight for the same funds. In short, to get funding for a meaningful wellness and fitness program, organizations need more than ideas and promises to get the money they need to implement the WFI. They need data and quantification of return on investment (ROI). A dollar spent on prevention often only appears a cost to budget people, and without a clear ROI, getting the necessary money might be difficult or impossible.

RETURN ON INVESTMENT

Some parts of WFI can be implemented without spending money, however to create a sustainable program that maximizes the value for everybody, organizations will need to invest. The intention of this chapter is to assist in highlighting the value of these programs. The goal of this chapter is to answer the question of why invest in a WFI program. This is accomplished with data from scientific studies and examples of how to measure the return on such an important investment.

Ultimately, the true ROI is the change in total cost of injuries after accounting for total program costs. Capturing total cost can be challenging. Qualitative cost such as social and emotional cost are difficult to quantify. However, organizations can capture the quantitative costs, such as direct medical costs, lost time, and backfilling of position with some simple data gathering of normally collected data. A good place to start is understanding what types of injuries are common across the industry.

INJURIES AND JOB-RELATED DISEASE IN THE FIREFIGHTING OCCUPATION

Firefighting and emergency medical service (EMS) work has an increased the risk of musculoskeletal injuries and cardiorespiratory illness compared to other occupations.[1,2] Occupational injuries remain the leading cause of disability and/or early retirement for uniformed personnel. Cardiovascular disease and cancer are the leading causes of causes of firefighter deaths. Occupational injuries and early deaths from cardiovascular disease and cancer have devastating physical and financial cost for the injured member. All these costs impact workers, their families and friends, and the community they serve.

Bearing significant financial/economic costs of injuries impacts both the fire departments and the citizens of the community. A body of research has emerged indicating these costs massively outweigh the cost of funding prevention programs, such as the ones recommended in this document. However, it will take some number crunching to convince your organization's financial leadership of this fact. They need to see clear data and ROI information.

The Work Environment

Fire fighters perform physically intense work in extraordinary environments including high heat, low oxygen, high carbon monoxide, high levels of toxic contaminants, and other combustible products. In addition to these job-related hazards, cardiac and cancer risk factors are higher among fire fighters than other comparable worker groups.[7]

■ Age

As uniformed personnel age, on average activity decreases and they experience higher rates of hypertension, low fitness level, and obesity. It doesn't take a scientific study to know this is the case, but scientific research reveals this as well.[8]

Consequentially, fire fighters' experience injuries at much higher rates than other comparable jobs. For example, fire fighters have an annual injury rate 8.6 times higher than miners.[9] This, coupled with the cardiac and cancer risk factors of fire fighters represents a population poised to benefit from WFI recommended programs.

■ Scientific Support

Previous studies have shown a 200%-600% cost savings (ROI) for each dollar invested in a wellness and fitness program. Researchers discovered that over a five-year period, departments using WFI programs spent only **1/3 the costs** for injuries and illnesses than departments that did not have such a program.

A recent 2016 joint study of the Tucson Fire Department, conducted by researchers at the University of Arizona and Boston College, quantified the immediate benefit at 2.4%. This means they saved 2.4% more money than it cost for the program, in the first year. It may not initially appear that 2.4% isn't massive, however understand this is the tip of the iceberg.

Data scientists estimate annual firefighting injury costs as high as $7.9 billion nationally. Even using pessimistic initial cost savings estimates (2.4%) we could project net savings at $189,000,000 across the industry in a single year. The aggregate effect over a 10-year period, given the pessimistic assumptions, is still billions of dollars in money saved.

Researchers from outside of the fire service have well-documented rationale for worksite health promotion. Several studies have addressed the question and have shown a favorable return on investment (ROI) for comprehensive health promotion programs[13-17]. In fact, over 143 studies that were reviewed demonstrate positive ROI associated with worksite health promotion. Examination of this peer-reviewed literature concludes that the financial benefits of well-designed, well-implemented health promotion programs substantially exceed their costs and have a positive ROI and benefit/cost ratio.[18-20] Note that most of the programs studied were in white collar or management industries; thus, the favorable outcomes were in the reduction of medical costs for chronic illnesses, rather than musculoskeletal injuries that are common in firefighting.[3-6]

WFI DEPARTMENTS versus NON-WFI DEPARTMENTS COST JUSTICATION RESEARCH

In 2006 and 2007, Human Resources and Risk Management Sections of the original 10 WFI fire departments were contacted to acquire aggregated data on workers' compensation claims, lost work hours, and total incurred costs, prior to and after implementation of the WFI. Eight (8) of the fire departments had sufficient data to be included in this report, but only four (4) had adopted tracking cost information prior to and after implementation (Fairfax County, Virginia; Indianapolis, Indiana; Los Angeles County, California; and Phoenix, Arizona).

The other four (4) fire departments for various reasons, did not advance in the adoption of policies, procedures, and practices recommended in the WFI. However, they did track occupational injury and illness claims and cost information to act as comparison or control sites (Austin, Texas; Calgary, Alberta; Miami-Dade, Florida; and Seattle, Washington).

The WFI fire departments have a mandatory, non-punitive policy for individual participation and the participation rates increased steadily over the course of implementation from an average of 54 percent in the first year to 79 percent in 2004. By working with each department, researchers were able to gather occupational injury/illness claims, disability costs, lost work hours, and total incurred costs annually for a period of at least five (5) years prior to (as a baseline) and after implementation of the WFI.

■ Measurement and Outcomes

All fire departments aggregated claims data were combined and are summarized in the following tables and graphs. Total number of occupational claims, number of lost days, total incurred costs, and cost per claim, were assessed between the four (4) WFI fire departments and the (4) non-WFI departments.

Participating fire department sites for seven years prior to and after implementation of WFI among WFI and non-WFI fire departments. Data from each department was totaled, then combined and averaged between the four (4) WFI participating and four (4) non-WFI fire departments. In doing so, this removed any ability to identify an individual fire department's cost data, therefore allowing each participating department to maintain financial confidentiality. The numbers presented, represent the mean number of claims and costs for one fire department (mean of the four (4) departments) over an annual time period.

The numbers of lost days from claims were available from some of the departments. Lost work hour data was also extrapolated and averaged from just those fire departments and adjusted for all the departments to get the estimated average number of lost days and hours per site. The mean total claims, lost hours, and total incurred costs represent service or occupational benefits paid, per fiscal year, for a department.

Data from these fire departments do not include any non-occupational claims and costs because of the difficulty in tracking this type of information through private insurance and individual medical providers. This exclusion of non-occupational injuries in the cost table below will logically cause the numbers to underestimate the cost savings and potential impact of the WFI intervention.

■ Costs and Claims

In Table 6.1, the summary data shows the WFI and non-WFI beginning with pre-implementation (1991-1997) to post implementation (1998 – 2004). Pre-implementation figures for the WFI sites showed there were a total of 3,033 claims, with a total of 40,611 days lost, and an incurred cost totaling $21,695,644. The average cost per claim over the seven (7) years was $56,845 per department. For the seven (7) years post WFI implementation, there was a five (5) percent increase in claims, a 28 percent reduction in days lost, a three (3) percent increase in total incurred costs totaling $22,276,143, and a 23 percent decrease in the average cost per claim.

By contrast, in the non-WFI departments there was a 22 percent increase in claims between the two (2) periods, a 55 percent increase in days lost, a 58 percent increase in total incurred costs, and a 35 percent increase in average cost per claim per fire department. Figure 6.1 is a graphical representation of Table 6.1. It shows the percentage change in claims, lost workdays, total costs, and average cost per claim for a WFI department versus a non-WFI department.

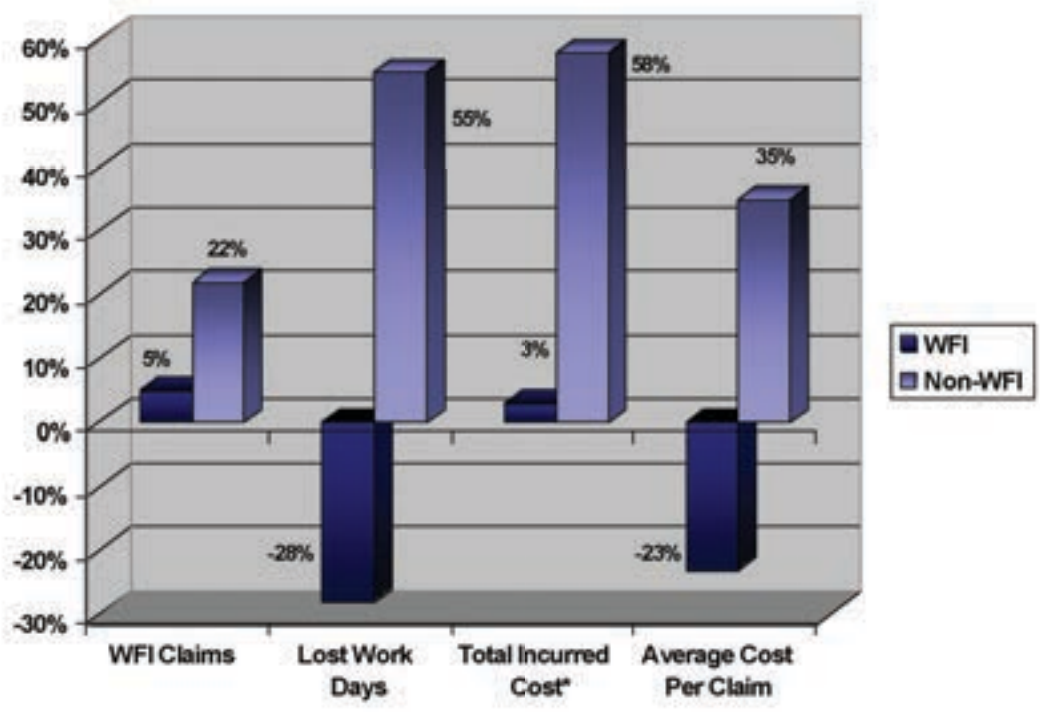
Statistically, there was a significant difference ($p < .026$) for occupational claims and costs between the fire departments that implemented the WFI and those sites that did not. Regarding occupational claims, there was a five (5) percent increase over the seven (7) years for a WFI department versus a 22 percent increase for a non-WFI department over the seven (7) years. For a non-WFI fire department, this represented an increase of 81 claims per year when compared to 25 claims per year for a WFI fire department. When comparing lost hours, there was a 28 percent reduction in lost hours for the WFI departments compared to a 55 percent increase in non-WFI departments. When assessing total incurred costs, there

Table 6-1: Mean Occupational Claims, Loss Work Days, Total Incurred Costs, and Average Cost Per Claim For WFI and Non-WFI departments.

	Claim Date	WFI Claims	Lost Work Days	Total Incurred Cost*	Average Cost Per Claim	Non-WFI Claims	Lost Work Days	Total Incurred Cost*	Average Cost Per Claim
PRE	1991	401	4213	$1,582,424	$7,645	344	3689	$2,243,993	$6,699
	1992	407	4753	$1,951,752	$7,571	339	3899	$2,155,654	$6,553
	1993	429	5759	$2,418,216	$7,626	347	3431	$2,402,384	$6,900
	1994	436	6085	$3,576,916	$8,146	359	3220	$2,385,562	$6,697
	1995	438	6326	$3,600,762	8,247	342	4441	$2,702,118	$7,279
	1996	434	6895	$4,236,084	$8,321	372	4189	$2,764,044	$6,724
	1997	488	6580	$4,329,490	$9,299	356	3878	$2,401,968	$7,060
	Totals	*3033*	*40,611*	*$21,695,644*	*$56,845*	*2,459*	*26747*	*$17,055,723*	*$47,912*
POST	1998	386	3351	$2,458,116	$6,233	371	3515	$2,536,780	$7,278
	1999	400	3834	$2,627,379	$6,177	387	4672	$3,104,697	$8,167
	2000	435	4716	$2,891,569	$6,391	442	5823	$3,476,799	$8,517
	2001	452	4847	$3,075,236	$6,115	464	6404	$3,806,243	$8,856
	2002	498	4725	$3,688,405	$7,175	428	6335	$4,080,519	$10,054
	2003	531	4702	$3,871,945	$7,061	449	7208	$4,919,355	$11,146
	2004	508	5496	$3,663,493	$7,073	482	7431	$5,067,383	$10,590
	Totals	*3210*	*31671*	*$22,276,143*	*$46,225*	*3,023*	*41388*	*$26,991,766*	*$64,608*
	Percent Change	*5%**	*-28%*	*3%**	*-23%*	*22%*	*55%*	*58%*	*35%*

****All Costs are Adjusted in 2001 dollars**

Figure 6-1: Percent change in Claims, Lost hours, Costs and Average claim cost between WFI and Non WFI departments 7 years pre and post implementation.



was a three percent (3%) increase in costs over the seven (7) years for the pre- and post-implementation WFI departments and a 58 percent increase in total costs for the non-WFI fire departments for both pre- and post-implementation.

In actual dollar amounts, this equates to a total incurred cost increase of $82,900 per year, per WFI department and a total incurred cost increase of $1,419,435 per non-WFI fire department, per year. This represents a difference of $1,336,535. This indicates that non-WFI departments spent over $1.33 million dollars more per year, per department, when compared to WFI departments. The results also indicate a similar cost benefit for the WFI sites as the average cost per claim was reduced by 23 percent (-$1,518 per claim) over the seven (7) year period for WFI sites, as compared to an increase of 35 percent (+$2,386 per claim) for non-WFI departments.

When these two (2) figures are combined, there was a savings of $3,904 per annual occupational claim per WFI fire department as compared to the non-WFI sites. In other words, a fire department with 500 occupational claims could save $1,952,000 per year. This potential savings, nearly $2,000,000 annually, per WFI department is from occupational claims alone and probably underestimates the potential longer-term savings from other wellness interventions including non-service related injuries, early screening and detection of disease, and behavioral health program components.

Conclusion

The information from this research suggests an interval reduction of occupational injury and illness claims and costs among fire departments that implemented the IAFF/IAFC Wellness Fitness Initiative when compared to fire departments that had only partially implemented the WFI.

The results also demonstrate that the WFI fire departments have a lower rate of increasing claims and costs, while simultaneously decreasing lost hours and average cost per claim. The fact that lost hours and average cost per claim is reduced suggests that injury and illness severity is reduced, especially in the face of rising health care costs that are greater than the rate of inflation.

The four (4) WFI fire departments sites averaged 1,665 fire fighters per department and had first year estimated implementation costs of $1,550,000 per site (~$931 per head), due to startup costs and capital expenditures. This was followed by an average annual cost of $865,930 (~$520 per head) for maintenance of the WFI program.

These results demonstrate that the WFI departments had a total cost savings of $1,336,535 the first year of implementation per site (due to startup costs) and $1,952,000 annually per site thereafter. This appears to be a positive return on investment with getting most of the initial costs back the first year and then receiving a positive return on investment of at least 1:2 for Year 2. Therefore, for every dollar spent on uniformed personnel wellness, via implementation of the WFI, results in an almost immediate return of over two (2) dollars in occupational injury and illness costs. Another positive consideration is that these numbers underestimate the true cost savings, since this does not consider non-occupational injuries and the long-term medical costs of premature morbidity and mortality. Substantial long-term cost savings are expected from preventing cardiovascular disease, certain cancers, and reducing early disability from musculoskeletal and back injury.

Therefore, adoption of the WFI provides a savings in the short term. It may be concluded that the long-term economic benefit could be much greater by preventing and reducing premature fire fighter musculoskeletal injuries and cardiovascular or cancer disease through a comprehensive health risk screening and health promotion program which also avoids the passive impacts of reducing off-duty injury and illness costs.

2017 RESEARCH ON THE ECONOMIC IMPACT AND COST JUSTIFICATION OF THE WFI

In 2015 and 2016, twenty eight fire department administrative staff in the United States and Canada were contacted to inquire about occupational wellness and the status of adoption and implementation of the WFI within their department. The initial survey was able to determine the level of partial or comprehensive adoption and implementation of the WFI. Of the initial twenty eight fire departments, fourteen fire departments had sufficient data collection to be included in this report. Table 6.2 shows the fire departments that participated in this project.

After establishing the 14 fire departments for this project, the researchers worked with each department to establish a liason who worked with the risk management and human resources department to review and compile the data. They de-identified worker's compensation claims, injury and illness costs including the type, location, and severity of injury. Additionally, they assessed wellness program costs among the 14 fire departments that partially or fully implemented the WFI since 2004.

Table 6-2: Participating Fire Departments in Cost Justification Study

FIRE DEPARTMENT	PERSONNEL 2014	Calls/Incidents	Fire-Related	Non-fire
Austin, TX	1049	88,612	3917	84,695
Calgary, ALB	1064	60,154	15,148	45,006
Charlotte, NC	1402	103,478	2084	101,394
El Paso, TX	881	76,338	1397	74,941
Fairfax County, VA	1340	91,308	18,256	73,052
Indianapolis, IN	1154	117,686	22,770	94,916
Los Angeles County, CA	2749	368,339	38,133	330,206
Miami-Dade County, FL	1839	246,408	23,412	222,996
Milwaukee, WI	802	82,030	14,291	67,739
Oklahoma City, OK	949	68,681	2872	65,809
Ottawa, ON	989	20,590	2784	17,806
Phoenix, AZ	1576	177,858	14,268	163,590
Portland, OR	671	72,023	2038	69,985
Seattle, WA	968	89,980	14,260	75,720

Results

A retrospective analysis of worker compensation claims firefighter and costs among the 14 large urban fire departments in the United States was conducted from 2004-2014. The fire departments were categorized into how much if any of the total WFI was adopted and implemented and for what period of time. The departments were categorized into low, partial, or high WFI implementation based which of the seven WFI categories were being implemented and when it started (comprehensive medical evaluation and screening, fitness program, nutrition, peer fitness trainers, injury prevention and rehabilitation, behavioral health, and data collection).

The definition to meet the criteria of low WFI implementation was data collection and behavioral health. Every fire department had an Employee Assistance Program (which included some behavioral treatment options) and every fire department had to collect data to be included in the study. The definition of partial WFI implementation was to offer the other wellness components without the comprehensive medical and physicals. These departments offered nutrition, peer fitness trainer, injury rehab and mandatory exercise but did not offer comprehensive medical and physicals. The high WFI implementation sites were those fire departments that offered and implemented all categories of the WFI including annual comprehensive medical/physicals. The total number of claims, total incurred costs, rate of claims per firefighter, and cost of claim per firefighter for each fire department were assessed among fire departments before, during, and after implementation of the WFI

For a fire department that had low implementation of the WFI, there were 0.36 claims per firefighter per year or 36 claims per 100 firefighters per year. For a fire department that had high implementation of the WFI, there were 0.22 claims per firefighter per year or 22 claims per 100 firefighters per year. For fire departments with high WFI implementation, there was a 40% reduction in annual firefighter occupational worker compensation claims as compared to fire departments with low WFI.

Regarding the cost of injury and illness claims, the fire departments with a low WFI incurred a cost of $76,895 as compared to $32,538 per 100 firefighters for fire departments with high WFI implementation. For a fire department with low WFI, the total incurred injury and illness costs were nearly 2.5 times higher as compared to those departments with full WFI. Fire departments with full WFI implementation including comprehensive medicals, fitness, nutrition, behavioral health, and injury rehabilitation realized an annual cost savings of $563,334 higher than the low WFI sites.

This annual cost savings of $563,334 represents only the tip of the iceberg for injury and illness costs from reduced claims and does not include any personnel backfill or overtime costs. The $563,334 is only the short term and immediate annual cost savings from full WFI implementation and does not include any of the long term expected cost savings from reducing the medical, hospitalization, disability, and legal costs associated with preventing and reducing heart disease, cancer, musculoskeletal injury, obesity, diabetes, depression, PTSD, sleep apnea and disorders, and pulmonary disease.

The data suggests there is a significant and substantial reduction in occupational injury/illness claims and costs among fire departments that implemented the full WFI as compared to fire departments that had no or low WFI implementation. Additionally, the severity of injury was reduced by almost 50% in the full WFI as compared to the low WFI sites. Implementation of the WFI confers a significant cost justification savings in the short term and we expect that the long-term economic benefit to be much greater by preventing and reducing premature firefighter musculoskeletal injuries, cardiovascular disease, cancer rates, metabolic syndrome, and fatigue and stress related mental health disorders.

Conclusion

Implementing the WFI makes good economic sense to reduce occupational injury and illness claims and costs. The annual cost savings of $563,334 realized by fire departments that implemented the WFI provides strong cost justification for fire departments to adopt and implement the WFI program. This data suggests that a fire department fully implementing the WFI should expect a significant reduction in fire department injury and illness claims and costs while simultaneously improving the long term health and safety of firefighters.

RETURN ON INVESTMENT OF FIRE DEPARTMENT WELLNESS PROGRAMS

This retrospective evaluation of firefighter injury and illness costs conducted among large urban fire departments assessed the cost justification of the WFI and the results suggest there is a substantial reduction in occupational injury/illness costs among fire departments that fully implemented the WFI. In other industries, research supports the cost-effectiveness of work site wellness programs having a positive cost benefit ratio on medical illness and injury, as well as costs by providing preventive care.[12-21]

The impact and cost justification, however, of firefighter wellness programs has been less obvious. A large-scale study examining the relationships among the cause, nature, and costs of firefighter injury found that overexertion accounted for a significant portion of injuries

(35% of all injuries) at a cost of $9,715 per claim.[45] Overexertion injury occurs when a physical task exceeds the capabilities of a particular fire fighter (lifting, pushing, pulling, etc), which can cause an injury to occur. Some of the contributing factors to overexertion injuries are improper staffing and training, unsafe environmental conditions, poor posture or unsafe positions, and fatigue. These activities are a part of firefighter's daily duties ranging from medical calls, rescuing and carrying patients, to fire suppression with maximal physical exertion under extreme heat and environmental conditions including wet and slippery surfaces. Walton calculated that eliminating injuries caused by overexertion saved, on average, $545,000 per year for a large city fire bureau.

Although firefighter injuries have been well documented, the data on costs associated with these injuries is limited and, more importantly, the costs associated with preventing injury are not well documented. In the TriData Corporation's final report to the National Institute of Standards and Technology (NIST) and the U.S. Department of Commerce on, "The Economic Consequences of Firefighter Injuries and Their Prevention" [9] it states on page 36, "while wellness and fitness programs are designed to improve overall firefighter health and reduce occurrence of injury, it is difficult to determine the annual cost of these programs". The report emphasizes that wellness programs appear to be the exception and not the rule among fire departments in the United States. The TriData report presents a general idea of what fire departments across the country pay annually for a wellness-fitness program ranging from $ 0 - $420,000 (this represented only eight departments with a wide range of services offered). The fire departments represented in this report were much larger than the fire departments assessed in the TriData report. Another positive consideration is that these numbers underestimate the true cost savings since this does not take into account non-occupational injuries and the long term medical costs of premature morbidity and mortality. It is expected that there would be a substantial cost savings in the long term from preventing cardiovascular disease, certain cancers, metabolic syndrome, fatigue related illness and injury, and reducing early disability.

Recent research over the past five years suggest that firefighter wellness programs are cost effective. Kuehl and colleagues demonstrated the a worksite behavioral health program tailored to firefighters conducted at the fire station over a 12 session program realized a cost savings of over $1000 per firefighter per year in worker compensation claims.[46] Baur et al conducted a cross-sectional study of 968 male career firefighters assessing the impact of fitness on cardiovascular disease.[47] Higher cardiorespiratory fitness level was significantly associated with lower diastolic blood pressure, body fat, serum triglycerides, low-density lipoprotein cholesterol and total/high-density cholesterol ratio, and higher high-density lipoprotein. This study demonstrated that increasing fitness has beneficial independent effects on CVD risk factor profiles among firefighters.

In 2016, Patterson and colleagues studied the impact of wellness-fitness programs to reduce cardiovascular events (CVE) and showed that a wellness fitness program prevented 10% of CVE that for an event rate of 0.9% at $1440 over 10-years, or an incremental cost-effectiveness ratio of $1.44 million per CVE prevented compared to no program.[48] In another recent study Seyedmehdi showed that firefighters with greater aerobic fitness had lower cardiovascular disease risk factors and may efforts to increase fitness may reduce cardiovascular disease and fatalities.[49]

In a study by Poston et al on the benefits of health promotion programs in the fire service, firefighters in a wellness program had less tobacco use, less anxiety, and greater job satisfaction as compared to firefighters without a wellness program.[50] Lastly, research has documented that obese firefighters with a BMI > 30 have a 3 fold increase in worker compensation claims,[51] and increased back injuries.[52] Firefighters in departments with documented wellness programs have less obesity than firefighters in departments without a wellness program.[53]

Uniformed personnel and administration officials are concerned that not enough is being done in terms of prevention (prefab) versus treatment (rehab). For instance, researchers in Oregon compared dollars spent on fire fighter health to dollars spent on apparatus maintenance and repair (Table 6.3). If maintenance is thought of as prevention, and repair is thought of as treatment, we can see how much a fire department spends on prevention versus treatment when comparing fire fighters to apparatus.

	Apparatus	Fire Fighter
Maintenance/Prevention	70%	3%
Repair/Treatment	30%	97%
Total	100%	100%

Table 6.3: Percent Cost of Maintenance (Prevention) and Repair (Treatment)

The example department's annual costs are 70 percent for apparatus preventative maintenance, with approximately 30 percent allocated to repair. In contrast, 97 percent of fire fighter expenditures are for work related injury and disability costs, and only three (3) percent is budgeted for prevention (fire fighter wellness). The interesting element in this scenario is that the apparatus depreciates over a 12- to 15-year life span with no return on investment (ROI) outside of functioning properly during its lifetime of use.

The observed trend in reducing occupational claims and costs from implementing the WFI is also supported by the ongoing PHLAME research study.[8] This demonstrates for every dollar spent on the fire fighter health promotion program, a substantial cost savings can be realized after the short-term.[30-31] In addition, the health promotion activities were also associated with significant reductions in work-related injury and illness. Table 6.4 shows the cost savings of the PHLAME health promotion program.

SUMMARY

This chapter advocates that fire department wellness programs do make economic sense and that adopting and implementing an occupational wellness program, such as the WFI, alone can reduce occupational claims and costs by while simultaneously improving the quality and longevity of a fire fighter's life. In addition, adoption of the WFI is an important first step in setting up a medical screening and wellness program for fire departments.[42-44] Adding additional behavioral health promotion programs will only enhance and improve cost savings. Summarily, organizations should invest in WFI programs because they save money, prevent harm, and improve quality of life for firefighters.

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Table 6.4: Return on Investment: PHLAME Program

Costs per Fire Fighter	Before PHLAME	After PHLAME
Prevention	$150	$585
Treatment	$5,175	$2,025
Total Costs Per Claim	$5,325	$2,610

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CHAPTER 7 — Data Collection

Management and Labor shall support systems that confidentially collect medical, health and fitness data and provide analysis to improve the wellness of all fire department members.

This chapter highlights the following:

- **Introduction**
- **The WFI Health Information Registry**
- **Minimum Data Set Elements**
- **The File Transfer Process**
- **The Future of the MDS and Data Collection**

INTRODUCTION

The Wellness Fitness Initiative (WFI) provides a comprehensive plan for the implementation of a fire service occupational health-wellness program. Where fully implemented, this program has provided a template for standardization of care and integration of various elements into a cohesive "best practices" clinical program. Without question, WFI clinical programs have saved lives and improved the quality of life for uniformed personnel in participating municipalities.

Separate and distinct from these clinical program elements, an overarching goal of the WFI has been to collect and analyze clinical and health outcome data generated in the ten (10) member jurisdictions which may be generalized to the wider uniformed personnel population. Since the inception of the WFI, there have been ongoing efforts to develop a centralized database which would be a repository for the collected data and information. Several prototype software efforts have made significant progress toward defining and understanding the system and software requirements of such an effort.

To that end, a pilot program involving the Fairfax County (VA) Fire Department and Indianapolis (IN) Fire Departments, in collaboration with the University of Maryland and the International Association of Fire Fighters (IAFF), has been underway since 2007. This program utilizes a web interface to upload data from the two (2) participating municipalities into a Structured Query Language (SQL) relational database housed at the headquarters of the IAFF in Washington, D.C.

THE WFI HEALTH INFORMATION REGISTRY

As the name implies, the goal for the WFI Health Information Registry (HIR) is a centralized database of medical and demographic data that will be generated by the clinical programs in all ten (10) member municipalities. This database will provide exposure and health outcomes data for thousands of uniformed personnel across North America and will be a unique resource for medical researchers who will ultimately use the HIR to conduct studies relevant to uniformed personnel health and wellness.

Registries are well known public health tools that have several useful applications. The formal definition of a public health registry is "…a data base of identifiable persons containing a clearly defined set of health and demographic data collected for a specific public health purpose."

Registries provide an organized system of data collection, storage, and retrieval that allow subsequent analysis and the ability to query the information in a structured manner, based on categories of interest. In this way, large data sets from the contributing WFI departments can be merged in an ordered manner, analyzed and retrieved to create meaningful reports on specific health conditions from the individual cases that have been entered into the data base.

The ability for the fire service to have robust and validated registry data will assist in future legislative agendas. It also offers several valuable uses in public health and medicine, including:

- Estimating the magnitude of specific health problems.
- Determining the incidence of disease.
- Examining trends of disease over time.
- Identifying high risk groups.
- Estimating health service needs.
- Conducting research.

Registries collect data on individuals who share certain characteristics, typically a specific disease or condition. This information includes demographic and medical information. Registries often seek validation of the data by collecting detailed test results, such as a pathology report from a biopsy or a specific blood test result. To read more about registries, please see FAQ on Public Health Registries at the following web address: www.ncvhs.hhs.gov/9701138b.htm.

In addition to following people with specific diseases, the registry concept has recently been applied to follow groups of people who share a common exposure history. An example of this concept is the National Exposure Registry

which is operated by the Agency for Toxic Substances and Disease Registries (ATSDR), a part of the Centers for Disease Control and Prevention (CDC). This registry identifies and enrolls persons likely to have been exposed to hazardous environmental toxicants, usually due to the location of the person's residence near a contaminated Superfund site. The registry establishes a pool of persons, potentially at increased risk of health harm, and allows tracking of this group. Health authorities can track and subsequently contact registered persons, and can offer pertinent health information, opportunities for participation in a study, or care recommendations. The course of the registrant's health may also be followed over time through periodic surveys performed by the registry.

ATSDR, in collaboration with the New York City Department of Health and Mental Hygiene, also operates a registry to track the health effects of 9/11. The persons enrolled in this registry not only include responders and clean-up workers, but also residents, students, workers and others within a prescribed geographic region in proximity to the event. For more information on this registry please visit www.nyc.gov/html/doh/wtc/html/registry/about5.shtml#2. These latter registry examples, of Superfund exposure or the 9/11 event provide an example of registries that are based on a shared exposure history. The IAFF registry is built on the shared exposure history model as well.

The WFI data collection effort is not a research program, per se. A formal research initiative would be beyond the scope and budget of the WFI participants. What the HIR does allow is systematic collection of high quality, validated medical data that will enable academic researchers to complete credible scientific studies regarding the health and fitness status of uniformed personnel. This team approach will enable the millions of dollars spent by WFI member jurisdictions, and the large amount of data collected during the WFI clinical operations, to be leveraged by a larger community of academic medical researchers whose analyses will in turn, inform and benefit the entire fire service membership.

MINIMUM DATA SET ELEMENTS

The two (2) participants in the current pilot program (Fairfax County (VA) FRD and Indianapolis (IN) FD) have been collecting demographic and medical data known as the "Minimum Data Set", or MDS. This set of 93 variables is collected during the annual medical evaluation. The goal of keeping the collection process feasible in a clinical setting has informed the data elements that were included in the registry. The data collected must be consistent throughout a longitudinal collection process over a period of years. In addition, the definitions of data items should conform to other similar registries and the confidentiality of the information must always be safeguarded.

This edition of the WFI includes an updated version of the data elements which will be collected and stored in the HIR. This version of data elements, compared to the initial data- base, has been significantly shortened and simplified. The revision of the data items was undertaken by a WFI Technical Committee when initial efforts to implement the original data dictionary revealed that the time, effort and resources required to complete the data collection were problematic for the members of the WFI. This minimum data set also allows for the collection of data in a reasonable amount of time in a clinical setting.

The MDS will consist of 93 data elements obtained from the WFI questionnaire and physical examination. Thirty-five (35) of the 93 data points are from the questionnaire and 58 from the physical examination.

Uniformed personnel, as part of the annual WFI examination will complete a health, wellness, and fitness questionnaire that will provide 35 data elements to the MDS. Information collected will include questions in the following areas:

■ MDS Questionnaire Data Elements N=35

Category *(number of questions):*

- ***Demographic information*** — such as gender, race, ethnicity and education level (5)
- ***Current and past fire service employment*** — including time and usual duties (6)
- ***Illness and injury experience*** — in the past year as measured by time off work (4)
- ***Tobacco and alcohol*** — use including estimates of quantity (10)
- ***Health history current and past*** — including diagnoses, medication use, screening tests, and surgeries (5)
- ***Physical activity*** — both aerobic and strength training (5)

The physical examination will produce 58 clinical data points for the MDS. The test results included in the MDS provide information as to the overall health and fitness of the uniformed personnel. The data points are separated into the 5 categories described below:

MDS Physical Assessment Data Elements N=58

Category *(number of data points)*

- ***Physical measurements*** — such as blood pressure (SBP, DBP), height, weight, and pulmonary function (FVC, FEV1, FVC/FEV) (10)
- ***Laboratory data*** — including blood counts, liver and renal function and cholesterol (15)
- ***Audiometry testing*** (14)
- ***Immunizations and testing for specific disease*** (7)
- ***Fitness testing*** (12)

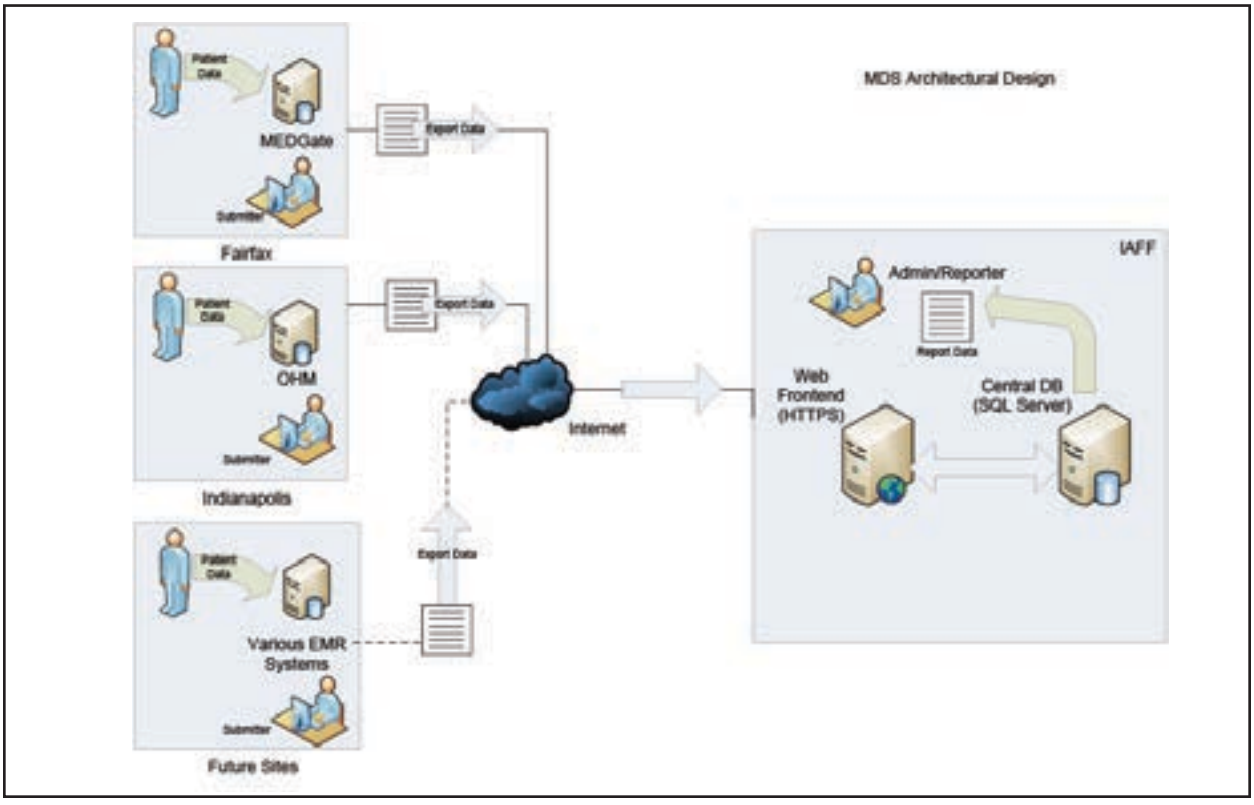
Collection and transmission of the MDS data elements to the IAFF health information registry has been refined throughout the implementation and execution process. The program has revealed the challenges to each local municipality of grafting data collection into established clinical practice. The challenge in accurately collecting and overcoming the technical issues transmitting data to the database has proved to be the biggest challenge. These challenges take place in a collaborative environment where both Fairfax County and Indianapolis have different medical information systems (MIS) and different levels of technical support. The MDS database requires standardized parameters for coding and allowable ranges for test results to be accepted for data entry. These standard parameters promote accuracy and assure data quality. Throughout deployment, there has been a re-evaluation of the required parameters for the MDS. Currently, there are fewer fields required than there were at the initiation of data collection

THE FILE TRANSFER PROCESS

The IAFF health information registry contains the MDS data on the members whose departments participate in the pilot program and is housed on a Microsoft SQL server. The SQL database uses a 4GL relational data model and stores case-related information on a calendar year. The interfaces to this data base is through web portals that allow jurisdictions to upload data files through secure links to the IAFF database. Specific tasks related to the data transfer design include:

- Development of core collection requirements and data import rules and integrations.
- Design of server database model and schema, processes for importing and web based entry.
- Assurance of secure site provisions for confidential health data transfer and storage.
- Data validation rules.
- Creations of security control SOPs.
- Testing and audit task methods trials development.

The following diagram depicts the original architectural design of the MDS system.



THE FUTURE OF THE MDS AND DATA COLLECTION

As discussed elsewhere in this document, there are several important health issues and concerns that are related to the very nature of employment in the fire service. In addition, the medical literature does not provide clear and definitive answers to most of these job-related medical concerns. Therefore, the WFI data collection effort may play an important role in supporting the medical researchers and academicians who are dedicated to addressing these medical concerns. While the implementation of a data collection effort by all members of the WFI has not been feasible up to this point to this point in time, the knowledge and experience gained in the pilot program identified opportunities to facilitate the eventual adoption of a data collection program involving all members of the WFI.

Specifically, these opportunity areas focused on ways/methods to improve the solution for occupational health centers (OHC) practitioners and researchers. Additionally, there was an emphasis on increasing the number of OHC program participants.

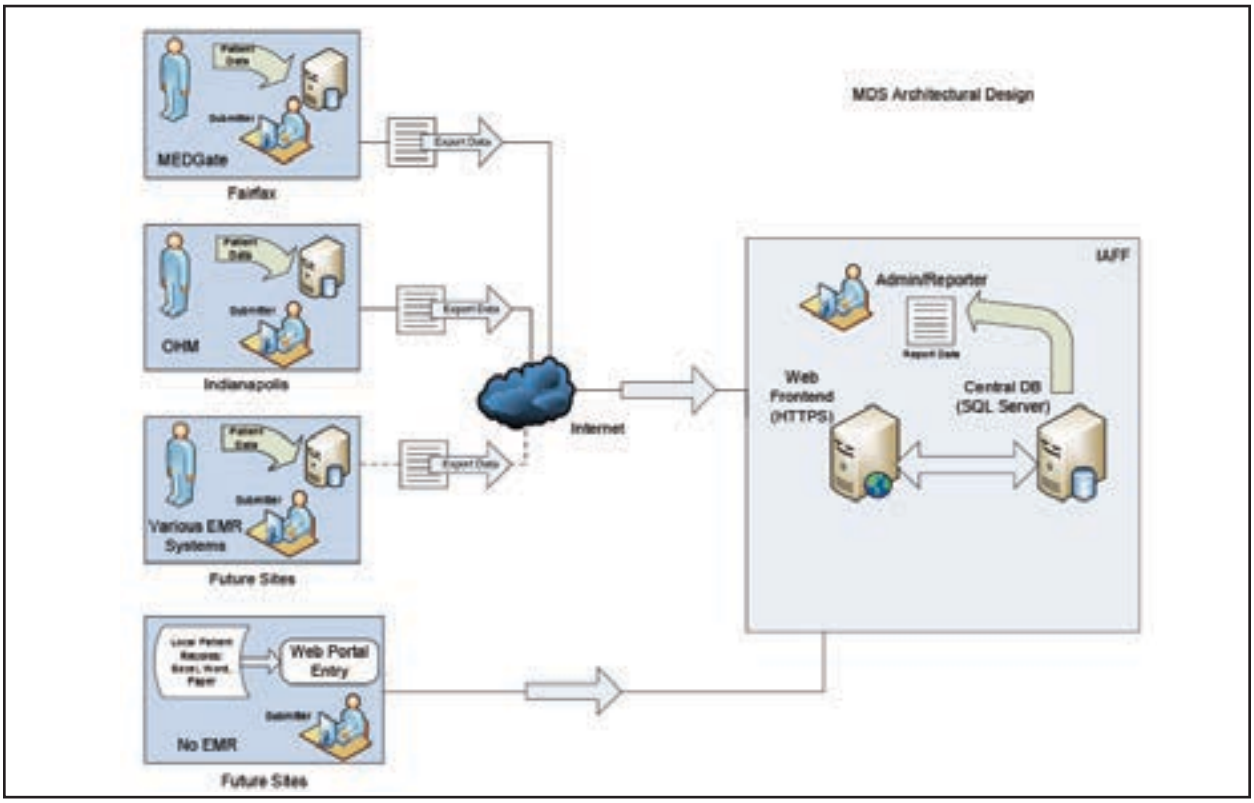
One of the key findings was tied to the fact that many OHCs, for various reasons including budgetary constraints, do not use source MIS systems in house. As such, The IAFF determined alternate methods of data transfer needed to be investigated to streamline the process and level the playing field for all participants. As part of the secondary development effort, the IAFF designed and developed a secure web based portal module to the original MDS solution that allowed OHCs to either manually enter data or upload data files directly to the central system. The second wave of development activity also included the development and implementation of tools and resources aimed at improving the messaging and error handling available in the system. This was done in order to facilitate the ability for OHC participants to successfully and consistently upload targeted patient data to the central system.

Technical resources designed, developed, and implemented targeted functional features and improvements to the existing MDS application allowing for increased participation by WFI jurisdictions.

Specifically, technical resources worked to design, develop, and implement the following key enhancements.

- Enhanced import/upload mechanism for previously defined CSV files.
- Web based form that allows manual entry of MDS data as an alternative to the CSV upload mechanism.
- Procedures/features that enhance file upload user workflows, and improve overall data acceptance.
- Improved feedback mechanism/messages to users during upload/data entry to include more specific data related to pass/fail results during validation.
- Automated guidance to users to facilitate the identification and remediation of data entry/submission errors.
- Improved the validation process to allow for upload/import of single csv upload file rows, in order to eliminate the all/or none validation requirement that rejects the entire file if any entries are incomplete or invalid.
- Changes required to the business logic, storage model, and database code, to support the functionality defined above.

The following diagram depicts the current architectural design of the updated MDS system.



It is intended that the web-based health information registry hosted by the IAFF will be more than a repository of medical and health outcomes data. Ultimately, it is anticipated that it will permit the generation of robust and validated epidemiologic data on the health outcomes of fire service members.

To achieve this, the HIR must be able to receive uploaded data from the participating WFI jurisdictions (one [1] functional interface) and can download results of queries made to it, such as report generation on frequency of a specific diagnosis, i.e. tuberculosis, in fire service members (the second functional interface).

This could document health risks (i.e. cancer excesses) in the fire service that could advance legislative or improvement in working conditions initiatives. The grouped data could also be used for health education purposes and to show return on investment for the WFI and other health promoting interventions.

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CHAPTER 8 — Implementation

Management and Labor shall work together to fully implement all components of the WFI.

This chapter highlights the following:

- **Introduction**
- **Step-by-Step Process for WFI Implementation**
- **Sample Documents and Checklists for WFI Implementation**
- **Agreement Phase**
- **Implementation and Maintenance**
- **Considerations for WFI Implementation**

INTRODUCTION

This chapter offers a step-by-step approach to implementing the Joint Labor-Management Wellness-Fitness Initiative (WFI). Any fire department can use this process to evaluate a current wellness-fitness program or to design and implement a new program. While various elements and methods of a wellness-fitness program vary from department to department, the program development process will be similar.

To assist in this process, sample worksheets are available at the IAFF WFI Resource webpage: http://www.iaff.org/hs/wfiresource/default.html

The greatest assets of any fire department are the firefighters.[1] It is a demanding job, and fire fighters suffer more preventable disease such as cardiovascular issues and cancer than the general population.[2] Uniformed personnel who respond to emergency incidents are required to put forth a high level of physical effort. This effort, over time, affects the long-term health and response-readiness of our first responders. To respond to emergencies safely and effectively and to avoid injuries and recover rapidly, uniformed personnel must possess a high level of physical fitness. This includes aerobic fitness, muscular strength, flexibility and endurance, as well as sound behavioral habits. If significant progress is to be made in the reduction of health-related fire fighter deaths and serious injuries, it is imperative that fire service organizations embrace a comprehensive wellness-fitness program.

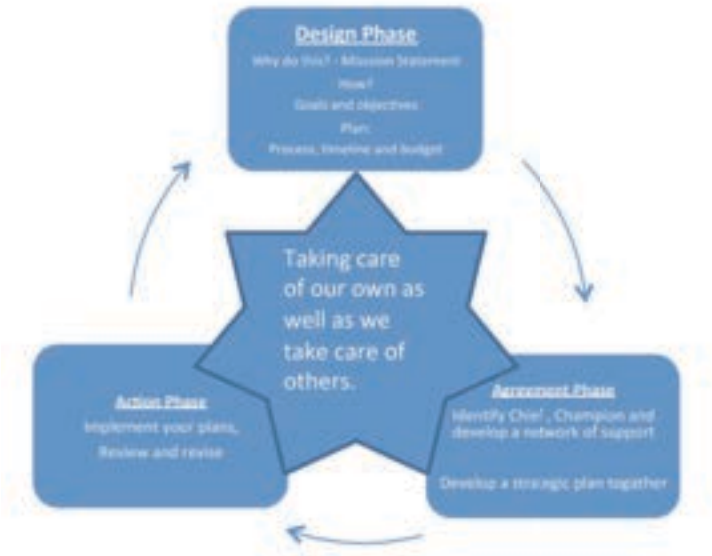
Prevention is known to be better than cure, both personally for the individual and economically for the department and community. $2.7 trillion is spent in the USA on healthcare, but an effective wellness plan can save lives, as well as saving almost four times as much as is spent.[3]

For the program to be effective, it needs to be well implemented so the firefighters, leadership, and other stakeholders are engaged and committed to improving their own health.

STEP-BY-STEP PROCESS FOR WFI IMPLEMENTATION — DESIGN PHASE

The following section overviews the steps for designing and implementing a WFI program (Figure 8.1). There may be slight variation in how individual agencies approach this goal, but the following process has generally been found to result in a successful outcome.

Figure 8.1



DESIGN PHASE

- **Obtain the Wellness-Fitness Initiative (WFI)**

  Those involved in the implementation of this program must take the time to review all chapters carefully to become familiar with the general program approach and objectives.

  Additional Resources:

  - WFI Checklist

- **Establish a Project Team**

  A project team should be established to develop and implement the program. Equal representation from both labor and management will help foster a non-punitive, cooperative environment and equality among department personnel.

One of the primary responsibilities of the team members will be to communicate with members throughout the organization about the development and implementation of the WFI. The use of a chief and a champion – for example the Peer Fitness Trainer PFT, or the physician, or wellness coordinator, as well as the fire chief and any other personnel committed to the cause[4] must foster a positive image about the program and provide the communications to the members.

Develop Mission Statement, Goals, and Objectives

Know where you are, where you are going and how you are going to get there.

- ***Mission statement:***

A summary description of an entity's purpose that is clear, direct and keeps the fire department and uniformed personnel focused within the scope of the WFI.

For example: VISION / MISSION:
Taking care of our own as well as we take care of others.

The best mission and goal statements come when EVERYONE is involved, contributes and owns them.

- ***Goal:***

An aim or end result of the proposed action, something to be accomplished that will assist the program in moving forward. Goals should be:

- Specific
- Measurable
- Attainable
- Realistic
- Time-bound

For example:
All participants will receive an annual physical and fitness assessment within the first 12 months of WFI program implementation.

- ***Objective:***

A specific, measurable statement which specifies the desired immediate or direct outcomes of the proposed program. Remember that your objectives should support your goal (i.e., the accomplishment of objectives leads to the overall accomplishment of goals).

For example:
To provide the services necessary to support and maintain fit, healthy, and capable fire fighters throughout their career.

To be successful you must know the following before you start:

- Target: What is the target population?
- How: Outline programs or needs required meeting the established goals (e.g., committees, consortiums, contracts, etc)?
- What: A clear statement of the behavior changes/results expected.
- When: Under what circumstances and what time will the task(s) be completed?
- Action: Move on to defining the tasks associated with each objective.
- Benchmarks: Use baseline measurements to start, and realistic benchmarks for progress. How and when will you check in and see how the program is going, good things, bad things and possible changes for the future.
- Measures: In what way will you measure the program's progress (e.g., via surveys, statistics measured against available baseline data)?
- Reports: When and how will you report the changes which are happening, and the areas for improvement? How will this be spread, and to whom? To your crews? To other fire departments? National office holders? Published?

Additional Resources:

- Sample Wellness — Fitness Considerations
- Department contribution with an equal or greater match. The account pays for items such as certification of Peer Fitness Trainers (PFTs), seminars, and exercise equipment.
- Seek out additional information and approaches used by other departments that have successfully reduced or contained implementation costs.
- Grant Funding — For information on fire service grants, visit the following website: www.firegrantsupport.com.

Identify Alternative Approaches for each Objective

Alternative approaches for each objective should be identified. For example developing a joint program with other public safety agencies, either in the same or adjacent jurisdictions, such as police and fire in the same jurisdiction or a regional fire- based program. There may also be other entities, either public or private, in the area that already have a similar program in place due to federal regulations. Nevertheless, the approach chosen by one fire department might not be feasible for another.

Develop a Budget

Develop a budget that is based on your long-term goals and objectives. The budget should divide costs into WFI program components or areas and delineate personnel, operating and capital costs per fiscal year. Developing the budget will assist in the planning process and should not be left to the last step. The budget can be divided and implemented in phases.

Additional Resources:

- Blank Time-Line Budget Worksheet.
- Determine Available Funding.
- At this time, a determination of available and/or additional funding should be made.
- Work with partners who can provide or share their resources or expertise.
- Consider teaming up with other fire service organizations or a local school or college athletic program.
- Negotiate a group rate with a commercial fitness center that could provide or share services or equipment. Such partnerships can benefit all parties.
- Work with the city, county council or other local governing bodies to secure funding for the program. Many fire departments and cities have established a "matching fund" account in which the city matches each.

Develop a Budget Justification

One of the major roadblocks in preventing fire departments from implementing the WFI is the perceived cost and concerns about economic benefit. The objective of budget justification is to determine the economic impact by calculating all costs related to disabilities in your organization. For more information on this topic see Chapter 6 on Cost Justification.

Prepare a Strategic Plan

The strategic plan must identify how the department intends to meet the objectives of the program. The plan must also present a timeline for phasing in components that will lead to full implementation.

Additional Resources:

- Sample Strategic Agenda

AGREEMENT PHASE

The following actions occur during the agreement phase of the process.

Review of the Strategic Plan

At this point, it is appropriate to conduct a comprehensive review of the drafted strategic plan, obtaining comments and suggestions from all stakeholders. This includes labor and management groups as well as groups from the legal, risk management, finance divisions, and any and others deemed necessary to ensure success of the program. Most importantly your members are stakeholders, and it would be great to get support from local government heads as well. Good relationships are the key to success.

Submit the Strategic Plan for Adoption

After the plan has been finalized, it should be submitted to the authority having jurisdiction for review and discussion. The anticipated benefits to the individual members, the fire department, and the community at large should be thoroughly documented.

Implement the Strategic Plan

After the concept of the plan has been accepted and approved, the plan should be officially adopted.

This may be accomplished through an administrative process, such as a general order signed by the fire chief, union contract negotiations, memorandum of understanding, or it may require formal adoption through a statute, law, or ordinance. This adoption process should establish a commitment to follow through with the programs, practices, and procedures identified in the strategic plan.

Additional Resources:

- Sample MOU
- Sample Request for Proposal (RFP)

Internal Education/Marketing

Educating all parties involved in the process regarding all aspects of the plan is crucial to the success of the program. The information needs to emphasize the benefits and safeguards for uniformed personnel and explain how the program will bring the fire department into compliance with accepted national fire service standards and federal regulations.

Additional Resources:

- Sample Communication Plan

ACTION PHASE

When implementing the Action Phase, it is important to remember your mission statement, such as: Taking care of our own as well as we take care of others. Keep this mind as you continue through the implementation and maintenance process.

Organize Implementation Teams

Once adopted, one or more implementation teams needs to be established to carry out the objectives of the plan. Each team shall be responsible and accountable for implementing specific sections of the plan. The process

cannot begin until the teams have been formed, briefed, and given a clear sense of direction and goals.

Additional Resources
- Sample Team Meeting Agenda

Develop an Implementation Strategy

The implementation strategy should consider the specific circumstances of the individual fire department. After the implementation strategy has been established, the plan should be implemented. The implementation should follow the step-by-step sequence identified.

Additional Resources:
- Sample Action Plan Worksheet

Monitor Progress

After implementation, progress should be regularly reviewed and periodically assessed for possible changes. Standard project management practices should be employed to maintain steady progress toward completing implementation.

Additional Resources:
- Sample Pre-Program Survey

Collect Data

It must be emphasized that baseline data collection is essential to future benchmark and comparison data. Often fire departments are quick to implement a program without setting clear baseline data points. The value of future cost-benefit support needs good baseline data. See Chapter 7, Data Collection, for further details.

Review and Update the Plan Regularly

It is essential that the plan be reviewed periodically to measure progress, evaluate effectiveness, and ensure that the objectives and assumptions are still valid. The information from program evaluations will help identify program strengths as well as needed improvements.

Additional Resources:
- Sample 1-Year Post Survey

CONSIDERATIONS FOR WFI IMPLEMENTATION

1. Identify the purpose.

2. Identify the key stakeholders.

3. Hold a meeting to create a strategic plan.

a. Describe the reasons for developing the wellness-fitness program (or enhancing an existing program), including regulatory issues, wellness-fitness needs of fire fighters, and roles/responsibilities of the department.
b. Describe the components and goals of the wellness-fitness program (e.g., use the IAFF/IAFC Joint Labor Management WFI materials for specifics and guidance; inquire about successful programs or strategies at other departments for additional ideas).
c. Identify action items and steps needed to come into compliance, and determine what can be accomplished in the short-term versus long-term (see step 4 below on completing a needs assessment).
d. Develop a process and timeline for each step or goal. Break down this process into manageable tasks.
e. Develop an action plan and make assignments (depending on department size and resources, working committees or subcommittees may be formed).
f. Identify a process for approval or consensus by the key stakeholders, as needed.

4. Complete a needs assessment.

a. Identify and review existing plans/programs?
b. Identify existing equipment and resources.
c. Identify gaps and needs (equipment, staff, funding).
d. What is needed to comply with key regulations and standards (NIOSH, OSHA, NFPA)?
e. Identify and address obstacles.
f. Identify and address any liability and insurance issues associated with the program.
g. Identify existing and potential funding sources.

5. Market the effort, identifying the benefits to program participants and stakeholders.

a. Publicize and inform (e.g., emails, newsletters, periodic meetings).
b. Use of data to justify expense (workers comp statistics, lost time injury tracking, etc.)
c. Identify and recruit advocates from each stakeholder group to help promote the program.

6. Program development.

a. Describe the purpose, rationale, and primary/shared goal(s) of the program.

b. Key elements and concepts to build a plan:

i. Scope of plan — Include components identified in the WFI; identify components to be offered through the department and externally (e.g., commercial or other local fitness facilities); and any testing, evaluation, and/or follow-up measures to track wellness-fitness improvements and program progress and successes.

ii. Identify partners and their role in the program.

iii. Identify funding mechanism(s); develop a funding plan.

7. Circulate the proposed plan to the stakeholders and finalize.

8. Roll out/implement program.

a. Publicize, inform, and educate.

b. Collect initial feedback.

c. Continue to inform, educate, and motivate through a variety of media (e.g., newsletters, emails, in-station classes. Consider rotating activities and training options available to participants.

9. Periodically review, evaluate, and update the program.

a. Develop a method and timetable for program review and revision.

b. Collect feedback from participants and other stakeholders (informal and/or formal commentary as needed or planned).

c. Collect data per recommended guidelines.

d. Revise and update the program as needed.

e. In seeking to achieve full compliance, re-assess resources and program/department infrastructure and support to incorporate additional components of the WFI.

END NOTES

International Association of Fire Fighters
Division of Occupational Health, Safety, and Medicine
1750 New York Avenue, NW Washington, DC 20006
202.737.8484
http://www.iaff.org

International Association of Fire Chiefs
4025 Fair Ridge Drive, #300
Fairfax, VA 22033-2868
703.273.0911
http://www.iafc.org

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The Fire Service Joint Labor Management Wellness-Fitness Initiative

4th Edition

APPENDIXES

 International Standard Book Number: 0-942920-41-4

APPENDIX A — Fitness Protocols

WFI FITNESS Assessments

OVERVIEW

Five components of fitness are being evaluated to determine a baseline level of fitness for fire service personnel, measure progress from year to year, and provide personalized exercise recommendations. The five components are: Body Composition, Aerobic Capacity, Power, Muscular Strength and Endurance, and Mobility and Flexibility. The assessment is also structured so that observations can be made regarding a performer's control of shoulder, knee and low back motion, and coordination of the upper- and lower-body. Fitness assessments may be conducted by the designated fire department's certified fitness personnel. All data collected by the evaluator shall be maintained in a secure location and adhere to strict levels of confidentiality.

1. BODY COMPOSITION: WAIST AND HIP CIRCUMFERENCE

There are many techniques available to estimate body composition. The WFI recommends a waist to hip circumference ratio. This measurement is simple to compute, reliable, accurate, and cost-effective.

2. AEROBIC CAPACITY: WFI TREADMILL/WFI STEPMILL

There are many assessments currently available to evaluate aerobic capacity. The WFI recommends two submaximal tests to predict maximum aerobic capacity, the WFI Treadmill Protocol and the WFI Stepmill protocol. A maximal aerobic capacity test can also be used to obtain maximal VO2 values. This protocol shall only be conducted in a medical facility under the supervision of a physician, including, ECG monitoring and resuscitation equipment. Certified fitness professional may also choose to document observations regarding a performer's control of knee and low back motion at different stages of the test.

3. SPEED AND POWER: VERTICAL JUMP

There are many assessments currently available to evaluate speed and power output. The WFI recommends a vertical jump because it is reliable, valid, cost-effective, portable, easy to administer and safe. As with all forms of exercise there are inherent risks for injury; however, with comprehensive pre-screening, appropriate instruction, supervision, and proper execution, the risks are minimized. The vertical jump employs a formula to calculate the power produced to propel the body upward. Certified fitness professional may also choose to document observations regarding a performer's control of knee and low back motion during the take-off and landing portion of the test.

4. MUSCULAR STRENGTH AND ENDURANCE: PUSH-UP, HORIZONTAL PULL-UP AND SIDE PLANK

There are many assessments currently available to evaluate muscular strength and endurance. The WFI recommends three submaximal tests that each provide a unique challenge. Two of the three submaximal tests are dynamic movements (i.e. push-up and horizontal pull-up) and the third is static (i.e. side plank). Certified fitness professional may also choose to document observations regarding a performer's control of low back and shoulder motion during these tests.

ALTERNATE GRIP PUSH-UP (ALTERNATIVE)

The alternate grip push-up (with stands) is an optional test for participants who experience muscular/skeletal discomfort in the performance of the standard WFI push-up. When utilizing the push-up handles, the height of the standard 5-inch range-of-motion prop must be adjusted to five inches, plus the height of the handles.

5. MOBILITY AND FLEXIBILITY: STRAIGHT LEG RAISE AND SHOULDER REACH

There are many protocols currently available to measure mobility and flexibility. The WFI recommends an active straight leg raise and shoulder reach test to assess range of motion of the hips and shoulders. Both tests accommodate different limb lengths among participants. Certified fitness professional may also choose to document observations regarding a performer's control of low back and shoulder motion during each test.

EQUIPMENT

All evaluation equipment must be as specified in these protocols. Equipment must not be substituted unless otherwise indicated. All equipment must be maintained and properly calibrated in accordance with the manufacturer's instructions. Failure to do so may result in inaccurate or invalid data.

The WFI fitness protocols, and the equipment needed to perform them are described below.

The WFI fitness protocols, and the equipment needed to perform them are described below.

1. BODY COMPOSITION

- Flexible tape measure

2. AEROBIC CAPACITY

TREADMILL

- Commercial treadmill capable of obtaining a minimum of 15% grade and 10mph.

- Heart rate monitor
- Calculator
- Stopwatch
- Height scale
- Weight scale

STEPMILL

- Commercial Stepmill (model StairMaster 7000PT). Because the steps/min rate may vary from model to model, it is imperative that the administrator ensures that the unit is calibrated to the same steps-per-minute rate for each level indicated in the testing protocol.
- Heart rate monitor
- Calculator
- Stopwatch
- Height scale
- Weight scale

3. SPEED AND POWER

VERTICAL JUMP

- The vertical jump shall be evaluated using one of two pieces of equipment: 1) a timing mat to measure flight time, or 2) a Vertec to measure jump height. The timing mat shall be the "Just Jump" mat from Probotics or another commercial timing mat. If an alternative device is used, the test administrator must verify that the device is equivalent to the Probotics "Just jump"mat. The Vertec should be the device from Jump USA or a manufacturer with an equivalent product.
- Safety tape or something equivalent to serve as a target.
- Calculator

4. MUSCULAR STRENGTH AND ENDURANCE

PUSH-UP

- Five-inch prop (e.g., cup, sponge)
- Metronome
- Stopwatch
- Exercise mat (optional)

ALTERNATE GRIP PUSH-UP

- Push-up stands or two 40 lb. hex dumbbells.
- Range-of-motion prop (e.g., cup, sponge). The range of motion prop shall be modified to ensure that the height is five inches, plus the height of the stands (e.g. a pair of five inch push-up stands will require a ten-inch prop).
- Metronome
- Stopwatch
- Exercise mat (optional)

HORIZONTAL PULL-UP

- Horizontal pull-up bar or equivalent (i.e. fixed bar)
- Five inch prop (e.g. cup, sponge)
- Metronome
- Stopwatch

SIDE PLANK

- Stopwatch
- Exercise mat

5. MOBILITY AND FLEXIBILITY

STRAIGHT LEG RAISE

- Plastic goniometer
- Dowel
- Exercise mat

SHOULDER REACH

- Measuring tape

MANDATORY PRE-EVALUATION PROCEDURE

All personnel shall be medically cleared within the last 12 months prior to participating in the WFI assessments. All personnel shall be health screened prior to conducting the WFI assessments (e.g., Par-Q, Health History).

Assessments shall be deferred if the following medical conditions exist:

- Chest pain, during or in the absence of physical activity
- Recent unexplained loss of consciousness
- Loss of balance due to dizziness (ataxia)
- Recent injury resulting in bone, joint or muscle problems that may be exacerbated by exercise
- Current prescribed drug that inhibits physical activity

- Chronic infectious disease (e.g., hepatitis)
- Pregnancy
- Any other reason the participant believes that he or she should not be physically evaluated

The following pre-evaluation procedure shall be conducted for all personnel prior to conducting fitness assessments:

- Obtain a resting heart rate and blood pressure. If resting heart rate is equal to or greater than 110 beats per minute and/or resting blood pressure is equal to or greater than 160/100 mm Hg, instruct the participant to rest for five minutes and re-evaluate. If the heart rate and/or blood pressure remain at these levels, cancel the fitness evaluation and refer the participant to the fire department physician. If the heart rate and/or blood pressure fall within the acceptable range, the assessment may continue.

The assessor shall:

Instruct the participant to refrain from eating, drinking, smoking and any physical activity that may influence performance prior to the assessment. Activities that affect heart rate and/or blood pressure measurements may adversely impact performance.

- Assure that participant is wearing appropriate attire.
- Record participant's age.
- Inform participant of the appropriate execution for each protocol.

ASSESSMENT SEQUENCE

The assessments are sequenced to minimize the effect of fatigue on subsequent performance, mitigate injury risk and standardize the protocol so progress can be monitored over time. The WFI requires that assessments be performed in the sequence outlined below. To ensure that personnel have the opportunity to recover from one assessment before proceeding to the next, minimum rest times are recommended between each test (i.e. at a minimum, performers must rest for the time listed; if necessary, they can choose to rest for additional time).

1. BODY COMPOSITION

(minimum of 1 minute rest before proceeding to straight leg raise)

2. MOBILITY AND FLEXIBILITY

a. Straight leg raise (minimum of 30s rest between right and left leg; minimum of 1 minute before proceeding to shoulder reach)

b. Shoulder reach (minimum of 30s rest between right and left arm; minimum of 1 minute before proceeding to vertical jump)

3. SPEED AND POWER

a. Vertical jump (minimum of 30s rest between trials, minimum of 2 minutes before proceeding to aerobic capacity)

4. AEROBIC CAPACITY

(minimum of 10 minutes before proceeding to push-up)

5. MUSCULAR STRENGTH AND ENDURANCE

a. Push-up (minimum of 2 minutes before proceeding to horizontal pull-up)

b. Horizontal pull-up (minimum of 2 minutes before proceeding to side plank)

c. Side plank (minimum of 2 minutes between right and left side)

INDICATIONS FOR STOPPING EVALUATION

- Onset of angina or angina-like symptoms
- Signs of poor perfusion: light-headedness, confusion, ataxia, poor pallor, cyanosis, nausea, or cold, clammy skin
- Failure of heart rate to increase with increase in exercise intensity
- Participant requests evaluation to stop
- Physical or verbal manifestations of severe fatigue
- Joint or muscle pain that becomes aggravated with exercise
- Failure of the testing equipment

ASSESSMENT PROTOCOLS:

BODY COMPOSITION

Objectives: Waist and hip circumference, and waist to hip circumference ratio

EQUIPMENT

- Flexible tape measure

ASSESSMENT GUIDELINES

1. Conduct pre-evaluation procedures.
2. Using the flexible tape measure, measure the participant's waist circumference (in centimeters). The measurement should be made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest (hip bone).
3. Measure the participant's hip circumference (in centimeters). The measurement should be taken around the widest portion of the buttocks.
4. For both measurements:

- The tape should be snug around the body, but not pulled so tight that it is constricting
- The tape should be placed at a level parallel to the floor.
- The participant should stand with their feet close together, arms at side, and body weight evenly distributed.
- The participant should be relaxed, and the measurements should be taken at the end of normal expiration.

5. Take two measurements at each site (waist and hips). If the two values are within 1 cm of each other then calculate the average of the two measurements. If the difference between the two measurements is greater than 1 cm, the two measurements should be repeated.
6. Compute the waist to hip circumference ratio by dividing the waist measurement by the hip measurement (waist-hip ratio = waist circumference / hip circumference)

EVALUATION CRITERIA

- Waist circumference (cm)
- Waist-hip circumference ratio

WFI ASSESSMENT PROTOCOLS:

AEROBIC CAPACITY

There are two submaximal assessments that can be used to determine a fire fighter's aerobic capacity: the WFI submaximal treadmill and the WFI sub-maximal Stepmill assessment. Using the calculations provided in the respective section, both assessments estimate a fire fighter's maximal aerobic capacity, expressed as VO2 max. Either the treadmill or Stepmill can be used as long as the results are calculated using the appropriate assessment formula. All aerobic capacity evaluation results must be recorded in milliliters (ml) of oxygen per kilogram (kg) of body weight per minute (VO2 max). These aerobic assessments are submaximal and are based on the heart rate response during graded exercise. Accurate estimation of maximal heart rate (MHR) is critical to the submaximal prediction used in these assessments. Be aware that the heart rate can be affected by variables such as body temperature, hydration state, anxiety, stress and medications. In addition to heart rate, body mass (height-to-weight ratio), is also a significant variable in both prediction equations. The relationship between height and weight is recorded as Body Mass Index (BMI). It is important to note that BMI is not being used in these aerobic protocols to estimate body composition; but rather, is used to represent the stature of each participant.

Pre-Evaluation Procedures

Choose the aerobic capacity protocol and worksheet. Measure the participant's:

- Resting heart rate and blood pressure
- Age, height and weight
- Gender

In addition:

- Determine the participants Body Mass Index (BMI) and Target Heart Rate (THR) by referring to the tables below.
- Record the target exercise heart rate on the protocol worksheet.
- Inform the participant of all evaluation components. Ensure that the participant is in proper clothing and footwear.
- Review all indicators for stopping the evaluation with the participant.

Secure the heart rate monitor transmitter around the participant's chest in accordance with the manufacturer's instructions. The evaluator shall hold or wear the heart rate monitor wrist receiver.

Table 1. Body Mass Index (BMI) Conversion Table. BMI = Weight (kg) / Height $(m)^2$ or BMI = 703 x Weight (lbs) / Height $(inches)^2$

BMI	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
HEIGHT	BODYWEIGHT (Pounds)																														
58" (4'10)	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239
59" (4'11)	99	104	109	114	119	124	128	133	138	143	148	153	158	163	268	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247
60" (5'0)	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255
61" (5'1)	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264
62" (5'2)	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273
63" (5'3)	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282
64" (5'4)	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291
65" (5'5)	120	126	132	136	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300
66" (5'6)	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309
67" (5'7)	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	308	312	319
68" (5'8)	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328
69" (5'9)	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338
70" (5'10)	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348
71" (5'11)	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	350	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358
72" (6'0)	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368
73" (6'1)	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378
74" (6'2)	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	281	389
75" (6'3)	160	168	176	184	192	200	206	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	291	399
76" (6'4)	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	285	394	402	410
77" (6'5)	169	177	186	194	202	211	219	228	236	245	253	261	270	278	287	295	304	312	320	329	337	346	354	363	371	380	388	396	405	413	422
78" (6'6)	173	182	190	199	208	216	225	234	242	251	260	268	277	286	294	303	312	320	329	338	346	355	363	372	381	389	398	407	415	424	433
79" (6'7)	177	186	195	204	213	222	231	240	249	258	266	275	284	293	302	311	320	328	337	346	355	364	373	382	391	399	408	417	426	435	444
80" (6'8)	182	191	200	209	219	228	237	246	255	264	273	282	291	300	310	319	328	337	346	355	364	373	382	391	401	410	419	428	437	446	455
BMI	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Table 2. Target Heart Rate (THR) for Respective Age. THR = [208-(0.7*Age)]*0.85

AGE	THR	AGE	THR	AGE	THR	AGE	THR	AGE	THR
18	166	27	161	37	155	47	149	57	143
19	165	28	160	38	154	48	148	58	142
20	165	29	160	39	154	49	148	59	142
21	164	30	159	40	153	50	147	60	141
22	164	31	158	41	152	51	146	61	141
23	163	32	158	42	152	52	146	62	140
24	163	33	157	43	151	53	145	63	139
25	162	34	157	44	151	54	145	64	139
26	161	35	156	45	150	55	144	65	138
27	161	36	155	46	149	56	143	66	138

TREADMILL

Objective: Aerobic capacity, heart rate recovery; control of knees and lower back with extended duration.

Equipment

- Commercial grade treadmill
- Calculator
- Stopwatch
- Heart rate monitor
- Height scale
- Weight scale

Assessment Guidelines

1. Conduct Pre-Evaluation Procedures.
2. Monitor the participant's heart rate continuously throughout the assessment. The participant straddles the treadmill belt until it begins to move. When the treadmill reaches approximately 1mph, instruct the participant to step on to the belt. Then increase the speed to 3mph at 0% grade.
3. Start the stopwatch when the treadmill reaches 3 mph at 0% grade. Continue with this speed and grade for 3 minutes (steady state).
4. After completing the 3-minute steady state interval, inform the participant that the speed will increase to 4.5 mph. OPTIONAL: Record the participant's rating of perceived exertion (RPE) during the last 5 seconds of each subsequent stage.
5. Advise the participant that the assessment is a series of 1-minute intervals, alternating between speed and percent grade. All subsequent speed increases occur at 0.5mph.
6. At 4:01 minutes, increase the grade from 0% to 2%. At this time, inform the participant that all subsequent grade increases occur at 2% intervals.
7. The assessment will continue until the participant's heart rate exceeds the THR rate for 15 seconds, or the subject exhibits the medical criteria for early termination.
8. Once the heart rate exceeds the Target Heart Rate (THR), note the time and continue the assessment for an additional 15 seconds. Do not make any changes to the assessment speed or grade during this time. If the participant's heart rate remains above the THR for the full 15 seconds, then stop the assessment and proceed to the cool-down phase. Record the total time, including the 3-minute warm-up, at which point the participant exceeds the THR. If the participant's heart rate exceeds the target, but then drops back to the THR or below within 15 seconds, then the assessment should continue. The assessment is not complete until the participant's heart rate exceeds the THR for 15 seconds. If this does not occur within 18 minutes, then terminate the assessment and record the time.
9. Once the assessment is completed, the time is recorded. The participant should perform a cool-down for a minimum of 3 minutes at 3 mph, 0% grade. Continue to monitor the heart rate during the cool-down. Record the recovery heart rate after each minute of the cool-down.

Submaximal Treadmill Test VO2 Estimation

10. Use the formula provided below with the treadmill time in minutes (TT), and body mass index (BMI) to estimate VO2.[1]

VO2 max (ml/kg/min) = 56.981 + (1.242 x TT) – (0.805 x BMI)

Time	Speed	Grade
0:00 - 0:00	0.0	0
0:00 - 3:00	3.0	0
3:01 - 4:00	4.5	0
4:01 - 5:00	4.5	2
5:01 - 6:00	5.0	2
6:01 - 7:00	5.0	4
7:01 - 8:00	5.5	4
8:01 - 9:00	5.5	6
9:01 - 10:00	6.0	6
10:01 - 11:00	6.0	8
11:01 - 12:00	6.5	8
12:01 - 13:00	6.5	10
13:01 - 14:00	7.0	10
14:00 - 15:00	7.0	12
15:01 - 16:00	7.5	12
16:01 - 17:00	7.5	14
17:01 - 18:00	8.0	14
0:00 - 1:00	3.0	0
1:01 - 2:00	3.0	0
2:01 - 3:00	3.0	0

Evaluation Criteria

- Test time (use to estimate VO2 max)
- RPE at specific speed/grade
- Heart rate recovery

Notable Observations (KNEES / BACK)

- Knee alignment (during each test stage)
- Low back curvature (during each test stage)

Reasons to Stop the Test

- The THR is exceeded for 15 seconds
- The THR has not been met after 18 minutes
- The participant asks to terminate the exercise
- The equipment malfunctions
- Medical conditions arise that prohibit completing the assessment

Table 3. Seconds converted to decimal

Time (s)	Decimal Equivalent	Time (s)	Decimal Equivalent	Time (s)	Decimal Equivalent	Time (s)	Decimal Equivalent	Time (s)	Decimal Equivalent
1	0.02	13	0.22	25	0.42	37	0.62	49	0.82
2	0.03	14	0.23	26	0.43	38	0.63	50	0.83
3	0.05	15	0.25	27	0.45	39	0.65	51	0.85
4	0.07	16	0.27	28	0.47	40	0.67	52	0.87
5	0.08	17	0.28	29	0.48	41	0.68	53	0.88
6	0.10	18	0.30	30	0.50	42	0.70	54	0.90
7	0.12	19	0.32	31	0.52	43	0.72	55	0.92
8	0.13	20	0.33	32	0.53	44	0.73	56	0.93
9	0.15	21	0.35	33	0.55	45	0.75	57	0.95
10	0.17	22	0.37	34	0.57	46	0.77	58	0.97
11	0.18	23	0.38	35	0.58	47	0.78	59	0.98
12	0.20	24	0.40	36	0.60	48	0.80	60	1.00

STEPMILL

Objective: Aerobic capacity, heart rate recovery; control of knees and lower back with extended duration.

Equipment

- Stairmaster 7000PT Stepmill
- Calculator
- Stopwatch
- Heart rate monitor
- Height scale
- Weight scale

Assessment Guidelines

1. Conduct Pre-Evaluation Procedures.
2. Monitor the participant's heart rate continuously throughout the assessment.
3. Instruct the participant to temporarily grasp the handrails to reduce the possibility of losing balance when the stairs begin to move.
4. The starting position is approximately two-thirds of the way up the stairs.
5. The assessment starts at level 4 for 2 minutes, then level 5 for 1 minute (warm-up period). Start the stopwatch once the Stepmill begins. Inform the participant that the evaluation is a series of 1-minute intervals with increasing work loads on each subsequent minute.
6. Once the assessment commences, do not allow the participant to hold or lean on the handrails; this will result in overestimation of aerobic capacity.
7. At the completion of the 3 minute-warm-up, proceed to level 7 for 1 minute (this is marked by an increase in workload from level 5 to level 7). OPTIONAL: Record the participant's rating of perceived exertion (RPE) during the last 5 seconds of each subsequent stage.
8. The assessment will continue until the participant's heart rate exceeds the THR rate for 15 seconds, or the subject exhibits the medical criteria for early termination.
9. Once the heart rate exceeds the Target Heart Rate (THR), note the time and continue the assessment for an additional 15 seconds. Do not make any changes to the assessment intensity level during this time. If the participant's heart rate remains above the THR for the full 15 seconds, then stop the assessment and proceed to the cool-down phase. Record the total time, including the 3-minute warm-up, at which point the participant exceeds the THR. The total Test Time (TT) begins from the time the participant starts on the Stepmill, to the point at which the participant exceeds their THR. It does not include the final 15 second monitoring period that the heart rate was above the THR. If the participant's heart rate exceeds the target, but then drops back to the THR or below within 15 seconds, then the assessment should continue. The assessment is not complete until the participant's heart rate exceeds the THR for 15 seconds.
10. Once the assessment is complete, the participant will cool down for 3 minutes at level 3. Continue to monitor the heart rate during the cool-down. Record the recovery heart rate after each minute of the cool-down. The participant may grasp the handrails during the cool-down phase.
11. Upon completion of the cool-down, instruct the participant to grasp the handrails. Stop the Stepmill and assist the participant off the apparatus.

Time	Level	Steps
0:00 - 0:00	0	0
0:00 - 1:00	4	46
1:01 - 2:00	4	46
2:01 - 3:00	5	53
3:01 - 4:00	7	65
4:01 - 5:00	8	75
5:01 - 6:00	9	82
6:01 - 7:00	10	89
7:01 - 8:00	11	97
8:01 - 9:00	12	104
9:01 - 10:00	13	111
10:01 - 11:00	14	118
11:01 - 12:00	15	126
12:00 - 13:00	16	133
13:01 - 14:00	17	140
14:01 - 15:00	18	147
15:01 - 16:00	19	155
0:00 - 1:00	3	39
1:01 - 2:00	3	39
2:01 - 3:00	3	39

Submaximal Stepmill Test VO2 Estimation

12. Use the formula provided below with the stepmill time in minutes (ST), and body mass index (BMI) to estimate VO2.[2]

VO2 max (ml/kg/min) = 57.774 + (1.757 x ST) – (0.904 x BMI)

Evaluation Criteria

- Test time (use to estimate VO2 max)
- RPE at specific speed/grade
- Heart rate recovery

Notable Observations (KNEES / BACK)

- Knee alignment (during each test stage)
- Low back curvature (during each test stage)

Reasons to Stop the Test

- The THR is exceeded for 15 seconds
- The THR has not been met after 16 minutes
- The participant asks to terminate the exercise
- The equipment malfunctions
- Medical conditions arise that prohibit completing the assessment

VERTICAL JUMP

Objectives: Lower-body power; control of the knees and lower back with elevated speed.

Equipment

- Jump Mat or Vertec
- Calculator

Assessment Guidelines

1. Record the participant's body weight in kilograms (# lbs ÷ 2.2 = kg).
2. Conduct pre-evaluation procedures.

Jump Mat Protocol

3. Place the jump mat on a level surface. Connect the cord attached to the jumping mat to the handheld computer port.
4. With the participant off the mat, turn the computer on.
5. Choose "One Jump" on the computer menu. The display should read "Step on Mat". Have the participant squat to a position where the knees are at a 90° angle and the hands by the sides (momentary pause @ 90°).
6. Instruct the participant to jump straight up as high as he/she can, reach toward the ceiling (or a target object) without tucking the legs, and land with both feet on the mat.
7. When the participant has completed the jump, the display will read the hang time and vertical jump in inches. The vertical jump mode resets automatically.
8. Have the participant perform a series of 3 jumps and record the highest distance in inches.

Vertec Protocol

3. Measure the participant's standing reach height using the following procedures:

- Adjust the Vertec height so the participant is able to touch the rungs of the device.
- Have the participant reach overhead with both arms and hands together (fingers pointed up).
- From behind, the assessor should hold the participant's arms at the elbows to assist them in reaching as high as possible.
- Have the participant walk beneath the Vertec, touching as many rungs on the device as possible. Continue until no additional rungs can be touched. Record the standing reach height.

4. Adjust the Vertec height so the participant must jump to touch the rungs of the device.
5. Have the participant stand directly beneath the rungs, and squat to a position where the knees are at a 90° angle and the hands by the sides (momentary pause @ 90°).
6. Instruct the participant to jump straight up as high as he/she can, touch as many rungs on the Vertec as possible, and land with both feet.

7. Clear all rungs touched and have the participant prepare to complete their next trial.
8. Have the participant perform a series of 3 jumps and record the highest distance in inches. Jump height will be computed by subtracting the standing reach height from the max jump height (jump height = max jump height (in) — standing reach height (in))

Both Protocols

9. Convert the highest jump achieved in inches to centimeters (# inches × 2.54 = cm).
10. Use the power formula provided below with the jump height (cm) and body weight (kg) to estimate leg power.[3]

Power (watts) = [(60.7×jump height (cm)) + (45.3×body weight (kg))] – 2055

Evaluation Criteria

- Jump height
- Power (using body mass)

Notable Observations (KNEES / BACK)

- Knee alignment (landing and take-off)
- Low back curvature (landing and take-off)

Reasons to Stop the Test

- The participant fails to land with both feet on the mat
- The participant tucks the legs instead of extending them while jumping
- Joint or muscular pain

Note: Administrators can minimize the tendency of participants to tuck the legs by suspending a target object above the mat for the participant to attempt to touch.

PUSH UP

Objectives: Lower-body power; control of the knees and lower back with elevated speed.

Equipment

- Five inch prop (e.g. cup; sponge)
- Metronome
- Stopwatch

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Advise the participant that the evaluation is a series of push-ups performed in a 2-minute time period, for a maximum of 80 push-ups. The evaluation is initiated from the "up" position (hands are shoulder width apart, back is straight, and head is in neutral position).
3. Prior to beginning, inform the participant of the following:

- The feet cannot be propped against a wall or other stationary object.
- The back must be straight at all times (neutral position).
- The arms must be fully extended during the up-phase.
- Cadence with the metronome must be maintained (one beat up and one beat down).

4. Position the 5-inch prop on the ground beneath the participants chin.
5. Set the metronome at a speed of 80 bpm, allowing for 40 push-ups per minute, and a maximum of 80 push-ups in 2 minutes.
6. The participant must lower the body toward the floor until the chin touches the prop.

Evaluation Criteria
- Repetitions

Notable Observations (KNEES / BACK)
- Low back curvature
- Shoulder position

Reasons to Stop the Test
- Reaches 80 push-ups
- Performs 3 incorrect push-ups (i.e. receives 3 verbal warnings)
- Fails to maintain continuous motion with the metronome cadence
- Joint or muscular pain.

ALTERNATE GRIP PUSH-UP

Objective: Pushing strength/ endurance; control of lower back and shoulders with extended duration.

Equipment
- Push-up handles
- Range of motion prop (e.g. cup; sponge)
- Metronome
- Stopwatch

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Advise the participant that the evaluation is a series of push-ups performed in a 2-minute time period, for a maximum of 80 push-ups. The evaluation is initiated from the "up" position (hands are shoulder width apart, back is straight, and head is in neutral position).
3. Prior to beginning, inform the participant of the following:
   - The feet cannot be propped against a wall or other stationary object.
   - The back must be straight at all times (neutral position).
   - The arms must be fully extended during the up-phase.
   - Cadence with the metronome must be maintained (one beat up and one beat down).
4. Instruct the participant to grasp the push up stands, and assume the "up" position. (Caution: hex dumbbells may roll).
5. Place the modified prop so that the chin of the participant will contact the prop during the lowering phase. (Prop height = 5" plus the height of stands).
6. Set the metronome at a speed of 80 bpm, allowing for 40 push-ups per minute, and a maximum of 80 push-ups in 2 minutes.
7. The participant must lower the body toward the floor until the chin touches the prop.

Evaluation Criteria
- Repetitions

Notable Observations (KNEES / BACK)
- Low back curvature
- Shoulder position

Reasons to Stop the Test
- Reaches 80 push-ups
- Performs 3 incorrect push-ups (i.e. receives 3 verbal warnings)
- Fails to maintain continuous motion with the metronome cadence
- Joint or muscular pain.

HORIZONTAL PULL-UP

Objective: Pulling strength/ endurance; control of lower back and shoulders with extended duration.

Equipment

- Horizontal pull-up bar
- Five inch prop (e.g. cup; sponge)
- Metronome
- Stopwatch

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Advise the participant that the evaluation is a series of horizontal pull-ups (i.e. inverted row) performed in a 2-minute time period, for a maximum of 80 pull-ups. The evaluation is initiated from the "down" position (knees are bent, feet and hands are shoulder width apart, back is straight, and head is in neutral position).
3. Instruct the participant to hang from the bar with his or her arms straight, grip the bar firmly with an overhand grip and position the hands shoulder width apart.
4. With their knees bent and feet flat on the floor, the participant's foot position should be adjusted so the bar will touch the chest when the body is raised.
5. Adjust the height of the bar so that when the participant is in the "bottom" position with their arms straight, their torso is approximately 1" above the floor.
6. Prior to beginning, inform the participant of the following:
   - The feet cannot be propped against a wall or other stationary object.
   - The body from the knees to the head must be straight at all times (i.e. hips must stay raised).
   - The arms must be fully extended at the bottom of each repetition.
   - Cadence with the metronome must be maintained (one beat up and one beat down).
7. Secure the 5-inch prop to the bottom of the bar above the participant's chest.
8. Set the metronome at a speed of 80 bpm, allowing for 40 pull-ups per minute, and a maximum of 80 pull-ups in 2 minutes.
9. The participant must raise the body toward the bar until the chest touches the prop.

Evaluation Criteria

- Repetitions

Notable Observations (KNEES / BACK)

- Low back curvature
- Shoulder position

Reasons to Stop the Test

- Reaches 80 pull-ups
- Performs 3 incorrect pull-ups (i.e. receives 3 verbal warnings)
- Fails to maintain continuous motion with the metronome cadence
- Joint or muscular pain.

SIDE PLANK

Objective: Trunk muscle endurance; control of lower back and shoulders with extended duration.

Equipment

- Stopwatch
- Exercise mat

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Instruct the participant to lie on their right side, supporting themselves with one forearm and both feet. The foot of the top leg should be placed front (i.e. heel of front feet just in front of rear foot's toes). The elbow of the support arm should be placed directly below the shoulder, and kept in this position throughout the assessment. The free hand should be placed on the top hip.
3. The ankles should maintain a 90° angle and the sides of both feet must remain in contact with the floor at all times.
4. Once the feet and forearm are in position, the participant must raise their body off the floor so that a straight line can be drawn through the head, hips and feet. The stopwatch can be started at this time.
5. Prior to beginning, inform the participant of the following:

- The feet cannot be propped against a wall or other stationary object.
- The body must be straight at all times (i.e. hips must stay raised and shoulders cannot be rotated forwards).

6. Any deviations from the above posture will warrant 2 verbal warnings. If a 3rd infraction occurs, the test will be terminated.
7. Perform for a maximum of 4 minutes. Repeat on left side.

Evaluation Criteria

- Time

Notable Observations (KNEES / BACK)

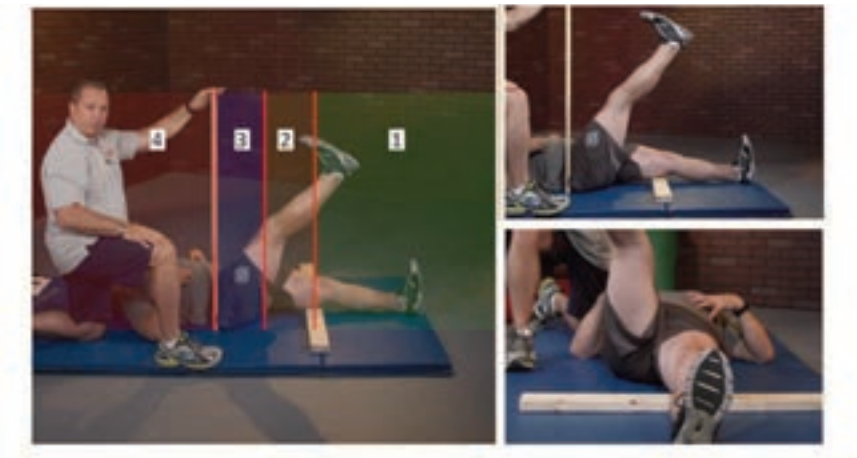
- Low back curvature
- Shoulder position

Reasons to Stop the Test

- Reaches 4 minutes
- Receives three verbal warnings regarding posture
- Joint or muscular pain

STRAIGHT LEG RAISE

Objective: Active hip flexion range of motion; control of low back motion.



Equipment

- Plastic goniometer
- Dowel
- Exercise Mat

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Instruct the participant to lie flat on the floor with the back of their thighs in contact with the floor and toes pointing up. Both arms should be placed next to the body with the palms facing up.
3. While keeping the left leg in contact with the floor, have the participant pull the toes of the right foot towards the shin, and raise the right foot as high as possible in a slow controlled motion.
4. Prior to beginning, inform the participant of the following:
   - The toes of the left leg must point up.
   - The left thigh and calf must remain in contact with the floor.
   - The right knee must be kept straight.
   - The toes of the right foot must be pulled towards the shin (e.g. ankle angle of 90°).
5. The top position must be held for a count of 2s before lowering the foot the floor.
6. Record one or both of the following measurements:
   - Hip flexion range of motion: using a goniometer measure the angle between the floor and the raised leg. Align the axis of the goniometer with the greater trochanter of the right hip (i.e. hip joint), and the arms of the goniometer with the floor and the right thigh. Hip flexion range of motion is the angle (in degrees) between the two arms of the goniometer.
   - Hip flexion score (1 to 4): document the position of the ankle joint with the respect to one of the following locations: a) below the knee (score of 1); b) between the knee and mid-thigh (score of 2); c) between the hip and mid-thigh (score of 3); and d) above the hip (score of 4).
7. Have the participant perform 3 trials on the right side and record the best measurement. Repeat with the left leg.

Evaluation Criteria

- Hip flexion range of motion (angle)
- Hip flexion score (1 to 4)

Notable Observations (KNEES / BACK)

- Low back curvature

Reasons to Stop the Test

- Joint or muscular pain

SHOULDER REACH

Objective: Active shoulder range of motion; control of low back and shoulder motion.

Equipment

- Measuring tape

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Measure the length of the right hand in centimeters (# inches × 2.54 = # cm).

Shoulder Flexion and External Rotation

3. Instruct the participant to stand tall with their feet together and arms hanging comfortably.
4. Have the participant make a fist with their right hand so the fingers wrap around the thumb.
5. In one motion, have the participant place their right fist overhead and down their back as far as possible in one slow and controlled motion. The participant should not be allowed to "wiggle" the hand after the initial fist placement.
6. Record one or both of the following measurements:

- Shoulder flexion range of motion: measure the shortest distance in centimeters between the fist and the neck line (i.e. 7th cervical vertebrae). Shoulder flexion range will be estimated by the distance in centimeters between these two points.
- Shoulder flexion score (1 to 4): document the fist with the respect to one of the following locations: a) more than ½ hand lengths above the neck line (score of 1); b) between 0 and ½ hand lengths above the neck line (score of 2); c) between 0 and ½ hand lengths below the neck line (score of 3); and d) more than ½ hand lengths below the neck line (score of 4).

7. Have the participant perform 3 trials on the right side and record the best measurement. Repeat with the left hand.

Shoulder Extension and Internal Rotation

8. Instruct the participant to stand tall with their feet together and arms hanging comfortably.
9. Have the participant make a fist with their right hand so the fingers wrap around the thumb.
10. In one motion, have the participant place their right fist up their back as far as possible in one slow and controlled motion. The participant should not be allowed to "wiggle" the hand after the initial fist placement.
11. Record one or both of the following measurements:

- Shoulder extension range of motion: measure the shortest distance in centimeters between the fist and the neck line (i.e. 7th cervical vertebrae). Shoulder extension range will be estimated by the distance in centimeters between these two points.
- Shoulder extension score (1 to 4): document the fist with the respect to one of the following locations: a) more than 1½ hand lengths below the neck line (score of 1); b) between 1½ and 1 hand lengths below the neck line (score of 2); c) between 1 and ½ hand lengths below the neck line (score of 3); and d) less than ½ hand lengths below the neck line (score of 4).

12. Have the participant perform 3 trials on the right side and record the best measurement. Repeat with the left hand.

Evaluation Criteria

- Shoulder flexion RoM (distance)
- Shoulder extension RoM (distance)
- Shoulder flexion score (1 to 4)
- Shoulder extension score (1 to 4)

Notable Observations (KNEES / BACK)

- Low back curvature
- Shoulder position

Reasons to Stop the Test

- Joint or muscular pain

OPTIONAL ASSESSMENTS

In addition to the tests outlined above, the WFI has previously recommended 4 additional protocols that can be used to evaluate various aspects of a firefighter's fitness. These additional assessments are: Skin-folds (Body Composition), Hand grip (Strength), Leg Dynamometer (Strength), Arm Dynamometer (Strength). Although each assessment does provide relevant information, the equipment needed has proven to be cost-prohibitive to many departments. For this reason, the 4th edition of the WFI now includes alternative assessments that capture similar information (see Appendix above). Departments with access to the necessary equipment who have been collecting this information may wish to continue doing so such that progress can still be monitored. The protocols for each of these four assessments are outlined below.

SKIN-FOLDS

Objectives: Body fat percentage

Equipment

- Lange Skinfold Calipers (or equivalent)
- Flexible tape measure
- Water-soluble marker

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Obtain the participant's age.
3. Note the gender-specific skinfold sites. Men are measured at the triceps, subscapular and pectoral sites; women are measured at the triceps, abdominal and supra iliac sites.
4. All measurements should be made on the right side of the body, with the subject standing upright.
5. Use the tape measure to mark the site to be measured with a water-soluble marker.
6. Place calipers directly on the skin surface, 1 cm away from the thumb and finger; perpendicular to the skinfold; and halfway between the crest and base of the fold.
7. Maintain pinch while reading the caliper. Wait 1 – 2 seconds (not longer,) before reading caliper.
8. Rotate through all three sites or allow time for skin to regain normal texture and thickness.
9. Take two measurements at each site. If the values are less than 1 millimeter of each other then calculate the average of the two measurements. If the difference between the two measurements is greater than or equal to 1millimeter, then a third measurement must be taken.

- If the differences between the three skinfold measurements are equal, then calculate the average of all three measurements [e.g., (1) 6 mm, (2) 9mm, (3) 12 mm the average of all three measurements is 9 mm].
- If the three measurements are not equal distance apart then calculate the average of the two closest measurements [e.g., (1) 7 mm, (2) 4 mm, (3) 5 mm the average is calculated for measurement #2 and #3 only. The average of the two measurements is 4.5 mm].

Evaluation Criteria

- Once the skinfolds are collected for all three sites, calculate the sum of the average skinfold measurement for each site. (Note: Sites are specific to gender.)
- To determine body fat percentage, cross-reference the sum of skin folds with the subject's age on the appropriate chart provided in this section (male: table 5.1; female : table 5.2).

MALE SKINFOLD SITES

- **Triceps** — located at the midpoint between the acromio-clavicular (AC) joint and the olecranon process (center of the elbow) on the posterior aspect of the upper arm.

Figure 5.0

Figure 5.1

- **Subscapular** — located on the same diagonal line as the inferior border of the scapula, 2cm beyond the inferior angle.

Figure 5.2

Figure 5.3

- **Pectoral** — Located on a diagonal line, midway between the axillary fold and the right nipple.

Figure 5.4

Figure 5.5

FEMALE SKINFOLD SITES

- **Triceps** – located at the midpoint between the acromio-clavicular (AC) joint and the olecranon process (center of the elbow) on the posterior aspect of the upper arm.

Figure 5.6

Figure 5.7

- **Abdominal** — located at the right of the umbilicus, on a vertical fold, 2cm from the right lateral border.

Figure 5.8

Figure 5.9

- **Suprailiac** — located on a diagonal line, 1-2 cm anterior to the crest of the pelvis (ASIS). Grasp a diagonal skin-fold just above and slightly forward of the crest of the Ilium.

Figure 5.10

Figure 5.11

Table 5.1
Percentage of Body Fat estimate for MEN
Based on the Sum of Triceps, Subscapular, and Pectoral Skinfolds

Skinfolds	Age up to Last Complete Year								
Sum (mm)	Under 22	23 - 27	28 - 32	33 - 37	38 - 42	43 - 47	48 - 52	53 - 57	Over 57
8 - 10	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6
11 - 13	3.0	3.5	4.0	4.5	5.1	5.6	6.1	6.6	7.1
14 - 16	4.5	5.0	5.5	6.0	6.5	7.0	7.6	8.1	8.6
17 - 19	5.9	6.4	6.9	7.4	8.0	8.5	9.0	9.5	10.0
20 - 22	7.3	7.8	8.3	8.8	9.4	9.9	10.4	10.9	11.4
23 - 25	8.6	9.2	9.7	10.2	10.7	11.2	11.8	12.3	12.8
26 - 28	10.0	10.5	11.0	11.5	12.1	12.6	13.1	13.6	14.2
29 -31	11.2	11.8	12.3	12.8	13.4	13.9	14.4	14.9	15.5
32 - 34	12.5	13.0	13.5	14.1	14.6	15.1	15.7	16.2	16.7
35 - 37	13.7	14.2	14.8	15.3	15.8	16.4	16.9	17.4	18.0
38 - 40	14.9	15.4	15.9	16.5	17.0	17.6	18.1	18.6	19.2
41 - 43	16.0	16.6	17.1	17.6	18.2	18.7	19.3	19.8	20.3
44 - 46	17.1	17.7	18.2	18.7	19.3	19.8	20.4	20.9	21.5
47 - 49	18.2	18.7	19.3	19.8	20.4	20.9	21.4	22.0	22.5
50 - 52	19.2	19.7	20.3	20.8	21.4	21.9	22.5	23.0	23.6
53 - 55	20.2	20.7	21.3	21.8	22.4	22.9	23.5	24.0	24.6
56 - 58	21.1	21.7	22.2	22.8	23.3	23.9	24.4	25.0	25.5
59 - 61	22.0	22.6	23.1	23.7	24.2	24.8	25.3	25.9	26.5
62 - 64	22.9	23.4	24.0	24.5	25.1	25.7	26.2	26.8	27.3
64 - 67	23.7	24.3	24.8	25.4	25.9	26.5	27.1	27.6	28.2
68 - 70	24.5	25.0	25.6	26.2	26.7	27.3	27.8	28.4	29.0
71 - 73	25.2	25.8	26.3	26.9	27.5	28.0	28.6	29.1	29.7
74 - 76	25.9	26.5	27.0	27.6	28.2	28.7	29.3	29.9	30.4
77 - 79	26.6	27.1	27.7	28.2	28.8	29.4	29.9	30.5	31.1
80 - 82	27.2	27.7	28.3	28.9	29.4	30.0	30.6	31.1	31.7
83 - 85	27.7	28.3	28.8	29.4	30.0	30.5	31.1	31.7	32.3
86 - 88	28.2	28.8	29.4	29.9	30.5	31.1	31.6	32.2	32.8
89 - 91	28.7	29.3	29.8	30.4	31.0	31.5	32.1	32.7	33.3
92 -94	29.1	29.7	30.3	30.8	31.4	32.0	32.6	33.1	33.4
95 - 97	29.5	30.1	30.6	31.2	31.8	32.4	32.9	33.5	34.1
98 - 100	29.8	30.4	31.0	31.6	32.1	32.7	33.3	33.9	34.4
101 - 103	30.1	30.7	31.3	31.8	32.4	33.0	33.6	34.1	34.7
104 - 106	30.4	30.9	31.5	32.1	32.7	33.2	33.8	34.4	35.0
107 - 109	30.6	31.1	31.7	32.3	32.9	33.4	34.0	34.6	35.2
110 - 112	30.7	31.3	31.9	32.4	33.0	33.6	34.2	34.7	35.3
113 - 115	30.8	31.4	32.0	32.5	33.1	33.7	34.3	34.9	35.4
116 - 118	30.9	31.5	32.0	32.6	33.2	33.8	34.3	34.9	35.5

Table 5.2
Percentage of Body Fat estimates for WOMEN
Based on the Sum of Triceps, Abdominal, and Suprailiac Skinfolds

Skinfolds	Age up to Last Complete Year								
Sum (mm)	18 - 22	23 - 27	28 - 32	33 - 37	38 - 42	43 - 47	48 - 52	53 - 57	Over 57
8 - 12	8.8	9.0	9.2	9.4	9.5	9.7	9.9	10.1	10.3
13 - 37	10.8	10.9	11.0	11.3	11.5	11.7	11.8	12.0	12.2
18 - 22	12.6	12.8	13.0	13.2	13.4	13.5	13.7	13.9	14.1
23 - 27	14.5	14.6	14.8	15.0	15.2	15.4	15.6	15.7	15.9
28 - 32	16.2	16.4	16.6	16.8	17.0	17.1	17.3	17.5	17.7
33 - 37	17.9	18.1	18.3	18.5	18.7	18.9	19.0	19.2	19.4
38 - 42	19.6	19.8	20.0	20.2	20.3	20.5	20.7	20.9	21.1
43 - 47	21.2	21.4	21.6	21.8	21.9	22.1	22.3	22.5	22.7
48 - 52	22.8	22.9	23.1	23.3	23.5	23.7	23.8	24.0	24.2
53 - 57	24.2	24.4	24.6	24.8	25.0	25.2	25.3	25.5	25.7
58 - 62	25.7	25.9	26.0	26.2	26.4	26.6	26.8	27.0	27.1
63 - 67	27.1	27.2	27.4	27.6	27.8	28.0	28.2	28.3	28.5
68 - 72	28.4	28.6	28.7	28.9	29.1	29.3	29.5	29.7	29.8
73 - 77	29.6	29.8	30.0	30.2	30.4	30.6	30.7	30.9	31.1
78 - 82	30.9	31.0	31.2	31.4	31.6	31.8	31.9	32.1	32.3
83 - 87	32.0	32.2	32.4	32.6	32.7	32.9	33.1	33.3	33.5
88 - 92	33.1	33.3	33.5	33.7	33.8	34.0	34.2	34.4	34.6
93 - 97	34.1	34.3	34.5	34.7	34.9	35.1	35.2	35.4	35.6
98 - 102	35.1	35.3	35.5	35.7	35.9	36.0	36.2	36.4	36.6
103 - 107	36.1	36.2	36.4	36.6	36.8	37.0	37.2	37.3	37.5
108 - 112	36.9	37.1	37.3	37.5	37.7	37.9	38.0	38.2	38.4
113 - 117	37.8	37.9	38.1	38.3	39.2	39.4	39.6	39.8	39.2
118 - 122	38.5	38.7	38.9	39.1	39.4	39.6	39.8	40.0	40.0
123 - 127	39.2	39.4	39.6	39.8	40.0	40.1	40.3	40.5	40.7
128 - 132	39.9	40.1	40.2	40.4	40.6	40.8	41.0	41.2	41.3
133 - 137	40.5	40.7	40.8	41.0	41.2	41.4	41.6	41.7	41.9
138 - 142	41.0	41.2	41.4	41.6	41.7	41.9	42.1	42.3	42.5
143 - 147	41.5	41.7	41.9	42.0	42.2	42.4	42.6	42.8	43.0
148 - 152	41.9	42.1	42.3	42.8	42.6	42.8	43.0	43.2	43.4
153 - 157	43.3	42.5	42.6	42.8	43.0	43.2	43.4	43.6	43.7
158 - 162	42.6	42.8	43.0	43.1	43.3	43.5	43.7	43.9	44.1
163 - 167	42.9	43.0	43.2	43.4	43.6	43.8	44.0	44.1	44.3
168 - 172	43.1	43.2	43.4	43.6	43.8	44.0	44.2	44.3	44.5
173 - 177	43.2	43.4	43.6	43.8	43.9	44.1	44.3	44.5	44.7
178 - 182	43.3	43.5	43.7	43.8	44.0	44.2	44.4	44.6	44.8

HAND GRIP

Objectives: Maximum isometric strength of the flexor muscles of the hands.

Equipment

- Hand dynamometer
- Towel

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Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Instruct the participant to towel dry his or her hands.
3. Place the dynamometer in the participant's hand to be sized for assessment. Ensure that the hand grip is adjusted to fit snugly in the first proximal interphalangeal joint. Prior to commencing the assessment, set the dynamometer to "zero" by rotating the red peak force indicator counter clockwise.
4. Advise the participant that the evaluation is a series of 6 trials, 3 for each hand, alternating hands with each attempt.
5. The participant will maintain the following positions for the duration of the assessment:

- Stand upright with spine in neutral alignment.
- Flex elbow at a 90° angle.
- Adduct shoulder and place hand in neutral grip position (hand shake position).

6. The participant will squeeze the device with maximum force for 3 seconds while exhaling. Instruct to slowly increase the strength of the squeeze (i.e. do not squeeze maximally right away).
7. The participant will slowly release grip. The needle will automatically record the highest force exerted.
8. Measure both hands, alternating between right and left, completing three trials per hand.
9. Reset the peak-hold needle to zero before obtaining new readings.
10. Record the scores for each trial in each hand to the nearest kilogram.
11. Record the highest score for each hand.

Evaluation Criteria

- Grip strength

ARM STRENGTH

Objectives: Maximum isometric strength of the flexor muscles of the arms.

Equipment

- Jackson Strength Evaluation System
- Straight handlebar
- Towel

PHOTO COURTESY OF LAFAYETTE INSTRUMENT COMPANY, INC.

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Instruct the participant to towel dry his or her hands.
3. Advise the participant that the evaluation is a series of 3 trials in which the he will "ease into" the isometric arm contraction and release slowly, without moving the arms or jerking hands.
4. Place the dynamometer base plate on a level and secure surface.
5. Have the participant stand upon the dynamometer base plate, with feet shoulder width apart and equal distance from the chain. The chain should travel vertically from the base to the hands.
6. The participant will stand erect with knees straight and arms flexed at 90° in the sagittal plane.
7. The participant will hold the bar with a wide grip and bend elbows at 90°.
8. Participants must stand erect without arching back.
9. Adjust the chain so that the bar can be held in the hands while the arms are flexed at 90° in the sagittal plane.
10. Ensure that the shoulders remain adducted.
11. Verify this position and ensure the chain is taut.
12. The participant must not shrug shoulders, bend back, or perform any other motion other than elbow flexion in an attempt to move the handlebar in a vertical direction.
13. The participant will contract maximally for 3 seconds.
14. After 3 seconds, the participant will slowly relax arms, and rest while standing for 30 seconds.
15. Once the participant has completed the 30-second recovery period, begin the 2nd trial.
16. Repeat evaluation for the 3rd trial using the same procedure.
17. Record the three trials to the nearest kilogram.
18. Record the highest trial.

Evaluation Criteria

- Arm strength

Note: Digital readout will display the peak force ("p") and the average force ("a") achieved during the three trials.

Reasons to Stop the Test

- Joint or muscular pain

LEG STRENGTH

Objectives: Maximum isometric strength of the back extensors and lower body.

Equipment

- Jackson Strength Evaluation System
- V-Grip handlebar
- Towel
- Weightlifting belt (optional)

PHOTO COURTESY OF LAFAYETTE INSTRUMENT COMPANY, INC.

Assessment Guidelines

1. Conduct pre-evaluation procedures.
2. Instruct the participant to towel dry his or her hands.
3. The participant may use a weightlifting belt for support.
4. Advise the participant that the evaluation is a series of 3 trials.
5. Place the dynamometer base plate on a level and secure surface. Have the participant stand upon the dynamometer base plate with his or her feet spread shoulder width apart and equal distance from the lifting chain. Inform the participant to notify the assessor if he/she experiences any pain or discomfort, especially around the spine. If notified, terminate the assessment.
6. Instruct the participant to stand erect with the knees straight.
7. Adjust the chain so the upper (inside) edge of the bottom cross- member of the V-grip handlebar is at the top of the participant's patella (legs are straight). Verify this position.
8. Instruct the participant to:
   - Flex at knees and hips until he/she can reach the handle.
   - Hold the bar and look straight ahead with neck in the neutral position.
   - Fully extend arms and maintain a straight (neutral) back.
9. Ensure the participant maintains the following positions:
   - The hips are directly over the feet, with trunk and knees slightly bent.
   - The shoulders are "set" or retracted to ensure that the spine is neutral (cervical, thoracic and lumbar).
   - The elbows are extended.
10. Advise the participant to "ease into" the isometric leg extension and release it slowly, without bending at the waist, flexing the arms, or jerking the hand.
11. Instruct the participant to extend legs, using proper form and technique. Encourage the participant to limit the first trial to approximately 50% of maximal effort.
12. Participant will apply approximately 50% force for a maximum of 3 seconds while exhaling.
13. After 3 seconds, instruct the participant to slowly relax arms and legs, and to remain at a standing rest for 30 seconds. The device will record the peak force exerted.
14. Once the participant has completed the 30-second recovery period, begin the 2nd trial.
15. The participant should use maximum effort during the 2nd and 3rd trials.
16. Record the two trials to the nearest kilogram.
17. Record the highest trial.

Evaluation Criteria

- Leg strength

Note: Digital readout will display the peak force ("p") and the average force ("a") achieved during the three trials.

Reasons to Stop the Test

- Joint or muscular pain

[1] Tierney MT1, Lenar D, Stanforth PR, Craig JN, Farrar RP. Prediction of Aerobic Capacity in Firefighters using Submaximal Treadmill and Stairmill Protocols. J Strength Cond Res. 2010 Mar;24(3):75

[2] Tierney MT1, Lenar D, Stanforth PR, Craig JN, Farrar RP. Prediction of Aerobic Capacity in Firefighters using Submaximal Treadmill and Stairmill Protocols. J Strength Cond Res. 2010 Mar;24(3):75

[3] Sayers SP, Harackiewicz DV, Harman EA, Frykman PN, Rosenstein MT. Cross-validation of three jump power equations. Med Sci Sport Exer. 1999;31:572–577.

APPENDIX A1

WFI FITNESS PROTOCOLS

WFI FITNESS ASSESSMENT
– Treadmill Recording Form –

BODY COMPOSITION

1. BODY MASS INDEX (Height, Weight)

Height		BMI
Mass		

2. WAIST/HIP RATIO (Circumference)

Waist		W/H Ratio
Hips		

AEROBIC CAPACITY AND RECOVERY

7. TREADMILL (Time, Heart Rate, RPE)

(✓)	Time	Speed	Grade	HR	RPE	Knee	Back
✓	0:00 - 0:00	0.0	0			✓	✓
	0:00 - 3:00	3.0	0				
	3:01 - 4:00	4.5	0				
	4:01 - 5:00	4.5	2				
	5:01 - 6:00	5.0	2				
	6:01 - 7:00	5.0	4				
	7:01 - 8:00	5.5	4				
	8:01 - 9:00	5.5	6				
	9:01 - 10:00	6.0	6				
	10:01 - 11:00	6.0	8				
	11:01 - 12:00	6.5	8				
	12:01 - 13:00	6.5	10				
	13:01 - 14:00	7.0	10				
	14:00 - 15:00	7.0	12				
	15:01 - 16:00	7.5	12				
	16:01 - 17:00	7.5	14				
	17:01 - 18:00	8.0	14				
	0:00 - 1:00	3.0	0				
	1:01 - 2:00	3.0	0				
	2:01 - 3:00	3.0	0				

MOBILITY AND FLEXIBILITY

3. STRAIGHT LEG RAISE (Hip Flexion Angle OR SLR Score)

Best of 3 Trials	Angle	Score	Back
Left			
Right			

4. SHOULDER FLEXION+ (Reach Distance OR SF Score)

Best of 3 Trials	Distance	Score	Back	Shld
Left				
Right				

5. SHOULDER EXTENSION+ (Reach Distance OR SE Score)

Best of 3 Trials	Distance	Score	Back	Shld
Left				
Right				

SPEED AND POWER

6. VERTICAL JUMP (Height, Power)

Standing Height	Reach Height	Jump Height	Knee	Back

STRENGTH AND ENDURANCE

8. PUSH-UP (Reps)

Max Reps	Back	Shld

9. PULL-UP (Reps)

Max Reps	Back	Shld

Push – Pull Symmetry _____

10. SIDE PLANK (Time)

Right Side	Back	Shld

Left Side	Back	Shld

Left – Right Symmetry _____

APPENDIX A1

WFI FITNESS PROTOCOLS

WFI FITNESS ASSESSMENT – Treadmill Recording Form Instructions

BODY COMPOSITION

1. BODY MASS INDEX (Height, Weight)

- Record mass in kilograms (1 lb = 0.454 kg)
- Record height in meters (1 inch = 2.54 cm)
- BMI = mass / (height * height)

TARGET: Waist Circumference
Men < 102 cm
Women < 88 cm

2. WAIST/HIP RATIO (Circumference)

- Record waist circumference (ribs-iliac crest)
- Record hip circumference (widest point)
- Ratio = waist / hip circumference

TARGET: Waist:Hip Circumference Ratio
Men < 0.90
Women < 0.85

SPEED AND POWER

6. VERTICAL JUMP (Height, Power)

- Record the participant's standing height (from the floor to the top of the fingers)
- Record the participant's reach height (from the floor to height touched)
- Vertical jump height = reach height – standing height
- Note the alignment of the knees and curvature of the low back during take-off and landing by placing a check (✓) or (×) in the corresponding box
- Power can be estimated using the following equation:

Power = [(60.7 x height (cm)) + (45.3 x body mass (kg))] – 2055

AEROBIC CAPACITY AND RECOVERY

7. TREADMILL (Time, Heart Rate, RPE)

- Record the participant's resting heart rate and their perceived exertion (scale of 1-10)
- During the last 10s of each 1-minute interval, record the participant's heart rate (HR) and ask them to rate their perceived exertion (RPE) on a scale of 1-10 (10 is hardest thing ever done)
- During the last 10s of each 1-minute interval, note the alignment of the knees and curvature of the low back by placing a check (✓) or (×) in the corresponding box
- As each interval is completed, place a check (✓) in the box at the left hand side of the page (if incomplete, record the time that the test was terminated)
- When test is terminated (submaximal test only), the participant's VO_2 can be estimated using the following equation: $VO_2 = 56.981 + (1.242 \times \text{treadmill time}) – (0.805 \times \text{BMI})$
- During the last 10s of each minute of the recovery, record the participant's heart rate and perceived exertion, and note the alignment of the knees and curvature of the low back.

TARGET: Treadmill Time
Test Time > 12:30 min

TARGET: Recovery Heart Rate
2-min HR < Max HR - 15 bpm

MOBILITY AND FLEXIBILITY

3. STRAIGHT LEG RAISE (Hip Flexion Angle OR SLR Score)

- Record the angle between the raised thigh and the floor (0° is start position), OR
- Record the straight leg raise (SLR) score (4: ankle past ASIS; 3: ankle past mid-thigh; 2 ankle past knee; 1: ankle not past knee)
- Note the curvature of the low back by placing a check (✓) or (×) in the corresponding box

TARGET: SLR Score > 2

4. SHOULDER FLEXION+ (Reach Distance OR SF Score)

- Record the distance between the lowest point of the first and C7 (positive is past C7), OR
- Record the shoulder flexion (SF) score (4: fist > half hand length past C7; 3: fist is past C7; 2 fist > half hand length above C7; 1: fist > half hand length above C7)
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: SF Score > 2

5. SHOULDER EXTENSION+ (Reach Distance OR SE Score)

- Record the distance between the highest point of the first and C7 (smaller = better), OR
- Record the shoulder extension (SE) score (4: fist < 0.5 hand length from C7; 3: fist is < 1 hand length from C7; 2 fist is < 1.5 hand length from C7 C7; 1: fist is > 1.5 hand length from C7)
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: SE Score > 2

STRENGTH AND ENDURANCE

8. PUSH-UP (Reps)

- Record the number of reps performed
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

9. PULL-UP (Reps)

- Record the number of reps performed
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: Push – Pull Symmetry
0.90 < Ratio < 1.10

10. SIDE PLANK (Time)

- Record the time to completion on the left and right side
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: Left – Right Symmetry
0.90 < Ratio < 1.10

APPENDIX A1

WFI FITNESS PROTOCOLS

WFI FITNESS ASSESSMENT – Stepmill Recording Form –

BODY COMPOSITION

1. BODY MASS INDEX (Height, Weight)

Height _____
Mass _____

BMI

2. WAIST/HIP RATIO (Circumference)

Waist _____
Hips _____

W/H Ratio

AEROBIC CAPACITY AND RECOVERY

7. STEPMILL (Time, Heart Rate, RPE)

(✓)	Time	Level	Steps	HR	RPE	Knee	Back
✓	0:00 - 0:00	0	0			✓	✓
	0:00 - 1:00	4	46				
	1:01 - 2:00	4	46				
	2:01 - 3:00	5	53				
	3:01 - 4:00	7	65				
	4:01 - 5:00	8	75				
	5:01 - 6:00	9	82				
	6:01 - 7:00	10	89				
	7:01 - 8:00	11	97				
	8:01 - 9:00	12	104				
	9:01 - 10:00	13	111				
	10:01 - 11:00	14	118				
	11:01 - 12:00	15	126				
	12:00 - 13:00	16	133				
	13:01 - 14:00	17	140				
	14:01 - 15:00	18	147				
	15:01 - 16:00	19	155				
	0:00 - 1:00	3	39				
	1:01 - 2:00	3	39				
	2:01 - 3:00	3	39				

MOBILITY AND FLEXIBILITY

3. STRAIGHT LEG RAISE (Hip Flexion Angle OR SLR Score)

Best of 3 Trials	Angle	Score	Back
Left			
Right			

4. SHOULDER FLEXION+ (Reach Distance OR SF Score)

Best of 3 Trials	Distance	Score	Back	Shld
Left				
Right				

5. SHOULDER EXTENSION+ (Reach Distance OR SE Score)

Best of 3 Trials	Distance	Score	Back	Shld
Left				
Right				

SPEED AND POWER

6. VERTICAL JUMP (Height, Power)

Standing Height	Reach Height	Jump Height	Knee	Back

STRENGTH AND ENDURANCE

8. PUSH-UP (Reps)

Max Reps	Back	Shld

9. PULL-UP (Reps)

Max Reps	Back	Shld

Push – Pull Symmetry _____

10. SIDE PLANK (Time)

Right Side	Back	Shld

Left Side	Back	Shld

Left – Right Symmetry _____

APPENDIX A1

WFI FITNESS PROTOCOLS

WFI FITNESS ASSESSMENT – Stepmill Recording Form Instructions –

BODY COMPOSITION

1. BODY MASS INDEX (Height, Weight)

- Record mass in kilograms (1 lb = 0.454 kg)
- Record height in meters (1 inch = 2.54 cm)
- BMI = mass / (height * height)

TARGET: Waist Circumference
Men < 102 cm
Women < 88 cm

2. WAIST/HIP RATIO (Circumference)

- Record waist circumference (ribs-iliac crest)
- Record hip circumference (widest point)
- Ratio = waist / hip circumference

TARGET: Waist:Hip Circumference Ratio
Men < 0.90
Women < 0.85

SPEED AND POWER

6. VERTICAL JUMP (Height, Power)

- Record the participant's standing height (from the floor to the top of the fingers)
- Record the participant's reach height (from the floor to height touched)
- Vertical jump height = reach height – standing height
- Note the alignment of the knees and curvature of the low back during take-off and landing by placing a check (✓) or (×) in the corresponding box
- Power can be estimated using the following equation:

Power = [(60.7 x height (cm)) + (45.3 x body mass (kg))] – 2055

AEROBIC CAPACITY AND RECOVERY

7. STEPMILL (Time, Heart Rate, RPE)

- Record the participant's resting heart rate and their perceived exertion (scale of 1-10)
- During the last 10s of each 1-minute interval, record the participant's heart rate (HR) and ask them to rate their perceived exertion (RPE) on a scale of 1-10 (10 is hardest thing ever done)
- During the last 10s of each 1-minute interval, note the alignment of the knees and curvature of the low back by placing a check (✓) or (×) in the corresponding box
- As each interval is completed, place a check (✓) in the box at the left hand side of the page (if incomplete, record the time that the test was terminated)
- When test is terminated (submaximal test only), the participant's VO_2 can be estimated using the following equation: VO_2 = 57.774 + (1.757 x stepmill time) – (0.904 x BMI)
- During the last 10s of each minute of the recovery, record the participant's heart rate and perceived exertion, and note the alignment of the knees and curvature of the low back.

TARGET: Stepmill Time
Test Time > 10:00 min

TARGET: Recovery Heart Rate
2-min HR < Max HR - 15 bpm

MOBILITY AND FLEXIBILITY

3. STRAIGHT LEG RAISE (Hip Flexion Angle OR SLR Score)

- Record the angle between the raised thigh and the floor (0° is start position), OR
- Record the straight leg raise (SLR) score (4: ankle past ASIS; 3: ankle past mid-thigh; 2 ankle past knee; 1: ankle not past knee)
- Note the curvature of the low back by placing a check (✓) or (×) in the corresponding box

TARGET: SLR Score > 2

4. SHOULDER FLEXION+ (Reach Distance OR SF Score)

- Record the distance between the lowest point of the first and C7 (positive is past C7), OR
- Record the shoulder flexion (SF) score (4: fist > half hand length past C7; 3: fist is past C7; 2 fist > half hand length above C7; 1: fist > half hand length above C7)
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: SF Score > 2

5. SHOULDER EXTENSION+ (Reach Distance OR SE Score)

- Record the distance between the highest point of the first and C7 (smaller = better), OR
- Record the shoulder extension (SE) score (4: fist < 0.5 hand length from C7; 3: fist is < 1 hand length from C7; 2 fist is < 1.5 hand length from C7 C7; 1: fist is > 1.5 hand length from C7)
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: SE Score > 2

STRENGTH AND ENDURANCE

8. PUSH-UP (Reps)

- Record the number of reps performed
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

9. PULL-UP (Reps)

- Record the number of reps performed
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: Push – Pull Symmetry
0.90 < Ratio < 1.10

10. SIDE PLANK (Time)

- Record the time to completion on the left and right side
- Note the curvature of the low back and position of the shoulders with a (✓) or (×)

TARGET: Left – Right Symmetry
0.90 < Ratio < 1.10

APPENDIX B

FIRE FIGHTER MEDICAL EXAMINATION

Dear Medical Provider,

The following medical examination is based on the unique risks and adverse working environments that fire fighters face daily. It allows for early detection of diseases and illnesses associated with the occupation of firefighting. There have been varying recommendations on the intervals of medical assessments usually based on an individual's age. However, the value of providing annual medical assessments for uniformed personnel within a high-risk occupation has been determined to be medically significant. It is cost-effective based on a history of saving members' lives through early intervention. An appropriate annual medical assessment for a fire fighter should include:

MEDICAL HISTORY QUESTIONNAIRE

A medical history questionnaire to establish a baseline before starting work as a fire fighter and/or a periodic medical history to provide follow-up information and identify changes in health status must be completed during each medical assessment.

HANDS-ON PHYSICAL EXAMINATION

❑ **Vital Signs** — Height, weight, blood pressure, temperature, heart rate and respiratory rate

❑ **HEENT** — Head, Eyes, Ears, Nose, and Throat

❑ **Neck** — Major vessels, lymph nodes, abnormal masses, gland enlargement

❑ **Cardiovascular** — Inspection, auscultation

❑ **Pulmonary** — Inspection, auscultation

❑ **Gastrointestinal** — Inspection, auscultation, percussion and palpation

❑ **Genitourinary** — Hernia exam and, as indicated, testicular or gyn exam

❑ **Lymph Nodes**

❑ **Neurological** — General mental status, cranial nerve, peripheral nerves, motor, sensory, reflexes

❑ **Mental Status Exam** – orientation, memory and judgement

❑ **Musculoskeletal** — Overall assessment of range of motion (ROM) of all joints

❑ **Skin** — Inspect for color, vascularity, lesions, and edema

BODY COMPOSITION

Excess body fat increases the workload and amplifies heat stress by preventing the efficient dissipation of heat when a person exercises. In addition, added body fat elevates the energy cost of weight-dependent tasks such as climbing ladders and walking up stairs, also contributing to injuries and an increased risk of many chronic diseases.

❑ **Body Fat Percentage— skinfold measurement**

❑ **Body Fat Distribution— waist circumference**

BLOOD ANALYSIS

Blood and urine testing should be conducted at baseline and at a minimum of every three years to the age of 40 and annually thereafter. Prior to age 40, this testing should be performed more frequently as a function of age, disease, risk factors and specific occupational exposures. Follow—up abnormal lab results as clinically appropriate. The following are components of the blood analysis. At a minimum, laboratory services must provide these components in their automated chemistry panel (aka SMAC 20) and complete blood count (CBC) protocols.

❑ **CBC with Differential**

❑ **Liver Enzymes and Function Tests**

- SGOT/AST
- SGPT/ALT
- LDH
- Alkaline Phosphatase
- Bilirubin
- Albumin

❑ **Glucose**

❑ **Creatinine**

❑ **Glomerular Filtration Rate (eGFR)**

❑ **Blood Urea Nitrogen**

❑ **Sodium**

❑ **Potassium**

❑ **Carbon Dioxide (bicarbonate)**

❑ **Total Protein**

❑ **Calcium**

❑ **Cholesterol**

- ○ Total Cholesterol
- ○ Low Density Lipoprotein (LDL—C)
- ○ High Density Lipoprotein (HDL—C)
- ○ Total Cholesterol/HDL Ratio
- ○ Triglycerides

HEAVY METAL AND SPECIAL EXPOSURE SCREENING

Baseline testing for heavy metals and special exposures may be performed under special circumstances and as indicated by regulations and OSHA standards. Examples include:

- ❑ Urine screen for arsenic, mercury and cadmium
- ❑ Blood screen for lead and zinc protoporphyrin

URINALYSIS

- ❑ Dip stick and microscopic

VISION TESTS

Assessment of vision must include evaluation of distance, near, peripheral, and color vision using color plates. Evaluate both corrected and uncorrected vision and each eye separately. Evaluate for common visual disorders.

HEARING EVALUATION

Uniformed personnel are at increased risk for noise—induced hearing impairment at an earlier age. A pure tone audiometric exam should be performed; hearing aids cannot be worn during the exam. For the purposes of data collection, the following frequencies are tested: 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz.

PULMONARY EVALUATION (SPIROMETRY)

FVC, FEV_1, FEV_1/FVC Ratio

CHEST X—RAY

A baseline chest X—ray is required.

AEROBIC/CARDIOVASCULAR EVALUATION

A resting **12—lead ECG** shall be performed at baseline, annually starting at age forty, and when clinically indicated. Before the age of 40, annual resting ECG testing for coronary artery disease and other cardiovascular diseases is of limited value (AHA & USPSTF guidelines); however, when evaluating a symptomatic fire fighter, a recent ECG for comparison is useful.

Asymptomatic uniformed personnel ≥ 40 years of age with no atherosclerotic cardiovascular disease (ASCVD) shall be assessed annually using the 10-year Heart Risk Calculator created by the American College of Cardiology/American Heart Association (ACC/AHA) (http://tools.acc.org/ascvd—risk—estimator/) and the Framingham heart risk table for 2 year risk (https://www.framinghamheartstudy.org/risk—functions/coronary—heart—disease/2—year—risk.php).

Those personnel assessed as having intermediate risk (defined as 2 to < 4 percent risk of ASCVD over the next 2 years or 10 < 20% risk of ASCVD over the next 10 years) should be evaluated with **symptom—limiting exercise stress testing to at least 12 METs, with or without imaging, using a validated exercise testing protocol**.

Asymptomatic fire fighters younger than 40 years of age known to be at high risk for ASCVD should also be assessed for coronary artery disease.

Testing may be done with or without imaging. When selecting imaging options, physicians should be aware of the large prevalence of left ventricular hypertrophy in fire fighters who experience on—duty cardiovascular deaths. Given that left ventricular hypertrophy is of greater concern in younger fire fighters and ischemic heart disease is of greater concern in older fire fighters, when stress imaging is ordered, consideration should be given to **echocardiography stress testing in younger fire fighters and nuclear stress testing in older fire fighters**.

Negative stress tests should be repeated at least every 2 to 5 years or as clinically indicated.

Those uniformed personnel assessed as being at high risk (defined as ≥4 percent risk over the next 2 years or ≥ 20 percent risk over the next 10 years) should be referred to a cardiologist for further evaluation and treatment.

ONCOLOGY SCREENING ELEMENTS

- ❑ Lung cancer— low—dose computed tomography (LDCT) annually on fire fighters over the age of 55 who have a 30-pack-year smoking history and currently smoke or have quit within the past 15 years.
- ❑ Skin cancer— skin exam
- ❑ Breast cancer— mammogram every two years after age 40 and annually after age 50

- ❑ Cervical Cancer – pap smear every 3 years for ages 21 to 65 or, in those ages 30 to 65 who want to lengthen the screening interval, a pap smear with HPV testing every 5 years
- ❑ Testicular cancer — testicular exam at baseline by a healthcare provider followed by routine self — examination
- ❑ Prostate cancer— male uniformed personnel shall be offered a discussion regarding Prostate Specific Antigen (PSA) testing at age 50. Male uniformed personnel who are considered to be at increased risk for prostate cancer shall be offered a discussion regarding PSA testing starting at age 40.
- ❑ Colorectal cancer — health care providers should discuss the possible increased risk of colorectal cancer resulting from occupational exposures along with the risks and benefits of initiating screening at age 40 in fire fighters. If the fire fighter decides to start screening at age 40, fecal occult blood testing (FOBT) is the method recommended for use as it has the lowest risk for adverse patient events and is the most cost effective. For ages 50—75, any of the following may be used:
  - ❑ Annual screening with high-sensitivity fecal occult blood testing
  - ❑ Sigmoidoscopy every 5 years, with high-sensitivity fecal occult blood testing every 3 years
  - ❑ Screening colonoscopy every 10 years
- ❑ Bladder Cancer — monitor for hematuria during annual urine testing
- ❑ Thyroid cancer — annual exam for palpable nodules
- ❑ Oral Cancer — annual mouth and throat exam

SLEEP DISTURBANCE

Screening for sleep disorders in the fire fighters' annual medical evaluation using a validated questionnaire such as the Berlin sleep questionnaire, Epworth Sleepiness Scale or BMI. Fire fighters with a high index of suspicion should be referred to a specialist for diagnostic sleep studies.

IMMUNIZATIONS AND INFECTIOUS DISEASE SCREENING

- ❑ Uniformed personnel should receive or have documentation of having received the following vaccinations:
- ❑ Hepatitis A Virus (HAV)
- ❑ Hepatitis B Virus (HBV)
- ❑ Tetanus/Diphtheria/Pertussis (Tdap)/ Tetanus/Diphtheria (Td) — Substitute Tdap for Td once, then Td booster every 10 years
- ❑ Influenza (annual)
- ❑ Measles, Mumps, Rubella (MMR) — two doses if serum titers are negative
- ❑ Polio
- ❑ Human Papilloma Virus (HPV) — up to age 26
- ❑ Varicella

■ Screenings

- ❑ Hepatitis C Virus
- ❑ Tuberculosis (TB)
- ❑ Human Immune Deficiency Virus (HIV)

OCCUPATIONAL STRESS AWARENESS CONSULTATION

An assessment for the heightened risks of stress associated with occupational exposures related to fire fighting and emergency medical services work using a validated questionnaire to assess for occupational stress such as the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) for post-traumatic stress, the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD PHQ2 and PHQ 9) for depressive disorders, and the CAGE-AID questionnaire to capture symptoms of potential alcohol and substance abuse. Fire fighters with a high index of suspicion must be referred to a licensed behavioral health specialist trained to recognize and treat stress-related and/or behavioral health disorders in fire fighters and first responders as indicated.

INDIVIDUALIZED HEALTH RISK APPRAISAL

Written feedback to uniformed personnel concerning health risks and health status is required following the annual examination. Reporting findings and risks and suggesting plans for modifying risks improves the physician—patient relationship and helps uniformed personnel claim ownership of their health status. Individualized health risk appraisals also must include questions that attempt to accurately measure the uniformed personnel's perception of their health. Health perception can be a useful indicator of potential problems.

APPENDIX C

INFORMATION FOR REHABILITATION PROVIDERS

Firefighting tasks require a broad base of physiologic and functional skills for safe performance of the essential job functions. During the entire recovery process, from early healing/recovery to the functional/performance stages of rehabilitation, these broad skills need to be considered.

NFPA 1582 ***Standard on Comprehensive Occupational Medical Program for Fire Departments*** Chapter 9 section 9.1 outlines the fourteen (14) essential job tasks for members. However, of those fourteen tasks only eight are physical tasks which fall within the rehabilitation provider's scope of practice and are included below:

1. While wearing personal protective ensembles and self-contained breathing apparatus (SCBA), performing firefighting tasks (e.g., hose line operations, extensive crawling, lifting and carrying heavy objects, ventilating roofs or walls using power or hand tools forcible entry), rescue operations, and other emergency response actions under stressful conditions including working in extremely hot or cold environments for prolonged time periods.

2. Wearing an SCBA, which includes a demand valve-type positive-pressure face piece or HEPA filter masks, which requires the ability to tolerate increased respiratory workloads.

3. Depending on the local jurisdiction, climbing six or more flights of stairs while wearing fire protective ensemble, including SCBA, weighing at least 50 lb. (22.6 kg) or more and carrying equipment /tools weighing an additional 20 to 40 lb. (9 to 18 kg).

4. While wearing personal protective ensembles and SCBA, searching, finding, and rescue-dragging or carrying victims ranging from newborns to adults weighing over 200 lb. (90 kg) to safety despite hazardous conditions and low visibility.

5. While wearing personal protective ensembles and SCBA, advancing water-filled hose lines up to 2 ½" (65 mm) in diameter from fire apparatus to occupancy [approximately 150 ft. (50 m)], which can involve negotiating multiple flights of stairs, ladders, and other obstacles.

6. While wearing personal protective ensembles and SCBA, climbing ladders, operating from heights, walking or crawling in the dark along narrow and uneven surfaces that might be wet or icy, and operating in the proximity to electrical power lines or other hazards.

7. Unpredictable emergency requirements for prolonged periods of extreme physical exertion without benefit of warm-up, scheduled rest periods, meals, access to medication (s), or hydration.

8. Critical, time-sensitive, complex problem solving during physical exertion in stressful, hazardous environments, including hot, dark, tightly enclosed spaces that is further aggravated by fatigue flashing lights, sirens, and other distractions.

Early in the rehabilitation timeline, it is advantageous for the rehabilitation provider to contact the respective fire department of the fire fighters they are working with in order to achieve the following;

- ❑ Establish a working relationship with a department peer fitness trainer, if available.
- ❑ Review loaner functional equipment availability such as hose packs and SCBA frame/tank.
- ❑ Review the policy on having the fire fighter bring turnout gear (jacket, pants, boots, gloves, hood, and helmet) to the rehabilitation facility.

Fire service peer fitness trainers are trained to assess **aerobic capabilities**, **muscular strength and endurance**, **mobility and flexibility**, **power,** and **body composition**. The peer fitness trainer emphasis on firefighter fitness is focused on neutral joint postures and the respective muscular control and joint flexibility to safely perform tasks. Baseline fitness data may be available for comparison.

For advanced performance skills, the rehabilitation provider is encouraged to:

- ❑ Progressively add gear to simulate the joint/spine/soft tissue compression, distraction and shear forces.
- ❑ Assess impact task tolerance initially assessing speed without impact, modified impact (example: tire) and full impact, as able.
- ❑ Assess lower extremity weight acceptance skills with one/two feet, level and uneven surfaces.
- ❑ Train aerobic/anaerobic capabilities using partial and then full gear to assess heat acclimation skills.
- ❑ Review the ergonomics of clothing fit and function in relation to the joint and area of injury or medical condition

APPENDIX D

A COMPREHENSIVE BEHAVIORAL HEALTH PROGRAM

OVERALL CHARACTERISTICS

Within the fire service, a comprehensive behavioral health program can be configured in multiple ways. However, the programs follow similar principles:

- ❑ Adopt a holistic approach and integrate behavioral health into overall wellness
- ❑ Are a labor-management initiative
- ❑ Stress the importance of non-punitive programs
- ❑ Address a wide range of issues pertaining to behavioral health (e.g., substance abuse, stress management, marital concerns, post-traumatic stress, death/grief counseling)
- ❑ Work to reduce stigma associated with behavioral health issues and access to services
- ❑ Target active and retired uniformed personnel, as well as their families
- ❑ Provide short-term behavioral health counseling through an EAP, Behavioral Health Specialist, or other mechanism
- ❑ Arrange for ongoing behavioral health education as part of the regular training schedule and through multiple platforms, including web-based training and electronic communication (e.g., Facebook and Twitter).
- ❑ Refer to an extensive network of behavioral health professionals and other supports in the community
- ❑ Facilitate follow-up care and periodic maintenance visits to individual and their families
- ❑ Access a wide variety of 24-hour help sources (e.g., local offices of 24-hour hotlines and referral networks)
- ❑ Are proactive promote resiliency
- ❑ Make use of trained peers to provide support and serve as a bridge to services
- ❑ Utilize evidence-based interventions
- ❑ Rely upon dedicated funding source(s).

COMPREHENSIVE SERVICES

A comprehensive behavioral health program can offer counseling and supports through a variety of ways: (1) Employee Assistance Program, (2) Behavioral Health Standing Committee, (3) Behavioral Health Specialist, (4) Periodic Behavioral Health Evaluations, (5) Peer Support Team, (6) Chaplain Services, (7) Post-Incident Response, (8) Family Support and (9) Education. The following outlines the key elements of each of these components.

1. Employee Assistance Program

- ❑ May be internal or external organization run by the union, fire department or jurisdiction
- ❑ Guarantees complete confidentiality and assurance that job security or future promotional opportunities are not jeopardized
- ❑ Permits employees to have direct access to EAP services
- ❑ Utilizes mental health professionals who are trained in traumatic stress and behavioral health concerns specific to the fire service
- ❑ Provides follow-up care.

2. Behavioral Health Standing Committee

- ❑ Is a joint labor-management Standing Committee that provides leadership and continued focus on behavioral health concerns (e.g., policies that facilitate access to behavioral health treatment and protect privacy)
- ❑ Works collaboratively to address systemic gaps
- ❑ Obtains resources to support the development of a comprehensive behavioral health program.

3. Behavioral Health Specialist

Responsible for:

- ❑ Developing and coordinating the department's behavioral health program
- ❑ Providing direct counseling and/or refer individual to behavioral health care services
- ❑ Coordinating professional assistance from EAPs, contracted agencies and/or through individual's health plan
- ❑ Overseeing follow-up care and referrals, as needed
- ❑ Consulting with and helping direct the peer program

- ❑ Providing education on topics on stress management, suicide prevention, and resiliency.
- ❑ Licensed mental health professional with a Ph.D. or Master's degree
- ❑ Familiar with the unique stressors and culture of uniformed personnel
- ❑ Trained in crisis intervention; general stress; group processes; human communication skills; direct intervention strategies; Post-Traumatic Stress Disorder (PTSD); depression; managing retiree transition; suicide awareness and postvention; substance abuse; alcoholism; family therapy and physiological bases of behavior.

4. Periodic Behavioral Health Evaluations

- ❑ Incorporate into annual medical examination
- ❑ Ask about behavioral health concerns on a regular basis (e.g., questions about stress management, substance use, and family issues)
- ❑ Provide follow-up information and support to address any concerns raised
- ❑ Ensure that evaluations, records and any follow-up support are confidential.

5. Peer Support Program

- ❑ Train members to provide support to their peers and offer behavioral health education
- ❑ Seek guidance and training regularly from designated behavioral health clinician
- ❑ Develop a robust list of community resources
- ❑ Arrange for continuing education for peers.

6. Chaplain Services

- ❑ Select local clergy person or internal chaplain to provide emotional and spiritual support to members
- ❑ Help members and their families deal with crisis situations and refer to available resources
- ❑ Use a non-denominational approach.

7. Post-Incident Response

- ❑ Have a system in place to respond to potentially traumatic events
- ❑ To be effective, response must be voluntary and tailored
- ❑ May provide pre-incident education and preparation; on-scene support services; large group interventions; small group intervention; individual crisis intervention; pastoral crisis intervention; family support services; organizational and staff consultation; post-incident education; and follow-up and referral.

8. Family Support

- ❑ Provide support and education to spouses, children and other family members
- ❑ Begin at the recruitment stage and continue through retirement
- ❑ Provide uniformed personnel with education and referrals to help with family well-being

9. Education

- ❑ Is integrated into department's regular training schedule
- ❑ Utilizes electronic education, including web-based trainings
- ❑ Helps to reduce stigma.

International Association of Fire Fighters
Division of Occupational Health, Safety, and Medicine
1750 New York Avenue, NW
Washington, DC 20006
202.737.8484
202.737.8418 (Fax)
www.iaff.org

International Association of Fire Chiefs
4025 Fair Ridge Drive, #300
Fairfax, VA 22033-2868
703.273.0911
202.273.9363 (Fax)
www.iafc.org