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A NEEDS ASSESSMENT:  
BARRIERS TO WILDLAND FIREFIGHTER FITNESS TRAINING

By

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Bachelors of Arts, University of Montana-Western, Dillon, Montana, 2011

Thesis

Presented in partial fulfillment of the requirements for the degree of

Master of Science

Health and Human Performance

The University of Montana Missoula, Montana

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Health and Human Performance

A Needs Assessment: Barriers to Wildland Firefighters Fitness Training

Chairperson: Dr. Annie Sondag

**Introduction:** Working on a wildland fire can be physically and mentally taxing. Given the physical demands of the job, fitness is a key component in keeping wildland firefighters (WLFFs) healthy and safe from injury. Unfortunately little is known about physical training (PT) programs of WLFFs.

**Purpose:** The purpose of this study was to examine motivators and barriers to PT in WLFFs. Personal, interpersonal, organizational and environmental factors that influence PT were identified. Strategies for overcoming barriers were recommended.

**Methods:** This study utilized a descriptive research design. Information about PT practices was collected through interviews with key informants (i.e. individuals in leadership positions who work directly with crew members). Interview data was analyzed qualitatively. Additionally, a questionnaire based on information from the interviews was developed, reviewed by experts, pilot tested and distributed electronically to WLFFs. Questionnaire data was entered in the SPSS statistical program. Barriers and motivators to engaging in PT among crew type were examined for differences.

**Results:** Sixteen interviews were conducted with key informants from multiple state, federal and volunteer agencies. Two over-arching concepts emerged from interviews as major influences on PT. The first concept, firefighter culture, encompassed several themes. Themes included the *powerful influence of leadership* and the *desire to be seen as a strong, capable and dependable crew member*. The second concept, environment, included the influence of factors such as *training facilities and equipment* and the need for *more education about PT*. Questionnaire results from over 1000 firefighters reveal the most frequently identified barrier to PT to be *projects and work related trainings taking precedence over PT*. Multiple motivating factors were identified including *having a supervisor that participates in PT* and *wanting to be seen as a strong crew member*.

**Conclusions:** This project was an attempt to gain an understanding of the current PT practices of WLFFs. More importantly, results from this study identify, from the perspective of the firefighters themselves, the major motivators and barriers to engaging in quality, consistent PT.

## **Acknowledgements**

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## **Chapter One:**

### **Introduction to the Study:**

Working on a wild land fire can be physically and mentally taxing. Wildland firefighter (WLFF) crews may work up to 24 hours in a single shift during an initial attack resulting in consistently high daily energy expenditure during wild fire suppression (Ruby, 2002). Higher exercise strain has been associated with the many activities carried out under extreme conditions during initial attack. Engaging in multiple tasks under extreme conditions requires firefighters to be physically fit (Rodriguez, 2011).

High levels of physical fitness have been shown to have multiple benefits. Improved mental acuity, fewer heart attacks, less risk of diabetes and reduced stress are some of the benefits of high fitness levels. (Sharkey and Gaskill, 2007). In other high stress jobs, like the military, physical fitness has been shown to buffer stress symptoms secondary to extreme stress (Marcus et al. 2008). Additionally, fit individuals achieve higher work capacity. Work capacity is an individual's ability to accomplish production goals without undue fatigue, and without becoming a hazard to oneself or coworkers. It is a complex composite of aerobic and muscular fitness, natural abilities, intelligence, skills, experience, acclimatization, nutrition, and motivation (Sharkey and Gaskill, 2009).

Although WLFFs may be physically fit injuries still occur. In a study done by Britton et al. (2013) injuries were examined among WLFFs between the years of 2003-2007 were examined. This study found that the age range at which injuries occur were from 17 years to 65 years of age. Britton et al. (2013) also found that Engine crews and Type 1 crews had the largest proportions of injuries to young firefighters. Overhead and camp crews had the largest proportion of injuries reported among older firefighters. The majority of injuries across all fire jobs were reported in July-September, which is consistent with the peak of fire season. The majority of these injuries were significantly associated with job assignments. The two most common causes

of injuries were slips/trips/falls and equipment/tools/machinery. These injuries accounted for 40% of the listed injuries. Sprains and strains comprised 45% of the most commonly reported injuries among WLFFs.

Other factors such as heart attacks significantly increase when volunteer firefighters are participating in wildland fire suppression. Heart attacks accounted for 3.2 fatalities/year from 1990-1998 and 4.9 fatalities/year from 1999-2006. This is a 51% increase in the annual average incidence. Heart attacks are even more prevalent among volunteer firefighters. Forty-four of the sixty-eight heart attack deaths, or 65% of all heart attack fatalities related to firefighters were among volunteers (Sharkey, 2008).

With goals to reduce injury, improve work capacity and overall safety, PT programs are crucial. Physical training programs in other professions, like the military, have been examined to discover what promotes and prevents members from exercising and maintaining physical fitness. Some of these studies have targeted fire crews, however, no studies were found that examined WLFFs' motivations and barriers to participating in PT. Understanding factors that serve as motivators and those that serve as deterrents to maintaining a high level of physical fitness will be useful in designing fitness programs that meet the needs of today's WLFF crews.

### **Purpose of Study:**

The purpose of this study was to examine facilitators and barriers to fitness training in WLFFs in the United States. Intrapersonal, interpersonal, institutional, community and societal factors that influence fitness training among WLFFs were assessed. This assessment describes the strengths of the current training program and identifies strategies for overcoming existing barriers.

### **Statement of Problem:**

Physical injuries among WLFFs are high. The majority of physical injuries take place while on the fire line or at work (Britton, 2012). While research demonstrates that physical fitness increases muscular strength reduces the risk of heart attacks among firefighters (Sharkey and Gaskill, 2009), not much is known about the PT regimen of WLFF personnel. This study examined firefighters' current fitness regimes and their barriers to consistent participation in Fire Fit and other programs designed specifically for WLFFs.

### **Significance of Study:**

Results from this study will be made available to the National Wildfire Coordinating Group and other agencies to enhance current understanding of PT programs, barriers to participation, and facilitators of PT of WLFF personnel. Information may be used to revise current fitness programs with the goal of increasing participation in those programs in all federal, state, and contract departments in the U.S.

### **Research Questions:**

1. What are the current fitness training regimens of WLFFs?
2. What are firefighters' perceptions of current fitness programs such as Fire Fit?
3. What are the barriers to participation in current physical fitness training programs?
  - a. What are the intrapersonal barriers?
  - b. What are the interpersonal barriers?
  - c. What are the community barriers?
  - d. What are the policy barriers?
4. What factors motivate firefighters to participate in physical fitness training programs?
  - a. What are the intrapersonal motivators?
  - b. What are the interpersonal motivators?

- c. What are the community motivators?
- d. What are the policy motivators?
- 5. What is the relationship between crew type, gender, age, time spent in PT and injury?
- 6. What are the differences in barriers and facilitators to PT:
  - a. among crew types?
  - b. between gender?

### **Definition of Terms:**

**Needs Assessment:** A needs assessment is a planned process that identifies the reported needs (whether real or perceived) of an individual or a group (Gilmore & Campbell, 2005). Identifies gaps between what exists and what ought to exist so programs can be designed to reduce these gaps.

**Intrapersonal Factors:** consist of knowledge, attitudes, beliefs, personality traits, skills, perceptions, self-efficacy

**Interpersonal Factors:** relating to physical fitness and training will be things such as relationships with relatives, friends, co-workers, and peers.

**Organizational/Institutional Factors:** rules, regulations, and institutional policies; i.e. flex time, access to health programs and facilities, healthy food selections, incentives for participation, etc

**Community Factors:** social networks, norms or standards of behavior that exist formally or informally

**Key Informants:** Persons who are knowledgeable about the issues being researched and able and willing to communicate with the researchers about them. They are utilized when more in-depth information is needed than can be acquired from the population being studied.

**Snowball sampling:** A recruitment technique in which research participants are asked to assist researchers in identifying other potential participants.

**USFS:** United States Forest service

**BLM:** Bureau of Land Management

**BIA:** Bureau of Indian Affairs

**FWS:** Fish Wildlife Services

**NP:** National Park Service

**DNRC:** Department of Natural Resources and Conservation

**PT:** Physical Training

**NRCC:** Northern Rockies Geographic Area Coordination Center

**NWCG:** National Wildfire Coordinating Group

**WLFF:** Wildland Firefighter

#### **Delimitations:**

The study was delimited to individuals age 18 or older who live in the United States and participate in wildfire suppression and management.

Data collected from key informant interviews was done in person and over phone. Key informants were individuals age 18 or older who live in the Montana and participate in wildfire suppression and management.

Data collected for the questionnaire was collected online from individuals in the fire community.

Data collected from participants was restricted to self-reports.

Participants in the study were volunteers who could discontinue involvement at any time, at their own discretion.

### **Limitations:**

Data collected from the interviews and online questionnaire were limited to the experiences and opinions of the participants

Data collected was limited to the participants' honesty, openness, memory recall, and willingness to share.

Data collected from key informants was limited to those individuals who responded to the solicitation of interviews e-mail sent out by researchers.

Data collected from the questionnaire will be limited to those individuals who received access to the questionnaire via key informant, researcher, or other participants and voluntarily completed the questionnaire.

Data collected is not equally representative of all agencies due to higher participation from some agencies and little to no participation by others.

## **Chapter Two:**

### **Literature Review**

This literature review is divided into four sections. The first section consists of a description of the Socio-Ecological Model of behavior change and its role in designing a needs assessment. The second section describes the various organizations and personnel that are involved in fighting wildland fires. Section three reviews the literature regarding the importance of physical fitness and the potential consequences of poor fitness levels. Section four provides an overview of the research conducted examining the barriers and motivators to engaging in PT in firefighters and other professions that require a high level of physical fitness.

#### **Socio-ecological Model:**

Traditionally, health promotion programs focused primarily on attempting to influence individuals' behaviors by impacting their knowledge, attitudes and beliefs. Not much attention was focused on the social, cultural and environmental factors that also are major determinants of behavior. A growing awareness of the multiple factors that impact health led to the development of the socio-ecological model (Edberg, 2015). In this model, the internal and external factors that influence behavior are presented as levels. These levels are often depicted as concentric circles with the smallest circle representing the internal or individual factors that influence health. Subsequent circles represent factors that are external to the individual such as interpersonal, institutional, community and policy levels of influence on behavior (Hayden, 2009).

As depicted in figure 1, intrapersonal level includes factors that influence an individual on a personal level. These factors are items such as knowledge, attitudes, behaviors, self-concept, skills, and developmental history. The interpersonal level assess at how an individual's interaction with their social surrounding affects their health behavior. The interpersonal level depicts the social interactions with family, peers, work groups, social networks, and social

support systems both formal and informal. The institutional factors consist of institutional and organizations rules and regulations for operating. These can be both formal and informal rules and regulations. The community factors that are observed in the socio-ecological model are interactions and relationships among institutions and organizations. The last area studied in the socio-ecological level is public policy. Public policy considers local, state, and national laws and policies and how these items influence health behavior.

Since behavior does not occur in a vacuum, using the Socio-ecological Model as a guide for developing health promotion programs ensures that the program will address multiple layers of influences on behavior. Health promotion programs based on socio-ecological models have been used with success in a multitude of settings, including worksite initiatives (Hayden, 2009).

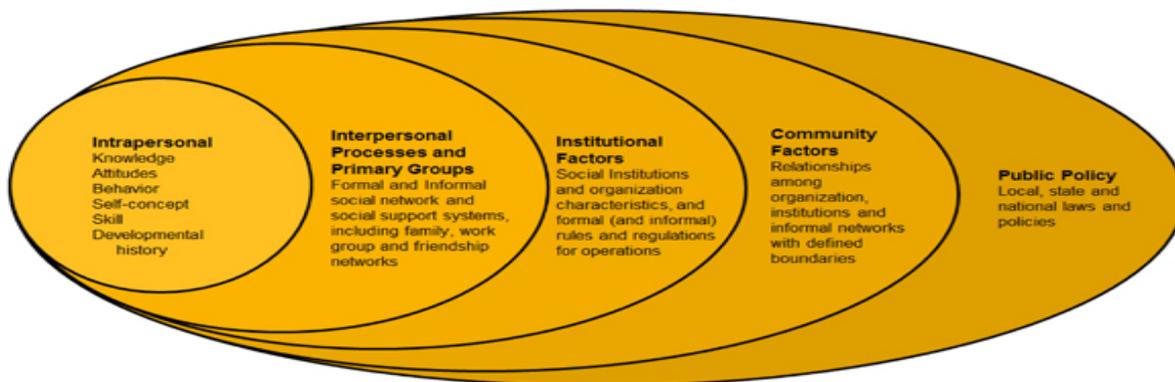


Figure 1. Socio-Ecological Model

### **Organizations and Personnel Involved in Wildland Firefighting:**

Within the Greater Northern Rockies Region there are multiple agencies within the federal government responsible for handling wild fires. The U.S. Forest Service, Bureau of Land Management, National Park Service, Bureau of Indian Affairs, and U.S. Fish Wildlife Service each

have wildland fire programs. In addition to the federal wildland fire programs the state of Montana has the Department of Natural Resources and Conservation. Other individuals typically seen fighting wildland fires are from private contract firefighting companies, local volunteer fire departments, and administratively determined (AD) persons hired and compensated under the Pay Plan for Emergency Workers (NWCG, 2012).

Wildland fire fighters may be volunteers, temporary seasonal, permanent seasonal or permanent employees that work on handcrews, engines, hotshot crews, helitack crews, helireplier crews, smoke jumper crews, and fire module crews. Smoke jumpers, hotshots, and helitack crews are seen as type 1 crews. Smokejumpers, hotshots, and helitack crews, typically have higher fitness levels, more experienced crew members, and more physically arduous jobs and are utilized more in initial attack than type 2 crews. Type 2 crews typically are made up of less experienced crew members. Although type 2 crews may participate in initial attack, they are utilized more in mop-up scenarios in which they extinguish or remove burning material near control lines, fell snags, and trench logs to prevent rolling after an area has burned, to make a fire safe, or to reduce residual smoke (NWCG, 2012). Positions on both type 1 and type 2 crews can be physically demanding. Not only do both crews hike while carrying their packs, hand tools, chainsaws and at time pumps, but they also clear brush, construct fire line, back burn and mop-up. All of these activities require a high level of fitness and high energy expenditure. Resource typing, in others words, designating crews as type 1 or 2, provides managers with additional information in selecting the best crews for various tasks (NWCG, 2012).

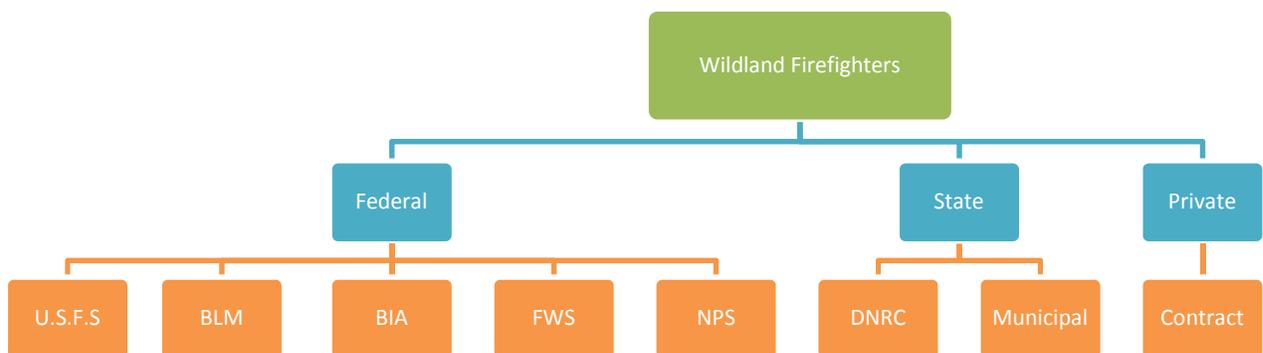


Figure 2: Organizations involved in WLFF

## **Physical Fitness:**

Fighting fires is a physically demanding job, and therefore, fitness is a necessity to work on the fire line. Physical fitness is a key component in keeping occupational athletes such as WLFFs healthy and safe from injury. Understanding factors that serve as barriers and motivators to maintaining a high level of physical fitness will help organizations that employ WLFFs design programs that motivate firefighters to maintain a high level of fitness.

### *Benefits of physical fitness:*

Working on a wild land fire can be physically and mentally taxing. Wildland firefighters have consistently high daily energy expenditure during wild fire suppression (Ruby, 2002) and must be able to engage in multiple tasks under extreme conditions. Initial attacks are particularly associated with higher exercise strain (Rodriguez, 2011). Fire crews may work up to 24 hours in a single shift during an initial attack.

High levels of physical fitness have been shown to have multiple benefits. Having higher physical fitness can result in improved mental acuity, fewer heart attacks, reduced risk of diabetes, and improved ability to handle stress (Sharkey and Gaskill, 2007). In other high stress jobs, like the military, physical fitness has been shown to buffer stress symptoms secondary to extreme stress (Marcus et al. 2008). In addition, fit individuals achieve higher work capacity. Work capacity is an employee's ability to accomplish production goals without undue fatigue, and without becoming a hazard to oneself or coworkers. It is a complex composite of aerobic and muscular fitness, natural abilities, intelligence, skills, experience, acclimatization, nutrition, and motivation (Sharkey and Gaskill, 2009).

### *Measuring the physical fitness of firefighters:*

The pack test is the only standardized test used to measure physical fitness with the exception of smokejumpers that have a standardized fitness test. All WLFFs are required to pass the pack test. The pack test, according to the NWCG, is used to determine the aerobic capacity of fire suppression support personnel and assign physical fitness scores. The test consists of walking

three miles with a weighted pack, in 45 minutes, with altitude corrections. Once firefighters pass the pack test, and go through fire refresher training, they receive their red card qualifying them to be on the fire line. However, firefighters need only pass the pack test once a year and yet they need to maintain a high level of fitness throughout the entire fire season. Working under extreme conditions of heat, weather, and topography, WLFFs need to be physically fit to manage to maintain a high work capacity in these conditions and to reduce the risk of injury, heat illnesses, and heart attack.

*Injuries:*

Although WLFFs may be physically fit injuries still occur. In a study done by Britton et al. (2013) injuries were examined among WLFFs between the years of 2003-2007. This study found that the age range at which injuries occur were from 17 years to 65 years of age. Britton et al.(2013) also found that Engine crews and Type 1 crews had the largest proportions of injuries attributed to young firefighters. Overhead and camp crews had the largest proportion of injuries to older firefighters. The majority of injuries across all fire jobs were reported July-September. This timing is consistent with the peak of fire season. The majority of these injuries were also significantly associated with job assignments. The two most common causes of injuries were slips/trips/falls and equipment/tools/machinery. These injuries accounted for 40% of the listed injuries. Sprains and strains consisted of 45% of the most commonly reported injury among WLFFs.

Other factors such as heart attacks significantly increase when volunteer firefighters are participating in wildland fire suppression. Approximately 100 volunteer firefighter deaths occur every year; about 45% of these deaths are caused by coronary heart disease (Scanlon and Ablah, 2008). Heart attacks accounted for 3.2 fatalities/year from 1990-1998 and 4.9 fatalities/year from 1999-2006. This is a 51% increase in the annual average. Volunteer firefighters accounted for 44 of the 68 heart attack deaths, or 65% of all heart attack fatalities on relating to fire (Sharkey, 2008). It is speculated volunteers are more prone to heart attacks because they are generally older than WLFFs and typically do not have the extremely high standards of physical fitness associated with WLFFs (Sharkey 2008).

## **Physical Fitness Training Barriers and Motivators:**

With goals to reduce injury, improve work capacity, and overall safety, PT programs are crucial. Physical training programs in other professions, like the military, have been examined to discover what is promoting and preventing members from exercising and maintaining physical fitness. Some of these studies have targeted fire crews, however, no studies were found that examined WLFF.

Staley et al. (2011) examined determinates of firefighters physical fitness in regards to their culture and coronary risk salience. Multiple factors surfaced through focus groups and personal interviews conducted by the researcher. Community and cultural barriers to adhering to PT were identified and similar among various crews and crew members. The most common barriers identified included lack of encouragement and support from supervisors to participate in PT and other nonresponse tasks (e.g. continuing education, public relations events, and daily job tasks) would take priority over PT.

In a similar studies, Staley et al. (2011) and Mayer et al. (2013) evaluated barriers and facilitators to firefighters' physical fitness at their worksite. Barriers such as lack of self-motivation to exercise, lack of peer support, and lack of time to exercise during the work shift were cited as reason for not practicing PT. The barriers and facilitators were broken down to intrapersonal, interpersonal, and organizational factors.

Intrapersonal factors included firefighters' knowledge about the importance of PT in relationship to their job and overall health. Firefighters agreed about the benefits of PT regardless of age or gender (Staley et al. 2011). However, some still lack the motivation to participate in PT. Factors that motivated individuals to engage in PT on an interpersonal level were education and periodic reminders about the specific health benefits of exercise, emphasizing the link between exercise, physical fitness, and job performance, providing individual incentives for exercise adherence and performance, and periodically changing the exercise routine (Mayer et al 2013).

Larger interpersonal influences to PT were leadership and peers. Often times a fitness norm is developed in an unspoken manner by the captain, or top management level's shared expectation, standard, or rule of what action is right in terms of physical fitness behavior and/or PT participation (Staley et al 2011). Due to this interpersonal interaction with their supervisor, participants noted they were more motivated to participate and adhere to PT when a form of management participated with the crew or promoted PT. The opposite of this is true as well. Some firefighters acknowledged they did not follow the mandated PT programs because they were not enforced (Staley et al, 2011).

Another significant interpersonal impact to PT were peers. Staley et al (2011) and Mayer et al. (2013) both acknowledge a high amount of camaraderie among firefighters and the substantial influences their social network, among peers can have on PT. Firefighters indicated they were more likely to engage in PT when their colleagues also participated and less likely to participate in PT without peer support (Staley et al, 2011; Mayer et al, 2013). Staley et al (2011) found because of crew camaraderie, crew members felt a need to be dependable and have dependability. Dependability implies having the ability to consistently rely on crew members during a response. Maintaining dependability and being able to perform job requirements well without harming oneself or others, was motivator for PT participation.

When assessing organizational factors multiple barriers were perceived. These barriers consisted of uncontrolled temperature, odors or fumes from the work facility, availability of time, space, and the quality or lack of equipment to exercise also affected personal motivation. However, focus group participants suggest an organizational motivator for PT is having the allotted time to exercise. (Staley, 2008; Mayer et al, 2013).

#### *Military personnel and fitness:*

Recently in the military there has been a rise in overweight members. There has also been a decline in the number of recruits and members who pass the physical readiness test (PRT) due to poor physical fitness and obesity (Anderson and Auld, 2005; Kelly and Schroeder 2000). Kelly and Schroeder (2000) looked at multiple barriers to exercise among naval men and women who

passed and those who failed the PRT. To determine if an individual passes or fails the PRT they are scored on how fast they can run a mile and half, and how many sit-ups and push-ups they can perform in two minutes. The results were ranked from high to low and given points. Individuals who receive low points are seen in the failing group, individuals given high point are seen as passing. Any male or female not meeting the height to weight ratio requirements are placed into a delayed entry program.

Results from the study revealed that the groups differed on exercise behaviors with the PRT pass group doing more aerobic exercising than the PRT fail group. Of those subjects who self-reported engaging in aerobic exercise the odds were 100% more likely that they would pass the PRT and be physically fit (Kelly and Schroeder 2000).

In a second study by Kelly and Schroeder (2002), the researchers used level of education, race, rank, weight, gender and aerobic exercise as predictors of physical fitness. Their findings indicate that the odds of being physically fit and passing the PRT were three times greater for females and four times greater for the subjects who held a college degree relative to those with only a high school diploma. Being overweight increased the odds of not passing the PRT by 92%. The failed PRT groups were more sedentary. However both groups pointed out things like the bad weather or not being close enough to a fitness facility for their reduced efforts to exercise (Kelly and Schroeder 2002).

Anderson and Auld (2005) examined senior military officers' educational concerns, motivators and barriers for healthful eating and regular exercise. This study determined the main barrier to eating healthy and working out was lack of time. Respondents from this study stated "They were too busy to maintain a regular exercise program." The other barriers to maintaining fitness were a dislike of exercise, and the non-availability of a fitness facility within close proximity. Kelly and Schroeder (2002) found similar barriers and motivators in their study. Perceived barriers stated by naval personnel were they were too busy, there was not enough time to work out, and exercising interferes with work assignments. The primary motivators were appearance, health, and passing the military's body fat standards. Having social support

and fitness facilities were also seen as motivators (Kelly and Schroeder, 2002; Anderson and Auld, 2005).

### **Summary:**

Wildland firefighters are faced with physically demanding jobs. Being in good physical shape is important in increasing muscular strength, improving work capacity and mental health. However, aside from the pack test, there are no fitness standards in place for many of the WLFF crews.

Studies examining other professions requiring high levels of fitness like the military and municipal fire departments, found common barriers to participating in fitness regimes. Barriers included factors such as the weather, lack of access to fitness equipment and facilities, lack of time, lower education level, dislike of exercise, lack of leadership involvement in PT, peers who do not engage in PT and lack of enforcement of mandated PT programs.

Common motivators to maintaining physical fitness were the desire to pass fitness tests, maintaining or improving health, maintaining an attractive personal appearance, social support for exercise, wanting to be seen as dependable and, being able to perform job requirements well without harming oneself or others, and competitive PT. Identifying common barriers and motivators to fitness among WLFFs will be helpful in the development of programs that meet the unique needs of this population.

## **Chapter Three:**

### **Methodology:**

#### **Description of Target Population:**

Individuals assessed in this study included people over the age of 18 who were WLFFs at the time of the study. WLFF are individuals who are trained in management response to wildfire, escaped wildland fire use, and prescribed fire. The appropriate management response results in curtailment of fire spread and elimination of all identified threats from the particular fire (NWCG). The WLFF community assessed included multiple federal agencies as well as state funded agencies, contract crews and volunteers. The agencies involved in this study are: Forest Service, Bureau of Land Management, Bureau of Indian Affairs, Fish Wildlife and Parks, National Parks Service, Department of Natural Resource Conservation, State contract crews, and local volunteer fire departments in the United States.

#### **Study Design:**

This assessment of the fitness training needs of WLFFs utilized the Socio-ecological Model as a structure for the development of research questions, the interview guide, and survey. The Socio-ecological Model is based on the concept that health behaviors are influenced by both internal factors such as beliefs, attitudes and skills, as well as by external factors such as the social and physical environment, social supports, role models and rewards. The basis of this model is the recognition that there exists a dynamic interplay among all levels of factors. The model suggests that the identification and targeting of factors that affect behavior on multiple levels is more effective than single level approaches (Hayden, 2009). Through this model we identified factors that hinder and facilitate the maintenance of a fitness regime on multiple levels, and by addressing the most salient factors we suggest ways to improve adherence to PT regimes among the WLFF community.

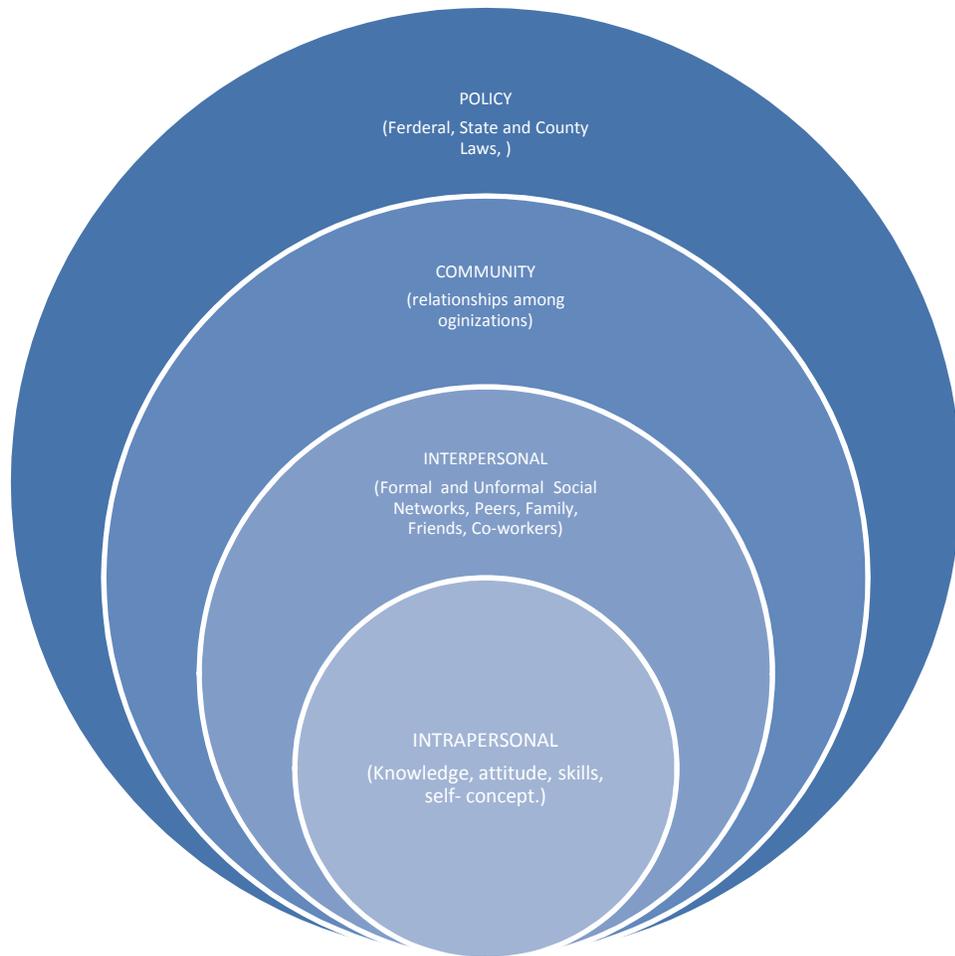


Figure 3. An illustration of the socio-ecological model used to structure this study.

This study utilized a mixed methods descriptive research design. Primary data was collected through interviews with key informants. Key informants included individuals in leadership positions who work directly with crew members and make influential decisions for the crew. In addition, primary data was gathered through a survey distributed online to WLFF in the U.S. Secondary data was gathered from existing documents including procedures manuals, journal articles and online resources.

## **Key Informant Interviews:**

### **Population:**

The key informant population consisted of current crew leads and supervisors with multiple years of experience in the WLFF community. Assistant fire management officers (AFMOs), Crew bosses, Engine bosses, Assistant crew/ engine bosses, and squad bosses from the federal, state, and contract crews were contacted and interviewed. All these positions are found in the various agencies with similar responsibilities. These particular leaders were interviewed because they spend the most time with the crew members and seem to have an influential role on the crew members' overall fitness routines and practices.

### **Sample Selection:**

Key Informants: Initially, a convenience sample of two or three key informants who are known to the researchers were contacted by phone or e-mail, briefed regarding the purpose of the study, and asked if they would like to participate in an interview. Additional participants were recruited using snowball sampling. Snowball sampling is a method by which known key informants will recommend and provide further contact information for other willing participants who fit the key informant description. By using the snowball sampling method the sample continued to develop throughout the course of the interviews. Interviews continued until data saturation occurred.

### **Instrument Development:**

The first source of primary data was the key informant interviews. The interview questions were structured based on the categories outlined in the Socio-ecological Model. The interview guide solicited information regarding the interviewee's perspectives on the current fitness training programs, and the barriers to participation in those programs, as well as perceptions of factors that might encourage participation (See Appendix). Main questions were followed by

probes in order to elicit more in-depth information. The key informant interview guide can be found in the appendix.

### **Data Collection:**

Interviews took place in the spring and summer of 2014. Sixteen interviews were conducted involving key informants from employees in federal, state, and contract agencies within the Greater Northern Rockies Region. Interviews were conducted both in-person and over the phone.

Key informants who agreed to an in-person interview identified a convenient meeting time and place for the interview. At the beginning, the key informant was provided with a verbal description of the study, a copy of the interview questions, and a demographic form (see Appendix). The demographic form provided information such as age, gender, years of experience and location and type of agencies for which the key informants work.

Key informants who were unable to meet in-person participated in a phone interview. The demographic form and the interview questions were e-mailed to the individuals prior to the interview. Phone interviewees were asked to complete and return the demographic form or were asked the demographic questions at the start of the interview.

The interviews lasted 30 minutes to one hour, were audio recorded, and then transcribed verbatim. After double-checking the transcription for accuracy the audio file were destroyed. Names of key informants are not connected to the data.

Upon completion of the interview a contact summary sheet was completed to record general information about the key informant and interview, such as meeting time, date, and location, age, gender, and qualifications for being included in the sample pool. An example of the contact summary sheet can be found in the appendix.

### **Data Analysis:**

The data collected from the interviews were analyzed both qualitatively and quantitatively. The quantitative information from the demographic forms was entered into SPSS 22 and reported descriptively. Frequencies were reported by actual count. Tables and graphs were used to illustrate the frequencies and relationships among variables when appropriate.

Analysis of the interview data was based on qualitative research techniques (Creswell, 1998). The interviews were recorded and notes taken. Immediately following the interviews, the interviewer recorded on a contact summary sheet general impressions of the interview process including length of interview, location, a general physical description of the interviewee, and any notable or unusual circumstances. The recordings were transcribed completely and compared to the notes to check for accuracy. The first part of the analysis involved reading the transcriptions through numerous times and creating coding schemes. The coding schemes were then given to a secondary coder to check for intercoder reliability. The coding scheme was then used to identify themes, patterns, perceptions and ideas presented by the participants. Furthermore, this step included the identification of unusual and significant information. Emergent themes and concepts were organized into separate categories. Lastly, the emergent themes were compared and condensed into overall themes.

### **Survey:**

#### **Target Population:**

The target population included individuals over the age of 18 who participate in managing or suppressing wildland fire. Each firefighter passed the pack test and was red card qualified. Thousands of employees work for these agencies. Attempts were made to solicit survey participation from the majority of these firefighters as well as from the volunteer crew members. Survey participants were from the United States and worked for a federal, state, volunteer, or contract fire crews.

### **Sample:**

On-Line Survey Sample: Supervisors and other employees in each bureau were asked to distribute the on-line survey to firefighters via e-mail. E-mail lists were kept confidential. The sample populations received an e-mail invitation from their supervisors to take the survey. The e-mail included a link to the online survey and a summary of the purpose of the survey.

### **Instrument Development:**

The survey was developed to include questions related to each of the four levels of the Socio-ecological Model. Results from the key informant interviews were utilized to inform the development of survey questions targeted at gaining insight into the internal and external barriers and motivators to participation in fitness training regimens. When completed, the survey was reviewed by a panel of experts consisting of university faculty and forest service administrative staff. Once reviewed, the survey was pilot tested with members of the target population, and revised based on the feedback from the pilot test. Both paper copies and on-line copies of the survey were available to participants.

### **Data Collection:**

On Line Surveys: Supervisors who were known to the researchers were asked to distribute the surveys. If a supervisor agreed to participate, he or she was sent a link to the Survey Monkey survey. The supervisor was asked to e-mail the survey link to their firefighter employees along with a request to complete the survey. The e-mail included information about the purpose of the study and a reminder that participation in the survey, while strongly encouraged, is voluntary. Responses to the survey remain anonymous so employees were not concerned about repercussions of refusing to respond to the survey or of responding in ways that might antagonize the administration.

### **Data Analysis:**

Data analysis began once the survey closed on December 31<sup>st</sup>, 2014. Survey responses from Survey Monkey were entered into SPSS (IBM Version 22) statistical analysis program.

Descriptive data including frequencies and crosstabs were calculated. Mean differences in barriers and facilitators to physical activity and crew type were examined using Chi-Square and Crosstabs. The relationship between injuries and crew type also were examined. Charts and graphs were used to illustrate findings when appropriate.

### **Synthesis of Interview and Survey Data:**

The data for this study was gathered through written documents, key informant interviews, and survey responses. Interview data initially was used to structure the survey questions. After the survey data was analyzed, the qualitative interview data was used to add depth and meaning to the quantitative survey responses. Based on these findings, recommendations for improving participation rates in training programs will be made to the National Wildfire Coordination Group.

## Chapter 4:

### Results:

#### Key Informant Interview Results:

##### Introduction:

Sixteen key informant interviews were conducted during the time period from May to July 2014. Eleven were conducted in person, two were by phone and three were written responses developed after reading the interview questions. The length of the interviews varied greatly with some interviews lasting 45 minutes while other interviews were less than 15 minutes. All interviews took place in USFS Region 1 including Montana and Northern Idaho. Seven interviews were conducted in southwest Montana. Six interviews took place in northwest Montana. Three interviewees were from central Montana.

##### Demographics:

An effort was made to interview individuals from multiple state and federal agencies whose employees are involved in fighting wildland fires. All individuals were qualified to fight wildland fires and were in some form of leadership role within their agencies and work with other individuals who fight fire. Table 1 provides details about the age, gender, agency and position of the key informants.

<u>Age</u>	<u>Gender</u>	<u>Agency</u>	<u>Position</u>
36	F	USFS	Assistant Handcrew Boss
39	M	USFS	Squad Boss
25	M	USFS	Squad Boss
32	M	USFS	Handcrew Boss
29	M	USFS	Squad Boss
44	M	USFS	Engine Boss
33	M	DNRC	FMO/Supervisor
31	M	DNRC	Engine Boss
35	M	DNRC	Engine Boss
59	M	DNRC	Safety Officer
26	M	DNRC	A.Engine Boss
31	M	Volunteer	Chief of Fire Department
46	M	Volunteer	Chief of Fire Department
51	M	NPS	FMO/Supervisor
43	M	US Fish Wildlife Service	Law Enforcement Officer
31	M	US Fish Wildlife Service	CrewBoss/Engine Boss

**Themes:**

**Introduction:**

Analysis of the data from 16 key informant interviews revealed two overarching concepts and 12 major themes related to barriers and motivators to participating in PT. The Socio-Ecological Model was used as a means of organizing the themes. Table 2 below identifies the themes in relationship to the levels of the model. Three themes fell in the intrapersonal level; four fell in the interpersonal level; three were categorized as belonging to the institutional/community level and one addressed policy level.

Table 2. Socio-Ecological Model of Overarching Concepts: Cultural Influences and Environmental Influences			
<b>Intrapersonal</b>	<b>Interpersonal</b>	<b>Institutional/ Community</b>	<b>Policy</b>
Culture: Desire to be seen as dependable	Culture: The Powerful Influence of Leadership	Environment: Physical Training Facilities and Equipment	Environment: Paid Time to Participate in Physical Training
Culture : The Prestige of being a Wildland Firefighter	Culture: The Crew’s Influence on Individuals Attitudes	Environment: Project Work and Trainings Take Precedence Over PT	
Culture: Physical and Emotional Fatigue	Culture: Competition as a Positive Force  Environment: Influences of Factors Outside of Work	Environment: The Need for Education About PT and Healthy Living	

## **Overarching Concept #1: Cultural Influences on Physical Training:**

Culture can be defined as the set of shared attitudes, values, goals, and practices that characterize an institution or organization (Merriam-Webster, 2014). Knowledge about the culture of WLFFs is critical to understanding their PT practices both during both fire and off season. Major themes associated with firefighter culture are described below.

**Theme #1: The Powerful Influence of Leadership:** Individuals are often more motivated and work harder when supervisors participate, encourage, and set precedence for PT. Often individuals want to work their way into a leadership position on a fire crew and see taking initiative to maintain physical fitness and lead PT as an opportunity to be viewed as dependable and reliable to co-workers and supervisors.

The Fire Management Officer (FMO) of a DNRC office expressed the importance of leadership and how leadership reflects in PT and work:

“As a supervisor I want to show up to a fire grab a Pulaski and put myself in the ff2 role and help them and to do that you need to be in shape to keep up and dig line..... I have to stay in shape so my crew says “I have to stay in shape because my boss is in shape.” It goes more towards the fire line leadership. I don’t see it so much in PT but more on fire.”

A Squad Boss for a district Forest Service hand crew, former hotshot, with several years of fire experience explained how a crew boss’ expectations can create a culture that motivates individuals to demonstrate their leadership potential:

“Yeah I think its [PT] a big thing. It depends on your crew, but like with my current crew being a PT crew, the crew bosses reflect highly on people being in good shape. I think it [PT] helps if you want this to be your career, if you want to go far with it, to set the example to not be injured and kind of lead the way and show that you’re a leader and help you move up and kind of have a good reflection upon yourself to the overhead [supervisors].”

**Theme #2: Crew's Influence on Individual Attitudes:** Attitude refers to the way an individual projects an emotion, in various situations, about certain ideas, thoughts, or actions. It can be thought of as a settled way of thinking or feeling about someone or something; typically one that is reflected in a person's behavior (Oxford, 2015). In general, the overall attitude among crew members can influence an individual member's perception of and participation in PT. Some crews are enthusiastic and encourage individual crew members to PT, while other crews have negative attitudes and discourage their crew members from engaging in PT.

Crews' attitudes can create an environment where PT is not valued and firefighters are unprepared for fire season. An Assistant Engine Boss for the DNRC had this to say about a crew lacking in PT:

"I think culture is a huge thing. The last crew that I worked at, PT was not a priority. You were allowed to PT, you weren't expected to PT, but it wasn't fully taken advantage of by everybody and the culture of it was, oh I'll just drink coffee go for a walk kind of thing which was not adequate preparation for fire season. People would take it upon themselves, like I would go do my own thing but the culture didn't want to, I guess you could say."

A squad boss for a forest service hand crew states his thoughts on crew member's attitudes and how those attitudes can affect PT:

"Attitude that is something you are always going to deal with. And attitude just goes into the people you're working with and some days people have bad attitudes and some days they don't. Bad attitude rubs off on a lot of people."

**Theme #3: Competition as a Positive Force:** Competition among crew members and peers was seen as a common motivating factor that increased participation in and the intensity of PT. The competitive mentality among WLFFs translates from PT to working on the fire line and wanting to produce quality work more efficiently than other crews on the same fire assignment.

A former hotshot and current squad boss on a district FS crew had this to say about competition:

"I think a big barrier is not having someone to workout with and push you. It's easy to go to the gym all season long and think you're staying in shape, but you're just maintaining. I personally need someone to push me to stay in shape. I think it's great for

the crew when everyone is back and with the crew and pushing each other. It's a lot of type A personalities, so everyone wants to compete and be the best."

**Theme #4: The Desire to be Seen as Dependable:** Being viewed as a dependable firefighter was a concept that was mentioned in almost all of the interviews. Wanting to be seen and known as a fit and strong individual capable of doing any task assigned in a timely manner was extremely important. Achieving personal fitness, wellness, and professional goals, and having crew members and leadership recognize capabilities and ask for help or assign them to more difficult tasks was an important motivator to participate in PT.

A Chief of a Volunteer fire department and Forest Service Engine Boss Assistant sums up and describes what being dependable means to firefighters:

"Firefighters have a bond that is difficult to explain. But one of the biggest things is that no one ever wants to let a fellow firefighter down. I feel that this is a huge driving factor in why firefighters want to stay in shape, for the "what ifs" and to help share the load of a very physical business."

**Theme #5: The Prestige of being a Wildland Firefighter:** Individuals become WLFFs because they like the job title and the idea of fighting fires. Unfortunately, liking the job title does not always translate to liking the actual job duties required of a WLFF; duties such as the PT and other physically demanding tasks required to accomplish the job.

A squad boss for a district forest service hand crew, former engine boss assistant and hotshot, states his thoughts on individuals wanting to be a WLFF and then not being able to perform necessary task:

"You get these people who have trouble working out or don't want to work out while at work. They like the job as far as what we do and the title of it but they don't want to put the work into what you actually have to do, to do the job."

An assistant engine boss for the DNRC describes how having the job title of Wildland Firefighter can have a positive influence on crewmembers:

"We are all firefighters, we are all first responders, and we are first on the scene and put on the spot. So that is definitely motivation....it's our job it's what we do"

**Theme #6: Physical and Emotional Fatigue:** The experience of fatigue, both physical and emotional, was referred to by the key informants as “burn-out.” Specifically, key informants talked about supervisors and crews experiencing feelings of being physically and emotionally worn out from fighting fires, participating in PT, doing project work and working with the same group of individuals for extended periods of time while spending less time with loved ones during the fire season.

A squad boss for a district hand crew identifies some of the causes of physical and emotional fatigue. He states:

“ you know even being on a hotshot crew previously, you notice by the end of the season, even though you’ve been working, you get on a hike towards the end of the season and everyone is just moving slower and they are just broken down from the year.”

“During the fire season, just getting burnt out is my biggest barrier. Some days you’re tired and you don’t feel like doing it (PT).”

### **Overarching Concept #2: Environmental influences on Physical Training**

Environment can be defined as the conditions that surround someone or something: the conditions and influences that affect the growth, health and progress of someone or something (Merriam-Webster, Year). Wildland firefighters’ environment includes not only the physical aspects that surround them such as climate, buildings and land, but also time, money, resources, family, and organizational influences. The themes below first address the important physical aspects of the environment that influence PT, and then address the broader environmental aspects such as time, resources, and factors that reach beyond the work place.

**Theme #1: Physical Training Facilities and Equipment:** Areas commonly used by firefighters to PT are their “training facilities.” These areas can be found both indoors and outdoors. At times these areas are well-constructed with good equipment, lighting, and air flow. However, the amount of money the agency or individual has to apply towards PT and other equipment can enhance or limit the capabilities of PT programs.

An engine boss for the DNRC expresses the importance of proper equipment for PT:

“I think that with our budget and financially restrictive problems that we have, not being able to purchase PT equipment is a big issue for us. If you want someone to be able to pack heavy gear around, you probably should have some heavy weights for them to pack around in my opinion.”

A supervisor for the DNRC talks about how routines are improvised when missing the proper equipment required in their exercise routine:

“We make do with what we have. Not having equipment we improvise the way we exercise. We do our own thing but it would be really nice to have some equipment, like medicine balls or just something like that for something different, to add a little more strength type exercise in there.”

**Theme #2: Hardships of Climate - Heat, Cold and Darkness:** Extremes of temperature and long days of darkness in the winter were identified as barriers to PT. For individuals with limited access to indoor facilities, PT is hindered by the lack of light and harsh weather.

Supervisor of an FWP fire crew discusses the hardships they face during PT brought on by the weather and environment:

“ One of the biggest barriers here is the weather, and if it is raining or the soil is wet, outside PT is not an option because of the soil type and it creates a safety hazard (ankle/ foot injuries) for people being out in the elements with huge clods of dirt on their shoes and boots.”

An assistant hand crew foreman for the forest service and former hotshot talks about the various elements and how they affect PT:

“Living in Montana the light and the weather make it (PT) more challenging for folks. I think that is a barrier.”

A supervisor for a state agency fire crew expresses his barriers to PT in the winter:

“The daylight up here is another thing that hampers as well. It gets dark, so it is kind of rough to go for a run in the snow when there is snow and the sidewalks aren’t plowed and its dark outside.”

**Theme #3: Project Work and Trainings Take Precedence Over PT:** When crews are not fighting fires, they often are required to either attend trainings or work on projects assigned by their agency. A project required by the agency to be completed in a certain amount of time can be physically demanding, which is why some crews replace PT with project work. However, in some instances project work is not physically demanding and takes precedence over PT because of unavoidable and unmovable deadlines.

A hand crew foreman for the Forest Service states how PT is neglected because of other projects-:

“A heavy workload takes time away from fitness. Having competing objectives, the need to meet targets and get paper work done overshadow the need to PT.”

Squad Boss for the Forest Service talks about workload taking precedence over PT:

“It seems like the Forest Service as a whole, has thousands of projects. They kind of rely on the fire community a lot to get these projects done. Then when it comes down to crunch time and it’s getting towards the end of the year and things haven’t gotten done because the fire crews have been out, all of a sudden a month or two before it’s time to get laid off, they want it (project work) all done now and it’s time to take away from PT and start trying to do these projects that haven’t been worked on in years and they’ve just added up.”

**Theme #4: Paid Time to Participate in Physical Training:** Wildland firefighters are provided, by their agencies, an allotted time during their work hours to engage and participate in PT. In other words, WLFFs are paid to participate in PT. This was seen as one of the largest motivating factors for participating in PT. However not all agencies allow all active red card holders to participate in a paid PT program. Some agencies do not have the funding, or are volunteer agencies where PT is not consistently practiced.

A head supervisor for the FWP fire crew talks about the motivating factor of being paid to PT:

“Paid time to PT is by far the biggest incentive. If not for the one hour of that we are afforded for PT, it most likely would not happen at all.”

An assistant supervisor for the Volunteer fire department states the difficulties their resources face due to the lack of monetary incentives:

“Unlike many paid departments or other agencies we don’t have the ability to offer monetary incentives for members staying in shape. We are trying to find other alternatives for motivating members though.”

A squad boss for the Forest Service talks about the enjoyment of being paid to PT:

“Being paid to workout is a great incentive. It’s awesome that we get time to PT. Other jobs you don’t really get to do that.”

**Theme # 5: The Need for Education about PT and Healthy Living:** Wildland firefighters have expressed the desire to be further educated on the benefits of PT, healthy eating, and lifestyle choices. Those who receive this type of training feel it is useful and applicable to their job and helps them succeed during fire season and during their off season. Some firefighters feel having consistent healthy lifestyle reminders within the work place would serve as reinforcing factors for these healthy choices and trainings.

An assistant engine boss for the DNRC talks about the lack of education about PT and healthy living as a barrier to PT:

We spend so much time training people how to use chainsaws and drive engines but we don’t teach them how to take care of their feet or how to properly lift things or exercise so that goes back to the awareness thing I guess...I think education about fitness should happen so people can learn about injury prevention and what not.”

AFMO for the DNRC talks about the lack of knowledge among crew members is likely to affect their health:

“I see a lot of guys with their energy drinks. I try and convince them that energy drinks are detrimental to their health long term and their current PT. You can say get 8 hours of sleep because that goes into your health but I think they struggle with that being 18 years old. Who didn’t want to stay up late then? You know you thought you were going to live forever. But they are not thinking 30 years down the road that getting a good night’s sleep now will add up for them later.... I think we are starting to do a better job of educating everyone about the long term health effects, the biggest incentive is health.”

**Theme # 6: The Influence of Factors Outside of Work:** Inevitably, home life (i.e. family, friends, school, work, and hobbies) greatly influence participation in PT for individuals during fire season and in their off season. Firefighters expressed a desire to spend time with loved ones during their days off during the fire season and during their off season. Some use this time to work a job outside of fire, study, or participate in extracurricular activities. What is done during this time, aside from work and studying, is strongly dictated by peer groups, family, and individual's lifestyles.

Engine Boss who works for the DNRC talks about how factors in his life prompt him to engage in PT:

“Given that I’m a father and a husband and I want to be there for my kids for the long-term. So yeah I have a pretty good motivator that looks me in the face every day. There are all kinds of motivations.”

A supervisor for a hand crew for the forest service acknowledges the impact outside influences have on PT:

“I would say family, having kids, and other obligations in the winter make it hard to work out.”

An engine boss for the forest service talks about the influence of peers and impacts on PT:

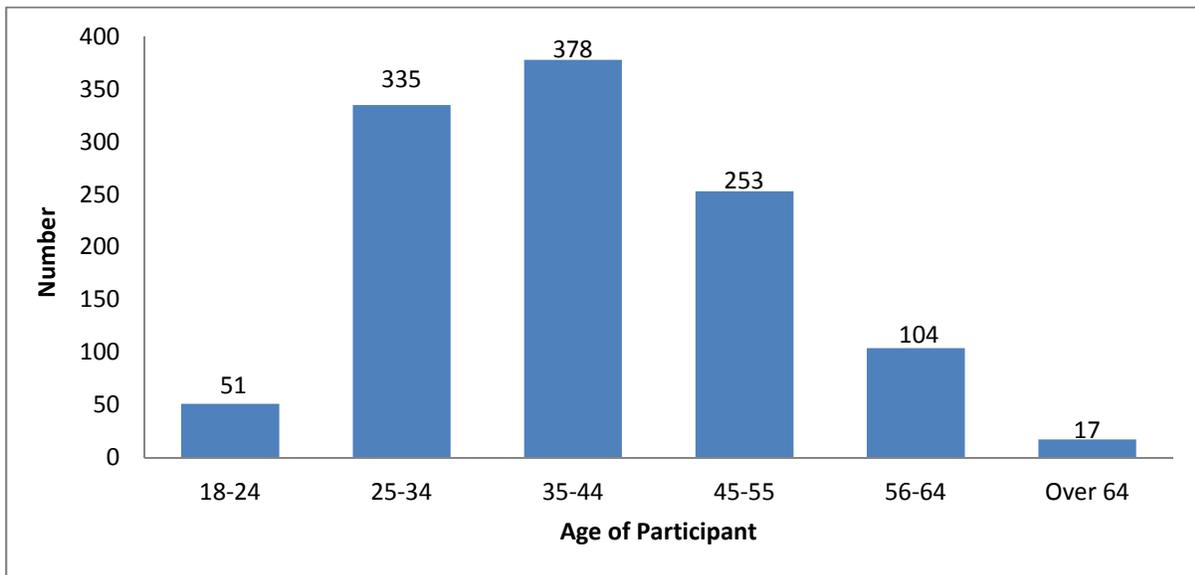
“Yeah some relationships outside of work can definitely play a factor. If they have a lot of friends who go do things like party a lot then that can become a factor in their fitness and stuff for work. Just home relationships with families can be tough as well. You get home and you got to deal with kids. Things like that can take up a lot of your time and not allow for fitness.”

### On-Line Survey Results:

Below is the data analysis for the survey administered from September 20<sup>th</sup> 2014 thru December 31<sup>st</sup> 2014. There were a total of 1141 survey respondents. It should be noted not all respondents participated in answering all questions on the survey. This chapter includes demographic information about the respondents, a description of the top five barriers and motivators to PT broken down by crew type, injury rates during PT among crew types, as well as, fire line injury rates. Finally, we assessed the degree to which Fire Fit, a PT program designed for WLFFs, was being utilized.

### Demographic Information:

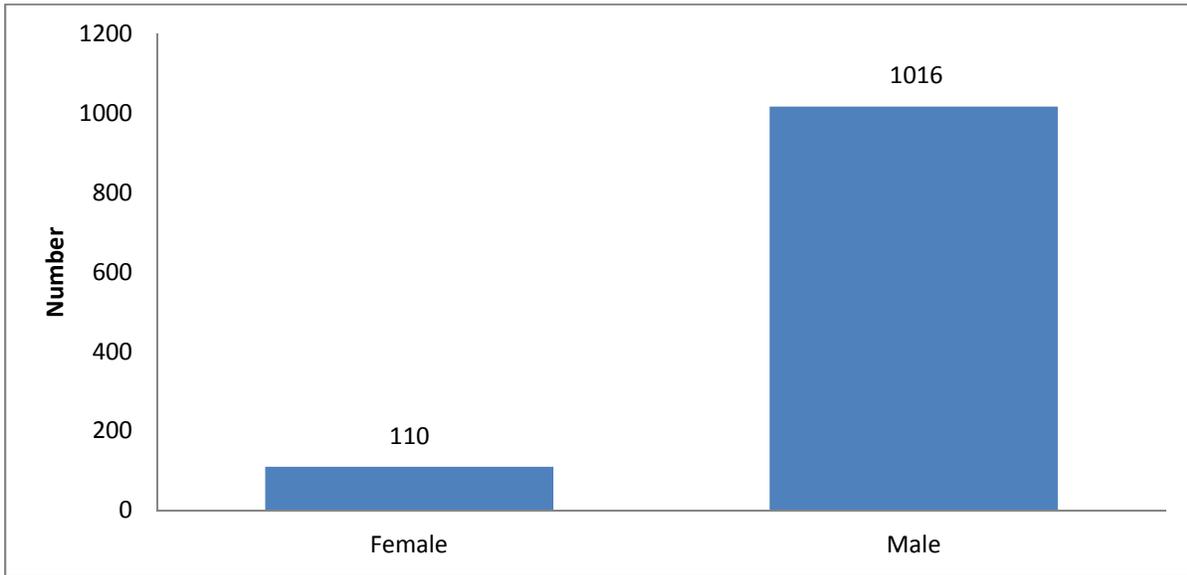
**Figure 4. Age of participants:**



*n=1,138.*

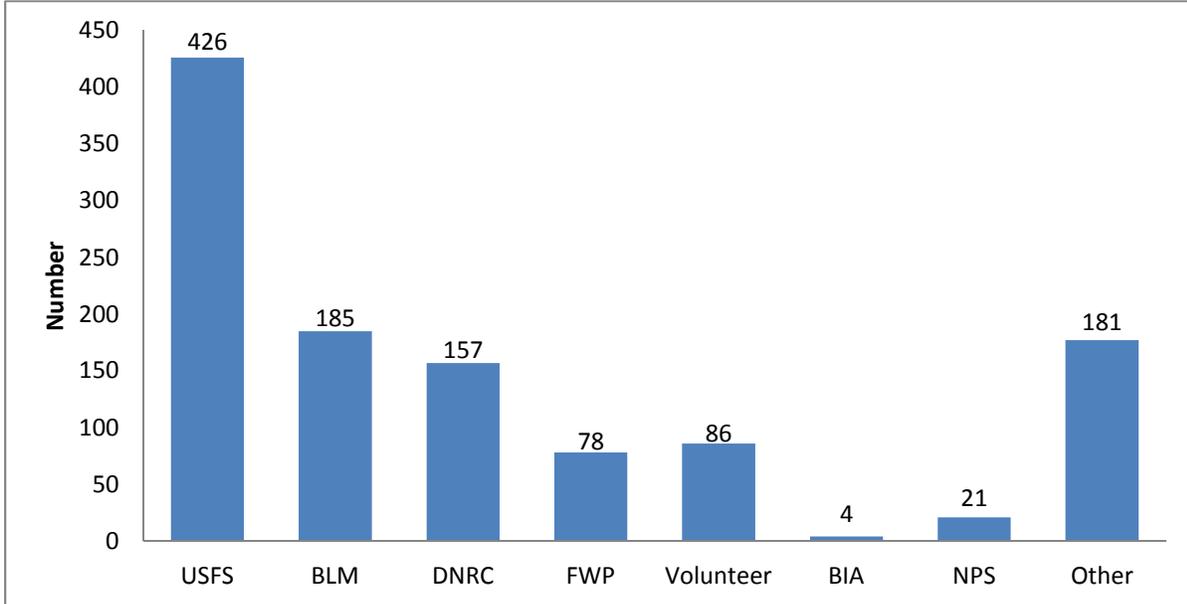
*5% age 18-24, 29% age 25-34, 33% age 35-44, 22% age 45-55, 9% age 56-64, 2% over age 64.*

**Figure 5. Gender of participants:**



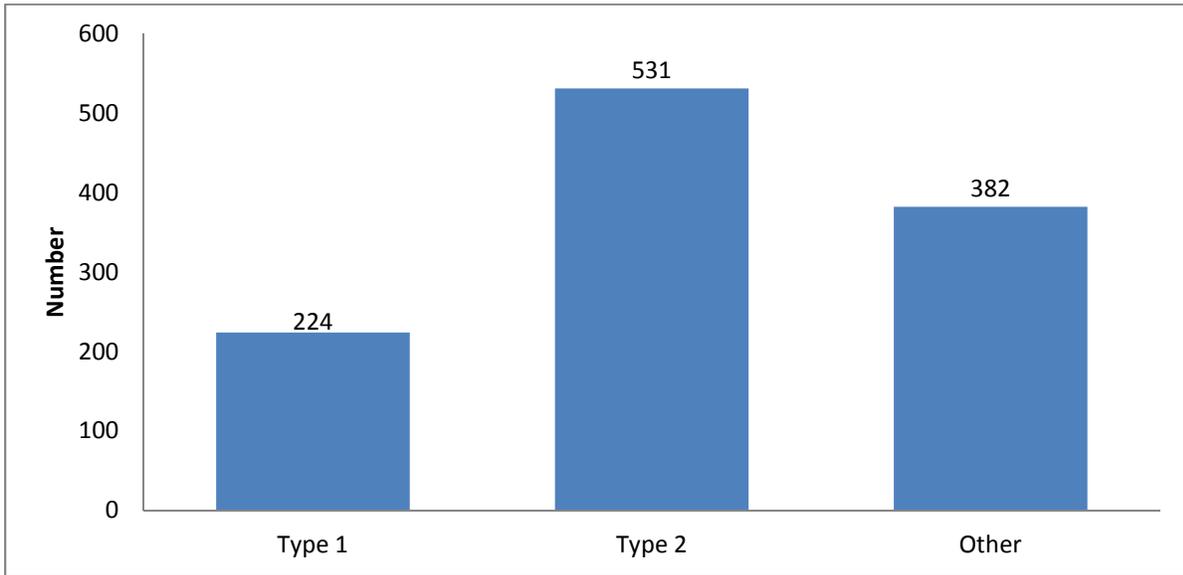
*n=1,126. 10% Female, 90% male.*

**Figure 6. Agency of participants:**



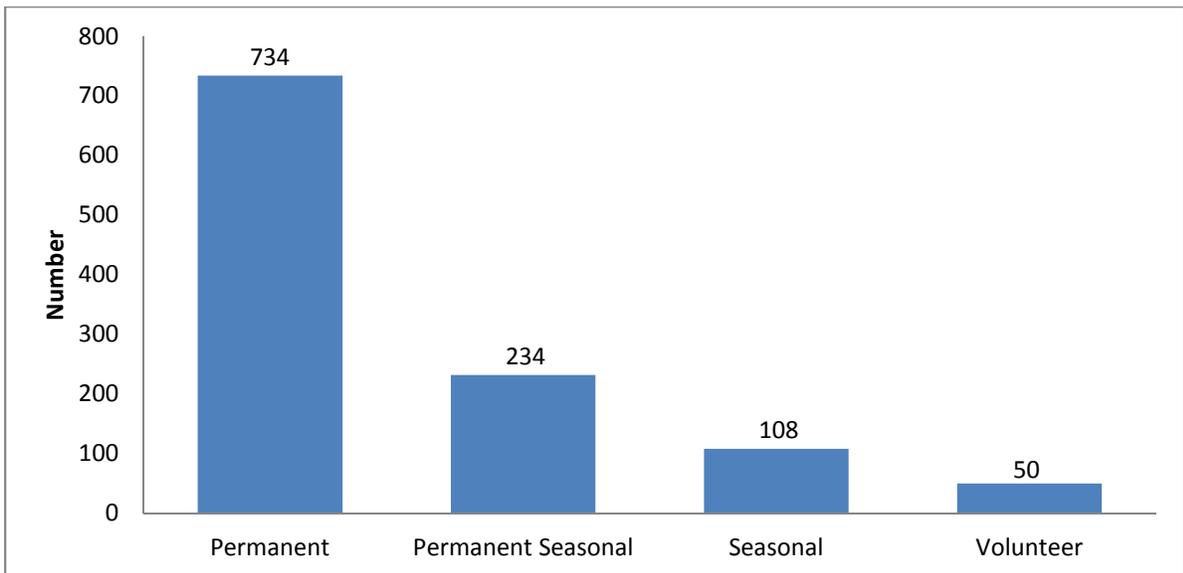
*n=1,138. USFS 37%, BLM 16%, DNRC 14%, FWP 7%, Volunteer 8%, BIA less than 1%, NPS 2%, Other 16%.*

**Figure 7. Crew Type of participants:**



*n= 1,137. 20% of participants are type 1 resources, 47% of participants are type 2 resources, and 33% are other resources that could not be identified as type 1 or type 2 resource.*

**Figure 8. Employment Status of participants:**



*n= 1,126 65% permanent, 21% permanent seasonal, 10% seasonal, 4% volunteer.*

**Top Five Barriers and Motivators to Physical Training During Fire Season:**

	<u>n</u>	<u>%</u>	<u>Total n</u>
Other projects take priority over PT	796	80 %	993
I get/am worn-out during fire season	446	45%	985
The importance of PT is not emphasized	407	41 %	987
Some crew members have low morale or bad attitudes about PT	380	39%	982
PT is optional, not mandatory	381	39%	987

<u>Barriers</u>	<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Other projects take priority over PT	166	83%	365	79%	262	80%
The importance of PT is not emphasized	85	43%	189	41%	131	40%
I am/ I get worn out during fire season	87	44%	209	46%	147	45%
Some crew members have low morale or bad attitudes about PT	61	31%	178	39%	138	42%
PT is optional not mandatory	84	42%	179	39%	116	35%

*\*Number of Type 1 Respondents = 197-199*

*Number of Type 2 Respondents = 455-458*

*Number of "Other" Respondents = 326-329*

A Pearson chi-square test was conducted to examine whether there was a relationship between crew type and the top five barriers to PT during Fire Season. The results revealed that there was one significant relationship between "crew type" and the barrier "some crew members have low morale or bad attitudes about PT." (Chi square value = 13.478, df =4, p = .009) Type 1 crews (69%) were significantly less likely to identify crew member's low morale and bad attitudes as a barrier to PT than Type 2 (61%) and Other (57%)

	<b>(n)</b>	<b>%</b>	<b>Total n</b>
<b><u>Motivators</u></b>			
Wanting to be physically fit to make work easier	945	96%	984
Achieving personal fitness standards	905	92%	984
Wanting to appear as a fit and dependable crew to ICs and other fire crews	873	89%	984
Being paid to PT while at work	851	88%	981
Wanting to be seen as a strong crew member	842	86%	982

<b><u>Motivators</u></b>	<b><u>Type 1</u></b>		<b><u>Type 2</u></b>		<b><u>Other</u></b>	
	<b><u>n</u></b>	<b><u>%</u></b>	<b><u>n</u></b>	<b><u>%</u></b>	<b><u>n</u></b>	<b><u>%</u></b>
Wanting to be physically fit to make work easier	190	96%	437	96%	314	96%
Achieving personal fitness standards	180	91%	421	93%	301	92%
Wanting to appear as a fit and dependable Crew	176	89%	403	89%	290	88%
Being paid to PT while at work	175	88%	390	86%	284	87%
Wanting to be seen as a strong crew member	169	85%	390	86%	279	86%

*\*Number of Type 1 Respondents = 197-199*

*Number of Type 2 Respondents = 454-455*

*Number of "Other" Respondents = 326-328*

A Pearson chi-square test was conducted to examine whether there was a relationship between crew type and the top five motivators to PT during Fire Season. The results revealed that there were no statistically significant associations between crew types and their motivators during fire season.

**Barriers and Motivators in the Off Season:**

<b>Table 7</b>			
<b>Top Five Barriers in the Off Season</b>			
<u>Barriers</u>	<u>n</u>	<u>%</u>	<u>Total n</u>
Environmental Factors	625	65%	957
Wanting to spend time with family and friends	623	65%	952
Finding a balance between work, school, or a job	553	58%	956
Physically or Emotionally worn out from other things like job, school, sports etc.	504	53%	955
Don't have a place to PT	326	34%	955

<b>Table 8</b>						
<b>Top Five Barriers in the Off Season by Crew Type</b>						
<u>Barriers</u>	<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Environmental Factors	120	63%	292	66%	211	66%
Wanting to spend time with family and friends	133	69%	277	63%	210	66%
Finding a balance between work, school, or a job	125	65%	244	55%	182	57%
Physically or Emotionally worn out from other things like job, school, sports etc.	103	54%	233	53%	167	53%
Don't have a place to PT	64	33%	149	34%	113	35%

*\*Number of Type 1 Respondents = 192-193*

*Number of Type 2 Respondents = 438-441*

*Number of "Other" Respondents = 317-320*

A Pearson chi-square test was conducted to examine whether there was a relationship between crew type and the top five barriers to PT during the off season. The results revealed that there were no statistically significant associations between crew types and their barriers during the off season.

<b>Motivators</b>	<b>n</b>	<b>%</b>	<b>Total n</b>
Wanting to Maintain good personal health	935	97%	961
Being an example for my crew members and supervisors	873	91%	959
Wanting to be seen as someone who can be counted on during the fire season	842	88%	961
Having access to PT equipment/ facilities	800	83%	960
Being required to meet fitness standards when returning to work	783	81%	959

<b>Motivators</b>	<b>Type 1</b>		<b>Type 2</b>		<b>Other</b>	
	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
Wanting to Maintain good personal health	190	98%	429	97%	322	97%
Being an example for my crew members and supervisors	176	91%	400	91%	321	91%
Wanting to be seen as someone who can be counted on during the fire season	173	89%	387	88%	322	86%
Having access to PT equipment/ facilities	160	82%	354	80%	321	83%
Being required to meet fitness standards when returning to work	155	80%	349	80%	322	78%

*\*Number of Type 1 Respondents = 194*

*Number of Type 2 Respondents = 438-441*

*Number of "Other" Respondents = 321-322*

A Pearson chi-square test was conducted to examine whether there was a relationship between crew type and the top five motivators to PT during the off season. The results revealed that there was one significant relationship crew type and the motivator "wanting to maintain good personal health." (Chi square value = 9.453, df =4, p = .051) Type 2 crews (81%) were significantly more likely to identify wanting to maintain good personal health as a large motivator than Type 1 (73%) and Other (74%).

## Injury Rates:

<b>Table 11</b>			
<b>Injury Rate</b>			
	<u>(n)</u>	<u>%</u>	<u>Total n</u>
Injury during PT at Work	(296)	28%	1026
Injury from PT Perceived as Preventable	(175)	42%	417
Injury on Fire line	(485)	46%	1058
Injury on Fire line Perceived as Preventable	(204)	36%	565

<b>Table 12</b>					
<b>Injured during PT at Work</b>					
<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
58	28%	138	25%	101	26%

*\* Total n = 1,048*

<b>Table 13</b>					
<b>Injured on Fire Line by Crew Type</b>					
<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
97	46%	215	44%	172	48%

*\* Total n = 1,057*

**Fire Fit Program Use:**

<b>Table 14</b>								
<b>Do you use Fire Fit</b>								
	<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>		<u>Total n</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	
Yes	11	5%	36	7%	17	5%	209	
No, but I am Familiar with Fire Fit	114	55%	250	51%	185	52%	486	
No I've Never Heard of Fire Fit	84	40%	200	42%	151	43%	353	

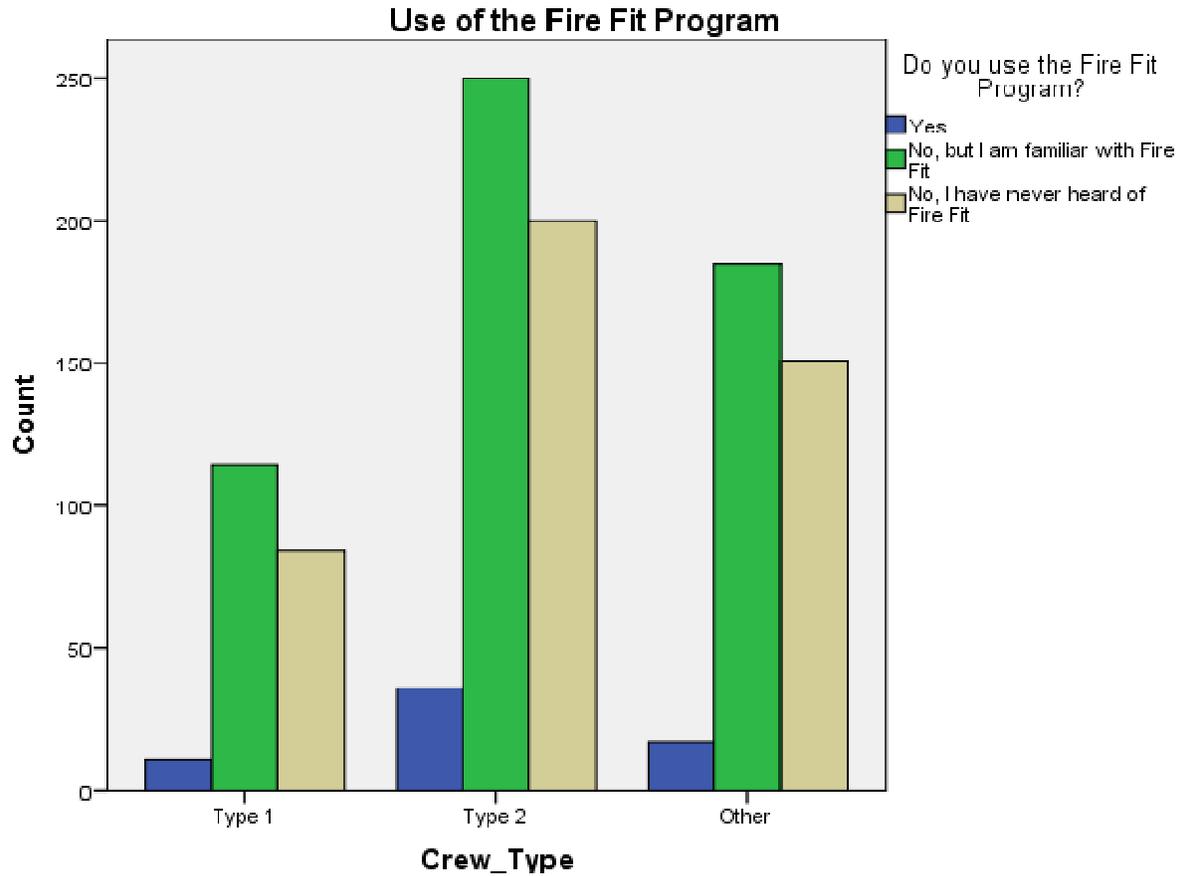


Figure 5. Use of Fire Fit by Crew Type

<b>Table 15</b>			
<b>Rate of Use of Fire Fit</b>			
	<b>n</b>	<b>%</b>	<b>Total n</b>
5-7 days a week	11	7%	159
2-4 days a week	30	19%	
Less than 2 days a week	118	74%	

Of the 17% of firefighters who report using Fire Fit, three-quarters report using it less than two days per week.

**Use of Other Training Programs:**

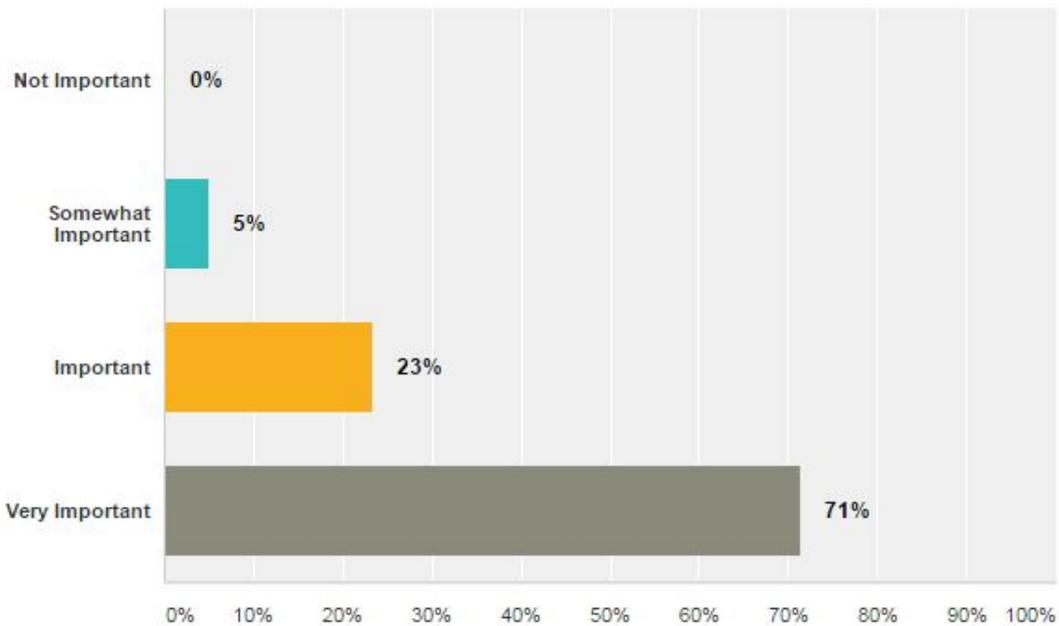
<b>Table 16</b>			
<b>Use of Other Programs</b>			
	<b>n</b>	<b>%</b>	<b>Total n</b>
Yes	563	53%	1058
No	495	47%	

Over half of the respondents use other PT programs, unrelated to Fire Fit.

<b>Table 16</b>			
<b>Intensity of PT</b>			
	<b>n</b>	<b>%</b>	<b>Total n</b>
Light	58	5%	1058
Moderate	448	42%	
Strenuous	452	43%	
We don't engage in PT	100	9%	

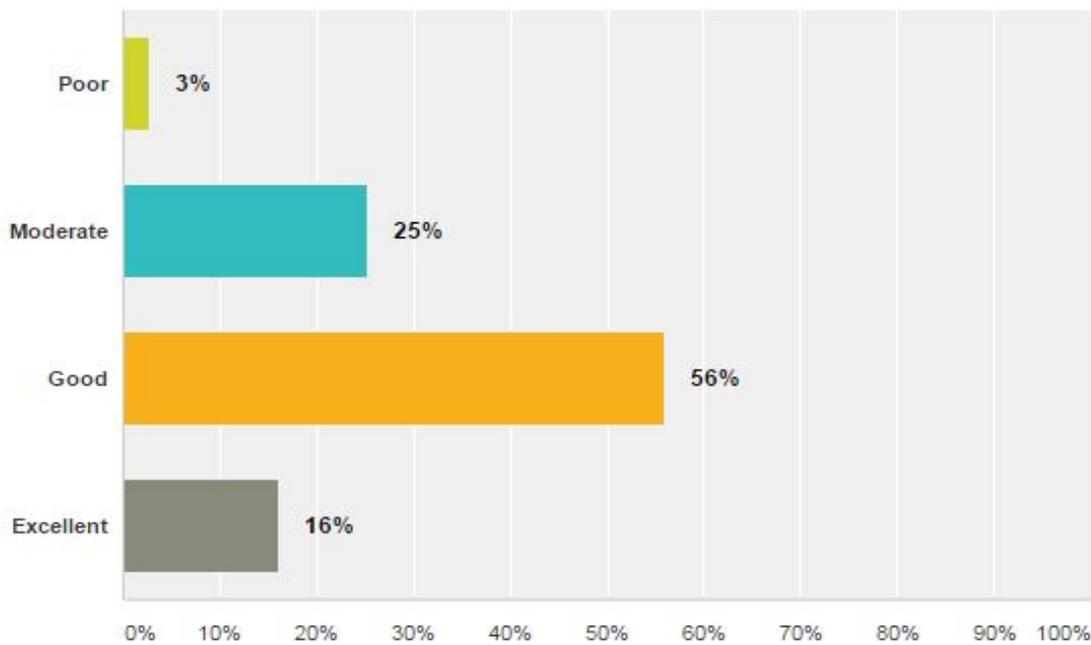
The majority (85%) of respondents engage in moderate to strenuous PTs.

### Importance of Physical Fitness as a Wildland Firefighter:



*n= 1,098. 55 participants identified with somewhat important, 258 identified with important, 785 identified with very important.*

### Current Level of Physical Fitness:



*n= 1,101. 29 participants identified with poor, 279 identified with moderate, 616 identified with good, and 177 identified with excellent.*

## Chapter 5

### Manuscript:

#### Abstract:

**Purpose:** The purpose of this study was to examine facilitators and barriers to fitness training in wildland firefighters (WLFF) in the United States. Intrapersonal, interpersonal, institutional, community and policy factors that influence fitness training among WLFFs were assessed. This assessment describes the strengths of the current physical training (PT) program and identifies strategies for overcoming existing barriers. **Methods:** This study utilized a descriptive research design structured around the Socio-ecological model. Information about PT practices was collected through interviews with key informants in leadership positions. Interview data was analyzed qualitatively. Additionally, a questionnaire based on information from the interviews was developed, reviewed by experts, pilot tested and distributed electronically to WLFFs. Questionnaire data were analyzed using the SPSS statistical program. Barriers and motivators to engaging in PT among crew type were examined for differences using Chi Squared, multiple regression and descriptive statistics. **Results:** The top barriers to PT during fire season for WLFFs are: *Other projects take priority, I get/am worn-out during fire season, the importance of PT is not emphasized, some crew members have low morale or bad attitudes about PT, PT is optional not mandatory.* The main facilitators to PT during fire season are: *Wanting to be physically fit to make work easier, achieving personal fitness standards, wanting to appear as a fit and dependable crew to ICs and other fire crews, being paid to PT while at work, wanting to be seen as a strong crew member.* These survey results coincided with the two overarching concepts and twelve themes developed from the key informant interviews. The first concept, firefighter culture, encompassed several themes. Themes included the *powerful influence of leadership* and the *desire to be seen as a strong, capable and dependable crew member.* The second concept, environment, included the influence of factors such as *training facilities and equipment* and the need for *more holistic education about PT and overall health.* Two overarching concepts emerged from the interviews as major influences on PT. **Conclusion:** This assessment was an attempt to gain an understanding of the current PT practices of WLFFs. More importantly, results from this study identify, from the perspective of the wild land firefighters themselves, and the major motivators and barriers to engaging in quality, consistent PT.

## **Introduction:**

Working on a wildland fire is well documented as an arduous occupation and is both physically and mentally taxing. Given the high physical demands of the job, fitness is a key component for job performance and in keeping WLFFs healthy and safe from injury. Unfortunately little is known about the PT programs of WLFFs.

While a number of studies have assessed structural fire crew PT no studies were found that examined WLFFs motivators and barriers to participating in PT. Understanding factors that serve as motivators and deterrents to maintaining a high level of physical fitness would be useful in designing or altering PT programs that meet the needs of today's WLFF crews. This study examined firefighters' current PT regimes and their barriers and facilitators to consistent participation in Fire Fit and other programs used by WLFFs. High levels of physical fitness have been shown to have multiple benefits. Improved mental acuity, fewer heart attacks, less risk of diabetes and reduced stress are some of the benefits of high fitness levels. (Sharkey and Gaskill, 2007). In other high stress jobs, like the military, physical fitness has been shown to buffer stress symptoms secondary to extreme stress (Marcus et al. 2008). Additionally, fit individuals achieve higher work capacity. Work capacity is an individual's ability to accomplish production goals without undue fatigue, and without becoming a hazard to oneself or coworkers. It is a complex composite of aerobic and muscular fitness, natural abilities, intelligence, skills, experience, acclimatization, nutrition, and motivation (Sharkey and Gaskill, 2009).

There are a large number of job classifications within the U.S. WLFF structure. The main designations of WLFF who actively participate in direct fire suppression include Type 1 (elite Hotshot, Smoke Jumper, Rappel, and Helitack) crews, Type 2 (hand) crews and Engine crews. Other individuals may also be qualified to be in the area of active fires and their designations are often lumped together including safety officers, crew supervisors and others. Non fire line designations include fire camp crews, overhead teams and support personnel. Firefighters may also be classified as agency (United States Forest Service-USFS, Bureau of Land Management-BLM, Department of Natural Resources-DNRC, Bureau of Indian Affairs-BIA, or National Park Service-NPS) or volunteer (generally local fire departments with individuals certified for WLFF).

Although WLFFs are expected to be physically fit and must pass annual fitness evaluations injuries still occur. In a study examining injuries among WLFFs between the years of 2003-2007 the authors reported that the age range at which injuries occur were from 17 years to 65 years (Britton, 2013). They also found that Engine crews and Type 1 crews had the largest proportions of injuries in young firefighters. Overhead and camp crews had the largest proportion of injuries reported among older firefighters. The majority of injuries across all fire jobs were reported in July-September, which is consistent with the peak of fire season. The majority of these injuries were significantly associated with job assignments. The two most common causes of injuries were slips/trips/falls and equipment/tools/machinery. These injuries accounted for 40% of the

reported injuries. Sprains and strains comprised 45% of the most commonly reported injuries among WLFFs.

Other factors such as heart attacks significantly increase when volunteer firefighters are participating in wildland fire suppression. Heart attacks accounted for 3.2 fatalities/year from 1990-1998 and 4.9 fatalities/year from 1999-2006. This is a 51% increase in the annual average incidence. Heart attacks are even more prevalent among volunteer firefighters. Forty four of the sixty eight (65%) heart attack deaths related to firefighters were among volunteers (Sharkey, 2008).

PT programs are crucial if WLFF are to meet goals to reduce injury and improve work capacity and overall safety. In developing the methodology for this study, PT programs in other professions requiring higher levels of fitness were examined to determine facilitators and barriers to PT and maintaining physical fitness. A number of studies evaluated military PT program barriers and facilitators (Kelly and Schroeder, 2002; Anderson and Auld, 2005) and a few studies targeted structural fire crews (Staley et al, 2011; Mayer et al, 2013). No studies were found that examined WLFFs' motivations and barriers to participating in PT. Therefore, the purpose of this study was to examine facilitators and barriers to fitness training in WLFFs in the U.S. Utilization rates of Fire Fit, the current training program recommended by U.S. fire agencies, and rates of injury also were assessed.

## **Methods:**

**Study Design:** This study utilized a mixed methods descriptive research design. Primary data was collected through interviews with key informants. Key informants included individuals in leadership positions who work directly with crew members and make influential decisions for the crew. In addition, primary data was gathered through an electronic survey, based on the key informant interviews and distributed to WLFFs throughout the U.S.

**Theoretical Basis:** The Socio-ecological Model was used as a structure for the development of research questions and the interview guide and survey. This model is based on the knowledge that health behaviors are influenced by both internal factors such as beliefs, attitudes and skills, as well as by external factors such as the social and physical environment, social supports, role models and rewards. The basis of this model is the recognition that there exists a dynamic interplay among all levels of factors. The model suggests that the identification and targeting of factors that affect behavior on multiple levels is more effective than single level approaches (Hayden, 2009).

**Instrument Development:** An interview guide designed to gather information about the motivators and barriers to PT was developed based on existing literature. Since the literature on WLFFs was limited, common barriers and motivators in PT programs among occupational

athletes such as military personal and structural fire fighters were used to construct the initial interview guide. The identified barriers and motivators were then sorted according to the levels of the socio-ecological model and structured into questions. The interview guide solicited information regarding the interviewee's perspectives on the current fitness training programs, and the barriers to participation in those programs, as well as perceptions of factors that might encourage WLFF's participation in PT.

**Key Informant Interviews:** Key informant interviews were conducted during the time period from May to July 2014. The length of the interviews varied greatly with some interviews lasting 45 minutes while other interviews were less than 15 minutes.

An effort was made to interview individuals from multiple state and federal agencies whose employees or volunteers are WLFFs.

**On-Line Survey:** Results from key informant interviews were critical to the development of the on-line survey. Key informants identified major motivators and barriers to PT which served as the foundation for the survey. Once the researchers completed a draft of the survey, the survey was reviewed by a panel of experts consisting of university faculty and forest service administrative staff. Following review, the survey was pilot tested with members of the target population and revised based on pilot test subject feedback. The survey was administered online through "snowball sampling." Snowball sampling allowed supervisors and key informants who were known to the researchers to distribute the surveys. If a supervisor agreed to participate, he or she was sent a link to the on-line survey and was asked to e-mail the survey link to their employees and other WLFFs they knew. The e-mail to prospective participants included information about the purpose of the study and noted that, while strongly encouraged, participation in the survey was voluntary. The e-mail also included a request that WLFF who completed the survey forward the link to their colleagues in an effort to continue the snowball sampling technique. Survey responses were anonymous.

**Data Analysis:** Key informant interview data were analyzed in accordance with the constant/comparative method of qualitative data analysis (Glaser and Strauss, 1967). Using this method researchers identified concepts, principles, and structural or process features relating to PT among WLFFS.

Survey data were initially examined descriptively via Survey Monkey. The data were checked and uploaded for analysis using SPSS (IMB Version 22). Cross Tab and Chi Square analyses were used to evaluate differences among key variables between groups of interest.

## **Results:**

**Key Informant Interview Results:** Sixteen key informant interviews were conducted during the time period from May to July 2014. Eleven were conducted in person, two were by phone and

three consisted of written responses. Seven interviews were conducted in South West Montana. Six interviews took place in the North West Montana. Three interviewees were from Central Montana.

There were fifteen males and one female participated in key informant interviews. Ages ranged from 25 to 44 years. USFS and the DNRC were well represented with six and five key informants participating in interviews respectively. US Fish and Wildlife Service and Volunteers were represented by two key informants each, and one key informant from NPS participated.

Interview data analysis revealed two overarching concepts, culture and environment, and twelve major themes related to barriers and motivators to participating in PT. Table 1 lists the levels of influence and identifies the themes that fall within each level. Three themes fell in the intrapersonal level; four fell in the interpersonal level; three were categorized as belonging to the Institutional/ Community level and one addressed policy level (see table 1).

<b>Table 1: Socio-Ecological Model of Overarching Concepts: Cultural Influences and Environmental Influences</b>			
<b>Intrapersonal</b>	<b>Interpersonal</b>	<b>Institutional/ Community</b>	<b>Policy</b>
Culture: Desire to be seen as dependable	Culture: The Powerful Influence of Leadership	Environment: Physical Training Facilities and Equipment	Environment: Paid Time to Participate in Physical Training
Culture : The Prestige of being a Wildland Firefighter	Culture: The Crew’s Influence on Individuals Attitudes	Environment: Project Work and Trainings Take Precedence Over PT	
Culture: Physical and Emotional Fatigue	Culture: Competition as a Positive Force  Environment: Influences of Factors Outside of Work	Environment: The Need for Education About PT and Healthy Living	

**On-Line Survey Results:**

A total of 1141 WLFFs responded to the survey. Not all participants responded to every question on the survey. The age of the respondents were as follows: 18-24 (5%), 25-34 (29%), 35-44 (33%), 45-55 (22%), 56-64 (9%), and over age 64 (2%). Survey respondents were 10% female and 90% male. The participants who completed the survey were 20% percent Type 1

resources, 47% Type 2 resources, and 33% were other resources that could not be identified as Type 1 or Type 2 crews.

The majority (94%) of survey respondents perceived the importance of physical fitness as very important (71%) or important (23%). When asked about personal fitness 3% identified their personal fitness as poor, 25% as moderate, 56% as good, and 16% as excellent. Respondents reported an average of 5 hours per week engaging in PT.

The top five barriers to and motivators for participating in PT during fire season among WLFFs overall and by crew type are shown in Tables 2 and 3.

<b><u>Barriers</u></b>	<b><u>Small Barrier</u></b>		<b><u>Large Barrier</u></b>		<b><u>Total n</u></b>
	<b><u>%</u></b>	<b><u>n</u></b>	<b><u>%</u></b>	<b><u>n</u></b>	
Other projects take priority	41%	410	39%	386	993
I get/am worn-out during fire season	37%	361	9%	85	985
The importance of PT is not emphasized	27%	265	14%	142	987
Some crew members have low morale or bad attitudes about PT	29%	284	10%	96	982
PT is optional, not mandatory	24%	239	14%	142	987

**Table 2 notes:** A Pearson chi-square test was conducted to evaluate differences between crew type for each of the top five barriers to PT during fire season. Type 1 crews (69%) were significantly less likely to identify “crew members low morale and bad attitudes” as a barrier to PT than Type 2 (61%) and other (57%) (Chi square value = 13.478, df =4, p = .009)

<b><u>Motivators</u></b>	<b><u>Small Motivator</u></b>		<b><u>Large Motivator</u></b>		<b><u>Total n</u></b>
	<b><u>%</u></b>	<b><u>n</u></b>	<b><u>%</u></b>	<b><u>n</u></b>	
Wanting to be physically fit to make work easier	17%	164	79%	781	984
Achieving personal fitness standards	29%	287	63%	618	984
Wanting to appear as a fit and dependable crew	27%	269	61%	604	984
Being paid to PT while at work	18%	172	69%	679	981
Wanting to be seen as a strong crew member	29%	285	57%	557	982

**Table 3 notes:** There were no statistically significant differences between crew types and their PT motivators during fire season.

**Injury Rates:**

Injury rates and the preventability of injuries, during PT and on the fire line, are reported by injury type and crew category in Tables 4-6.

<b>Table 4</b>			
<b>Injury Rate and Perception of Injury Preventability</b>			
	<u>(n)</u>	<u>%</u>	<u>Total N</u>
Injury during PT at Work	(296)	28%	1026
Injury from PT Perceived as Preventable	(175)	42%	417
Injury on Fire line	(485)	46%	1058
Injury on Fire line Perceived as Preventable	(204)	36%	565

<b>Table 5</b>					
<b>Injured during PT at Work</b>					
<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
58	28%	138	25%	101	26%

<b>Table 6</b>					
<b>Injured on Fire Line by Crew Type</b>					
<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>	
<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
97	46%	215	44%	172	48%

**Use of Fire Fit by Crew Type:**

Fire Fit is a website providing WLFF PT programs. The Fire Fit program is supported and recommended by WLFF agencies. 60% of WLFF are aware of Fire Fit but only 5% report basing their PT on information provided by Fire Fit. Only 41 (3.9% of all respondents) reported using Fire Fit information 2 or more days a week. Table 7 lists numbers and percentages of respondents who use Fire Fit or are aware of the program. Table 8 reports frequency of Fire Fit program use.

<b>Table 7</b>							
<b>Do you use Fire Fit?</b>							
	<u>Type 1</u>		<u>Type 2</u>		<u>Other</u>		<u>Total n</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>N</u>
Yes	11	5%	36	7%	17	5%	209
No, but I am Familiar with Fire Fit	114	55%	250	51%	185	52%	486
No I've Never Heard of Fire Fit	84	40%	200	42%	151	43%	353

<b>Table 8</b>			
<b>Number of days per week that users of Fire Fit reported using the program.</b>			
	<u>n</u>	<u>%</u>	<u>Total N</u>
5-7 days a week	11	7%	159
2-4 days a week	30	19%	
Less than 2 days a week	118	74%	

Most respondents (53%) use other PT programs, unrelated to Fire Fit. Frequently reported programs included "Cross Fit", "Insanity", "P-90X", or a combination of multiple programs that they take parts from.

**Intensity of Physical Training:** Reported intensity of most training is shown in Table 9.

<b>Table 9</b>			
<b>Intensity of PT</b>			
	n	%	Total N
Light	58	5%	1058
Moderate	448	42%	
Strenuous	452	43%	
We don't engage in PT	100	9%	

n= 1058, the majority (85%) of respondents engage in moderate to strenuous PTs.

**Importance of Physical Fitness for Wildland Firefighter:** Of the 1,098 on-line survey responses, 94% reported physical fitness to be Very important (71%) or important (23%) and 5% felt that physical fitness was only somewhat important.

### **Discussion:**

The study represents one of the first attempts to explore the physical training needs of WLFFs from the perspective of the WLFFs themselves. Three aspects of PT were examined through interviews with key informants and surveys of current WLFFs including: the barriers and motivators to PT during fire season; the utilization rates of Fire Fit, the current firefighter fitness program; and finally, the rates of injury among type 1 and type 2 resources.

The large number of survey respondents was a representative sample of WLFFs relative to age, crew type and gender typical of wildland firefighters. It came as no surprise that most WLFFs who participated in this study perceived physical fitness in relation to their job to be important or very important, and that they reported engaging in PT for 5 hours or more a week during their work season. A high level of physical fitness is important for WLFF as it improves work capacity (Sharkey and Gaskill, 2009) and has been shown to buffer stress symptoms secondary to extreme stress (Marcus et al. 2008).

There are annual fitness requirements for all levels of WLFF who are qualified to be near or working directly on active fires. While elite Type I crews have both formal (required) and informal fitness requirements, Type 2 and engine crew members are required only to pass the “arduous pack test” of hiking three miles in 45 minutes on a flat course while carrying a 45 pound pack. Aerobically this has an oxygen consumption cost of about 21 ml/kg/min (6 METS).

Data collected recently by Gaskill, Domitrovich and Sol (unpublished) shows that elite WLFF frequently sustain oxygen consumption over 40 ml/kg/min and that Type 2 crews frequently sustain oxygen use over 30 ml/kg/min well above the fitness standard required. Sharkey and Gaskill (2007) reported that heart attacks are most likely in engine crew members during the arduous pack fitness test as their jobs are more sedentary and they have often not done adequate PT prior to their fitness test.

Despite the importance of being fit, the majority of WLFFs did not view themselves to be in “excellent” condition, but rather viewed themselves to be in “moderate” to “good” physical condition. The lack of responses in the “excellent” category could be due to the fact that data for this study was gathered during the off season when physical fitness levels may be lower. Additionally, self-perception of physical fitness is relative to the needs that each individual has for physical fitness, thus this result suggests that most respondents were suggesting that their fitness was adequate to perform the tasks necessary for their position in WLFF.

Frequently, when examining barriers to PT activities, Americans tend to focus on the individual. In other words, we hold the individual responsible for either lacking or possessing the motivation, the knowledge, the skills, and the initiative to exercise. This focus on the individual is not necessarily misplaced, but it does not tell the entire story. The key to overcoming nearly all of the top barriers to PT identified in this study lies in examining both the individual and the environment surrounding the individual. Clearly, there are multiple levels of influence on physical activity, including individual characteristics, interpersonal relationships, work culture, organizational priorities, and work related policies that encourage or discourage PT.

The effects of multiple levels of influence on PT were obvious when examining the top barriers identified by WLFFs. The number one barrier to PT was not much different than the number one barrier identified by most Americans. Regardless of occupation, “lack of time to exercise” is a common barrier (CDC, 2011). Lack of time, in the case of WLFFs, was attributed to the perception that other work-related projects were more important and took priority over PT. One key informant described it well when he said, “A heavy workload takes time away from fitness. Having competing objectives, the need to meet targets and get paper work done overshadow the need to PT.”

This number one barrier, the perception that other work-related projects are more important than fitness, is likely influenced by other barriers identified by study participants, such as the belief that PT is not emphasized by co-workers or supervisors. Adding to the belief that other priorities take precedence over PT is that PT is not mandated by the organizations that recruit and hire WLFFs. And finally, the perception that fellow crew members have low morale resulting in bad attitudes about PT lends credibility to the idea that interpersonal relationships and the culture of the workplace and organizational policy, all interact to influence a WLFF’s likelihood of engaging in regular PT.

The perception that other tasks get in the way of PT may reflect the possibility that many crew supervisors understand that preparatory work such as trail repair and building, controlled burning and other pre-season tasks require physical exertion that may substitute for PT. In

other cases, individuals identified many of the tasks that were prioritized ahead of PT as being “busy work” tasks. This may be an area where crew supervisors need education about the value of PT and about the types of tasks that can substitute for PT.

It should be noted that WLFFs appeared to be reluctant to emphasize the barriers to PT. Survey participants were given the opportunity to mark a barrier as “not a barrier,” “small barrier” or “large barrier.” When identifying barriers most participants marked “small barrier.” Perhaps to their credit, WLFFs were more likely to emphasize the things that motivated them to engage in PT and to mark them as “large” motivators. Many of the motivators identified by WLFFs from the survey also were common among our key informants. Once again, the top motivators point to the importance of paying attention to the multiple levels of influence on PT. Individual level motivators such as the desire to achieve personal fitness standards and the desire to make work easier by being physically fit interact and are influenced by interpersonal relationships. Wanting to be seen as a dependable crew member and a person who is perceived by co-workers as being fit and strong were large motivators to engage in PT. At the organizational level, paid-time to participate in PT was one of the most frequently cited motivators. Gaskill, in a technical report for the Missoula Technology and Development Center (USFS, 2004), adds support to the contention that requiring and providing paid time for PT is important. In this study, Gaskill found that the 25% most physically fit individuals did the equivalent to 2.8 hours more work during a 10 hour shift than did the lowest 25% physically fit crew members with a crew. These findings provide evidence that increased time spent in PT, working to increase fitness levels, results in significantly higher work capacity.

Researchers hypothesized that barriers and motivators for engaging in PT might differ depending on crew type. Somewhat surprisingly, tests of statistical difference between crew types revealed only one significant difference. The number of WLFFs who reported that “crew members’ bad attitudes or low morale” was a barrier was significant ( $p = .009$ ) only in that type 1 crews are less likely to identify with this barrier than other crew types. This would seem to indicate that type 1 crew members have a more positive attitude about PT and either ignore those with low morale or reduce talk of low morale.

There does not appear to be consistency in the source of PT programs used among agencies or crew types. Less than 10% of the participants in this study reported using Fire Fit, the standard training program specifically developed for WLFFs by federal agencies. The remaining 90% of survey respondents were fairly evenly split between WLFFs who had heard of Fire Fit but didn’t use it, and those who had not even heard of Fire Fit.

Most WLFFs reported following a training program other than Fire Fit, or engaging in an individualized program of their own making. This lack of consistency in type, duration, and frequency of PT could be part of the reason injury remains a frequent problem during PT and wildfire suppression. Of the 28% of respondents that reported an injury, nearly one-half of the participants believed their injury during PT was preventable. This reinforces the need for more or better education about physical fitness and training.

**Limitations:**

There are several limitations to this study. First, the sampling method, snowball sampling, is not a randomized means of recruiting participants and therefore results cannot be generalized beyond the sample described in this study. Second, it was not possible to obtain equal representation of federal and state agencies. Forest Service, Bureau of Land Management, and Department of Natural Resource Conservation are well-represented the Bureau of Indian Affairs, Fish Wildlife Service, National Parks Service, Volunteers, and other WLFF resources are under-represented. Third, there is little information regarding the total number of WLFFs, or numbers associated with each agency or crew type. Therefore, it is impossible to determine how representative our sample is of the total population. Finally, not all respondents could be clearly defined as belonging to a type 1 or type 2 crew, thus necessitating the need for a category labeled "other."

**Recommendations:**

The researchers recommend that policy makers, supervisors and administrators that are interested in improving the physical health and well-being of WLFFs consider the multiple levels of influence on the complex behavior of engaging correctly and consistently in PT. On an individual and interpersonal level, results of this study suggest that personal health, dependability and strength as a crew member are motivating factors. On an organizational level, making PT a priority equal in importance to other projects, and continuing the policy of providing employees paid time to PT are critical to creating a culture where PT is seen as valued by the leadership and is an integral part of being a competent, trustworthy and dependable WLFF. On a policy level, it appears that creating and publicizing a PT program designed to meet the specific needs of WLFFs is necessary. Once a program is developed, providing in-depth training for both supervisors and employees in carrying out the program is critical if the ultimate goal is to engage all WLFFs in a consistent, safe and positive PT regimen. Maintaining physical fitness in this profession is crucial to having a better work capacity (Sharkey and Gaskill, 2009). With adequate knowledge and an effective PT program the researchers believe that WLFFs will be more likely to engage in proper techniques for PT and hopefully result in healthier WLFFs that experience fewer preventable injuries, complete more work and are able to endure an entire season without undue fatigue and season-end burn-out.

**Conclusion:** Understanding factors that serve as motivators and those that serve as barriers to maintaining a high level of physical fitness will be useful in designing fitness programs that meet the needs of today's WLFF crews. A number of recommendations are made concerning how WLFF agencies could improve PT using a multifactorial model encompassing both internal factors such as beliefs, attitudes and skills, as well as by external factors such as the social and physical environment, social supports, role models and rewards.

**Appendix A:**

**Key Informant Demographics Questionnaire:**

**Name:** \_\_\_\_\_

**1. Age:** \_\_\_\_\_

**2. Gender:**     Male         Female         Other \_\_\_\_\_

**3. Agency:** \_\_\_\_\_

**4. Position:** \_\_\_\_\_

Permanent     Permanent Seasonal     Seasonal         Volunteer

**5. Years of experience as a wildland firefighter:** \_\_\_\_\_

**6. Years spent in your current position:** \_\_\_\_\_

**7. Highest degree or level of school completed: (please circle one answer)**

- High school
- Some college, no degree
- Associates Degree
- Bachelor's Degree
- Master's Degree
- Other (please specify) \_\_\_\_\_

**8. What is your marital status? (please circle one answer)**

- Single
- Married or domestic partnership
- Separated
- Divorced
- Widowed

**9. How much time, on average during the week, do you spend with your crew members? (please circle one answer)**

- Less than 5 hours
- 5- 10 hours
- 11-20 hours
- 25 or more hours

## Key Informant Interview Questions:

### Section 1: Perceptions of physical training

#### *Training Program*

- What have you heard about *Fire Fit* or other fitness training programs?
- What is the current fitness training program for your crew?
- What do you think about your current fitness program?

### Section 2: BARRIERS to Engaging in the Fitness Training Program

1. *Personal Factors:* (knowledge, attitudes, beliefs, personality traits, skills, perceptions, self-efficacy, etc.)
  - What are your personal barriers to maintaining a fitness regimen?
  - What do you think are your crew member's personal barriers to maintaining a fitness regimen?
  - Do you think there is a lack in training and education about physical training among crew leaders and crew members? Please explain why or why not.
2. *Interpersonal/Community Factors:* (relationships with relatives, friends, co-workers, peers, social networks, norms or standards of behavior that exist formally or informally, etc.)
  - What are your interpersonal barriers to maintaining a fitness regimen?
  - What do you think are your crew member's interpersonal barriers to maintaining a fitness regimen?
  - What are some crew dynamics or social behaviors/norms that interfere with PT?
  - Do you believe there is a lack in fitness program services in your community and other firefighter's communities that interfere with PT? Please explain why or why not.

3. *Organizational/Institutional Factors:* (rules, regulations, and institutional policies; i.e. flex time, access to health programs and facilities, healthy food selections, incentives for participation, etc.)
  - What are your organizational barriers to maintaining a fitness regimen?
  - What do you think are your crew member's organizational barriers to maintaining a fitness regime
  - What policies interfere with PT during work hours?

### **Section 3: Incentives and Motivations to Engage in PT**

1. *Personal Factors:* (knowledge, attitudes, beliefs, personality traits, skills, perceptions, self-efficacy, etc.)
  - What motivates you to work out?
  - What do you think motivates your employees to work out?
  - How confident are you in your knowledge of physical fitness?
  - How confident are you in your ability to lead a physical training program?
2. *Interpersonal/Community Factors:* (relationships with relatives, friends, co-workers, peers, social networks, norms or standards of behavior that exist formally or informally)
  - How do co-workers, family, friends and other relationships outside of work encourage PT?
  - What are some crew dynamics (social behaviors or norms) that promote PT?
  - Are there any social networks in the larger communities for firefighters that promote PT? (*e.g. Facebook or other social network hubs*)
3. *Organizational/Institutional Factors:* (rules, regulations, and institutional policies; i.e. flex time, access to health programs and facilities, healthy food selections, incentives for participation, etc.)
  - How does policy positively affect PT?
  - Does your organization pay crews to PT?
  - What do you think of requiring your crew to utilize standardized fitness regimen if it were to be implemented?
  - What types of incentives do you think would motivate firefighters to maintain regular PT?

## Wildland Firefighter Fitness Survey:

**Purpose:** The purpose of this survey is to determine the barriers wildland firefighters face when attempting to maintain a physical training program. Information from this survey will assist the National Wildfire Coordinating Group in designing programs and policies that will help firefighters meet their physical training needs.

**Instructions:** Your participation is voluntary. Please do not put your name anywhere on the survey. All responses are strictly anonymous.

1. Age  18-24  25-34  35-44  45-55  55-64  Over 64
2. Gender:  Male  Female  Other \_\_\_\_\_
3. Agency: \_\_\_\_\_
4. Job Title and Position: \_\_\_\_\_  
 Permanent  Permanent Seasonal  Seasonal  Volunteer
5. Years of experience as a wildland firefighter: \_\_\_\_\_
6. Years spent in your current position: \_\_\_\_\_
7. Highest degree or level of school completed: (please circle one answer)  
 High school  
 Some college, no degree  
 Associate Degree  
 Bachelor's Degree  
 Master's Degree  
 Other (please specify) \_\_\_\_\_

### Individual Factors Influencing Physical Training:

1. In relationship to your job, how important is physical fitness to you?  
 Not important  Somewhat important  Important  Very important
2. How would you describe your level of fitness?  
 Poor  Moderate  Good  Excellent
3. On average, how many hours a week do you exercise at work during fire season?  
\_\_\_\_\_ hours  I don't exercise at work  I am not allowed to exercise at work

4. On average, how many hours a week do you exercise outside of work during fire season?  
 \_\_\_\_\_ hours       I don't exercise outside of work
5. On average, how many hours a week do you exercise during your off-season?  
 \_\_\_\_\_ hours       I don't exercise during off-season
6. Do you have fitness standards to maintain aside from passing the pack test at work?  
 Yes       No       Not Sure

**Interpersonal and Community Factors Influencing Physical Training:**

7. How high of a priority is physical fitness to your crew?  
 Low       Medium       High       Extremely High
8. Who leads physical training at work?  
 No one       A supervisor       Myself       Other crew members
9. Do you feel the person or persons leading the workouts have the knowledge and skills required to lead the workouts effectively while preventing injuries?  
 Yes       No       We don't workout
10. Does your crew workout together?  
 Yes       No       We don't workout       We work out independently
11. How would you describe the intensity of your physical training?  
 Low       Medium       High       We don't engage in training
12. Have you ever had an injury occur while participating in physical training?  
 Yes       No       I don't train

If yes what type of injury was it? \_\_\_\_\_

- Do you think the injury could have been prevention with proper training?  
 Yes       No       I don't train

13. Have you ever had an injury occur while on the fire line?

- Yes       No

If yes what type of injury was it? \_\_\_\_\_

Do you think the injury could have been prevention with proper training?

- Yes       No       I don't train

**Organizational and Policy Factors Influencing Physical Training:**

14. Do you use the Fire Fit Program?

- Yes       No, but I am familiar with Fire Fit       Never heard of Fire Fit

If yes, how often do you use it?

- 5-7 days per week       2-4 days a week       1 or fewer days per week

If no, what are your reasons for not using it? Please briefly explain. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

15. Do you use other fitness programs?

- Yes       No

If yes, what program(s) do you use? \_\_\_\_\_

16. Is there fitness equipment available at your facility?

- Yes       No       Yes, but it is in poor condition

17. Are you paid to exercise while at work?

- Yes       No       Not Sure

18. What are your barriers to maintaining a physical training program? (place a checkmark in the box that best describes you)

	Big Barrier	Small Barrier	Not a Barrier
I don't like to work-out			
Supervisor doesn't encourage working out			
I don't have time at work			
I have other projects that take priority			
The weather is not conducive to working out			
My family and friends don't work out			
My crew doesn't work out			
I don't have access to equipment			
I don't have access to a work-out facility			
I don't have a specific training program to follow			
Other reasons (please specify)			

19. What would motivate you to regularly participate in a physical training program?

	Big Motivator	Small Motivator	Not a Motivator
Having mandated time for physical training at work			
Being taught a specific training program			
Being able to work-out with crew members			
Having access to workout equipment			
Having access to a workout facility			
Having friends and family with whom to workout			
Needing to pass a fitness test			
Maintaining a fit and healthy appearance			
Enjoying fitness competitions			
Wanting to perform my job well and not put myself or others at risk of harm			
Wanting to be seen as a crew members others can depend on			
Other reasons (please specify)			

20. Final thoughts or comments about effectiveness/ineffectiveness of physical training and exercise programs of your crew:

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