2018

Evaluation of a Web-based Performance Program for Wildland Firefighters

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EVALUATION OF A WEB-BASED PERFORMANCE PROGRAM FOR WILDLAND
FIREFIGHTERS

By

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Thesis

Presented in partial fulfilment of the requirements for the degree of:

Master of Science
Health & Human Performance, Community Health & Prevention Sciences

The University of Montana
Missoula, MT

May 2018

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Abstract

Peña Cueto, José M., M.S., Spring 2018   Health and Human Performance

Evaluation of a web-based performance program for wildland firefighters

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Introduction: In an effort to increase work capacity and reduce occupational injury rates and mortality rates among wildland firefighters, a web-based performance program named *The Black* was developed. The training program was designed to provide evidence-based training specific to wildland firefighters' needs.

Purpose: A formative and process evaluation of the program was conducted to study the user rates, and user's attitudes and preferences regarding the program during the pilot of its first phase.

Methodology: A sequential mixed-methods design was utilized for this evaluation. Qualitative interviews were conducted with firefighters who attended an introductory seminar. Interview data was utilized by program evaluators in the creation of a predominantly quantitative instrument to survey firefighters who were invited to participate in the first-year program pilot.

Results: Nine firefighters were interviewed and thirty-six partially or fully completed survey responses were collected. Despite users' positive attitudes toward the program's content and high regard for the expertise of its developers, evaluation data brought to light issues with usability of the program's online platform and other content delivery methods. Incompatibilities with, and lack of adaptability to the target population's traditional practices and seasonal needs were also noted.

Conclusions: The heterogeneity of the wildland firefighter population makes it a uniquely challenging population to provide a standardized training program for. Further segregation of content to address specific needs of sub-populations conveyed through compatible delivery methods, along with the application of concepts from Diffusion of Innovations Theory, may lead to the widespread utilization of *The Black*.

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Chapter One: Introduction

Introduction to the Study

Part of the job of a wildland firefighter (WLFF) entails wildfire suppression and management. Wildfires can be complex, unpredictable and destructive, making suppression and management arduous tasks that require strenuous physical and mental effort. During the fire season, WLFFs must work long shifts doing physically and mentally demanding tasks in the outdoors, exposed to heat, smoke and wildlife among other factors. Such efforts are often followed by long periods of time spent in rough outdoor conditions, sometimes for up to two weeks with rationed food, limited access to personal hygiene facilities, and lack of quality sleep. These conditions are often overlooked by firefighters, as they have found in this occupation a space to do a valuable, fulfilling public service while enjoying the outdoors and the excitement of working alongside their peers on fire-related activities.

Except for a few areas in the United States where wildfires are an ongoing threat, they are commonly confined to a season, which regularly corresponds with the late Summer and early Fall (Littell et. al., 2016). As a result, the need for active-duty WLFFs vary not only from year to year, but also within the year-cycle. Thus, WLFFs may be employed as permanent full-time, permanent part-time, permanent seasonal, or temporary seasonal employees (National Park Service, n.d.). Several federal, state, tribal, territorial, local, and private agencies across the country employ WLFFs every year, and a large percentage of wildland fire departments consist entirely of volunteers (Wildland Fire Leadership Council, 2014).

The high levels of organizational complexity required to properly carry out wildfire management and suppression has led to a stratification of WLFFs into specified crew types, each of them responsible for specific tasks. The number of individual members of a crew may vary depending on the type of crew, as well as the leadership organization within. Different crew types, which include hand crews, engine crews, overhead crews, hotshot crews, helitack modules, and smokejumpers, among others, play different roles in wildfire suppression, and therefore their physical demands can vary greatly (National Park Service, n.d.; US Department of Interior, 2017; U.S. Forest Service, n.d.). The National Park Service of the U.S. Department of Interior lists three physical fitness qualifications, and all firefighting personnel must meet the

standards associated with their assigned duties. The three qualifications are listed as arduous, moderate, and light, and they are met through the successful completion of the arduous pack test, the moderate field test, or the light walk test respectively (National Park Service, n.d.). There are exceptions to this rule, as there few specialized positions that require no physical fitness standards (National Wildfire Coordinating Group, 2016).

Wildland firefighting can be an extremely strenuous job. Fire suppression activities for an individual firefighter may last up to 14 16-hour days in a row. The tasks required for wildfire management and suppression can be very physically taxing on WLFFs, who may spend over 6,000 kcals on a single day (Cuddy, Ruby, 2011). In addition to the physical requirements of the job, WLFFs are exposed to other occupational stressors including sleep deprivation, heat, rationed nutrition, falling snags, and smoke (Aisbett et al., 2012). Situational awareness and knowledge about fire behavior are key elements of occupational safety due to the threat of rolling rocks and logs, fire-weakened timber, changes in wind direction and speed that alters fire behavior, among other hazards (National Wildfire Coordinating Group, n.d.).

The hazardous nature of the profession may lead to occupational injuries, as well as loss of life among any resource type. Most WLFFs endure at least one occupational injury within a five-season period, often having a direct impact in their ability to perform their duties (Purchio, 2017). Trips, slips, and falls, as well as the use of equipment, tools and machinery often cause sprains and strains, fractures, dislocations, contusions and wounds. Along these lines, environmental exposures on the job may cause burns, poisoning, and heat-related injuries (Britton et al., 2013). Fatalities are not uncommon among WLFFs. Since agencies started monitoring fatal accidents in 1910, and up to 2016, 1,114 individuals have lost their lives on job-related instances, averaging 15.5 fatalities per year in the last decade (National Interagency Fire Center, n.d.). Aircraft and vehicle accidents, heart attacks, and burnovers are the main causes of death among wildland firefighters. Over half of all deaths by heart attack were suffered by volunteer firefighters (Mangan, 2007).

To safely perform their duties, WLFFs must be in exceptional physical condition. Among WLFFs, as with other professions that require high standards of physical fitness (i.e. military occupations and law enforcement), increased physical fitness and healthy body weight has been continuously associated with decreased injury rates and improved health outcomes (Britton et al.,

2013; Grier et. al., 2001; Kaufman, Brodine, Shaffer, 2000; Kuehl et al., 2012; Lisman et. al., 2013; Lisman et. al., 2017; Poplin et al., 2016; Wynn et al., 2012). The ability of WLFFs to perform their duties without becoming fatigued, or a hazard to oneself or others is called "work capacity", a combination of endurance and strength, supplemented by a set of knowledge and skills, and motivation, among other factors (Sharkey & Gaskill, 1997). To achieve high levels of work capacity, appropriate job-specific physical training is vital, supplemented by guidelines for stress management and proper nutrition (Sharkey & Gaskill, 2009). In an attempt to address the physical training needs of WLFFs, efforts have been made in the past to create a comprehensive physical training program. Such efforts in the past have not been fruitful, as programs such as FireFit have had low user rates among the target population. Instead, WLFFs have been drawn to traditional approaches, personal experience, and popular programs such as P-90X, Crossfit, and Insanity (Mangan & Sondag, 2015). These tools can be beneficial in increasing physical fitness, but they do not address the complex needs of WLFFs.

Understanding what drives and deters WLFFs' motivation to engage in physical training is relevant to the creation of a successful physical fitness program. A recent study analyzed the barriers and motivators to physical training among WLFFs both in and off-season. The main motivators to engage in physical training are to be seen as a dependable member of the crew during the fire season, and as a strong role model for other crew members and supervisors. The main barriers to physical training were time constrains, as many WLFFs have other commitments, families, jobs, and school to balance when they're off duty (Mangan & Sondag, 2015).

The Missoula Technology and Development Center of the U.S. Forest Service has partnered with exercise physiologists, biomechanists, and athletic trainers at the University of Montana's Health and Human Performance Department to create an evidence-based program that addresses the physical fitness needs of WLFFs. The product of this partnership is a web and mobile app-based performance program called The Black, an allusion to the name that WLFFs have given to a previously burned area, which serves as a safety zone for them to retreat to in dangerous situations. The Black not only offers physical training routines that are specific to the needs of WLFFs, but also includes educational material about physical performance, stress tolerance, nutrition and injury prevention. Introductory audiovisual material has been included in the program's platform to explain how it operates. Other features include, but are not limited to:

outreach emails, social media platforms, a nutrition log, and recommendations to improve the body's mobility and flexibility. The program's platform also includes fitness tests that individuals may perform and consequently submit their scores, which serves as a form of data collection for exercise physiologists to assess the efficacy of the resources offered. Because of the seasonal nature of wildfire suppression, The Black has been segmented into three phases: Alpha, Bravo, and Charlie. These phases offer content specific to the pre-season, fire season, and post-season respectively. The program started for all users in March 2017, open to WLFFs who were recruited through an invitation extended to the crew mates of individuals who attended a two-day seminar earlier that year in Bakersfield, CA.

This study will evaluate the perceptions and attitudes of users about the program's content and delivery method during the Alpha phase, as well as reported changes in beliefs and behaviors regarding physical training. Conclusions drawn from this study will inform program developers about its strengths and weaknesses, implementation issues, and users' preferences to guide future improvements.

Statement of the Problem

Every year, wildland firefighters are injured or die in the performance of their duties. While there is a paucity of published research regarding the dangers of fighting wildland fires, records indicate that between 1990 and 2006, 310 firefighters lost their lives while performing their duties (Mangan, 2007). Furthermore, reports published in the International Journal of Occupational and Environmental Health indicate that 1,301 non-fatal injuries occurred to WLFFs in the U.S. between 2003 and 2007, during both physical training and firefighting activities (Britton et al., 2013).

Proper physical training has been shown to reduce risk of occupational injuries and certain types of fatalities in military personnel and structural firefighters (Knapik et al., 2005; McDonough et al., 2015). Standardizing WLFFs' physical training to address their needs has been attempted in the past. Such attempts have not been fruitful, and most wildland firefighters today rely on physical training regimes dictated by a crew's training traditions, external non-wildland firefighter-specific programs, or personal experience and knowledge of crew members (Mangan & Sondag, 2015). The Black attempts to provide evidence-based, comprehensive

training guidelines for WLFFs, with an emphasis on mental stress management and nutrition along with promotion of high work capacity levels.

Purpose of the Project

The purpose of this project is to conduct a two-phase program evaluation of the Alpha (pre-season) segment of The Black, a performance program designed exclusively for WLFFs. The first phase of the project will consist of a formative evaluation. Formative evaluations are useful during the pilot testing or initial implementation phase of programs. Data gathered from this evaluation will be used for program refinement and improvement. The second phase of the project is designed to assess the process, impact, and outcome of the program. Information regarding program participation, user experience, attitudes toward, and preferences for using certain features of the program will be gathered, along with participants' perceived effect of the program in their ability to safely perform their duties.

Significance of the Study

Awareness of the dangers of fighting wildland fires and the lack of a broadly used standardized physical training program for WLFFs led the Forest Service to partner with Exercise Science, Athletic Training, and Community Health and Prevention Sciences faculty at the University of Montana to create a performance program called The Black, with the intent to increase the work capacity of WLFFs and reduce the rates of injuries sustained both during physical training as well as on the fireline. Evaluation data gathered from WLFFs involved in the training program will be used to make targeted improvements and refinements. Ultimately, data gathered through this evaluation project will be shared with stakeholders and developers to enhance their understanding of the strengths and challenges associated with the program from the perspective of the users. This program evaluation is a search for feasible and effective ways to engage WLFFs in the future, and to provide immediate feedback from the users to the developers of The Black, enabling short-term improvements to the program's content and delivery platform.

Research Questions

<u>**Formative Evaluation**</u>

From the perspective of the WLFF program participants:

1. What are the strengths and weaknesses of the physical training program?
2. What are the barriers to program use?
3. What changes/adjustments to the program will enhance its usefulness?

<u>**Process and Impact Evaluation**</u>

4. Has the program been utilized?
    a. How many members of the target population are initially enrolled in the program?
    b. What are the rates of retention of the program at pre-determined intervals?
    c. How regularly are participants engaging in the recommended training regime?
    d. How frequently are enrolled participants using the program?
5. What are the demographic characteristics of WLFFs that are utilizing the program (i.e. age, gender, employment status, job title, crew type, and position on the crew)?
6. Which components of the program are most frequently used?
7. What are participants' perceptions in regard to:
    a. satisfaction with the delivery platform?
    b. usability of the delivery platform?
    c. satisfaction with the educational content of the program?
    d. usefulness of the program features?
    e. barriers to using the program?
    f. frequency of delivery of outreach emails?
8. Are participants reading the outreach emails? And if so, are they relevant and useful?
9. Are participants engaging with the program's social media outlets? And if so, are they relevant and useful?

<u>**Outcome Evaluation**</u>

10. Have users' confidence in their ability to carry out their occupational duties increased?

Definition of Terms

1. **Formative Evaluation:** process of measuring program feasibility, acceptability, and appropriateness during its development and implementation (CDC, n.d.).

2. **Impact Evaluation:** measurement of the program effects in the target population by assessing the progress in the objectives that the program is to achieve (CDC, n.d.).

3. **Outcome Evaluation:** process of measuring program effectiveness in achieving its ultimate goals (CDC, n.d.).

4. **Process Evaluation:** process to determine whether program activities have been implemented as intended (CDC, n.d.).

5. **Purposive Sampling:** a non-representative subset of some larger population, constructed to serve a very specific need or purpose (UC Davis, 2007).

6. **Reliability:** refers to whether scores to items on an instrument are internally consistent (i.e., are the item responses consistent across constructs?), stable over time (test-retest correlations), and whether there was consistency in test administration and scoring (Creswell, 2013).

7. **The Black**: performance program for today's endurance athlete that will keep them safe and operating at their highest levels (The Black Performance, 2017).

8. **The black:** a previously burned area that serves as a safety zone for wildland firefighters (Mangan, 2007).

9. **Usability:** A product is usable if the intended users can achieve their goals with effectiveness, efficiency and satisfaction in a specified context of use (Bevan, 2009).

Delimitations

1. Enrollment in the program is optional, and program use following enrollment is not mandatory.

2. Interview respondents will be limited to WLFFs who attended the "Train the Trainer" seminar in Bakersfield, CA.

3. Survey respondents will be limited to WLFFs who belong to a limited number of crews that were invited and agreed to participate in the program pilot study.

4. This study will be delimited to data collected through phone interviews and electronic surveys.

5. The scope of this evaluation is delimited to reported perceptions and behaviors of program users.

Limitations

1. Participants enrolled are not mandated to continue using the program. Thus, interview and survey respondents may not be familiar with the program's platform and/or content.
2. Data collected will be limited to user self-report.

Chapter Two: Review of Literature

The Many Roles of the Wildland Firefighter

Wildland firefighters have many roles and are required to accomplish a variety of tasks. The description for an entry-level WLFF job includes being able to work 12-hours shifts, complete multiple consecutive assignments, adjust pace of work to emergency situations, and live out of a backpack for two or more weeks. Some of the physical requirements include extensive walking, climbing, hiking and kneeling while wearing multiple pieces of equipment in very loose, rocky, muddy surfaces. Listed also in the description are occupational environmental exposures such as extreme heat, airborne particles, falling rocks and trees, holes and drop-offs, snakes, insects and poisonous plants, among others.

Wildland firefighters are a very heterogeneous population, composed of a wide age range performing a wide variety of tasks (Mangan & Sondag, 2015). Duties and physical fitness standards vary greatly between individuals of different crew and employment types. Wildland firefighters may be employed as permanent full-time, permanent part-time, permanent seasonal, or temporary seasonal employees. Employment opportunities depend upon workload fluctuations, which may vary greatly from year to year (National Park Service, n.d.). In the United States, several agencies employ WLFFs at the federal level: Bureau of Indian Affairs (BIA); Bureau of Land Management (BLM); Fish and Wildlife Service (FWS); Forest Service (USFS); National Park Service (NPS); and United States Fire Administration (USFA), among others (National Wildfire Coordinating Group, n.d.). State, tribal, territorial, local, and private agencies also employ WLFFs. Multiple local volunteer fire departments are present across the country as well, accounting for a large percentage of the total number of WLFFs (Wildland Fire Leadership Council, 2014).

Active career WLFFs are organized in crews, usually composed of 18 to 20 individuals. The number of crew members may be reduced for certain crew types. Crews are often led by one crew boss and three squad bosses. Crews are given assignments which may last 14 consecutive days, often with two to four days of rest between assignments. Crews may be identified as type 1, type 2 or other resources depending on the crew members' experience, leadership, and

availability. Crews tend to specialize in certain tasks, and certain crew types are expected to play specific roles in fire suppression.

Due to the complexity of wildfire management, certain resource types may not fall into the listed categories. The crew types include, but are not limited to: engine crew, fire effects crew, fuels crew, hand crew, helitack crew, hotshot crew, prescribed wildland fire crew, smokejumper, wildland fire modules (National Park Service, n.d.; US Department of Interior, 2017; U.S. Forest Service, n.d.). Individuals may work for crews of different types within the same season, depending on availability and need of personnel. Specialties vary among crew types, and so do their physical fitness standards. On one end of the spectrum, there are overhead personnel, which play a vital role in incident management, planning, and communication, providing logistic support, but not necessarily engaging in strenuous physical activity. On the other end, we have type 1 crews such as smokejumpers, rappelers, and hotshots, who are deployed by air or ground into remote areas, carrying heavy loads for long distances, serving as first responders in fire suppression in inaccessible areas, and performing physically strenuous tasks for long periods of time (National Park Service, n.d.).

Physical fitness level standards are determined by individual agencies, and it is up to them to perform measurable evaluations for said standards. As a general guideline, the National Wildfire Coordinating Group (NWCG) has established four levels of physical fitness: arduous, moderate, light, and non-required. Arduous physical fitness standards are meant for WLFFs who are involved in fieldwork requiring above-average and occasionally extraordinarily strenuous physical demands, under adverse conditions and over long periods of time. Moderate physical fitness standards are required of WLFFs performing fieldwork that requires complete control of physical faculties over long periods of time, and occasionally requires engaging in moderately strenuous activities. Light physical fitness standards are required for WLFFs performing duties that involve office-type work with occasional field activity involving tasks that require low exertion, which require baseline health standards. Certain positions are the exception to the rule, as they do not require holding a physical fitness or baseline health standard (Sharkey & Gaskill, 2009).

Hazards of Wildland Firefighting

The job of a WLFF entails exposure to several occupational hazards. Working for long hours in dirty, hot conditions, and in unfamiliar terrain can be detrimental to the firefighters' physical and mental health. Crews commonly sleep near the fireline, eat rationed portions of food, and often don't have access to basic utilities for personal hygiene. These conditions may last days at a time, with many of the tasks carried out at night, to avoid daytime high temperatures and winds (National Park Service, n.d.). For individuals working intermittently for long hours, along with irregular sleep patterns, while exposed to a hot and smoky environment these conditions are exacerbated and may have a greater effect on a WLFFs physiology than the sum of the effect of each of these factors separately (Aisbett et al., 2012).

These hazards have intensified over the years, and wildfires have become more frequent due to global climate change. Such changes have increased the dangers that WLFFs face on a regular basis, and an increase in such changes is expected over the coming decades (Withen, 2015). Projected increases in wildland fire severity and length of fire seasons (Parks et. al., 2016) is likely to be more physically taxing for WLFFs. Thus, the program, which this study proposes to evaluate, gains further relevance, as it attempts to provide guidelines for WLFFs to build and maintain individual work capacity year-round with the inclusion of the latter Bravo (in-season) and Charlie (off-season) phases.

Injuries and Deaths and the WLFF

The profession of wildland firefighter is a high-risk occupation. Occupational injuries and deaths are not uncommon (Mangan, 2007). Between 2003 and 2007, 1,301 non-fatal injuries were officially registered and reported in the Fire Management Accident Report released by the United States Department of the Interior. The most common causes of injuries in WLFFs were slips, trips and falls, followed by accidents involving equipment, tools, or machinery. Sprains and strains appear to be the most common injuries among WLFFs, accounting for 45% of all injuries in engine, smokejumpers, and helitack crews. Other injuries were identified as products of environmental exposures, including poisoning, burns, and heat-related injuries. Fractures and dislocations accounted for 3.9% of all injuries, and wounds and contusions amounted to 21% of the total (Britton et al., 2013). Engine crew workers suffered a third of WLFF injuries between

2003 and 2007, while overhead crews had the largest proportion of injuries endured by older firefighters. Most injuries took place between July and September, which coincides with the peak of fire season (Britton et al., 2013).

The dangers that WLFFs face while carrying out their duties may have fatal consequences. Between 1990 and 2006, 310 deaths were reported during wildland fire operations. Eighty-nine percent of the crude mortality rate was attributed to four main causes: aircraft accidents (23%), vehicle accidents (23%), heart attacks (22%), and burnovers (21%). From the total number of deaths by heart attack during the study period (68), 65% affected volunteer firefighters (Mangan, 2007). Mangan hypothesized that the high rates of mortality due to heart attacks in volunteer firefighters is the consequence of a lack of physical fitness screening at the organizational level.

Fitness has indeed been associated with occupational health outcomes in WLFFs. A retrospective cohort study conducted by Poplin et al. (2016) found increased risks of injury by a factor of 1.82 (95 % CI 1.06–3.11) in individuals with a decreased comprehensive level of fitness in comparison to more fit individuals, considering strength, endurance, flexibility and body composition. Accounting for sprains and strains only, the study found that unfit WLFFs are 2.9 (95 % CI 1.48–5.66) times more likely to endure these type of injuries, making fitness levels even more relevant, since sprains and strains are the most common occupational injuries associated with the profession (Poplin et al., 2016; Britton et al., 2013).

In occupations with similar physical demands such as the military, higher injury rates have largely been associated with low levels of current physical activity, and low levels of previous occupational and leisure physical activity, among others (Kaufman et al., 2000). Wynn et al. (2012) conducted a study to observe the relationship between screening for cardiorespiratory fitness for recruitment of firefighters and occupational health outcomes in the United Kingdom.   lack of such standards as a criterion for recruitment resulted in increased incidence of injury during training (Wynn et al., 2012). Other variables such as BMI have been identified as injury risk factors. A study found that overweight firefighters (BMI >25 and <30) were 15% more likely to endure occupational injuries, while obese firefighters (BMI >30) were at 48% greater risk of sustaining an injury compared to those with normal body weight (Kuehl et al., 2012).

For a long time, a link between improved physical fitness and reduced risk for occupational injuries has been observed in professions that require high physical demands. In structural firefighters, individuals who scored higher in comprehensive fitness metrics were at a lower risk of injury as compared to those with lower scores (Poplin et al., 2016). Low levels of cardiorespiratory endurance in athletic and military populations has been linked to an increased risk in musculoskeletal injuries (Grier et. al., 2001; Lisman et. al., 2017). The ability of individuals undergoing military training, to run a faster 3-mile dash were less likely to endure consequent injury, and trainees who ran a slower 3-mile dash, as well as scoring low on functional movement tests, were more likely to endure injuries during training (Lisman et. al., 2013).

WLFF Fitness

The use of hand tools to dig a fireline, hiking, lifting and carrying loads are physically taxing tasks that WLFFs must be able to perform for several hours at a time, often under strenuous conditions. In order to carry out their duties safely, WLFFs must build work capacity, which is defined as the "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, skill, experience, acclimatization, nutrition, and—of course— motivation" (Sharkey & Gaskill, 1997, pg. 5). Optimal work capacity varies among different WLFF crew types, and physical training recommendations must be season-specific, as pre, during, and post-fire season periods impose different needs. Due to the complexity and comprehensiveness of a work capacity, effective training requires a multi-disciplinary approach, where not only physical training principles are considered, but also factors such as stress management and nutrition. A combination of these components provides a broader sense of wellness and reduces risk of injury and disease (Sharkey et al., 2009).

With the mission of promoting health and safety, and reducing injuries among WLFFs, a task group was appointed by the National Interagency Fire Center to create a comprehensive fitness program (National Interagency Fire Center, n.d.). The program, named FireFit, was released in May 2006 with the intention of providing guidelines that could be adapted for the specific needs of a wide variety of wildland fire resources (National Interagency Fire Center, n.d.). A recent study, which surveyed 1,141 WLFFs across the United States, indicates that

FireFit has not been able to reach the target population, with a rate of use between five and seven percent. Between 51 and 55% of all respondents were familiar with FireFit, but didn't use it, and over 40% had never heard of it (Mangan & Sondag, 2015). FireFit was developed by WLFFs for WLFFs and provided content that was specific to potential users. However, the program did not fulfill its purpose. A systematic evaluation of FireFit may have provided feedback for improvement and offered clues as to how future programs could address physical training needs effectively. Such evaluation was never conducted, or at least never published.

Wildland firefighters are aware of the relevance of physical training in their ability to perform their job successfully and safely. Nearly 85% of surveyed WLFFs reported engaging in moderate to strenuous physical training, although such training was, in most cases, not specific to their occupational needs. Most WLFFs use independent programs to guide their physical training, with some of the commercial brands such as P90-X, Insanity and Crossfit among the most popular (Mangan, Sondag, 2015). Although these resources may yield some beneficial outcomes, they do not target or are based upon the specific needs of WLFFs.

Barriers and Motivators to WLFF Physical Training

Although physical training is a major factor in the ability of WLFFs to carry out their duties, and despite the many years for which this has been known to be so, there has been very limited research regarding what motivates WLFFs to engage in physical training, as well as what prevents them from doing so.

A study conducted in 2015 (Mangan, Sondag), explored the barriers and motivators to engaging in physical training among WLFFs through an electronic survey, which was successfully disseminated through snowball sampling, yielding over 1,100 responses. This study also looked at the current trends in physical training and rates of use of FireFit, perceptions regarding the importance of physical training, self-reported injury rates, among other variables.

The study found that the main motivators for WLFFs to engage in physical training during the off-season were to maintain good personal health, being a role model for crew members and supervisors, wanting to be seen as someone who can be counted on during the fire season, having access to physical training equipment/facilities, and being required to meet fitness standards upon return to work, in that order. During the fire season, the main motivators were to

be physically fit to make work easier, achieving personal fitness standards, wanting to appear as a fit and dependable crew to incident commanders and other fire crews, being paid to engage in physical training, and wanting to be seen as a strong crew member. There seems to be a strong link between motivation to engage in physical training and a desire to be dependable (Mangan & Sondag, 2015).

As far as barriers to engage in physical training during the off-season, WLFFs reported that environmental factors such as low temperatures and darkness, wanting to spend time with family and friends, finding a balance between work, school, or a job, being physically or emotionally worn out, and not having a place to do physical training were the main obstructing factors. During the fire season, the main barriers to engage in physical training were other projects taking priority, being worn-out, a lack on emphasis on physical training, low morale or bad attitudes of other crew members about physical training, and physical training being optional instead of a mandatory activity. The common theme among barriers to physical training seems to be time constrains, and not being able to fit physical training into their schedule (Mangan & Sondag, 2015).

It is worth noting that responses for motivators were significantly higher than responses for barriers in this study, which tells us that WLFFs are a population more focused on motivators than they are on barriers. Along these lines, 94% of respondents in the same study reported that they perceive physical fitness to be important or very important for WLFFs, and none of the respondents reported perceiving physical fitness as not important (Mangan & Sondag, 2015).

The Black

Concern about the lack of physical training programs specific to WLFF led the Missoula Technology and Development Center of the U.S. Forest Service to partner with University of Montana researchers to develop a training program that would increase the work capacity of the firefighter to decreasing their risk of injury and death both on and off the fireline. This partnership resulted in the development of a program currently named The Black.

The black is a concept used by WLFF's to refer to a safety zone - an area which has been previously burned, deprived of fuels that can sustain fire and flames. Because this area cannot burn again, the operational phrase "keep one foot in the black" has become a successful meme,

providing WLFF's with a safety zone they can reach in case of a threatening situation (Mangan, 2000). The name given to the physical training program, The Black, alludes to the "safety zone", as the objective of the program is to facilitate guidelines for WLFFs to reach a state in which they can perform their job safely, through a comprehensive intervention that includes physical training, mental stress tolerance, and nutritional guidelines. The program, in an attempt to promote healthy behaviors specific to WLFFs during the full cycle of a year, was developed as a series of three consecutive sections, each of which are homologous to the occupational seasons of the job and are named as follows: Alpha phase (preseason), Bravo phase (in-season), and Charlie phase (off-season).

The evaluation efforts described in this document refer exclusively to the Alpha phase. The Alpha phase was the first to be made available to the users, opening its digital doors in March 2017. The main objective during Alpha phase is to prepare WLFFs for their upcoming fire season, after most of them have been off-duty since the end of the previous fire season. More specifically, at the physical performance level, the goals of this phase are to increase strength, endurance, and work hardening. As far as nutrition, the goals of this phase are to improve hydration, increase consumption of fruits and vegetables, and reducing consumption of highly processed foods to achieve a healthy body weight. Goals related to mental stress tolerance are to increase efficacy in the performance of job-specific tasks, and to enable WLFFs to translate these skills to the fire grounds. Similarly, another goal of the program is to establish physical training guidelines through a platform that is useful, satisfactory, attractive, and user-friendly, based on findings about barriers and motivators to physical training reported by WLFFs in a previous study.

Efforts adjacent to this evaluation study are being conducted to assess the effectiveness of the program regarding physical fitness markers and injury rates.

WLFFs enrolled in the Alpha section of The Black will have access to overview and introductory videos that explain how the program works, its mission, and its components. Further educational reading resources will be available for participants to familiarize themselves in more detail with the evidence behind the program. These educational materials will be separated into three categories: physical performance, tactical stress tolerance, and tactical nutrition. A Safety Zone Screening test will be performed by participants to assess mobility and flexibility, and

exercises to improve these measures will be offered to participants with suboptimal scores. Fitness tests that assess physical condition specific to the needs of WLFFs are available in the program's platform, with the option of registering the results, which will be collected and analyzed by exercise physiologists. Outreach emails will be sent to participants at least three times a week, each email containing summarized information about either physical performance, tactical stress tolerance, or tactical nutrition. WLFF-specific physical training routines will be available to participants on a weekly basis. Every day of each week will be assigned a physical training routine, which will be delivered in PDF format. Instructional videos explaining proper form for each exercise included in the physical training routines will be available for participants in the program's website. Social media platforms including Twitter, Facebook, and Instagram are available for participants to interact with the program.

Logic Models

A logic model is a visual tool that allows for a systematic way to present the logical progression of the program evaluation process, providing a context for its components and the relationships within and among them. Logic models are used in program evaluation to provide an understanding of the process leading to desired outcomes, and to help identify components where improvements can be made through targeted alternative strategies (W.K. Kellogg Foundation, 2004; Millar et al., 2001; CDC, 1999).

Two logic models will be utilized to provide a framework and context for this program evaluation. The first model consists of a recommended framework for the program evaluation cycle as a whole, displaying the steps to be taken by the researchers for valid conclusions to be drawn, justified, and utilized. The second model displays the factors and components specific to The Black that will be accounted for in this study.

The first model was developed by the CDC in 1999 as a framework for conducting a program evaluation. CDC recommends this model as a means to provide "a practical, nonprescriptive tool, designed to summarize and organize essential elements of program evaluation" (CDC, 1999, p. 4). This model is comprised of six steps which are connected, interdependent, and sequential, providing context and organization for the elements included in the evaluation. A set of standards are included in this model to ensure the effectiveness of the

evaluation. These standards are clustered into four groups: utility, feasibility, propriety, and accuracy. Standards in this framework include, but are not limited to, the following: it must ultimately serve program users, it must be realistic and prudent, legal and ethical, and should provide accurate information (CDC, 1999, p. 4).
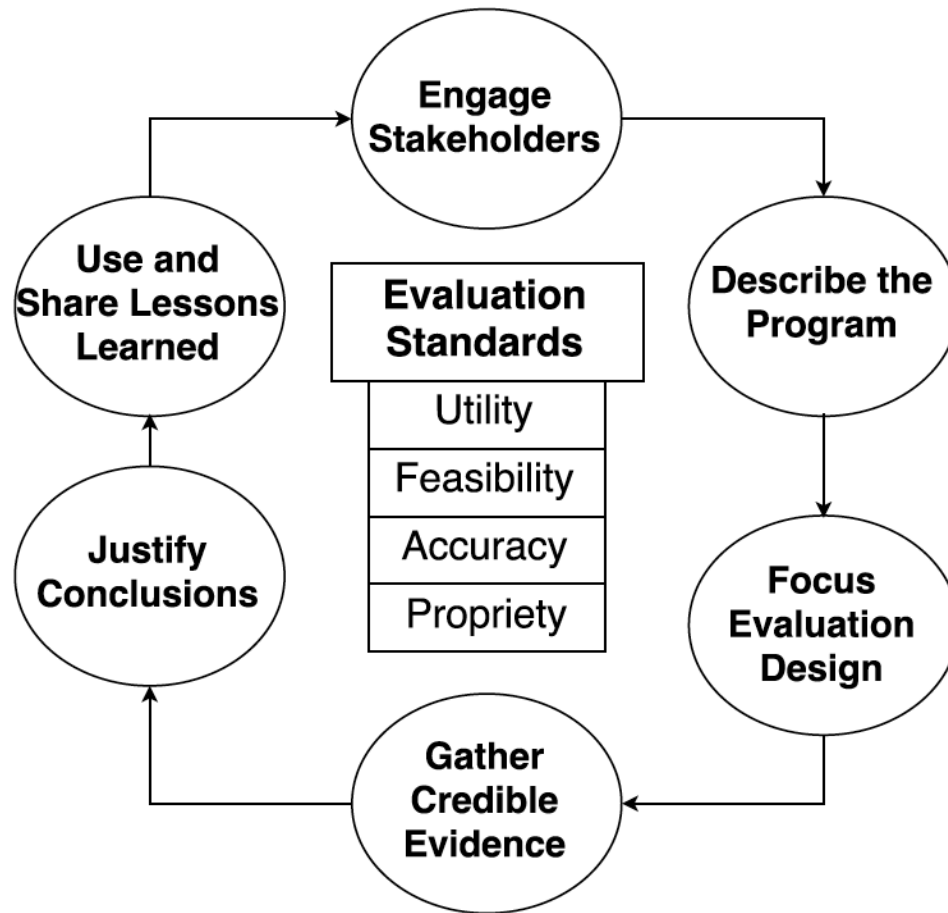
Recommended framework for program evaluation (CDC, 1999, p. 4)

The second logic model summarizes the components of the program, including the features that will be evaluated in this study. This logic model was adapted from *Program Evaluation: An Introduction to an Evidence-Based Approach* (Royse, Thyer, Padgett, 2016) and designed to visually display the program's projected program inputs, activities, implementation, as well as its desired impact and outcomes. Inputs are financial, organizational, and human resources needed. Activities refer to the development of the platform and the content of the program. Implementation refers to the steps taken to provide users with access to the program's platform and its content. Impacts are expected changes in behavior, knowledge, and attitudes as a

product of program use. Outcomes are the program's objectives, described as improvements in health and quality of life as a product of using the program. The purpose of this model is to enhance evaluators' ability to explain concepts and approaches to stakeholders and developers, enable critical examination, identify core processes to allow for systematic improvements, and clarify the sequential nature of these processes (W.K. Kellogg Foundation, 2004; Royse, Thyer, Padgett, 2016; Creswell, 2014).

LOGIC MODEL
FOR WILDLAND FIREFIGHTER PHYSICAL TRAINING PROGRAM EVALUATION

Inputs

- Funding Support from the U.S. Forest Service
- Expertise of University of Montana Health and Human Performance Researchers
  - Athletic Trainers
  - Exercise Physiologists
  - Biomechanists
- Partnership with "The First Twenty" Online Platform Developer

Activities

- Develop evidence-based physical training program targeted to WLFFs
- Develop fitness tests and Safety Zone Screening
- Develop instructional exercise videos
- Develop educational and introductory videos
- Collaborate with partners at "The First Twenty" to develop online platform
- Provide orientation and training pilot program volunteer WLFFs
- Create social media accounts to foster connectivity among users

Implementation

- Physical training routines are loaded into the online platform and made available to WLFFs weekly
- Program pilot volunteers log into the program, and watch introductory and instructional videos
- Program pilot volunteers encourage their co-workers to sign in to the program
- Outreach e-mails are sent to users, containing summarized program information and summarized educational materials

Impact

- Users complete Safety Zone Screening and perform fitness tests, and record their results
- Users engage in recommended physical training regime daily
- Users read educational materials
- Users regularly engage with social media accounts
- Users regularly read outreach e-mails
- Users recognize the value of and support the physical training
- Program Users report degree of satisfaction with:
  - delivery platform
  - program content
  - usefulness of physical training regime
  - usefulness of educational materials
  - outreach emails and social media accounts

Outcomes

- Users demonstrate increased job readiness
- Users demonstrate increased work capacity
- Rates of occupational injuries decline
- Users feel more confident about carrying out their occupational duties

Adapted program evaluation logic model for The Black – Alpha phase.

Chapter Three: Methodology

Study Design

This evaluation project used a mixed-methods design by collecting, analyzing, and synthesizing both qualitative and quantitative data (Royse et. al., 2016). A combination of both qualitative and quantitative methods in program evaluation allows for the exploration of a broader and more complete set of research questions, and the weaknesses of each separate method may be overcome by the strengths of the other. Convergent data from dissimilar methods allows for stronger evidence to support latter conclusions through the corroboration of findings (Johnson & Onwuegbuzie, 2004).

This design consists of the collection and analysis of qualitative data, which informs the collection of quantitative data. Data from both methods is synthesized to draw conclusions. The purpose of taking this approach is to determine whether data collected from a smaller subset of the population can be generalized to a larger sample of the target population (Creswell, 2014).

Preliminary qualitative data was collected through qualitative interviews during the implementation phase of the program. These data were analyzed, and findings were reported to program developers to address implementation issues. Furthermore, the results from qualitative interviews informed the development of the survey instrument for quantitative data collection.

Quantitative data was collected through an electronic survey once the Alpha phase of the program has ended and analyzed using Qualtrics software. The original methodology described the use IBM SPSS 23 statistical software for data analysis. [Researchers deemed the use of this statistical software unnecessary due to the small size of the sample surveyed, which did not call for quantitative analysis further than descriptive statistics]. Data was synthesized, merging the results of both the qualitative and quantitative approaches, allowing for a comprehensive interpretation of results. Results were reported to program developers.
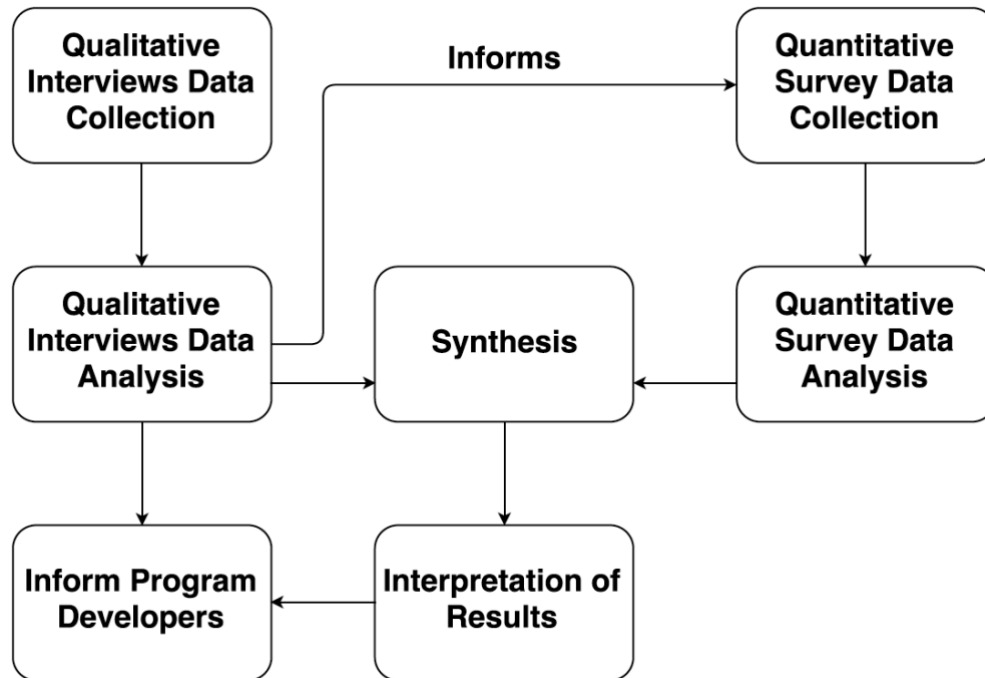
Sequential Mixed Methods Program Evaluation Research Design Logic Model.

Participant Recruitment

Wildland firefighters, including administrative staff from five agencies that employ firefighters, were invited by officials at the Missoula Technology and Development Center to participate in a pilot test of The Black physical training program. Thirty-five male individuals between the ages of 18 and 65, from a variety of crew types and geographical locations within the United States, volunteered to participate in the program. All volunteers were sent an invitation to a three-day training seminar called "Train the Trainer," in Bakersfield, CA, where they were briefed by the program developers about the science behind the program, as well as the next steps for the program's implementation. This group was asked to consequently inform other members of their own crews about the information conveyed during the seminar, as their crew mates would later be included in the program. "Train the Trainer" participants were encouraged to become familiar with the electronic platform that contains the program, and to actively engage in a variety of fitness tests that will be used to track participants' progress.

Formative Evaluation Sample

A purposive sample of 10 to 15 individuals who volunteered to attend the Bakersfield three-day seminar were sent an email with an invitation to participate in a 25 to 30-minute phone interview about their experience using The Black. If any individual refused to participate or couldn't be reached, another name was chosen from the list of Bakersfield volunteers until the interviewer had reached a minimum of ten interviews and/or data saturation had been reached.

Impact and Outcome Evaluation Sample

All individuals who participated in the Bakersfield three-day training, and members of their crews who also have logged into The Black, were sent an email with a link to the electronic survey and asked to provide feedback regarding their experience with The Black. Approximately one week after the first email was sent, a reminder email containing the survey link was sent to all participants requesting that they complete the survey if they hadn't already done so.

Instrument Development

Interviews

A structured interview guide was developed, based upon the research questions, to explore the reactions of program users during the early stages of implementation. The interview guide consists of 11 sections. Section one (1) requests information regarding program use, including general thoughts about the program to date, as well as use rates and whether participants followed the instructed steps during the first week of the program. Section two (2) requests information regarding the introductory videos embedded in the website, whether participants watched the videos, and whether they were helpful to program users. Section three (3) requests information about the use of the workout plans offered by the program, if and how these were performed, whether they were well-received, and feedback regarding corresponding audiovisual instructions. Section four (4) requests information about physical tests and assessments required by the program, and ease of data input. Section five (5) requests information about the use of the nutrition log embedded in the program's website, and whether it was useful. Section six (6)

requests information about the emails sent by the program, how often they were read, and feedback regarding the quantity of emails and relevance of their content. Section seven (7) requests information about the additional reading resources added to the program's website. Section eight (8) requests information about participants' beliefs and perceptions about the program. Section nine (9) requests information regarding the rates of engagement and familiarity with social media platforms associated with the program, and well as the relevance their content. Section ten (10) requests information about the participant and his crewmates' main barriers associated with use or lack of use of the program. Section eleven (11) provides the participant an opportunity to share personal comments and suggestions for the program and its developers. The interview guide was reviewed for face and content validity by individuals familiar with the program, and consequently revised and pilot-tested. Minor revisions were made based on the pilot test. The interview was anticipated to take 25 to 30 minutes to be completed.

Survey

A survey was developed based upon the research questions regarding the implementation, impact, and outcome of WLFFs participation in the pilot test of The Black. The survey consists of seven sections. Section one (1) requests demographic information, along with an overall level of satisfaction with the program. Section two (2) requests information about the usefulness of individual program features. Section three (3) requests information about personal preferences regarding individual program features. Section four (4) requests information about attitudes and beliefs related to individual program features, as well as to the program as a whole. Section five (5) requests information about engagement rates associated with individual program features. Section six (6) requests information about the barriers to program use or performance of individual tasks. Section seven (7) consists of a validated scale to measure platform usability.

As defined by the exploratory sequential mixed methods design used in this program evaluation, the survey instrument was bound to be modified based on the results obtained from qualitative information collected and analyzed prior to survey dissemination. Once modifications based upon the qualitative data have been completed, individuals familiar with the program reviewed the survey for face and content validity. Finally, a small group of WLFFs were to be asked to pilot-test the survey after which minor revisions may be made. [No current WLFF

revised the final version of the survey, although it was reviewed by faculty and a former member of the target population]. The survey was anticipated to take 10 to 15 minutes to be completed.

Data Collection

Interviews

Three to four weeks into the program's onset, a purposive sample of pilot program participants was contacted via email and asked to volunteer for an interview. Primary contact information, as well as best dates and times to be reached for a phone interview were requested at that time. Individuals who responded affirmatively to the email were called at the time specified in their reply. Upon reaching the participant via phone call, the interviewer read the informed consent, asked for verbal agreement, and reminded the participant that the interview was to be audio recorded. The interviewer followed the written interview guide during the interviews, which remained unchanged throughout the interview process. Interviews were expected to last 25 to 30 minutes, although the interviewee could choose to end his participation at any time.

Survey

At the end of the Alpha segment of the physical training program, all participants who had enrolled in the program through the online platform were asked, via email, to respond to the survey. Email addresses were obtained through the platform's data collection devices. The body of the email contained a link to the survey, and individuals who chose to participate were asked to click on the link provided, leading them to the digital survey embedded in Qualtrics survey platform. Answers to the survey were anonymous. The survey was anticipated to take approximately 10 to 15 minutes to be completed.

Data Analysis

Interviews

Interviews were audio recorded and transcribed. Once transcribed, the recordings were erased. Interview transcripts were qualitatively analyzed.

Qualitative analysis followed a linear, hierarchical approach comprised by seven steps: (1) organizing and preparing data for analysis; (2) reading through all data; (3) coding the data; (4) identifying of main themes and describing of data; (5) interrelating themes and description; (6) interpreting the meaning of themes and descriptions; and finally (7) validating of the accuracy of the information (Creswell, 2014). Data will be coded according to Tesch's Eight Steps in the Coding Process, which include: (1) getting a sense of the whole; (2) finding underlying meaning of the content of several transcripts; (3) listing, clustering, and organizing all topics found; (4) abbreviating topic clusters as codes to create a preliminary organizing scheme; (5) describing codes, creating, and merging categories; (6) finalizing categories for the organizing scheme and alphabetizing codes; (7) assigning transcript data to their respective categories; and (8) recoding existing data if necessary (Creswell, 2014).

Survey

Data from the surveys was exported into SPSS for analysis [although no statistical analysis was perform using this software]. Descriptive statistics were reported.

If appropriate, differences among demographic groups and variables regarding formative, impact, and outcome evaluation were to be explored. Demographic groups were segregated based on criteria that may be relevant to perceptions of the program and behavior change (i.e. age, gender). Because the survey instrument was bound to be shaped by the results from qualitative data analysis, these criteria were subject to change.

Other quantitative data analysis tests were to be performed as appropriate, depending on the variables explored through the final version of the survey instrument.

Synthesis

Data from both the quantitative and qualitative sources was synthesized. Qualitative data was used to support and provide depth to the quantitative findings. Key findings were reported, limitations of the data were noted, and conclusions and recommendations were offered to the program developers.

Chapter Four: Results

Interviews

Nine interviews were conducted during the month of April 2017. By the time these interviews were conducted at least one month had passed since the program's onset. These interviews were conducted by phone, following a previously developed and pretested protocol, and posteriorly transcribed and interviewees de-identified. The length of these interviews varied between four and 28 minutes. All interviewees were pulled from a pool of 34 WLFFs who had attended the "Train the Trainer" seminar in Bakersfield, CA, three months before the program was made available.

<u>Demographics</u>

All nine interviewees were male wildland firefighters employed during the 2017 fire season, representing six different resource types from two federal agencies.

Interviewee	Resource	Forest	Agency
#1	Overhead	Fire Leadership Team	BLM
#2	IHC	Eldorado	USFS
#3	IHC	American River	USFS
#4	Job Corps	Sentinel, Nampa	USFS
#5	Handcrew	Bitterroot	USFS
#6	IHC	Diamond Mt.	BLM
#7	Handcrew	Folsom Lake	BLM
#8	HRAP	Siskiyou	USFS
#9	Engine	Tonto	USFS

Themes

The interview guide was structured so as to provide feedback about the program in general, as well as about individual features specifically. Three categories were defined to organize the recurring themes identified in the interview transcripts: feedback regarding (1) delivery method, (2) program content, and (3) beliefs and attitudes about the program.

Program Platform and Delivery Method

Multiple difficulties and barriers to program use associated with the methods by which the program features were delivered were identified in the interviews. The static timeline of the program's initial phase and low usability of the online platform were the main ones.

Usability

The platform was described by interviewees as cumbersome and unintuitive. Navigating the website and retrieving the desired content proved to be a major difficulty for users. Confusion over buttons and sections within the website, as well as with login information were clear barriers for participants to sustain engagement with the program.

> *"Delivery method is confusing and not very user friendly, especially compared to some of the things that are out there"*

Because the content for the Alpha phase was offered on the website on a weekly basis, users were able to go backwards in the timeline but not forwards. This static timeline made it very difficult for participants to follow recommendations. Several users had been preparing months in advance, and the recommendations offered by the program were deemed inadequate for their training stage at the time. Similarly, many users were not yet employed or had logged into the website until several weeks posterior to the program's onset. For these participants, the program was already way underway when they began to prepare for their fire season. Finding the right information offered on previous weeks was difficult and unintuitive.

"The problem was a late starting point for us…when we started the whole introduction of workouts…I was already months into my training"

Fitness Tests and Safety Zone Screening

Although instructions to proceed with fitness tests and the Safety Zone Screening were clear to users, many expressed difficulties logging their test results onto the website. Difficulties finding where to enter test results, unfamiliarity with the metric system, and technical issues with the website were mentioned as barriers to reporting test results.

"when you take a test, you want results and there's no results given I don't think. Like did I do good or bad, did I do ok?"

Mobile Application

Two main issues related to program's mobile application were identified. First, many users had difficulties finding and downloading the application, because the application was embedded in an overarching platform that users were unfamiliar with.

"I don't know if there are instructions somewhere else on how to [download the app] …Maybe that is something that could be a little more up front"

Secondly, the application was perceived not to be up to the industry's standard and presented many of the same navigation issues associated with the desktop version. Users would be more willing to participate in the program's activities if they were able to easily access the platform from their mobile device.

"I'm a part of a bunch of other fitness programs, and they have apps…they're so much easier to use"

Emails

Program emails were perceived to be a good method to maintain engagement over time, a good reminder of the program's availability, and regarded as a valuable feature by some. Nonetheless, frequency of program emails was regarded by many as excessive, provoking "burnout" in some users, prompting them to disregard new emails. Furthermore, for multiple interviewees these

emails were arriving as spam or "suspicious" email, decreasing the chances that they would open and read them.

"Yeah, I actually think that one of the "radest" things about it is the emails…When I first started getting them I was like "oh, man, this is sweet" …But then it's just every day, it's a bit of a burnout"

Exercise Videos

Because physical training routines were offered in PDF format, the videos showing and explaining how to properly perform every exercise were not readily available to users when they were needed. Although these videos could be accessed from a mobile device, many users were not familiar with the mobile version of the platform, some reported not being able to stream them from their personal device, while others had trouble finding the videos in the website or app due to navigation issues.

"I need to be able to watch the video in our workout area"

Workouts

The delivery method for the physical training routines offered in the program was criticized by users. The routines were made available on the website and mobile platform as PDF files, which were useful in print. Most users did not print these out, accessing them when needed proved to be a cumbersome task. Interviewees reported using these routines as a reference in creating their own instead of following them strictly.

"Honestly, the workouts in my opinion are awesome…I just think the delivery method of the workouts is poor"

Social Media

Interviewees reported no engagement with the program's social media accounts. Most identified themselves as someone who is generally uninterested in social media.

Nutrition Log

The nutrition log tool included in the platform was briefly explored by some but used by none. This tool was perceived to be a good asset for others, but none of the interviewees perceived it to be a useful tool for themselves. Some comments were made about the program's inability to synchronize with other programs and applications not only associated with nutrition, but physical activity as well.

"I got on there just the first time. I just tooled around on it and just wanted to see what my calorie intake was for the day…kind of calibrated me to how much fuel I'm putting in versus how much I'm using or not using"

Program Content

Exercise Videos

The exercise videos, which showed and explained the proper form of each exercise included in physical training routines in The Black were perceived to be of poor quality. The quality of the video itself was not up to the standard, and the exercises were perceived as being performed poorly.

"I think that a lot of those videos are kind of poor…the exercises are done poorly"

Introductory Videos

The program's introductory videos provided a good overview of the program to users. These videos were viewed as a good reinforcement for those who attended the "Train the Trainer" seminar, and as a good introduction for people new to the program. Most interviewees reported having watched these videos and perceived their content to be informative and effectively explain the program's expectations.

"I liked all of them. There was a lot of good information there, it explained…exactly what you guys are trying to do here"

Workouts

The content of the workouts was perceived positively by many. One subset of workouts that gained attention and support were the High Intensity Interval Training (HIIT) routines.

"I've utilized them. Especially the HIIT training ones, I follow those verbatim"

Two aspects of the physical training routines were criticized. First, the recommended equipment to be used when performing these routines was not exercise equipment per-se. The assumption that WLFFs don't have access to exercise equipment is erroneous and kept users from following program guidelines. Secondly, the routines were not perceived as being intense or hard enough. This was even more prominent among resources that require a high fitness standard, who felt the recommended routines would not prepare them for their duty, and the difference in physical demand between some resources and others was not acknowledged and/or considered.

"I understand we're trying to use equipment that is available to us, but we're making assumptions that firefighters do not have equipment"

Educational Resources

Although the educational resources were not well organized and difficult to access, their content was highly rated by users. The information provided was perceived to be reliable, and details about the topics included were appreciated. Interviewees said this was the feature they gravitated towards the most and recommended to others, even among those who were most critical of the program.

"I actually spent more time cruising through the additional information than the rest of the whole website. But still, the delivery method…the information there is hard to get"

Beliefs and attitudes

Credibility

Program users valued the presence of accomplished scientists behind the program. All interviewees had the opportunity to meet and interact with the scientists involved during the "Train the Trainer" seminar and had been briefed on the science backing the program. The scientists' expertise was appreciated by the users and gave the program credibility.

> *"I like it because first of all it was put together by professionals, true scientists that knew what they were doing"*

A Step in the Right Direction

The program was perceived to be a step in the right direction, an improvement from previous efforts to standardize physical training in wildland fire, albeit still insufficient. Even though most interviewees stopped using the program shortly after it started, they expressed a willingness to participate initially. The program's content and delivery are not perceived to be up to the industry's standard, and users are aware of similar products that are free and available to them.

> *"I'm looking forward to the response once it goes into the mainstream. It's a good step in the right direction"*

Insufficient Intensity

Interviewees, especially type 1 resources, said that the program did not meet the needs of their crew. The intensity of the workouts was not perceived to be high enough as to prepare WLFFs to perform their duties. Type 1 resources acknowledged that it is difficult to change the traditions and approaches to training their crews have developed and maintained over many years. Furthermore, there is no concern among WLFFs about their approach being less effective, downplaying the need to adopt a different one.

> *"If someone who was new to fire only did The Black workouts, they would be poorly prepared for the workouts done by crews"*

> *"Not hard enough to prepare an individual to succeed on a type 1 crew"*

Lack of Purpose to Engage in Program Activities

Users were not compelled to follow the program activities as recommended. The input of data from fitness tests and safety zone screening seemed purposeless to users, mainly because of the expectation that they would receive useful feedback based on their results. Getting individualized feedback and being able to compare results to standards and other WLFFs was a motivation to engage in the program, and disappointment was expressed related to the program's inability to provide it.

> *"This was one of the main features I was looking forward to, getting feedback from professionals…it would help me gauge where I'm at"*

Survey

A survey instrument was developed, informed by the findings from the interviews conducted. The survey was made available using Qualtrics survey software and disseminated via email. Survey responses were collected over a one-month period between June and July 2017, and eligible respondents were ultimately any employed WLFF regardless of their participation in the program. Those who had never logged into The Black or hadn't been invited to participate in the first-year pilot were asked to provide qualitative information indirectly related to the program. Several reminders were sent from multiple senders, including the program's database, researchers' email addresses and email addresses from USFS officials, to maximize response rates.

Demographics

Survey respondents (N=36) ranged from 25 to 57 years old, with 40.6% between 32 and 38. Although over 80% were male, female WLFFs were overrepresented in this sample in comparison to the male to female ratio in the profession overall.

	n	%
Age	**32**	**100**
18-24	0	0
25-31	7	21.9
32-38	13	40.6
39-45	5	15.6
46-57	7	21.9
Gender	**32**	**100**
Male	26	81
Female	6	19

The vast majority of respondents (83.8%) were permanent employees, 81.5% of them employed full-time. About 83% had been WLFFs for 10 or more years, and none were in their first year of employment. Out of those who were not employed full-time as WLFFs, only half had some type of employment when not fighting fires. Two federal agencies, the U.S. Forest Service and the Bureau of Land Management, were represented were represented in the sample. Over one third of the 29 respondents who reported their current crew type belonged to hotshot crews, while fire use module, hand and engine crews made up 41.4% of the sample, and overhead made up 17.2% of the sample. Two specialized resources responded to the survey but didn't fall within the listed categories. Passing the arduous pack test was required for employment for every single one of them.

	n	%
Years of experience as a	**32**	**100**
2-5 years	4	12
6-9 years	1	3
10+ years	24	75
Employment as a WLFF	**32**	**100**
Permanent, full-time	22	69
Permanent, seasonal	5	16
Temporary, seasonal	4	12
Other	1	3
Agency	**29**	**100**
USFS	8	72
BLM	21	28
Resource Type	**29**	**100**
Engine	7	24
Fire use module	3	10
Handcrew	2	7
Hotshot	10	35
Overhead/IC	5	17
Other	2	7

Over 60% of respondents started their employment for the 2017 season in May, about 18% did so between February and April, and over 21% started in January of the same year.
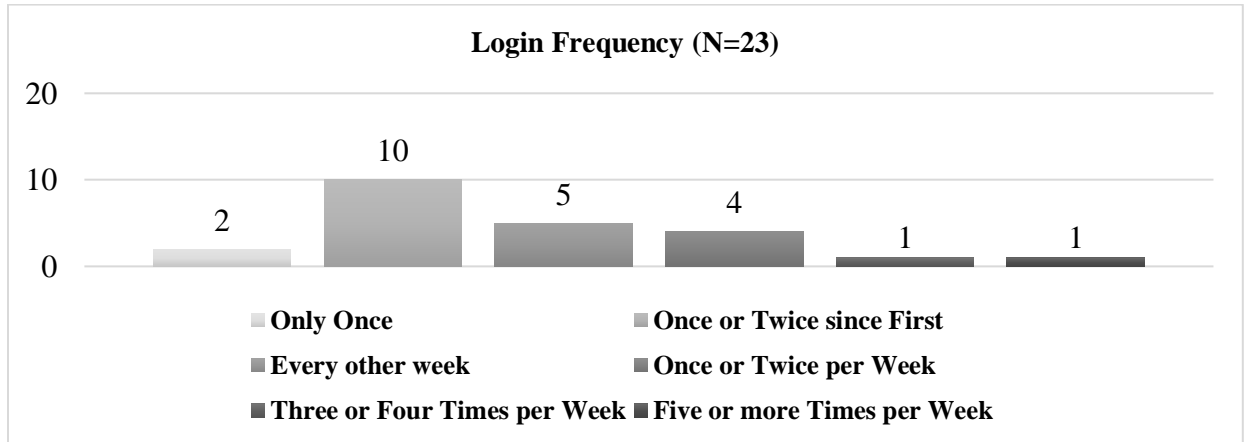
Employment Start Date (N=29)
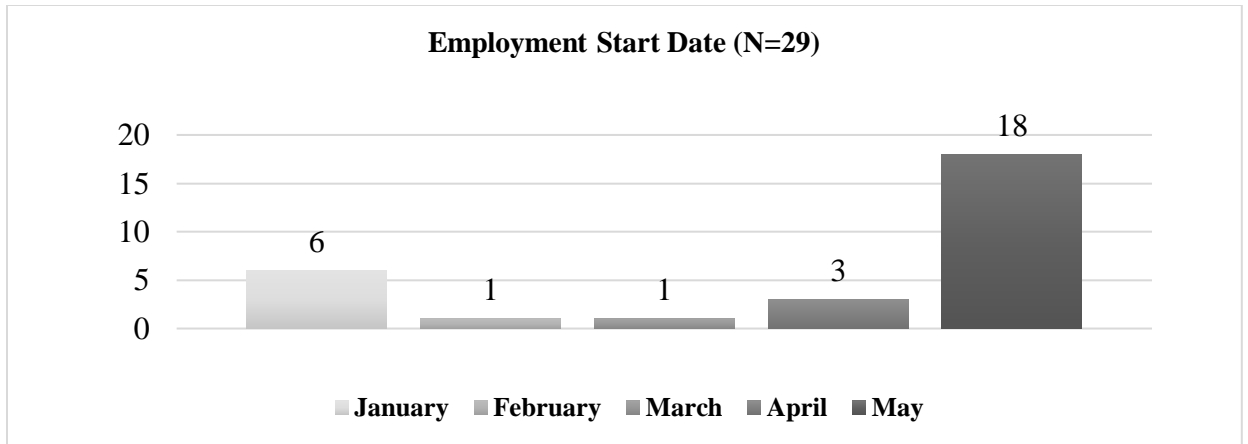
By the time the survey was closed, half of respondents had been on fire assignments during the present year, with Hotshot crews being the most active during the early fire season (80% having been on assignment). Over 78% of those who had been on assignment (n=14) were first on assignment in May or June, while 21% were so in February or March.

First Fire Assignment (N=15)
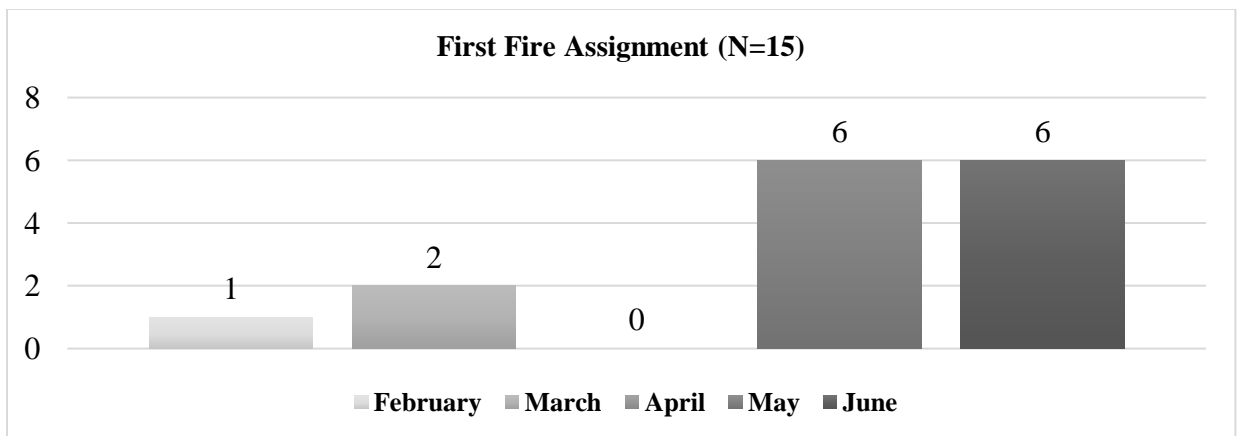
User Rates

Approximately 96% of respondents had received an invitation to join The Black. Over 88% of the sample did initially log into the program. Those who didn't initially log in reported four reasons for not having done so: (1) "didn't have time to log in", (2) "invitation looked like spam or went to junk mail", (3) "The Black was available too late in the pre-season" and (4) "we already have a program that works". About 74% of respondents had joined the program between March and April. No respondents had joined the program after April 18th. Oddly, over 25% of respondents reported having joined The Black before March, at a time when the program had not yet been made available.

Over half of those who reported logging in initially did so only once or twice after their first time. Twenty-two percent reported logging in every other week, and only 26% did so once or twice per week. Less than 9% reported entering the platform three or more times per week.

Login Frequency (N=23)

Legend:
- Only Once
- Once or Twice since First
- Every other week
- Once or Twice per Week
- Three or Four Times per Week
- Five or more Times per Week

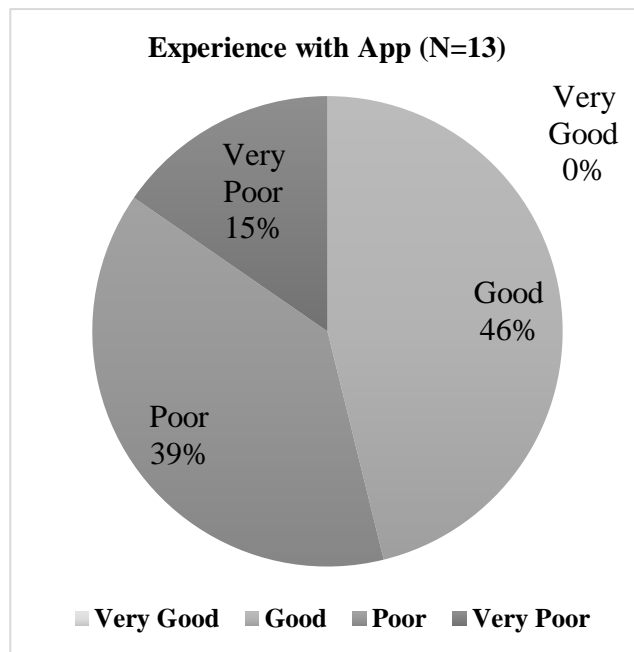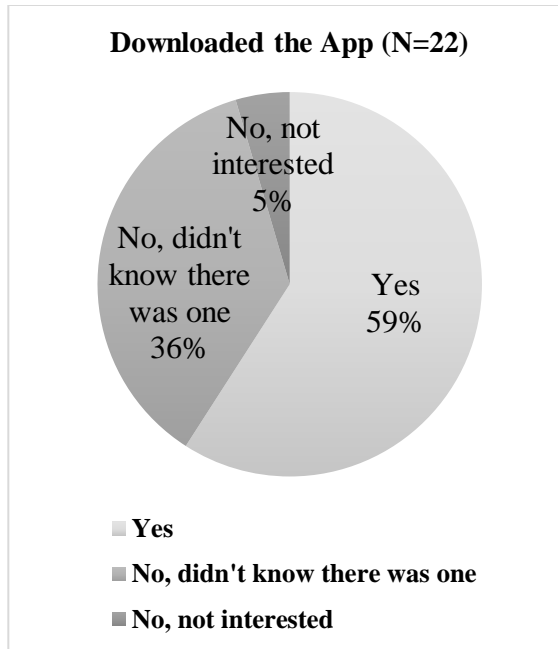Bar values: 2, 10, 5, 4, 1, 1

Usability

The program platform's usability -the ease of use and learnability of a human-made object (Merriam-Webster, 2017)- was evaluated using a standardized 10-item scale called the *Systems Usability Scale (SUS)*. This scale provides a score from zero to 100 that should only be considered in terms of percentile ranking. In this scale, a score of 68 is considered average. The Black scored 49 in this scale (n=22), placing it at the bottom 25th percentile, between "OK" and "Poor" according to Bangor et al. (2009).

Features

Mobile App

The app was downloaded by almost 60% of respondents (n=22), none of whom rated it as "very good." Less than half rated it as "good" and about 54% rated it as "poor" or "very poor."

Users reported problems downloading, logging into, and using the app. Respondents reported confusion over the name of the app because it was embedded in a platform that was named differently. Speed and performance issues, along with the inability of the app to synchronize with other applications were reported as problems associated with the mobile platform.

Downloaded the App (N=22)

No, not interested
5%

No, didn't know there was one
36%

Yes
59%

■ Yes
■ No, didn't know there was one
■ No, not interested

Experience with App (N=13)

Very Good
0%

Good
46%

Poor
39%

Very Poor
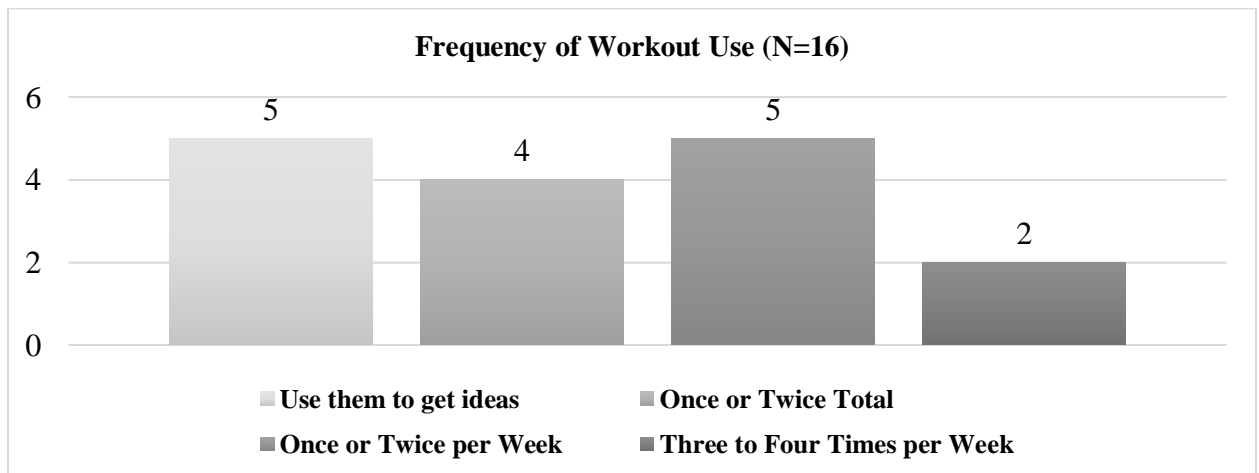15%

■ Very Good   ■ Good   ■ Poor   ■ Very Poor

Most users who didn't download the app reported being unaware that a mobile app for the program was available. Other reasons not to download it were a lack of interest and doubts about the legality of its use in a government-issued device.

"I think I would use The Black more if I was able to access the program functions via my cell phone"

Workouts

Almost three quarters of respondents reported having used at least one workout from The Black (n=22). Those who didn't, listed already having a workout program, or working out as a crew and the PT leader not using The Black as the main reasons not to do so. Other reported not believing that The Black would prepare them for the fire season or found the physical training routines "too easy." Concerns related to equipment, timing of program onset, and ease of access to the workouts were also expressed.

Over 30% of those who reported having used at least one workout from The Black reported using it/them as a reference or to get ideas from them. Forty-four percent reported using them one to four times per week. Over half of those who used the workouts retrieved them using a mobile device, while 20% printed them out and another 20% referenced them from a desktop computer.

Frequency of Workout Use (N=16)

Category	Count
Use them to get ideas	5
Once or Twice Total	4
Once or Twice per Week	5
Three to Four Times per Week	2

The intensity and difficulty of the workouts offered in The Black were labeled as inappropriate for type 1 firefighters, adding that performing only the workouts recommended by the program would leave users poorly prepared for the workouts done by crews.

Along with educational resources, the workouts were the program's most liked feature.

Exercise Videos

All respondents reported having watched the videos explaining and demonstrating the correct way to perform the exercises included in the workout routines, and 90% deemed them very or

somewhat helpful. However, the videos were qualified as unprofessional, and the performance of the exercises in the videos were perceived to be incorrect.

The importance of performing exercises correctly was acknowledged by respondents, who valued the availability of these videos. Recommendations for developers regarding the exercise videos including filming actual WLFFs performing the movements, and having trainers trained by The Black within their crews to assess and correct the movements during physical training.

Fitness Assessments

Sixty-eight percent of respondents had performed at least one of the fitness assessments included in the program. Even though the instructions for these assessments were either "clear" or "very clear" to 87% of respondents, 20% of those who performed them did not record their results. Not knowing where to input their results and difficulties navigating the platform were mentioned as reasons not to do so. Half of those who did record their test results said that doing so was easy, and also half reported discontent with the lack of feedback provided after inputting their results, which was a feature that users were looking forward to.

Introductory Videos

The program's introductory videos were widely watched among survey respondents. Over half of them reported having watched all of them, and over 40% watched at least some of them (n=22). Over 95% of respondents found these videos to be somewhat or very helpful (n=21).

Educational Resources

Even though more than 77% of respondents had read at least one educational article from The Black, almost half of them did so only once or twice total. Almost 30% of them read an article from The Black once or twice per week, and just over 23% did so three or more times per week.

The three themes covered in the articles - "Physical Performance", "Tactical Nutrition", and "Tactical Stress Tolerance" - were preferred evenly, ranked in that order with 35, 32 and 30% of preferences respectively.
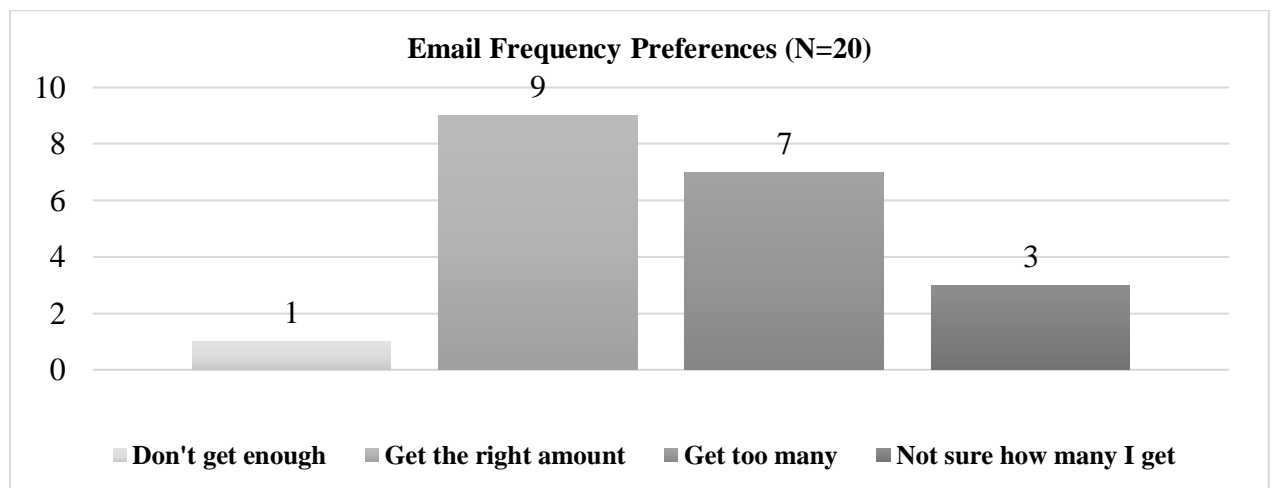
Respondents reported retrieving educational resources not from the website or the mobile app. Rather, users arrived at these articles through the program emails.

Along with the workouts, the educational resources were the most liked feature of the program.

Emails

Ninety percent of respondents reported getting the program emails. Nine percent of those who received the emails reported receiving as spam, suspicious, or junk mail.

About 45% of respondents reported receiving "the right amount" of emails from The Black. Thirty-five percent reported "getting too many" emails from The Black. Five percent were "not getting enough" and 15% of them were not sure about the frequency with which they received them.

Email Frequency Preferences (N=20)

Bar	Value
Don't get enough	1
Get the right amount	9
Get too many	7
Not sure how many I get	3

Thirty percent of those who were receiving the program emails reported reading every single one of them, 40% read them between one and three times per week, and another 30% read an email from The Black once or twice total.

Nutrition Log

Less than 30% of respondents reported having used the nutrition log tool included in the online platform. Over 80% of those who used it did so only once or twice total. Only one of six respondents who reported having used the tool did so regularly (five or more times per week).

The tool was deemed "inconvenient" by respondents. Those who used it reported confusion and frustration over the inability of the tool to take into account energy expenditure, focusing solely on energy intake. The inability of The Black to synchronize with other calorie-counting platforms was a barrier for users to log their nutritional intake.

Open-ended Questions

What Inspires You to Be the Best Wildland Firefighter You Can Be?

Love for the profession

- "It is an extremely important profession…continues to challenge me"
- "to be safe, enjoy the job and improve myself"
- "the love of the job and the people in it"

Making a difference

- "Allows me to feel like I'm making a difference"
- "Being a public servant"
- "Being that one person that people can count on"

Striving to be the best

- "I take pride in what I do"
- "I don't want to be the last person hiking up the mountain"
- "being in top physical shape"

The crew comes first

- "to benefit and support the crew"
- "my crew"
- "Other firefighters…You can be competitive and also supportive by understanding that it's not about the score, it's about the physical training"

To inspire others

- "Being an inspiration to younger people"
- "Others beginning their careers"

- "To lead by example"

Safety

- "To be safe"

- "To be safe and healthy"

Messages from Users to Other WLFFs

It's a worthwhile profession

- "This is a great profession, you will make good money, get paid to work out"

- "Making a difference in protecting the American people"

Get motivated

- "Train hard, it will pay off"

- "Stay hungry and humble"

- "Strive for excellence"

Take good care of yourself

- "Practice self-care"

- "Quality over quantity"

- "You can run from a lot of things, but you can't outrun a bad diet and a poor exercise regime"

Knowledge matters

- "Know the science, respect the science"

- "Knowledge is power!"

Chapter 5: Discussion, Recommendations and Conclusions

A group of researchers and academics at the University of Montana were tasked and funded to create a performance program to improve work capacity and prevent injuries among wildland firefighters (WLFF) in the United States. The program, metaphorically named "The Black" in reference to a previously burned area of a fire that can't burn again and used by WLFFs as a safety zone in case of adverse circumstances, aimed to become an ongoing "safety zone" through evidence-based, job-specific physical training routines, educational material and physical fitness screenings, among other features and methods of communication. Two evaluators were tasked to assess the implementation of the program, as well as users' attitudes toward and perceptions of its components.

The Black was conceived as a three-phase program, coinciding with the annual occupational stages of WLFFs, consisting of a pre-season (Alpha) phase, an in-season (Bravo) phase, and a post-season (Charlie) phase. The scope of this evaluation is limited to the implementation of the Alpha phase. The Alpha phase was designed to help WLFFs get physically and mentally ready for the strenuous demands and conditions of the fire season and consisted of the following features: (1) Introductory videos, (2) physical training routines, (3) exercise videos, (4) fitness assessments and Safety Zone Screening, (5) educational Resources, (6) program emails, (7) a nutrition log, and (8) social media accounts. The program's content was delivered via a website embedded in Total Health Interactive (a corporate wellness service), as well as a mobile application embedded in The Fit Compass (a hub for fitness and weight loss programs), both designed for The Black by a contractor with previous experience in the development of performance programs for structural firefighters.

During the Alpha phase, which started on March 6th, 2017, and ended on June 4th, 2017, physical training routines and educational material were offered weekly. Physical training routines were assigned to each day of the week, while the educational material was offered for the week as a whole. Performance and input of results of fitness assessments and Safety Zone Screening were requested on weeks one, two, ten, eleven and twelve. Users were not allowed to move forward in the program, though going back to previous weeks was always allowed.

To evaluate the Alpha phase of The Black, evaluators used a mixed-methods research approach. Nine qualitatively-oriented interviews were conducted over the phone with

experienced WLFFs, leaders within their fire crews, who attended the "Train the Trainer" seminar conducted over three days in Bakersfield, CA. Attendees were meant to become gatekeepers to the first-year pilot sample, consisting of themselves and their crew mates. The interviews were conducted over the period between April 11th, 2017 and April 17th, 2017. Posteriorly, utilizing input from interviews, a digital quantitatively-oriented survey instrument was developed and disseminated via email to all involved WLFFs, initially through the "Train the Trainer" attendees and posteriorly using an open link and sent to WLFFs from the evaluators, website developers and U.S. Forest Service employee email addresses. The online survey was opened on June 2nd, 2017, and the last response considered was submitted on July 14th, 2017. Thirty-six responses were recorded. Data collected through both methods were analyzed and synthetized. A summary of the findings related to the program's delivery method, individual features, and beliefs and attitudes toward it is presented below.

Based on evaluation data, both of the most disliked aspects of The Black are related to the program's **delivery method**. The website scored in the bottom 25th percentile in terms of usability, the ease of use of a website. The site was described as confusing and not user friendly, making it difficult for users to find the right content and enter data precisely. As a product, there was a tendency of users to dismiss the program after their first or second interaction. Users compared The Black to other performance programs or tools freely available, stating that the program was not up to the standard of the industry. Similar problems arose with the use of the mobile application, which users would've been more prone to using if they hadn't had difficulties downloading and using it. Fifty-four percent of survey respondents reported their experience with the mobile app to be "Poor" or "Very Poor", while none reported a "Very Good" experience. The second most disliked aspect of the program was its static timeline, by which every user would be at the same point in their training, as every new weekly set of recommended activities was the same for every user on a given week. Multiple users had been following a physical training regime for months in advance of the start of the Alpha phase of The Black, a few had already been on fire-related assignments, and others had not yet been employed. The variability of the training approaches by different resource types, crews and individuals decreased the likelihood that potential users would commit to the program's recommendations because that would mean the discontinuation of their current practice for some and pose a problem for those who didn't begin their training until The Black was too far into the Alpha

phase. A one-timeline-fits-all approach to physical training for WLFFs to prepare for the fire season seems to be inadequate considering the different needs and approaches of different sub-populations within the target population. Segmentation of the program to address their specific needs over time may yield positive results.

The Black's **introductory videos** included an overview of instructions on how to use the website, as well as introductory information about nutrition, physical training and mental training. Survey data suggests that these videos were widely used. Fifty-nine percent of respondents reported watching all of them, and 95% reported watching at least one, 95% of whom deemed them to be at least "Somewhat" helpful. These videos were a good overview for users who were unfamiliar with the program, and a "nice refresher" for those who had seen them in the "Train the Trainer" seminar. Introductory videos are an effective way to provide basic information about the program, as long as they are well positioned within the program's delivery platform.

The **physical training routines** were the program's most liked feature, and almost three quarters of survey respondents reported using a recommended workout at least once. Nonetheless, over 30% of those who used them did so only to get ideas for their own routines, and less that 44% used them more than once or twice total. A poor delivery method (offered as PDF documents), as well as difficulties retrieving these documents, were two of the main reasons why the physical training routines were not widely used. Another aspect of objection was the assumption that most WLFFs don't have access to exercise equipment, with many of the exercises included in the recommended routines intended to be performed using work equipment such as fire hoses. Although the survey respondents and interviewees are mostly experienced, permanently employed WLFFs who are more likely to have access to exercise equipment year-round than seasonal employees, starting with the assumption of either exercise equipment being available or not having equipment at all, and offering alternative options for those who don't, may be a better approach. Furthermore, the workouts were perceived to be "too easy", not intense enough to successfully prepare a type 1 firefighter for the fire season. Most of the praise fell on the High Intensity Interval Training (HIIT) routines, which were liked by users, who reported following the verbatim. A more user and mobile friendly delivery method for these workouts may facilitate their implementation. Segmentation of the target population to provide

more resource-specific training may help address the individual and group-specific needs of users.

Exercise videos explaining and demonstrating the proper execution of each of the exercises included in the physical training routines were also made available. Even though every single survey respondent reported watching these videos, deemed as "Very" or "Somewhat Useful" by 91% of them, users perceived these videos to be poorly made and the exercises to be poorly performed, as well as difficult to retrieve in the workout area. Some user suggestions include demonstrating the exercises using exercise equipment instead of work-related equipment, having actual firefighters demonstrate how to perform the exercise, and making it easy for the user to access these videos away from their computers, namely, on their smartphone or other mobile device.

Fitness assessments, as well as a **Safety Zone Screening**, were included for users to perform periodically during the Alpha phase of The Black. These assessments aimed to give users an estimate of their current physical condition at the time, allowing them to compare their initial to their latter results. These assessments were also a data collection method for exercise scientists at the University of Montana to evaluate the effectiveness of the prescribed training. Although many users were unable to record their results on the program's website because of technical issues or unfamiliarity with and unavailability of measuring devices using the metric system, some did successfully record their results for the initial assessments. Of those survey respondents who did record their results (n=15), 47% reported disappointment with the lack of feedback offered following their data input. Personalized feedback was a feature that multiple users looked forward to, hoping to gauge their condition and adjust their training accordingly, but it wasn't possible for the developers to introduce this capability to the first iteration of the program. Reducing technical difficulties and providing actionable feedback to users who enter their assessment results may yield valuable research data in the future, as well as useful information to program users.

Educational material about physical training, mental training and nutrition was offered to users every week during the Alpha phase of The Black. Over three quarters of survey respondents reported reading at least one piece of educational material, over half of which did so at least once or twice per week. The content of these articles was perceived to be good, important

and interesting and, along with the workouts, was the most liked feature of the program. Similar to the workouts, the problem with the educational material was associated with the delivery method, as users found it difficult to find the information they were looking for. One interviewee stated: "I actually spent more time cruising through the additional information than the rest of the whole website. But still, the delivery method…the information there is hard to get." User suggestions regarding the educational material included offering these resources openly without the requirement to log into the website. Offering these educational pieces in a more organized manner and making them easy to find and retrieve may increase the rate at which they are utilized.

Almost daily during the Alpha phase, **program emails** were sent to those who initially joined the program. These emails contained topic-specific short pieces of information, as well as links to the weekly resources on program's website. Users found the content of these emails to be useful information, easier to retrieve than the information on the website. These emails were a good reminder for users of the program's existence. Although 64% of survey respondents reported receiving these emails, 60% of them read an email from The Black once a week or less, and 50% said they received too many of them. The latter is supported by interview data, as users reported being "burned out" by the amount of emails, suggesting that the frequency should be lowered to one email per week. Furthermore, interviewees and 25% of survey respondents reported getting the program emails as spam or in their junk mail, decreasing the likelihood of these emails being read. Reducing the frequency of program emails sent to users or allowing them to customize the frequency with which they receive them, as well as sending these emails from a trusted source that won't label them as spam or junk, may increase the rates at which these emails are read, as well as users' engagement with the program.

In order to help WLFFs improve their nutritional habits, a **nutrition log** was included in the program's website. Out of 21 survey respondents 29% reported having used this feature at least once, though 83% of them used it only once or twice total. The tool was perceived as a good for those who may be interested in using it, but perceived as complicated by those who used it, and "just too much to enter every day" without a comprehensive mobile app. Allowing the program's platform to easily interact with third-party applications that perform this function effectively may be a better alternative for users than the use of a nutrition log embedded within the program.

Three different **social media** accounts were set up for The Black in three popular networks: Facebook, Twitter and Instagram. Interview and survey data suggests that the engagement with the target population through these platforms was negligible, which is consistent with the limited interaction observed in the program's profiles and posts since their conception. Nonetheless, the sample demographics for this evaluation represent an older, more experienced sample than the average WLFF, and it's likely that the lack of interest in their engagement with social media is generational rather than representative of the population as a whole. The use of these platforms in a targeted manner may yield positive outcomes in engaging younger generations of WLFFs.

Both interviewees and survey respondents had the opportunity to share their **beliefs** about and **attitudes** toward The Black. Overall, the program was considered to be a reliable and valuable source of information, and users perceived the scientific expertise of the developers as well as the specificity of the program as positive and were willing to try the recommended approach. Even though respondents regarded the program to be insufficient to effectively prepare them for their job, it was perceived as a good resource for new recruits to understand the demands of the profession. Wildland firefighters are an already highly motivated population and The Black did not increase their motivation to engage in physical training, even more so among type 1 resources who were reluctant to change their traditional approaches to training. These resource types felt positively about the program being offered to other resources but deemed The Black to be insufficient training for themselves.

## EVALUATORS' RECOMMENDATIONS

Undoubtedly, the exercise scientists, athletic trainers, and performance psychologists involved in developing the WLFF performance program, The Black, are experts in their fields of study. Indeed, the formative evaluation revealed that the developers of the program were held in high regard by the WLFFs that piloted it. Nonetheless, these same WLFFs were unlikely to continue using the program. Unfortunately, if the intended audience does not utilize the program, then the best efforts of the experts are of little value.

Given, therefore, the critical need to promote widespread adoption of The Black, a program designed to increase job readiness and decrease injury rates among WLFFs, evaluators

recommend that program developers utilize the principles of Diffusion of Innovation Theory. Since first developed by E.M. Rogers in 1962, this robust theory has been successfully used across multiple disciplines, fields of study, populations and geographical areas to promote adoption of new ideas, practices, programs and technologies (Dearing & Kreuter, 2010). According to this theory, an innovation is an idea, process, or a technology that is perceived as new or unfamiliar to individuals within a particular area or social system. Diffusion is the process by which the information about the innovation flows from one person to another over time within the social system.

The Innovation-Decision Process

The process by which an individual decides to adopt or reject an innovation does not consist of a single dichotomous decision, but rather of a more complex process. Diffusion of innovation theory breaks down this process into five stages (Figure 1), where (1) the individual learns about the innovation and how it works (Knowledge), (2) the individual forms a positive or negative opinion about the innovation (Persuasion), (3) the individual engages in actions that lead to the adoption or rejection of the innovation (Decision), (4) the individual begins to use the innovation (Implementation), and (5) the individual seeks reinforcement for the decision to adopt or reject the innovation (Confirmation). During each of these stages, the potential adopter engages in a series of behaviors that aim to reduce uncertainty associated with the decision to adopt the innovation (Rogers, 2003, p. 168).
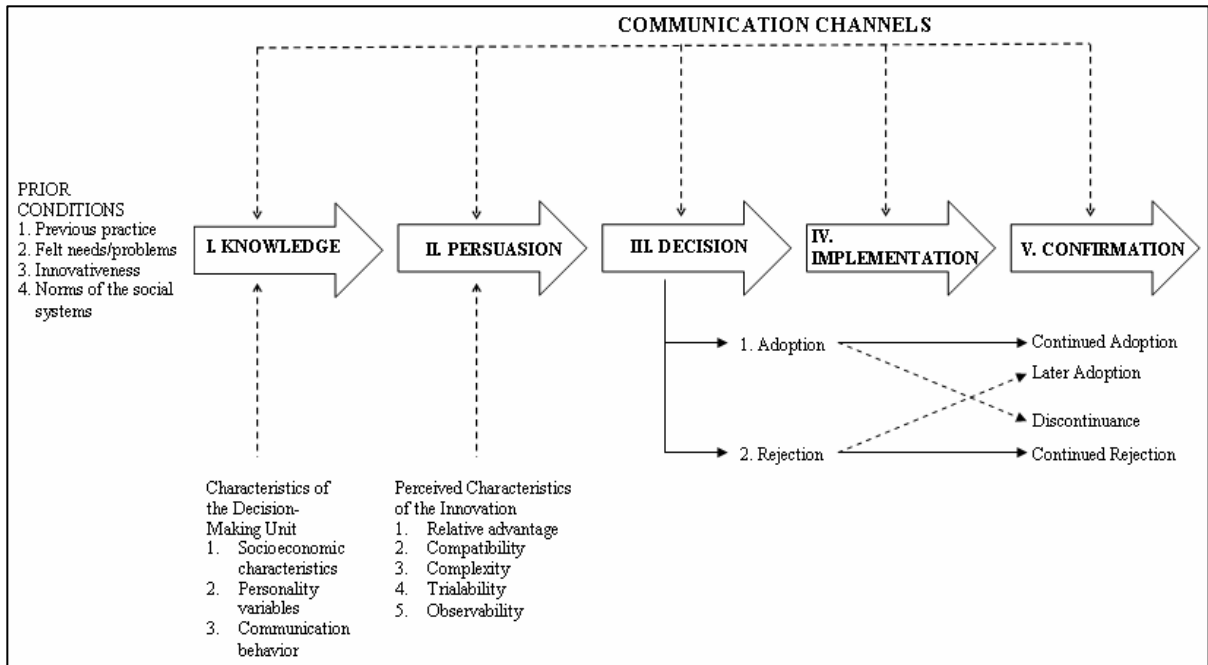
(**Figure 1**. Model of the innovation-decision process. Rogers, Everett M. Diffusion of Innovations, 5th Edition, p. 170).

Key Concepts from Diffusion of Innovations

The diffusion of innovation theory posits that there are four main determinants of success in regard to gaining widespread adoption of an information technology innovation: (1) the attributes of the innovation, (2) the social system, (3) the characteristics of the adopters, and (4) communication channels (Zhang et al, 2015). The application of each determinant of the theory to WLFF's adoption of The Black provides actionable insights regarding modifications that can be made to the program to increase the likelihood of adoption. Successful utilization of the Diffusion of Innovation theory ideally culminates with the confirmation of The Black as the new normal in regard to holistic training for WLFF's job readiness and injury prevention. Below is a brief explanation of the major constructs of the theory and a description of their relevance to the widespread adoption of The Black.

Determinant #1: Attributes of an Innovation

In his traditional theory, Rogers lists five main attributes of an innovation that influence the rate of its adoption: (1) Relative advantage, (2) Compatibility, (3) Complexity, (4) Trialability, and (5) Observability. Each of these attributes is described below, followed by its respective application

to the Alpha phase of The Black and the evaluators' recommendations associated with it (Rogers, 2003, p. 15).

Relative advantage

Relative advantage is the degree to which an innovation is perceived as better than the idea, product or program it supersedes. Potential adopters evaluate the advantages of an innovation based on economic factors, social prestige, convenience and satisfaction. The perceived advantage relative to the cost of adoption and the advantages of its predecessor will increase or decrease the likelihood of adoption of the innovation (Rogers, 2003, p. 15).

Recommendation #1: Integrate into promotional messages for The Black the advantages of adopting the program over their current methods of performance enhancement.

According to a 2015 Assessment of the barriers to WLFFs' physical training, the majority of WLFFs engage in a previously established training program. Particularly popular among WLFFs were programs they developed themselves and commercial programs such as P-90X and Crossfit (Mangan & Sondag, 2015). In launching The Black, few efforts were made to provide clear and convincing evidence that the new program offered significant advantages over the programs currently in use.

Although evidence-based arguments are important in relaying the superiority of The Black over other programs, of greater importance when promoting the advantages of the new program is an appeal to the benefits of the new program over currently used programs. Emphasizing the advantages of The Black's approach to performance training and conveying the program in a more appealing manner may increase the perceived relative advantage of the program.

Compatibility

Compatibility captures the extent to which an innovation is consistent with the existing technical and social environment. The more an innovation can integrate or coexist with existing values, social norms, past experience and the needs of potential adopters, the greater its prospects for

diffusion and the more rapid its rate of adoption will be (Rogers, 2003, p. 15); Zhang et al., 2015).

__Recommendation #2: Shape The Black's accessibility, content and recommended workouts to reflect the existing cultural values, social norms and technical and social environment of WLFFs.__

Wildland firefighters, although a very heterogeneous population, share certain social and cultural values. Salient cultural values identified in the formative evaluation include a deep sense of pride in the profession, a sense of responsibility to fellow crew-members, a profound need to be perceived as dependable and a desire for competition among members within a crew and among crews.

Additional practical aspects of compatibility focus on the differences between resource type, employment terms and geographical location. Evaluation data revealed that Type 1 and Type 2 crews have diverse needs in regard to physical training programs. Additionally, an individual WLFF may or may not have access to proper exercise equipment or be able to utilize outdoor spaces for physical training during the winter months. The variability of the start and end of the fire season for different resource types was another major difficulty, making programming for performance enhancement a moving target. When promoting adoption of The Black, recognizing the diversity of the WLFF community and yet tailoring messages consistent with their over-arching values and culture is important.

Complexity

Complexity measures the degree to which an innovation is perceived to be difficult to understand, implement or use. An innovation that is less complex is more likely to be rapidly accepted by end users. is the degree (Rogers, 2003, p. 16).

Recommendation #3: Review existing programs that are popular among WLFFs and incorporate some of the elements of those programs into The Black. Ensure that the program is intuitive and simple to use.

One of the biggest issues with the first version of The Black was the complexity of the online platform. The website was embedded in an overarching fitness service that created confusion among users, who seldom utilized the plethora of tools this service provided. Furthermore, the use of a PDF format to deliver workouts was less than ideal as users had difficulties accessing them from a mobile device, and very few were capable of printing out the documents. Simplifying the user interface, making the platform more mobile friendly, and emulating characteristics of successful programs with which WLFFs are already familiar may reduce complexity and increase likelihood of adoption of The Black.

Recommendation #4: Adapt to individual needs of WLFFs by offering a diverse array of training and injury prevention interventions and educational resources to increase program compatibility.

The static timeline of the Alpha phase of The Black, where the program offered the same progression over a fixed period of time to all users regardless of their individual needs at the time, was one of the main barriers to adoption. Because WLFF's preparation and work calendars vary greatly, many users disregarded the program because either they had been preparing themselves for the fire season months before the program was made available or were not yet employed by then.

Offering a variety of interventions and recommendations that are adaptable to the needs of any given potential adopters and can be easily applied at any point in time would increase compatibility and increase likelihood of an individual to enter the innovation-decision process.

Trialability

Trialability is the ability of an innovation to be put on trial without total commitment and with minimal investment. An innovation with higher trialability is associated with lower levels of

uncertainty by potential adopters, increasing likelihood of adoption through the possibility to "learn by doing" (Rogers, 2003, p. 16; Zhang et al., 2015).

Recommendation #5: Separate the program into components that can be tried independently. If a user finds that one component of the program does not fit his or her unique needs, make it easy to try a different component.

The Alpha phase of The Black was offered as a bundle of interventions, including but not limited to self-assessments, physical training routines, videos and written educational materials. Users were expected to engage in the program during a specific time period, follow a set schedule each week, and complete a fairly complex array of assessments and activities following their initial sign-in to the program. The high level of commitment and investment required to become a regular user of The Black appeared to discourage all individuals who attempted to adopt it.

Wildland firefighters will be more likely to adopt the program if they are offered a set of features that can be tried individually, require little initial investment in regard to time and effort, and can become increasingly complex as the user becomes more familiar and comfortable with the program. Diversification of the media channels and methodology may supplement this increase in trialability.

Observability

Observability is the extent to which the benefits of an innovation are visible to potential adopters. Only when the results are perceived as beneficial, will an innovation be adopted (Rogers, 2003, p.16)

Recommendation #6: Create a platform in which it is easy for users to observe their personal progress and where they can record and compare their actions with those of their peers. Create social groups that can provide support for program use.

Data collection methods in the Alpha phase of program were designed to provide program developers with information regarding individual levels of fitness and injury risk assessments. Feedback to users, however, was not offered during the initial program launch.

Program evaluation data revealed disappointment on the part of users because they were not able to monitor their progress and were not able to compare their level of fitness with other WLFFs engaged in the same program. WLFFs will more likely maintain engagement with the program if they are able to easily record and monitor their progress, and to share and compare their progress with others.

Determinant #2: Social System

A social system is a set of individuals, informal groups, organizations and/or subsystems who are tied together by a common goal or objective. When the social system is structured and patterns of social interactions between units can be identified, individuals' behavior can be predicted to a certain extent, decreasing uncertainty. Social and communicational structures, along with social norms, are a window to predictable behavioral patterns that can be utilized to enhance diffusion through opinion leaders among WLFFs (Rogers, 2003, p. 23).

Recommendation #7: Identify and utilize patterns of social interaction when disseminating messages regarding The Black to opinion leaders within the population.

Understanding how crews and individual WLFFs interact and communicate with each other is vital for the successful formatting and dissemination of information from The Black. Adapting communication strategies and recommendations to that of the WLFF social system may enable early adopters and opinion leaders to further diffuse the program and its core ideas.

Determinant #3: Characteristics of the Adopter

Individuals of a social system are categorized into five groups based on their attitudes toward an innovation: innovators, early adopters, early majority, late majority and laggards.

Recommendation #8: Identify the early adopters in each segment of the WLFF social system and seek their input and engagement in the development of the new platform, as well as in the dissemination of The Black.

The cumulative adoption of an innovation is characterized by an S-shaped curve over time (Figure 2), where Innovators (2.5%) and Early Adopters (13.5%) are the first to adopt, followed by the Early Majority (34%), followed in turn by the Late Majority (34%) and finally

by the Laggards (16%). These groups are defined by the time it takes them to adopt a given innovation.
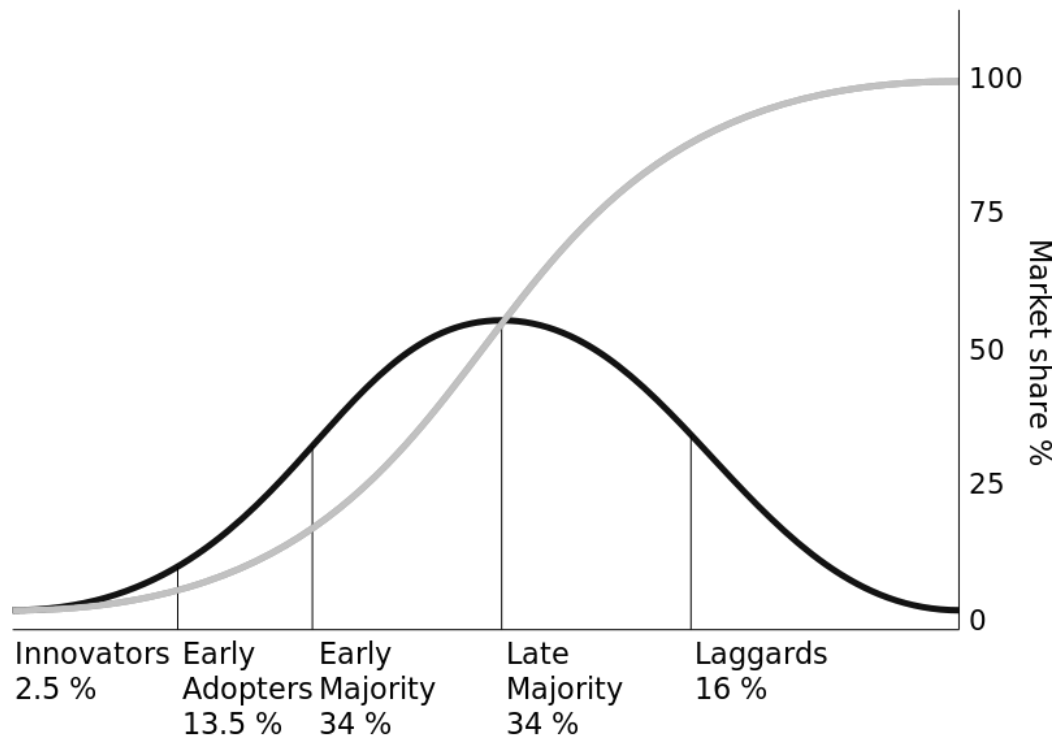
(**Figure 2.** The accumulated (in yellow) and distributed (in blue) diffusion of an innovation over time (Based on Rogers, E. (1962) Diffusion of innovations. Free Press, London, NY, USA).

Although it is the innovators who are first to adopt or reject the innovation -fulfilling the vital role of introducing it to the social system- the key players in the successful diffusion of an innovation are the **early adopters**. Because early adopters (13.5% of potential adopters) are respected and socially integrated individuals, they are regarded as role-models and opinion leaders and wield therefore the ability to informally influence potential adopters' attitudes toward and behaviors associated with The Black. If early adopters give the innovation their "stamp of approval", a "tipping point" may be reached where the rate of adoption of the innovation dramatically increases (Rogers, 2003, p. 282).

Identifying and reaching out to WLFFs who match the description of an early adopters and encouraging their participation in the program (applying the aforementioned attributes of an innovation) may lead to a "tipping point" wherein The Black is spontaneously diffused across the rest of the population with little to no need for further promotion of the program.

Determinant #4: Communication Channels

Communication channels refer to the medium through which people obtain the information about the innovation and perceive its usefulness. These can be formal or *mass media* channels (e.g. television, radio, internet, print media) or informal or *interpersonal* (face-to-face exchanges and online interactions). Formal channels are more important in the earlies stages of the innovation-decision process, while informal ones are more so in the latter stages (Rogers, 2003, p. 18).

> ***Recommendation #9: Identify the major modes of communication in each of the segmented social systems. Ensure that both interpersonal and more formal means of communication are utilized in the dissemination process.***

Determining the most effective formal and informal channels for promoting and communicating information about The Black will require an examination of the various segments of the WLFF community. It is important to note that the informal, interpersonal channels are the most important to the diffusion of an innovation. Those who have not yet adopted the program develop their initial impressions from talking with adopters about the advantages and disadvantages. Individuals that have experience with the program are particularly credible sources of information, and their positive communication regarding the program is critical to its widespread adoption. Encouraging this flow if information may increase the rate of diffusion of the program.

CONCLUSIONS

Formative evaluation data from the Alpha Phase of the pilot testing of The Black revealed several major barriers to WLFFs' adoption of The Black as their default performance training program. These major barriers included the lack of usability of the program's platform, issues with communication channels such as emails going to "spam" folders, incompatible formatting and organization of information and recommendations, and an inability to provide feedback and adapt to individuals' needs.

If The Black is to enjoy widespread adoption among the WLFF community, the barriers described above must be addressed. Diffusion of Innovation theory provides an organized, theory-based framework within which to address these barriers not only at the point of promotion

but most importantly to be applied in the design of the platform and its content. While application of the theory to dissemination of the program may seem laborious, undertaking the following actions may yield the widespread dissemination the program seeks.

First, care should be taken to explore and explicitly describe the social system that comprises the WLFF community. Understanding the social system is critical to the identification of early adopters within each sub-set of that social system and is critical to the identification of communication channels that will be most effective in spreading the word about the program. Second, it is important to remember that no matter how comprehensive the understanding of the social system, the target population, and the means of communication, if the innovation itself does not meet certain criteria, then its adoption will not be widespread. Critical aspects of the innovation itself, in this case The Black, include potential adopters' perception that: 1) The Black is better than the training programs WLFFs are currently using; 2) The Black is compatible with WLFFs current lifestyles; 3) The Black is simple and easy to understand and to use; 4) individual features of The Black can be tried and tested with minimal investment of the part of WLFFs; and 5) The Black provides observable results through increased fitness levels or through the ability to compare one's progress with that of others.

While the time and effort involved in incorporating the principles of Diffusion of Innovation theory into the marketing of the program may seem to be less important than incorporating effective, evidence-based training strategies into The Black, both are critically important if the program is to enjoy widespread adoption among WLFFs and serve its ultimate goal of assisting them in increasing work capacity and reducing injury rates.

Appendix A - Qualitative Interviews Moderator's Guide

The Black

Alpha Phase

Program Evaluation

Phone Interview Protocol and Moderator's Guide

Protocol

Interviews will be conducted three weeks into the program's onset, which was on Wednesday, March 1st, 2017. The purpose of these interviews is to assess the first stage of the implementation process. Participants will be drawn at random from a list of candidates who have agreed to participate in the program, and were present in the three-day pilot that was conducted in Bakersfield, Cal, in January of 2017. Potential interviewees will be contacted via email, requesting permission, primary contact information, as well as best dates and times to be contacted. A minimum of 10 interviews will be conducted. If a participant is contacted but does not agree to being interviewed, the next participant in the randomized list will be contacted. This process will continue until the minimum amount of completed interviews is reached. The interviewer will follow a written moderator's guide during the interviews, which will remain unchanged throughout all interviews. The interviews will be conducted over the telephone, and will not last more than 20 minutes, unless the participant is willing to maintain communication for longer than that amount of time. With consent of the participant, the interview's audio will be recorded using a mobile phone, and consequently transcribed into NVivo software for posterior qualitative analysis. Data analysis will be conducted following a coding scheme, which will be developed upon data collection and based on the data collected.

Interview Moderator's Guide

Interviewer: José Miguel Peña Cueto

Interviewer's location: University of Montana, Missoula, Montana.

Interviewee's location: varies.

Date and time of interview: varies.

Length of the interview: Less than 20 minutes, unless participant is willing to maintain communications for longer than the amount of time stated.

Content

Introduction

• Proper introductions will take place.

• Interviewee will be told the purpose of the interview, and informed that the interviewer will follow a moderator's guide.

- Interviewee will be informed of the following:
  - Data collected during the interview will be confidential.
  - Honesty is much appreciated, as the data collected is vital for future success of the program.
  - Interviewee has the liberty not to answer any of the questions asked, and may finalize the interview if he so desires.
- Verbal consent will be requested by the interviewer for the interview's audio to be recorded. Failure to consent to such request will automatically finalize the interview.
- Interviewee will be given a chance to ask questions before the interview commences.

Questions

- Interviewer will ask the interviewee the questions listed in the moderator's guide. The interviewee is expected to answer the question and expand on his/her answer as preferred.

Closing Statements

- Once the interviewer has asked every question in the moderator's guide, the interviewee will have the opportunity to provide any information related to the program that was not included in the interview.
- Interviewee will be asked if he/she would be willing to provide data about the program in the future, and upon acceptance he/she will be asked about his/her preference for future contact by the program evaluators.
- A closing statement and gratitude will be expressed by the interviewer.

Interview Script and Questions

Hello [participant's name], my name is José Peña from the University of Montana, how are you? [participant's response] I'm calling you today to talk about the wildland fire performance program "The Black".   We're currently trying to get some feedback from wildland firefighters about the program through and interview that takes about 20 minutes, potentially longer or shorter depending on how much feedback you want to provide. Is his a good time for you? [participant's response] Great! I will let you know when we're approaching the 20 minute mark, see where we are and ask you if you want to continue. Any information you provide will be kept completely confidential. I have a number of set questions to ask you, and it is up to you to provide either short answers or expand as much as you want, any further information is appreciated. I will try not to interrupt you in order not to influence your answers. Keep in mind that the purpose of evaluating the program is to make future improvements. I will ask you to please feel free to express criticism and be honest about your answers. This evaluation process is for the firefighters to evaluate The Black, not the other way around.

That being said, I'd be beneficial if we could record this conversation so we can analyze the content later on. Would that be okay with you? [Participant's response] Terrific!

Do you have any questions for me before we start? [participant's response]

Let's move on to the first question…

Program Use

1. Have you had a chance to log into the program? What do you think so far?
2. Do you know if other members of your crew using the program?
3. How often do you log into The Black's website?
4. Did you complete your Safety Zone Screening in week 1 and the 1 mile pack test?
5. Do you know if the rest of your crew completed their Safety Zone Screening on week 1 and the 1 mile pack test?
6. Have you downloaded the program's mobile app?

Introductory videos

7. Did you watch the introductory videos? How helpful were these videos?

Workouts

8. Have you been using the workouts from The Black?
9. How often do you complete a daily workout from The Black?
10. Do you perform these workouts individually or as a crew?
11. Do you print out the workouts? If you don't, how do you make sure you are doing the right exercises?
12. How helpful were the videos explaining how to properly perform the exercises?
13. What do you like and/or dislike about the workouts in The Black?

Tests

14. Have you performed the physical tests required by The Black other than the 1 mile pack test?
15. How clear were the instructions for the tests?
16. How often did you record your test results on the website?
17. What difficulties did you face when you performed the tests and/or recorded the results?

Nutrition Log

18. Do you ever use the nutrition log on The Black's website? How useful is it?
19. How often do you use it?

Emails

20. Have you been receiving emails from The Black?

21. How often do you read the entire email?

22. Do you get too many or not enough emails?

23. How relevant is the information contained in the emails?

24. Do you have any other comments or thoughts about the emails from The Black?

Additional Reading Resources

26. Have you read any of the additional reading resources on the program's website? How helpful were they?

Beliefs related to the program

27. Since you started using "The Black", do you feel more positive about engaging in physical training?

28. Since you started using "The Black", do you engage in physical training more regularly?

29. Do you think "The Black" addresses the physical training needs of your type of crew?

30. Do you think that "The Black" will prepare you to do your job as a wildland firefighter?

Blog and Social Media

31. Have you visited the Facebook, Twitter, and/or Instagram pages of "The Black"?

32. If you have, can you relate to the content posted in social media?

33. Have you ever visited the Wildland blog?

34. If you have, was the content of the blog relevant and/or interesting?

35. What would you like to see more of in these outlets?

Barriers to Program Use

36. What are the main difficulties you have faced when using the program so far?

37. Do you know if your crew has faced difficulties using the program? And if so, what are they?

Closing Statements

38. Before we hung up, what comments or suggestions do you have for "The Black"?

We will be sending out an electronic survey to further evaluate the program, which will be embedded in "The Black" website by the end of the Alpha phase. We ask that you please

respond to that survey as well and ask your crew to do so as well if possible. We want to make this program yours, and we believe that it has the potential to be a great tool in the future.

Thank you for your time [participant's name], we really appreciate your feedback, we'll use this information to make "The Black" a better tool for wildland firefighters. Have a great rest of your day!

Appendix B - Rate The Black: Program Evaluation Survey

Rate The Black

Q1 The purpose of this survey is to gather your input about **The Black**

performance program.

Even if you haven't logged into the program, we need your input!

This survey was designed to be completed in **approximately 10 minutes.**

Q2 Age

○ 18-24 (1)

○ 25-31 (2)

○ 32-38 (3)

○ 39-45 (4)

○ 46-57 (5)

Q3 Gender

○ Male (1)

○ Female (2)

○ Transgender (3)

○ Other (please specify) (4) _____

○ Prefer not to say (5)

Q4 Current employment status as a wildland firefighter

○ Permanent, full-time position (1)

○ Permanent, seasonal position (2)

○ Temporary-seasonal position (4)

○ Volunteer (5)

○ Other (please specify) (6) _____

Skip To: End of Block If Current employment status as a wildland firefighter = Volunteer
Skip To: Q6 If Current employment status as a wildland firefighter = Permanent, full-time position

----

Q5 Employment during the off-season

◯ Student (1)

◯ Employed part-time (2)

◯ Employed full-time (3)

◯ Self-employed (4)

◯ Not employed (5)

◯ Other (please specify) (6) _____

Q6 Years as a wildland firefighter (including current season)

◯ First year (1)

◯ 2-5 years (seasons) (2)

◯ 6-9 years (seasons) (3)

◯ 10 or more years (seasons) (4)

Q7 Agency

◯ U.S. Forest Service (1)

◯ National Park Service (2)

◯ Bureau of Land Management (3)

◯ U.S. Fish & Wildlife Service (4)

◯ Bureau of Indian Affairs (5)

◯ Other, state/local/private agency (please specify) (7)

_____

Q8 Your current crew type

○ Hand crew (1)

○ Engine crew (2)

○ Prescribed wildland fire crew (3)

○ Fire use module (11)

○ Fuels crew (4)

○ Hotshot crew (5)

○ Rappellers (10)

○ Helitack crew (6)

○ Smokejumper (7)

○ Overhead/IC (8)

○ Other (please specify) (9) _____

Q9 Pack test required for employment

○ Arduous pack test (1)

○ Moderate pack test (2)

○ Light pack test (3)

○ Non-required (4)

○ Other (please specify) (5) _____

End of Block: Demographics #1

Start of Block: Demographics #2

Q10 Employment start date of crew this season for majority of crew members (best guess)

Month (1)

Date (2)

▼ January (1) ... December ~ 31 (377)

Q11 Have you been on assignment this season?

○ Yes (1)

○ No (2)

Skip To: End of Block If Have you been on assignment this season? = No

Q12 Date of first fire assignment (best guess)

Month (1)

Date (2)

▼ January (1) ... December ~ 31 (377)

End of Block: Demographics #2

Start of Block: Program Use

Q13 Have you logged into The Black website or mobile app?

○ Yes (1)

○ No, but I received the invitation to sign up (2)

○ No, I didn't receive an invitation to sign up (3)

Skip To: Q59 If Have you logged into The Black website or mobile app? = No, I didn't receive an invitation to sign up

Skip To: Q15 If Have you logged into The Black website or mobile app? = Yes

Display This Question:

If Have you logged into The Black website or mobile app? = No, but I received the invitation to sign up

Q14 What kept you from signing up for The Black? (choose all that apply)

☐ Didn't have time to log in (1)

☐ The login information didn't work for me (2)

☐ Invitation looked like spam or went into junk mail (3)

☐ The Black was available too late in the pre-season (4)

☐ Was already on assignment (5)

☐ By the time I received the link, the program was way underway (6)

☐ Didn't know The Black was a performance program for wildland firefighters (7)

☐ Using a different program (please specify) (8)

_____

☐ Other reasons (please explain) (9)

_____

Q59 What inspires you to be the best wildland firefighter you can be?

_____

_____

_____

_____

_____

Q60 If you could put one message in a billboard to share with thousands of wildland firefighters, what would it say?

_____

_____

_____

_____

_____

Q15 First time you logged into The Black (best guess)

Month (1)

Date (2)

▼ January (1) ... December ~ 31 (377)

Q16 How often do you log into The Black?

◯ Only once (1)

◯ Once or twice since I first logged in (2)

◯ Every other week (3)

◯ Once or twice per week (4)

◯ Three or four times per week (5)

◯ Five or more times per week (6)

End of Block: Program Use

Start of Block: Usability

Q17 Please score the following 10 items about The Black's website with one of five responses that range from Strongly agree to Strongly disagree:

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
I think that I would like to use The Black website frequently. (1)	○	○	○	○	○
I found The Black website unnecessarily complex. (2)	○	○	○	○	○
I thought The Black website was easy to use. (3)	○	○	○	○	○
I think that I would need the support of a technical person to be able to use The Black website. (4)	○	○	○	○	○
I found the various functions in The Black website were well integrated. (5)	○	○	○	○	○

I thought there was too much inconsistency in The Black website. (6)	○	○	○	○	○
I would imagine that most people would learn to use The Black website very quickly. (7)	○	○	○	○	○
I found The Black website very cumbersome to use. (8)	○	○	○	○	○
I felt very confident using The Black website. (9)	○	○	○	○	○
I needed to learn a lot of things before I could get going with The Black website (10)	○	○	○	○	○

End of Block: Usability

Start of Block: Mobile app

Q18 Have you downloaded the mobile app for The Black?

○ Yes (1)

○ No (2)

Q19 Reasons why you haven't downloaded the mobile app (choose all that apply)

☐ Didn't know there was a mobile app available (1)

☐ Don't own a smartphone (2)

☐ Couldn't figure out how to download it (3)

☐ Not interested in a mobile app (4)

☐ Other (please specify) (5) _____

Q20 How would you rate your experience with the mobile app?

○ Very good (1)

○ Good (2)

○ Poor (3)

○ Very poor (4)

Q21 Suggestions for the mobile app:

_____

_____

_____

_____

_____

End of Block: Mobile app

Start of Block: Workouts

Q22 Have you used/been using the workouts from The Black?

○ Yes (1)

○ No (2)

Q23 Why haven't you used the workouts from The Black? (choose all that apply)

☐ Already have a workout program (1)

☐ Don't have time to do the workouts (2)

☐ Don't believe The Black will prepare me for the fire season (3)

☐ Can't easily access the workouts (4)

☐ We work out as a crew and the person who leads it doesn't use The Black (5)

☐ Don't like the workout routines (6)

☐ Other (please explain) (7) _____

Skip To: End of Block If Why haven't you used the workouts from The Black? (choose all that apply) = Don't have time to do the workouts

Skip To: End of Block If Why haven't you used the workouts from The Black? (choose all that apply) = Don't believe The Black will prepare me for the fire season

Skip To: End of Block If Why haven't you used the workouts from The Black? (choose all that apply) = Can't easily access the workouts

Skip To: End of Block If Why haven't you used the workouts from The Black? (choose all that apply) = We work out as a crew and the person who leads it doesn't use The Black

Skip To: End of Block If Why haven't you used the workouts from The Black? (choose all that apply) = Don't like the workout routines

Q24 How often do you perform a full workout from The Black?

○ Only use them to get ideas for workouts (1)

○ Never performed an entire physical training routine from The Black (2)

○ Once or twice total (3)

○ Once or twice per week (4)

○ Three to four time per week (5)

○ Five or more times per week (6)

Q25 How do you access the physical training routines?

○ Print them out (1)

○ Pull them up on my phone (2)

○ Reference them from a computer (3)

○ Write them down on paper (4)

○ Other (please specify) (5) _____

Q26 Comments or suggestions about the workouts from The Black:

_____

_____

_____

_____

_____

End of Block: Workouts

Start of Block: Exercise Demonstration Videos

Q27 Have you watched the videos that show how to perform the exercises included in the workouts?

◯ Yes (1)

◯ No (2)

Q28 How helpful are these videos?

◯ Very helpful (1)

◯ Somewhat helpful (2)

◯ Not at all helpful (3)

Q29 Comments or suggestions about the exercise demonstration videos:

_____

_____

_____

_____

_____

End of Block: Exercise Demonstration Videos

Start of Block: Fitness Assessments

Q30 Have you performed any of the fitness assessments in The Black?

○ Yes (1)

○ No (2)

Q31 How clear were the instructions?

○ Very clear (1)

○ Somewhat clear (2)

○ Somewhat unclear (3)

○ Very unclear (4)

Q32 Have you recorded your assessment results in The Black?

○ Yes (1)

○ No (2)

Display This Question:

If Have you recorded your assessment results in The Black? = No

Q33 Reasons for not recording your assessment results (choose all that apply)

☐ Didn't know where to record them (1)

☐ Not clear why I had to record them (2)

☐ Having to log back into the website is inconvenient (3)

☐ Other (please specify) (4) _____

Skip To: End of Block If Reasons for not recording your assessment results (choose all that apply) = Didn't know where to record them

Skip To: End of Block If Reasons for not recording your assessment results (choose all that apply) = Not clear why I had to record them

Skip To: End of Block If Reasons for not recording your assessment results (choose all that apply) = Having to log back into the website is inconvenient

Skip To: End of Block If Reasons for not recording your assessment results (choose all that apply) = Other (please specify)

Q34 Experience recording your scores

☐ Could easily input my score (1)

☐ It was unclear how to input my score (2)

☐ Disappointed there was no feedback after recording my scores (3)

☐ Other (please specify) (4) _____

Q35 Comments or suggestions about the fitness assessments:

_____

_____

_____

_____

_____

End of Block: Fitness Assessments

Start of Block: Introductory Videos

Q35 Did you watch the Alpha phase introductory videos?

○ Some of them (1)

○ All of them (2)

○ None of them (3)

Skip To: End of Block If Did you watch the Alpha phase introductory videos? = None of them

Q36 How helpful were these videos?

○ Very helpful (1)

○ Somewhat helpful (2)

○ Not at all helpful (3)

Q37 Comments or suggestions about the introductory videos:

_____

_____

_____

_____

_____

End of Block: Introductory Videos

Start of Block: Educational Resources

Q38 Have you read any of the educational resources?

○ Yes (1)

○ No (2)

Q39 How often do you read an educational material?

○ Once or twice total (1)

○ Once or twice per week (2)

○ Three or four times per week (3)

○ Five or more times per week (4)

Q40 Which topics from the educational materials did you like the most? (choose all that apply)

☐ Physical Performance (1)

☐ Tactical Stress Tolerance (2)

☐ Tactical Nutrition (3)

☐ None of them (4)

☐ I'm not familiar with the types of educational materials (5)

Q41 Comments or suggestions about the education resources:

_____

_____

_____

_____

_____

End of Block: Educational Resources

Start of Block: Program Emails

Q42 Have you been receiving emails from The Black?

○ Yes (1)

○ Yes, but in my junk/suspicious mailbox (2)

○ No (3)

Skip To: End of Block If Have you been receiving emails from The Black? = No

Q43 What do you think about the frequency of the emails?

○ Get too many emails from The Black (1)

○ Get the right amount of emails from The Black (2)

○ Don't get enough emails from The Black (3)

○ Not sure how many I get (4)

Q44 How often do you open and read an email from The Black?

○ Never, I ignore them (1)

○ Never, they go to my junk/suspicious/spam mailbox (2)

○ Once or twice total (3)

○ Once per week (4)

○ Two or three times per week (5)

○ I read every email from The Black (6)

Skip To: Q45 If How often do you open and read an email from The Black? = Never, I ignore them
Skip To: Q45 If How often do you open and read an email from The Black? = Never, they go to my junk/suspicious/spam mailbox

Q45 Comments or suggestions about the program emails:

_____

_____

_____

_____

_____

End of Block: Program Emails

Start of Block: Nutrition Log

Q46 Have you ever used the Nutrition Log in The Black?

○ Yes (1)

○ No (2)

Q47 How often do you use the Nutrition Log?

○ Once or twice total (1)

○ Once or twice per week (2)

○ Three or four times per week (3)

○ Five or more times per week (4)

Q48 Comments or suggestions about the nutrition log?

_____

_____

_____

_____

_____

End of Block: Nutrition Log

Start of Block: Barriers and Motivators to Using The Black

Q49 What don't you like about The Black?

☐ There was nothing I didn't like (1)

☐ The program is not appealing (2)

☐ The program doesn't address the needs of my crew (3)

☐ The platform is confusing and not user-friendly (4)

☐ I already have a training program that works for me (5)

☐ I don't have time to go to the website (6)

☐ The intensity of the workouts is not high enough (7)

☐ There's a lack of support from upper management (8)

☐ The program assumes I don't have exercise equipment (9)

☐ The program was rolled out too early or too late (10)

☐ Not getting paid to work out (11)

☐ Others (please specify) (12)

_____

Q50 What do you like about The Black?

☐ There was nothing I liked (1)

☐ It's developed by experts and based on science (2)

☐ It's easy to access and use (3)

☐ It provides valuable information (4)

☐ Not needing exercise equipment (5)

☐ There's support from upper management (6)

☐ It's not as intense as other programs (7)

☐ It's specially designed for wildland firefighters (8)

☐ The program is new and exciting (9)

☐ Having the opportunity to shape the program that wildland firefighters may use in the future (10)

☐ Being one of the first wildland firefighters to ever use the program (11)

☐   Others (please specify) (12)

_____

Q51 Choose up to 3 features of The Black you liked best

☐ Introductory Videos (1)

☐ Safety Zone Screening (2)

☐ Fitness Assessments (3)

☐ Educational Resources (4)

☐ Nutrition Log (5)

☐ Emails (6)

☐ Workouts (7)

☐ Exercise Videos (8)

☐ Social Media (i.e. Twitter) (9)

☐ None (10)

End of Block: Barriers and Motivators to Using The Black

Start of Block: Closing Statements

Q52 I believe The Black has increased my ability to do my job as a wildland firefighter

◯ Strongly agree (1)

◯ Somewhat agree (2)

◯ Somewhat disagree (3)

◯ Strongly disagree (4)

Q53 What inspires you to be the best wildland firefighter you can be?

_____

_____

_____

_____

_____

Q58 If you could put one message in a billboard to share with thousands of wildland firefighters, what would it say?

_____

_____

_____

_____

_____

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