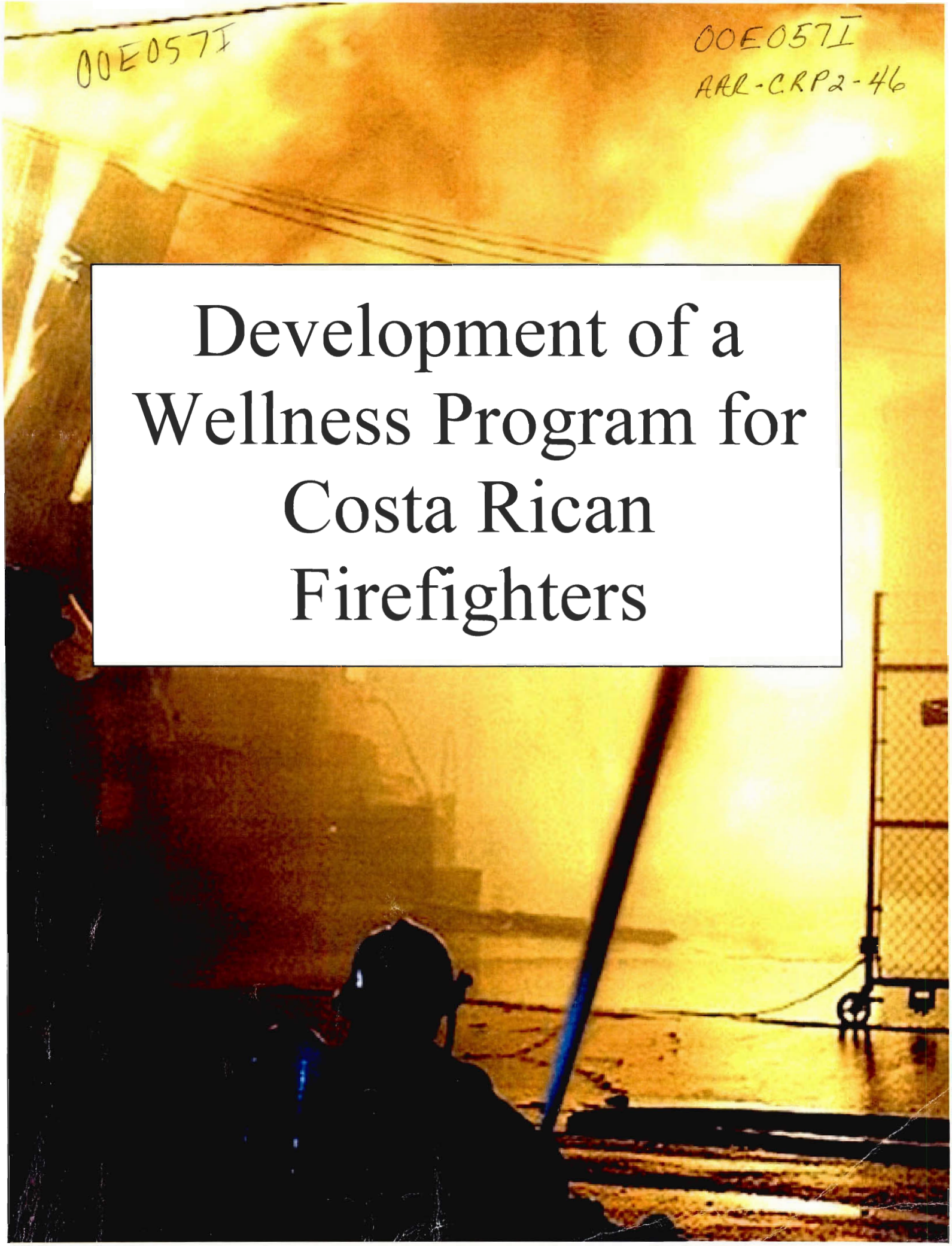


Development of a Wellness Program for Costa Rican Firefighters

Interdisciplinary Global Studies Division
Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 01609-2280

5 Julio, 2000

Sr. Juan Esteban Ramos González
Benemérito Cuerpo de Bomberos de Costa Rica
Instituto Nacional de Seguros - 5° piso
calle 9, avenida 7
Apto. Postal 4329-1000
San José, Costa Rica

Querido Sr. Ramos:

Junto a esta carta podrá encontrar nuestro informe titulado "Development of a Wellness Program for Costa Rican Firefighters." El informe fue escrito durante el periodo del 18 de marzo al 4 de julio del 2000. Copias del informe han sido presentadas al Profesor Ángel Rivera y al Profesor Roberto Pietroforte, simultáneamente, para aprobación. Luego de la revisión hecha por la facultad, la copia original será catalogada en la Biblioteca Gordon del Instituto Politécnico de Worcester. Agradecemos el tiempo que nos ha dedicado.

Muy atentamente,

Nancy Baccheschi

Brian Gilman

Justin Lutz

Interdisciplinary Global Studies Division
Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 01609-2280

July 5, 2000

Sr. Juan Esteban Ramos González
Benemérito Cuerpo de Bomberos de Costa Rica
Instituto Nacional de Seguros - 5° piso
calle 9, avenida 7
Apto. Postal 4329-1000
San José, Costa Rica

Sr. Ramos:

Enclosed is our report entitled, "Development of a Wellness Program for Costa Rican Firefighters." The report was written during the period of March 18 through July 4, 2000. Copies of the report are being submitted simultaneously to Professors Ángel Rivera and Roberto Pietroforte for evaluation. Upon faculty review, the original copy of the report will be catalogued in the Gordon Library at Worcester Polytechnic Institute. We appreciate the time you have devoted to us for this project.

Sincerely,

Nancy Baccheschi

Brian Gilman

Justin Lutz

Report Submitted to:

Professor Ángel Rivera

Professor Roberto Pietroforte

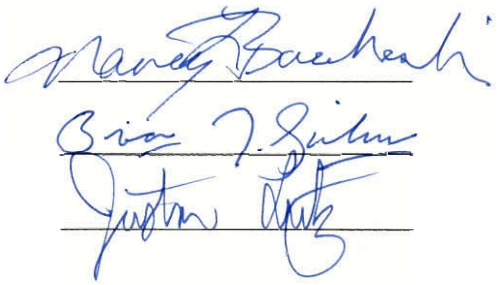
Costa Rica, Project Center

By

Nancy Bacchesch

Brian Gilman

Justin Lutz



In Cooperation With

Sr. Juan Esteban Ramos González

Instituto Nacional de Seguros
Benemérito Cuerpo de Bomberos de Costa Rica

DEVELOPMENT OF A WELLNESS PROGRAM FOR COSTA RICAN FIREFIGHTERS

05 Jul 00

This project report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the authors and do not necessarily reflect the positions or opinions of El Cuerpo de Bomberos del INS or Worcester Polytechnic Institute.

This report is the product of an education program, and is intended to serve as partial documentation for the evaluation of academic achievement. The report should not be construed as a working document by the reader.

Abstract

This report, prepared for El Cuerpo de Bomberos del Instituto Nacional de Seguros, details the development of a wellness program for Costa Rican firefighters based on existing programs in the United States. The objective of the wellness program is to promote the total well-being of the firefighters. The developed program includes a physical fitness training program, health-related educational activities, a firefighter task-related test, guidelines for medical examinations, and an administrative guide for physical fitness trainers.

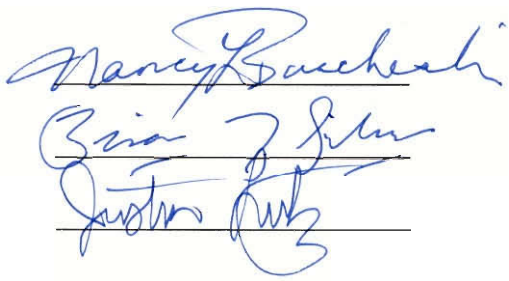
Authorship Page

We swear on the souls of our mothers' goats that we contributed equally to all parts of this paper. Anyone who wants to step can face the wrath of "la familia."

Nancy Baccheschi

Brian Gilman

Justin Lutz



Acknowledgements

We would like to thank the following groups and individuals for their contributions to our project:

Ing. Juan Esteban (Sr. Bigotes) Ramos González del Instituto Nacional de Seguros, gracias por ser un asesor excepcional durante el proyecto. También, gracias por todos los tiempos que hizo más que ser nuestro asesor y hacerse nuestro amigo. Gracias por los sandwiches cuando tomamos café cada mañana; gracias por llevarnos por dos horas, buscando bencina; gracias por ser paciente con nuestro Español; gracias por todo que hizo para aumentar nuestra experiencia en Costa Rica.

Professors Ángel Rivera and Roberto Pietroforte of Worcester Polytechnic Institute, thank you for advising our project and reading through the endless drafts that led to the final product.

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Captain Lassopoulos of the Washington D.C. Fire & EMS Department, thanks for the information you supplied us with concerning the Washington physical agility test.

El Tigre de la Soda el Sesteo, gracias por todos los almuerzos deliciosos y el ambiente que gozamos cuando estuvimos en Costa Rica.

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Executive Summary

Fire fighting is one of the most physically and mentally demanding occupations in the world. In the line of duty, firefighters must perform physical tasks ranging from climbing smoke-filled flights of stairs with heavy equipment to maneuvering fully charged hoses. In addition to the physical requirements, firefighters must cope with the mental stress of risking their own lives to save the lives of others. For these reasons, firefighters need to maintain excellent physical and mental condition to keep personal risk to a minimum.

The objective of this project was to create a wellness program to promote the total well-being of firefighters. A wellness program includes physical fitness training, exercise prescriptions, firefighter task-related testing, health risk assessment, health-related education, and medical examinations. The finalized program was created for the firefighters of Costa Rica, who are a part of El Cuerpo de Bomberos del Instituto Nacional de Seguros. The program starts in July 2000 at ten fire stations, which we call the Ten Initial Stations. Eventually the permanent and volunteer firefighters at all fifty-five stations in Costa Rica will use the program.

In order to develop the wellness program, we performed background research of relevant literature in the United States. The literature research provided information about wellness programs in the United States, and laws regarding firefighter physical fitness. The information was found in journal articles, books, and research papers.

We also performed research at fire stations in Costa Rica, which consisted of surveys and interviews. The surveys were distributed to all of the permanent and volunteer firefighters at the Ten Initial Stations, and the results provided us with

information about the current health and health knowledge of the firefighters. The interviews were distributed to the same sample as the surveys and supplied us with information about the interests of the firefighters regarding physical fitness training and health-related education. The data from the surveys and interviews helped us to develop the health-related education, physical fitness training, and exercise prescription sections of the wellness program.

We conducted informational interviews to learn more about Costa Rican firefighter tasks and existing wellness program components in Costa Rica. In addition, we interviewed Engineer Esteban Ramos, assistant chief of engineering for El Cuerpo de Bomberos, to learn about the critical firefighter tasks and firefighting in Costa Rica. The list of tasks enabled us to develop a task-related test that accurately reflects the job requirements for the firefighters. We also interviewed Dr. José García to learn about the medical examinations for firefighters. The information from the interview helped us to develop the medical examination and health risk assessment sections of the wellness program.

The recommendations for the wellness program are divided into four sections: physical fitness training, health-related education, task-related testing, and medical examinations. For the physical fitness training, El Instituto Nacional de Seguros will hire a physical fitness trainer to develop and monitor fitness programs for all of the permanent firefighters in the Ten Initial Stations. Eventually there will be three additional trainers to work with every firefighter in Costa Rica. The trainer for the Ten Initial Stations will visit each station two consecutive days every month to assist with stretching, aerobic exercises, muscular strength and endurance exercises, and the proper form for each. The

trainer will monitor the physical training progress of each firefighter through progress charts, and using these he will make exercise prescriptions to help the firefighters concentrate on their areas of weakness.

The trainer will also conduct health-related classes every two months for all the firefighters. He or she will conduct classes on various topics in which the firefighters have expressed an interest, as well as any additional topics that are important to the health of the firefighters. Attendance at these classes will be mandatory for all firefighters. However, the firefighters will only be required to attend the classes on the topics that they have not learned about already.

The task-related test is intended to test the ability of the firefighters to perform tasks related to their job. The test will be held at the recreation center of El Instituto Nacional de Seguros in San José. The first official test will be held in December 2000 after a trial run of the test is administered to determine the time requirements of each event. The fire chiefs at each station will be responsible for administering the test, annually, to the firefighters.

The test consists of eight events related to the critical tasks of a Costa Rican firefighter. He or she must pass six out of the eight events in order to pass the entire test. The firefighters will take the test wearing equipment to simulate what they would wear when fighting a fire. For the test, the firefighter will wear a helmet, gloves, air tank, and a weighted vest. If a firefighter does not pass the test, the trainer will modify their physical fitness program in order to pass the following year.

The medical examinations, which will be administered once every six months, include tests for body composition, aerobic capacity, and mental health. Finally, we are

recommending that the firefighters also receive a health risk assessment questionnaire to determine their medical risks.

This report will address the issues of training the firefighters of Costa Rica to be physically fit and testing their ability to perform the tasks of their job. In addition, we address administrative process for the training and testing programs.

1 Introduction

Fire fighting is one of the most physically and mentally demanding occupations in the world. In the line of duty, firefighters must perform physical tasks ranging from climbing smoke-filled flights of stairs with heavy equipment to maneuvering fully charged hoses. In addition to the physical requirements, firefighters must cope with the mental stress of risking their own lives to save the lives of others. For these reasons, firefighters need to maintain excellent physical and mental condition to keep personal risk to a minimum.

This report details many aspects related to the development of a wellness program for Costa Rican firefighters. The subject matter of this report is intended for an audience interested in the well-being of firefighters who need a way to obtain and maintain an excellent level of health as well as a process to monitor their level of physical fitness. This project provides a way to fulfill these needs by developing a wellness program that includes physical fitness training, exercise prescriptions, firefighter task-related testing, medical examinations, health screenings, and educational support activities. The finalized program was created for El Cuerpo de Bomberos del Instituto Nacional de Seguros (INS), which oversees the firefighters of Costa Rica. The goal of the wellness program is to reduce the level of personal risk for the firefighters by increasing their health and health awareness, and therefore their ability to perform fire-fighting tasks.

The original project of El Cuerpo de Bomberos was to conduct a physical fitness training program for ten stations in and around San José, the capital of Costa Rica. The initial program would run from July until December of 2000 as a trial, and as of January

of 2001, the program would be introduced at all fifty-five fire stations in the country. We chose to expand the original project into a full wellness program that addressed all aspects of health.

In order to create the wellness program, we performed research regarding physical fitness training, firefighter task-related testing, current level and knowledge of fitness of Costa Rican firefighters, and administration of the program. For this purpose, we conducted research about fire departments in the United States and their current wellness programs. The reasoning behind using fire departments from the United States is that El Cuerpo de Bomberos adheres to the same set of regulations to which fire departments in the United States must adhere. The National Fire Protection Association (NFPA) of Quincy, Massachusetts develops these regulations, which mandate that all firefighters must be offered the chance to participate in a physical fitness program. The regulations indicate that current wellness programs at fire departments in the United States would likely fulfill the needs of Costa Rica. Because of this fact, El Cuerpo de Bomberos asked us to develop a program based on existing programs in the United States.

We evaluated the physical fitness level and knowledge of the Costa Rican firefighters through the use of a survey to determine the type of education and exercise programs necessary in the wellness program. The surveys were distributed by visiting fire stations, including the Ten Initial Stations that would initially receive the program, and by mailing surveys to a sample of eleven of the remaining fire stations in Costa Rica. The purpose of both visiting and mailing surveys to the stations was so we could get information from a large sample to make our results more accurate by decreasing the bias of a small sample. The sample included the Ten Initial Stations so we could develop the

program to their needs since they were receiving the program first. The results from the eleven stations enabled us to determine if the needs of the forty-five remaining fire stations were the same as the Ten Initial Stations.

In addition to assessing their physical fitness knowledge, we conducted personal interviews of the firefighters to establish their desired activities as part of the wellness program. We used the same sample for the interviews as the personnel surveys. At the fire stations that we visited, we recorded and evaluated the available physical training equipment to evaluate the equipment available for the physical fitness training program. We also recorded any additional facilities nearby, such as soccer fields and basketball courts.

Our results were compiled using Microsoft Access database and analyzed in Microsoft Excel. We discovered trends in firefighter physical fitness and knowledge and summarized the equipment currently available for training. From the results of our data analysis, we designed a wellness program for the Costa Rican firefighters. We divided the recommendations for the wellness program into four sections for the write-up: physical fitness training, health-related education, task-related testing, and medical examinations. We also included information about the administration of the program in each section.

The first section of the wellness program covers physical fitness training. The physical fitness training information includes the types of exercises that should be included, the rationale for each exercise, the equipment that is needed for the training, and a sample set of charts that can be used to record firefighter progress. The types of

exercises were based on the needs, interests, and current physical shape of the Costa Rican firefighters.

The information about the current knowledge of Costa Rican firefighters regarding physical fitness was used along with existing information to create the health-related education portion of the program. Health education includes information about the health topics that should be covered, the significance of each topic, and how the topics can be presented to the firefighters.

The third section contains the task-related test. This section includes a description of each test activity and the rationale for choosing the activity, requirements for successfully completing each activity, a schematic of the testing facilities, and a list of equipment necessary to construct the testing facilities. The test was based on task-related tests from Massachusetts, New York City, and Washington D.C. since these locations have some of the most advanced firefighter tests in the United States. Massachusetts and New York City are special because they were pioneers in firefighter task-related testing to be used throughout the career of a firefighter. Washington D.C. uses a test that is based on information from ten large cities in the United States and Canada. The Washington D.C. test was a good model for our project since it was based on the needs of so many cities.

The final section details the medical examinations. We discuss what should be included in the examination, how often a firefighter should be examined, and who should conduct the examinations. We also discuss what can be done with the information gathered from the medical examinations.

This report was prepared by members of Worcester Polytechnic Institute Costa Rica Project Center in conjunction with the Costa Rican national fire department, El Cuerpo de Bomberos del Instituto Nacional de Seguros. The relationship of the Center to El Instituto Nacional de Seguros and the relevance of the topic to El Instituto Nacional de Seguros are presented in Appendix A. This research project is an Interactive Qualifying Project (IQP), a requirement for obtaining a bachelor's degree at Worcester Polytechnic Institute. An IQP is meant to create student awareness of socially related technological interactions. The Project teaches students to recognize links between social and technological systems and guides them into the habit of assessing social values and structures. This project fulfills the provisions of an IQP by addressing the issue of how firefighters can decrease personal risk while fighting fires. The technological aspect of the project includes advancements in medical and health science in areas such as physical fitness training and evaluation, nutrition, and health assessment.

2 Background

This chapter contains information that we gathered from research in the United States and Costa Rica. The purpose of providing the background is to supply the reader with the necessary information that will enable an accurate understanding of the project. We first introduce the tasks of firefighters and the details of fire fighting. We then provide information on wellness programs, especially in relation to firefighters. Finally, we include firefighter physical fitness regulations that apply to both the United States and Costa Rica.

2.1 Fire Fighting

Fires are unpredictable disasters that can occur almost anywhere and can quickly put lives in danger. For this reason, fire fighting is a valuable service to the safety of any community. Firefighters have many important duties that must be performed under demanding circumstances in order to provide these services. It is the structure of the fire service that provides the organization that allows the work of the firefighters to go smoothly under difficult conditions.

2.1.1 Duties of Firefighters

At the scene of a building fire, a firefighter performs tasks such as handling a live hose, climbing ladders, performing emergency medical services, operating a pump, and ventilating areas in the building (Fast Forward Productions, 1998). Firefighters must climb stairs with full equipment, break through doors to gain entry to a fire, find victims

within fire scenes and carry them to safety (Commonwealth of Massachusetts Human Resources Division, 1998).

Firefighters must also operate a variety of tools. The tools that each fire department uses may vary, but there are categories of tools that most firefighters need to accomplish certain tasks. The types of tools firefighters use can be grouped into eight categories: cutting tools, cutting/striking tools, prying tools, striking tools, poles, personal tools, several-in-one tools, and special-purpose tools (Fritz, 1997). Many of these tools are difficult to use because they are heavy and require skill to manipulate.

When responding to a typical building fire in Costa Rica, firefighters have a set of important duties to perform that are crucial to extinguishing the fire and rescuing fire victims. Firefighters first hear the fire alarm at the fire station, put on their gear, and depart for the fire on the fire engine. At the scene of the fire, firefighters must unload hoses and drag them into place, set up ventilation machines that weight forty-three kilograms (ninety-five pounds) to clear the smoke from the building, and break down doors to gain access to the fire. Many houses in Costa Rica have locked metal gates in addition to their locked doors which can make forced entry twice as difficult as the common one door system in the United States. Once access to the building is secured, firefighters must move ladders into place, puncture holes in the ceilings to look for fires, search the building for any victims, and drag them to safety (Ramos, 2000).

2.1.2 Organization of Fire Service

The organization of most fire departments can be grouped into two categories: external components and internal components. External components include a city or

county council and manager, the fire department, an emergency management organization, a building department, the engineering department, the water agency, planning and zoning departments, the police department, central services, general service, a municipal airport, and private developers (Coleman, 1988).

The internal components differ between small, medium-sized, and large fire departments as well as between volunteer or combination departments. All fire departments, however, have four functions: fire suppression, fire prevention, special services, and support functions. The traditional fire department has a fire chief at the head and various levels below that rank. Departments share many titles based on historical development as a paramilitary organization. As described by Roger Belhumeur, the fire chief of Auburn, Massachusetts, the fire service works by a chain of command similar to the military. The fire chief is at the top of the chain and below him is the deputy chief. In some cities, the departments are broken up into districts, each headed by a district chief underneath the deputy chief. Below this person are the company officers in the order of captain then lieutenant, and under the command of the company officers are the firefighters. In some communities, specific positions such as lineman and driver are assigned to certain people. However, in other communities, there are not enough firefighters for each to have a specific job, so each firefighter must know how to do every job in the department.

As mentioned earlier, each fire station or company may be under the command of an officer called a captain, lieutenant, sergeant, foreman or senior firefighter. Depending on the size of the department, the fire-fighting training of the members can be assigned to

a single officer who also has other responsibilities, or there may be a full-time training officer (Coleman, 1988).

Fire departments are grouped into four categories: volunteer, mostly volunteer, mostly paid, and fully paid. The mostly volunteer and mostly paid department classifications depend on how the majority of the firefighters are employed. Firefighters in the United Stated are usually employed by one station and spend their time working at that station. The only time firefighters work at another station is when their crew is covering a station for a department that is out fighting a fire (Belhumeur, 2000).

In Costa Rica, there are fifty-five fire stations throughout the country with approximately 310 permanent firefighters and 850 volunteers. The permanent and volunteer firefighters have their own chief at each station, and the overall administrative infrastructure is controlled by El Cuerpo de Bomberos del Instituto Nacional de Seguros (see Appendix A). Firefighters are hired by El Instituto Nacional de Seguros instead of by a particular station and can work at any station; however, they usually work at one location until they are needed elsewhere.

There is a separate group of firefighters under the control of El Instituto Nacional de Seguros, Los Bomberos Forestales, who handle forest fires. For our project, we are developing a wellness program strictly for the regular firefighters at the request of El Cuerpo de Bomberos.

2.1.3 Fire Fighting Conditions

The factors that affect firefighting conditions are so diverse that fighting a fire is never the same. Firefighters in the United States have to fight fires in residences, skyscrapers, factories, forests, and open fields. The type of fire is determined by the geography of the country, which is diverse in the United States and in Costa Rica. Fires in the United States can happen in a densely populated city or in a remote country location. In Costa Rica, there are over 1,100,000 people living in and around the capital city of San José (INFO Costa Rica, 2000). Many of the buildings in San José are residences and are limited to one or two stories. There are some taller buildings are as high as the twenty-two-story Banco Nacional building. The majority of the residences in San José have iron fences with locked gates lining the perimeter of the property. Outside of the San José area, it is very common for a building to have only one story.

When fighting a fire, firefighters wear equipment that permits tolerance to the fire atmosphere. However, the equipment also creates a greater demand on the body of the firefighter. The equipment consists of boots, pants, jacket, helmet, gloves, air tank, and respirator and weighs about twenty kilograms (forty-four pounds) without the air tank. The tank weights an additional twelve kilograms (twenty-six pounds). The bulky gloves reduce the amount of precision that firefighters have with their hands.

In the United States, firefighters usually work in ten-, twelve-, or twenty-four-hour shifts and average about forty to forty-five hours of work per week (Belhumeur, 2000). Firefighters in Costa Rica work for twenty-four hours and then have twenty-four hours of rest. However, they can change their work schedule by trading workdays with a fellow firefighter. The first hour of the workday is from eight until nine in the morning

and is devoted to obtaining information from the previous crew. The day is spent doing work at the station or answering calls for fires or emergencies. At night, the firefighters complete their twenty-four hour shift by sleeping at the station. At least one firefighter must stay awake to answer any calls. If a call comes in during the night, the firefighters must go from sleeping to being ready to fight fires in a matter of minutes.

At the scene of a fire in the United States, firefighters are only allowed to stay in the building for fifteen to twenty minutes. After their time in the building is up, the firefighters must rest outside the blaze for another fifteen to twenty minutes until they can return. Costa Rica uses a similar system. Firefighters work in the building in twenty-minute shifts and then they rest outside the building while another crew enters to fight the fire (Ramos, 2000).

2.2 Wellness Programs

Wellness programs are designed to address the overall health of an individual from a physical and mental standpoint. The components of a wellness program include health risk assessment, medical examination, firefighter task-related tests, educational support activities, and physical fitness programs (Massachusetts Department of Public Health, 1998). The variety of components makes a wellness program more desirable than just a physical fitness program because there is a focus on the total well-being of the individual.

2.2.1 History

Although organized fire fighting in the United States has been around since the early nineteenth century (Zurier, 1999), the concept of training firefighters to be physically fit to do their jobs has only been established in the last thirty years. Before 1970, there was never a national standard for physical fitness training of firefighters. There were a variety of entry-level examinations throughout the country, but the content of each was different (Dotson, Santa Maria, Davis & Schwartz, 1977). The physical testing that did exist was developed by individual fire departments, and the testing usually did not accurately replicate the tasks done by the firefighters.

The idea of evaluating the national physical fitness of firefighters was presented in 1974. A team of work physiologists at the University of Maryland's Sports Medicine Center proposed that they could establish physical fitness tests that would be equivalent to the tasks performed by firefighters (Davis, 1991). The first evaluation of the physical conditioning of firefighters came in 1977 when the National Fire Prevention and Control Administration funded a study that would quantify the physiological and physical requirements of a firefighter (Dotson, et al., 1977). The evaluation simulated tasks that would be done by a firefighter including ladder extension, 57 kg (125 lb) weight carry, standpipe hose load carry, 15 m (50 ft) hose pull, 53 kg (117 lb) dummy drag/carry, and a simulated forced entry test. The test also included grip strength measurement, a five-minute step test, and a flexibility test. One hundred firefighters of different ages, positions, gender, and localities took part in the study.

The results of the study were astounding. The study showed that about thirty-three percent of the firefighters in the United States were physically unfit to accomplish

their job-related tasks. Since nearly a third of the firefighters were unable to complete basic fire fighting tasks, the National Fire Academy, which provides education about fire-related topics, created a program in 1978 called "Managing a Fire Service Fitness Program" (Davis, 1991). The program was meant to inform the medical physicians of fire departments about training the firefighters to improve physical fitness. The program eventually died, but it was a major step in spreading the idea of physical fitness training for firefighters.

During the next fifteen years, private and public companies in the United States began to use wellness programs to improve the total well-being of their employees. Many fire stations saw the importance of addressing the total well-being of firefighters and expanded on their physical fitness training and testing programs by adding health screenings and health education activities. The total program addressed the mental health of firefighters and gave firefighters more control over their personal health.

In Costa Rica, there has never been an official wellness program for firefighters. However, some parts of a wellness program do exist, such as medical examinations and some health-related education. There is no physical fitness training or testing program, but there has been an attempt to introduce a physical fitness training program. El Cuerpo de Bomberos began a program with the University of Costa Rica to train fifteen firefighters about physical fitness. These firefighters were to return to their stations and supervise the physical fitness program of each firefighter at the station. However, due to problems beyond the control of El Cuerpo de Bomberos, the program was cancelled in April 2000.

To replace the program, El Cuerpo de Bomberos asked us to develop a new program with professional physical fitness trainers instead of trained firefighters. The program would include physical fitness training and testing to improve the health of each firefighter. One trainer would be hired in June 2000 and would implement the physical fitness training program to the Ten Initial Stations in the San José area from July until December 2000. The remaining forty-five stations in the country would begin the program in January 2001 with three additional trainers. Appendix B contains a copy of the letter from Héctor Chaves of El Cuerpo de Bomberos that outlines the contract for a physical trainer including a description of the physical fitness program.

2.2.2 Benefits

The benefits of wellness programs affect firefighters, fire victims, and fire departments. Wellness programs reduce the level of personal risk for firefighters, enable them to perform their jobs better, and can save money.

Wellness program are important because they promote an appropriate level of firefighter physical fitness, which can prevent health risks. Usually, when firefighters begin their careers, they are in sufficient physical shape to handle the requirements of their work. However, as firefighters age, their level of physical fitness generally decreases. The loss in physical fitness increases the risk of injuries and fatalities for firefighters (Ball, 1999).

Physical fitness training can reduce the obesity of firefighters, which significantly reduces the personal risk for firefighters. With less body fat, a firefighter's body is able to dissipate heat effectively, which reduces cardiovascular problems. A 1992 study,

"Characterization of the Physical Demands of Fire Fighting," reported that obesity reduces the ability of firefighters to complete their jobs and adds increased cardiovascular risks (Ball, 1999). Also, over fifty percent of the firefighters who die in the line of duty die from heart failure and other stress-related problems (Gray, 1993). Studies have shown that an increased level of fitness can reduce the risk of these deaths.

Firefighters can also use a wellness program as a way to improve mental health. When firefighters train together, they improve their friendships since they are overcoming obstacles and improving their health together. Because of the bonds of friendship and the feeling of being physically fit, there is an increase in morale and self-confidence for the firefighters (Ball, 1999).

If firefighters are in better shape to perform their duties, there is a greater chance that a fire victim trapped in a building can be rescued. Dr. Paul Davis, an exercise physiologist specializing in firefighter physical fitness, states that the muscular strength obtained from physical fitness training enables firefighters to more easily manipulate heavy tools. He also points out that firefighters with greater muscular strength and endurance can fight fires for longer periods of time (Lautner, 1998).

Wellness programs can save money for fire departments. With the use of a wellness program, medical costs and workman's compensation are reduced since there are fewer firefighter injuries. When the Riverside, California Fire Department implemented a wellness program, the department saved over $104,664 based on a cost-benefit analysis that spanned three years. There was a twenty-three percent decrease in medical costs and a ten-percent decrease in workman's compensation benefits over the three-year period (Ball, 1999). Another study conducted by Ron Bennett of the Aurora,

Colorado Fire Department, indicated that between 1991 and 1996, the department saved $184,464.36 by implementing a $30,000 physical fitness program (Lautner, 1998). Assistant Chief Nick Olivas from the Tukwila, Washington Fire Department says that a ten percent reduction in sick leave or workman's compensation claims would pay for their wellness program in a year (Ball, 1999).

Currently, there is no system in Costa Rica to keep track of firefighter health risk information, the money spent on workman's compensation and the number of days lost to injuries. Without this information, there is no way to track the benefits of a wellness program (Ramos, 2000).

2.2.3 Physical Fitness Training

The term "physical fitness" applies to any person. The general definition of being physically fit is being in a physical state that allows a person to perform their daily tasks without any physical restrictions. Since firefighters perform fire-fighting tasks as part of their daily routine, a good level of physical fitness for a firefighter means being able to complete these tasks without any physical restrictions (Andricolo, 1987). More specifically, the Commonwealth of Massachusetts' Human Resources Division (1998) categorizes firefighter physical fitness into cardiovascular fitness, muscular strength, muscular endurance, and flexibility. Jones (1998) also includes body composition in his definition of physical fitness.

Cardiovascular fitness is the ability to use the entire body for vigorous activity for extended periods of time. The cardiovascular system, including the heart and lungs, is responsible for providing the body with oxygen. Cardiovascular fitness is a measure of

how well the cardiovascular system provides oxygen. Muscular strength measures the maximum amount of weight that a muscle can move a single time. Muscular endurance measures how many times a muscle can move a certain weight. Flexibility is the amount that a joint, such as the knee, can move and bend. Body composition is a measure of the components that comprise the body. The components of body composition are fat, muscles, and bones (Commonwealth of Massachusetts Human Resources Division, 1998).

To address each component of physical fitness, a training program should include warm-up exercises, stretching, aerobic activity, weight training, and a cool-down. The program should be specific to individuals and should take into consideration their current physical condition and exercise interests. Physical fitness programs should be preceded by a qualitative and quantitative health assessment. The qualitative assessment is fulfilled by a medical examination to make sure the individual will not have problems with exercising. The individual usually completes the quantitative assessment by performing a certain set of measured exercises.

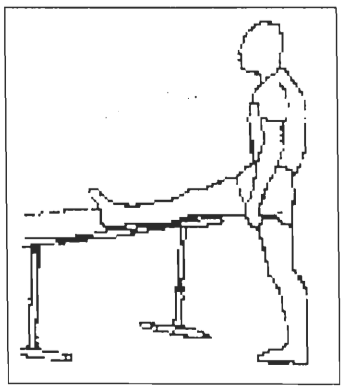
The warm-up exercises are designed to prepare the body for exercise by slowly increasing the heart rate. Typical exercises include light jogging, rapid walking, or jumping jacks. The warm-up exercises should last for five to ten minutes or until the target heart rate has been reached. A target heart rate is the optimum rhythm for exercising. It is equivalent to the maximum heart rate, which is 220 minus the person's age in years, multiplied by 0.7. Once the heart rate has been increased, the body receives more oxygen and is ready for exercise. When the body is in this warmed-up state, stretching exercises should be performed to loosen up the muscles and tendons, which

increases short- and long-term flexibility. Figure 1 illustrates a typical stretching exercise.

Figure 1 – Sample Stretching Exercise

Hamstring Stretch

Stretches the muscles in the back of the thigh
Stand facing sturdy bench approximately 2-3 feet high. Keeping hips and shoulders straight forward, place one heel on top of bench. Maintain a flat back while hinging slightly forward at the hips until you feel the stretch. Do not bend at the waist.



Note: From "Massachusetts Fire Departments Physical Ability Test Preparation Guide" by the Commonwealth of Massachusetts Human Resources Division, 1998.

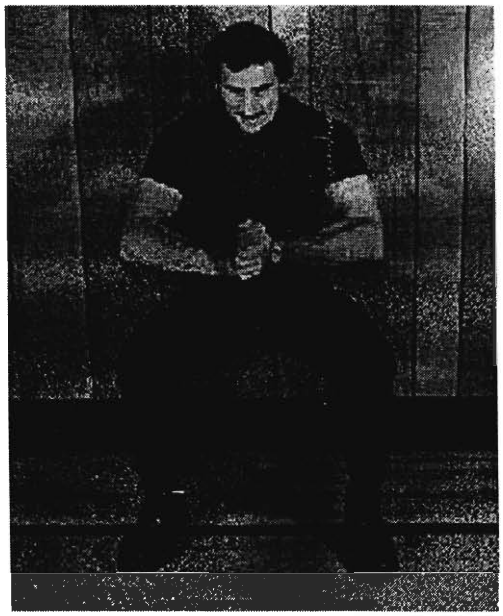
Aerobic exercises are performed for long periods of time at a rhythm that allows the body to replace as much oxygen as it uses. The goal of aerobic exercises is to improve cardiovascular fitness. According to the American Lung Association, aerobic exercises should be conducted at least three times per week in half-hour periods. Aerobic exercise must be done in periods of at least twenty minutes to receive any long-term cardiovascular benefits. Examples of aerobic exercise include running, swimming, cycling, basketball, soccer, walking, dancing, and aerobics.

Weight training is usually accomplished by performing calisthenics and weight lifting. The benefits of weight training include improved muscular strength and muscular endurance. Calisthenics are exercises that do not require equipment and usually use the

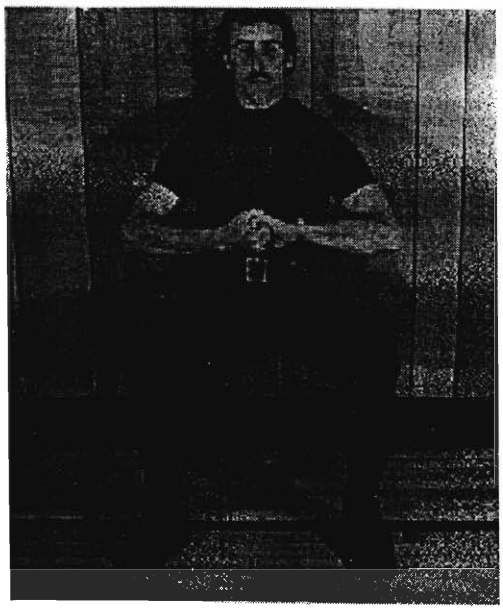
body's own weight as resistance. Some common calisthenics include sit-ups, chin-ups, push-ups, and jumping jacks. Weight lifting involves using equipment to provide resistance for muscles. Being able to use equipment for weight training is important because weight lifting equipment can provide more resistance for muscles than just the weight of the body can.

One way to supplement weight training when there is no equipment available is by performing isometrics. Like calisthenics, isometrics use the body's resistance for strength exercises. The difference between isometrics and calisthenics is that isometrics involve pushing and pulling instead of motion. An example of an isometric exercise is demonstrated in Figure 2.

Figure 2 – Sample Isometric Exercise



Tension Push



Tension Pull

Note: From "Physical Fitness and the Fire Service" by D. Jacobs, 1976.

The cool-down should come at the end of an exercise routine. It is unhealthy for the heart to jump from a working pace to a resting pace, so a cool-down is used as a way to slowly return the heart to its normal rhythm. Walking is the most common way to decrease the rhythm of the heart and should last for about five minutes or until the heart has regained a normal rhythm. Once the heart has reached a resting pace, stretching exercises should again be performed to increase flexibility and relax the muscles and tendons.

2.2.4 Exercise Prescriptions

An exercise prescription is the part of a physical fitness training program that helps an individual continue to make satisfactory improvement in their level of physical fitness. If a physical fitness trainer notices that an individual is having difficulty improving in part of the program, the trainer will prescribe exercises that should be conducted to help the individual make progress. For example, at the Tukwila, Washington Fire Department, each firefighter went through a series of fitness evaluations and received the results of them as well as a custom exercise prescription (Ball, 1999). The prescriptions should include a description of the type, intensity, duration, and frequency of the exercise. According to the Massachusetts Department of Public Health (1998), the exercises should adhere to the American College of Sports Medicine guidelines.

2.2.5 Task-Related Tests

Task-related tests are used to ensure that firefighters are in the proper shape for their job. The tests are usually made up of seven to ten events, which are based on firefighter tasks such as dragging a hose or carrying a ladder. The tests have several purposes: to monitor a firefighter's current level of physical fitness, to determine eligibility of a candidate to become a firefighter; and to justify continued employment by a fire department (Massachusetts Department of Public Health, 1998).

Firefighters must complete an event in a certain amount of time in order to successfully pass the event. Massachusetts and Washington D.C. require firefighters to pass each event in order to pass the overall test (Commonwealth of Massachusetts Human Resources Division, 1998; District of Columbia Fire and Emergency Medical Services Department, 1999). New York City requires that firefighters pass six out of the eight events to successfully complete the test (New York City Department of Citywide Administrative Services, 1999). A sample of each of the three tests can be found in Appendix D.

Usually there are administrators at the test to assure that each firefighter properly completes each event. The administrators time the events, direct the firefighters to the proper event, and monitor the firefighters for any physical distress. There are also requirements that the test administrators have to meet. The test administrators for New York are required to be in good shape since they have to run alongside each firefighter for the duration of the test (Patitucci, 2000). Washington provides a training manual, which must be read and fully understood before administering a test (Lassopoulos, 2000). In Massachusetts, the administrators must have extensive knowledge about all the

individual tests including the specific timing and format (Commonwealth of Massachusetts Human Resources Division, 1998).

Firefighters are tested for physical fitness more than once in their careers because their physical health can change. According to Massachusetts' general law, firefighters are required to take physical fitness tests no less than once every two years, although fire departments have the ability to require more frequent testing if they desire (Massachusetts General Law, 1996). The Massachusetts Department of Public Health recommends physical testing for firefighters in a time frame between one and two years (Massachusetts Department of Public Health, 1998). In 1998, Massachusetts passed a law that requires all firefighters instated after November 1, 1996 to take and pass a physical fitness test every two years. Firefighter candidates are also required to pass the test before becoming firefighters (Commonwealth of Massachusetts Human Resources Division, 1998).

2.2.6 Medical Examinations

In the United States, firefighter medical examinations consist of a total-body exam, which includes a regular physical and additional examinations such as cholesterol, blood glucose, obesity, body mass index, and respiratory function (Massachusetts Department of Public Health, 1998). Donald Jacobs (1976) stresses that the examination should include an active portion where the firefighter is monitored during physical activity such as running on a treadmill.

According to NFPA 1582, *Standard on Medical Requirements for Fire Fighters*, a medical examination should be given periodically. The frequency of medical exams is

based on the age of the firefighter. The code states that for firefighters less than thirty years of age, a medical examination is conducted every three years, and for the firefighters between the ages of thirty and thirty-nine, every two years. Firefighters forty years old or older need a medical exam every year. For firefighters with coronary problems, a treadmill test is included with their exam. This test is required at least once every two years, but the frequency of testing should increase with firefighter age (NFPA 1582, 1997).

Many departments in the United States have a physician who is responsible for a station or a group of stations. The physician conducts medical examinations and treats any injuries that a firefighter receives. In Costa Rica, there is a group of doctors who work for El Cuerpo de Bomberos that takes care of the medical examinations and firefighter injuries. Currently, firefighters in Costa Rica are required to have medical examinations twice a year. The examinations test basic health components such as blood pressure, reflexes, eyesight, and hearing. Firefighters also receive a blood test, x-rays, lung capacity test, treadmill test, and a spinal exam. The doctors check the psychological state of the firefighters and their body composition, which includes amounts of muscle, fat, bone, and cholesterol (García, 2000).

2.2.7 Health Risk Assessment

Health Risk Assessment is a tool that estimates the risk a person has for developing certain diseases. For example, a person who does not exercise, has a family history of heart disease and has high cholesterol is at high risk for developing heart disease. According to the Massachusetts Department of Public Health's Wellness

Program Manual, there are three components to a health risk assessment: a risk assessment questionnaire, a risk estimation based on screening results such as cholesterol levels, and presentation of the results to the individual.

Questions on the risk assessment questionnaires seek information about family medical history, dietary habits, and personal medical history. The questionnaires usually contain questions about level of physical activity, smoking habits, and alcohol consumption of the individual.

The screening results are usually from the medical exams. In order to use the results, fire departments need permission to view medical records of the firefighters, which can be granted in the form of a waiver signed by the firefighters. The screening results are combined with information from the risk assessment questionnaire to summarize the health of the individual.

Health risk assessment is an important part in understanding the current health and fitness of department members. Jones (1998) says that health risk assessment is so important that it should be included in the computer records of each fire department. With the health risk data, fire departments can develop accurate profiles of fire department personnel, which will provide important firefighter health information. This information can be used to gain knowledge of the overall health of the department, provide personal feedback on health concerns for each firefighter, and design health-related educational support activities.

2.2.8 Educational Support Activities

Health-related educational support activities provide an opportunity for firefighters to increase their health awareness, change or modify health-related behaviors and receive support to lead healthy lives. Methods of administering these activities included: demonstrations, films, videos, seminars, workshops, speakers, newsletters, individual or group counseling, and support techniques for behavior modification (Massachusetts Department of Public Health, 1998). The topics of these programs can include making healthy food choices, strategies to control cholesterol and blood pressure, developing a personal physical activity program, substance abuse prevention, toxic substance management, emotional stress, meditation/yoga, occupational health, and injury prevention (Massachusetts Department of Public Health, 1998).

There has to be a trained individual to conduct the educational support activities with the firefighters. For this purpose, every fire department in Massachusetts is required to have a wellness director on staff. The wellness director is a firefighter who has been trained to conduct the educational support activities as well as provide physical conditioning activities such a basketball, running, and aerobics (Belhumeur, 2000).

2.2.9 Program Implementation

Deciding on how to implement a wellness program is just as important as deciding on the contents of the program itself. According to Paul Davis, Ph.D., there are certain components essential to a successful program: the formation of a committee to plan and implement the program, budgeting, formal written policy, assignment of a

health and fitness coordinator, health risk screening, medical physicals, technical assistance, and testing.

The committee that plans and implements the wellness program should include firefighters in the development process. Programs have a greater chance of acceptance and success if the firefighters feel that the program is partially their creation. Davis also indicates that when implementing a program, if there is no fitness expert employed by the fire department, the department should seek outside assistance from local exercise specialists (Lautner, 1998). One way to involve firefighters is to solicit their suggestions on what activities they would like included in the wellness program. Another way to involve the firefighters is to keep them informed about the development of the program. Los Angeles fire departments in California keep their firefighters informed of the wellness program through a newsletter that includes letters from the wellness program director, health facts, and information about any current developments of the program (Los Angeles Fire Department, 1999). El Cuerpo de Bomberos has a newsletter for firefighters called *Prueba de Fuego*, which is distributed every two months.

The planning committee also has to decide if participation in the program is going to be mandatory or voluntary. In general, the fire service has displayed a negative attitude towards adopting a mandatory physical fitness program for many reasons. One of these reasons is the fear of the consequences of not meeting the standards set by the program. Another reason for the resistance is the firefighters' attitude against being forced into performing physical fitness as part of the job.

However, in an article for *Health and Safety* magazine, Gregory Walterhouse supports a mandatory program because individuals are not always motivated to conduct

their own health program. As Dr. Paul Davis points out, the goal of fitness standards is to make certain that firefighters have the ability to perform their jobs without undue risk to themselves or others, making wellness programs too important to be voluntary. In an article for *Minnesota Fire Chief*, Dr. Davis also says that unfit firefighters, the individuals who would receive the most benefit from a wellness program, are unlikely to participate if the program is voluntary (Lautner, 1998).

2.2.10 Equipment

Fire departments need equipment in order to conduct certain sections of the physical fitness training. At least a minimal set of equipment is usually needed to improve cardiovascular fitness, muscular strength, and muscular endurance. However, flexibility can be improved without equipment.

Some fire departments use machines such as treadmills, NordicTracks, StairMasters, and stationary bicycles for aerobic exercise (Ball, 1999). Sporting equipment such as basketballs and soccer nets are also helpful for aerobic exercises. However, activities such as running and walking can fulfill the aerobic exercise requirement and require little to no equipment.

To improve muscular strength and endurance, a firefighter must perform weight training. There are two different types of equipment for weight training: machines and free weights. Machines provide a simplistic approach to weight lifting since each machine usually performs only one or a few types of exercise. Changing the amount of weight on a machine involves moving a peg to add or subtract weights. However, weight machines can be costly.

Free weights are less bulky, cost less, and can be used for more exercises than a machine. Free weights also work the smaller muscles between the larger muscle groups because the smaller muscles are used to balance the weights during lifting. A set of free weights consists of barbells, dumbbells, plates, and a bench. The barbells and dumbbells should include two short bars, a long bar, and a set of weights totaling 50 kg (110 lb). There should be a pair of 1 kg (2½ lb) weights included with the set in order to increase weights in small increments. The bench should have a bench press rack and an attachment for doing leg extensions. The equipment can also include an adjustable bar that can fit in doorways and be used for pull-ups. Another piece of useful equipment is an inclined board, which can be used for sit-ups of varying difficulty (Schwarzeneggar, 1981).

For the physical fitness testing, firefighting equipment and building materials are needed. Some of the equipment needed for a typical test includes ladders, stair-climbing machines, pole hooks, sledgehammers, stopwatches, hoses, plywood, and metal pipes. In addition, firefighters have equipment they need to use while taking the assessments such as a helmet, a weighted vest to simulate the weight of a firefighter's equipment, and optional knee and elbow pads (Fast Forward Productions, 1998).

2.2.11 Costs

Startup expenses will be incurred for the first few years of the program, but in the long run, the department will save money. One of the first expenses is paying for a fitness professional. There is also the cost for physical training equipment, which can range from a few hundred dollars for free weights to thousands of dollars for exercise

machines. One way to reduce costs is by obtaining used or repossessed equipment from health clubs (Ball, 1999).

The cost of the equipment for the physical fitness tests can also be significant. For example, $10,000 - $15,000 is needed to finance the Candidate Physical Agility Test for the International Association of Fire Chiefs (Stittleburg, 1999). The initial health risk assessments are costly at first as well. Since it comes at such a high cost, this can be an optional part of the program, but it is highly recommended. At the Tukwila Fire Department in Washington, they calculated that the average cost to replace a firefighter, including uniforms, training and physical performance evaluations, to be at least $15,000 before the institution of the wellness program. The firefighters in need of replacement in this case would be those on long-term disability or eligible for early retirement. They found it would be more cost-effective to spend the money on the start-up costs of a fitness program than on the early retirement or disability costs. Taking this into consideration, Tukwila began research for implementing a wellness program. They created a budget for the wellness program of $10,000 annually for the first three years and $3,000 annually thereafter (Ball, 1999).

2.2.12 Program Considerations

One consideration to take into account when designing a wellness program is the repercussions for failing the task-related test. Since physical fitness assessments are meant to determine a firefighter's ability to perform his or her job, the results of each firefighter's individual assessment may have repercussions. For instance, as indicated from research conducted for the Range Complex Fire Department, personnel who

maintain accepted fitness levels are not required to take the task-related test (Lautner, 1998). The task-related test is administered to all candidates and any incumbent not meeting minimum fitness standards. It is also used to determine duty positions for personnel coming from light duty and work-related injuries (Lautner, 1998).

At the Dallas Fire Department, members who fail the task-related test are subject to reassignment to light duty and other remedial actions until they have improved their fitness levels to an acceptable level (Bass, 1991). This acceptable level is achieved by working with the fitness coordinator towards the goal.

According to section 8-5.2 of the 1987 NFPA 1500 code, firefighters who do not meet physical requirements must participate in a physical fitness improvement program until they meet the requirements. Gil Gray, Battalion Chief of the Rapid City Fire Department in South Dakota, recommended that if an employees fails the fitness evaluation, they will be required to participate in a prescribed fitness improvement schedule and be retested at a later date (Gray, 1993).

Another consideration when designing the wellness program is gender. Some careers have separate requirements for males and females due to their different physiques. However, there can be no distinction between the requirements of male and female firefighters since they both must be able to fully complete the tasks of a firefighter. Since the requirements are the same for both men and women, the physical fitness test should be based on the firefighter tasks to avoid sexual discrimination (Anderson, 2000).

Just as men and women must pass task-related tests consisting of the same standards, new firefighters as well as incumbents are required to perform according to the

same standards since they all have to perform the same duties regardless of age (Anderson, 2000). Refusing a job to an older firefighter is not considered discrimination by the American Disabilities Act (ADA) as long as the reasoning behind it is the lack of the firefighter's ability to perform the necessary tasks of his or her job.

2.3 Firefighter Physical Fitness Laws

The main source for firefighter laws in the United States is the National Fire Protection Association (NFPA). The NFPA is an organization based in Quincy, Massachusetts, which is responsible for developing fire-related regulations. The United States uses the regulations as part of the National Fire Code (NFC). El Cuerpo de Bomberos is a member of the NFPA and uses the NFPA regulations as guidelines for their own programs.

2.3.1 NFPA 1500

One NFPA regulation that affects firefighter physical fitness is NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*. The regulation was developed in 1987 and is meant to increase safety in fire fighting by addressing the medical and physical requirements of a firefighter.

There have been three editions of NFPA 1500. The first two editions presented ways for firefighters to increase their safety in dangerous fire-fighting environments. (NFPA 1500, 1997). The third edition addressed risk management and training requirements for personnel.

The first section of the fire code that addresses physical fitness is chapter 8-2, *Physical Performance Requirements*. Chapter 8-2 focuses on firefighter task-related testing. The section states that each fire department must establish physical performance requirements for two groups of people: possible candidates and current firefighters that perform emergency operations (NFPA 1500, 1997). The possible firefighter candidates must meet the physical performance requirements instituted by the fire department before they are even trained to become a firefighter. The current firefighters who perform emergency operations must be tested annually on the physical requirements instituted by the fire department. If the firefighter does not pass, then he or she must complete a mandatory physical performance rehabilitation program (NFPA 1500, 1997). If the firefighter fails to complete this program, he or she is terminated from his or her job.

The second section of the fire code that addresses physical fitness is chapter 8-3, *Physical Fitness*. This section focuses on physical conditioning and training to prepare the firefighters for physical evaluations. The section states that each fire department must provide each firefighter with the chance to participate in a physical fitness program. The code also states that all firefighters of each department must participate in the physical fitness program. In addition, each fire department must have a health and fitness coordinator who administers the physical fitness program (NFPA 1500, 1997). However, complying with this could simply mean that the fire department provides memberships to a nearby fitness center.

2.3.2 NFPA 1582

NFPA 1582, *Standard on Medical Requirements for Firefighters*, was created in 1992 to address the medical requirements necessary for firefighters (NFPA 1582, 1997). Previous medical requirements were defined in NFPA 1001, but the requirements only applied to entry-level firefighters. One U.S. federal law, the Americans with Disabilities Act, states that requirements for a fire-fighting position must apply to anyone who is currently employed in that position or who might be employed in that position. The Americans with Disabilities Act also states that firefighters with disabilities who create hardship for the rest of the department can be dismissed without legal repercussions for the fire department. However, the firefighter can only be dismissed after completing a medical evaluation that states that he or she is physically incapable of doing his or her job (NFPA 1582, 1997). Therefore, the updated version of NFPA 1582 covers the medical requirements for all firefighters in all positions, both candidates and current firefighters.

2.3.3 NFPA 1583

NFPA 1583, *Standard on Health Related Fitness Programs for Firefighters*, is currently in draft form. The main focus of NFPA 1583 is on developing the structure for a physical fitness program for firefighters. The draft mentions that each fire department shall have a Health and Fitness Coordinator (HFC) who will be responsible for administering the mandatory fitness program. The Health and Fitness Coordinator can be a member of the fire department or somebody hired from outside the department (NFPA 1583, 2000).

The draft establishes guidelines for a physical fitness assessment. Its major components should consist of aerobic capacity, body composition, muscular strength, muscular endurance, and flexibility. The assessment should be conducted no less than once per year (NFPA 1583, 2000).

The health-related fitness program should include health education, an individualized exercise routine, warm-up exercises, cool-down exercises, and safety and injury prevention training. The program should also include exercises that address aerobic capacity, muscular strength and endurance, and flexibility (NFPA 1583, 2000).

NFPA 1583 also mandates that each fire department keep track of training and fitness data for each firefighter. The data can be used for administrative purposes such as modifying the physical fitness program as long as the firefighters do not sacrifice their privacy. It should include demographic information, a pre-assessment questionnaire, the fitness assessment, and program participation data (NFPA 1583, 2000).

3 Methodology

The methodology chapter is a description of the procedures that we followed to obtain the data necessary for developing the wellness program. We conducted background research in the U.S. to gain further knowledge of wellness programs. In Costa Rica, we conducted surveys and interviews with a sample of firefighters at various fire stations to determine their current knowledge of physical fitness as well as their current fitness activities. In addition, we collected a list of physical training equipment available at the fire stations we visited. The list informed us of the equipment that could be used by the firefighters for the physical training component of the wellness program. To complete our background information, we conducted personal interviews with various people from El Instituto Nacional de Seguros and the United States. The interviews provided us with information about physical fitness testing, fire fighting conditions for Costa Rican firefighters, and any existing components of a wellness program in Costa Rica.

3.1 Literature Research

The first step in our methodology was literature research, which was useful because it was more efficient for us to extract data from existing research instead of gathering the data on our own. We searched through journal articles, research papers, books, and Web sites in the United States at the request of El Cuerpo de Bomberos to find information about wellness program components and firefighter physical fitness laws. By using current literature, we were able to examine physical fitness training and

testing for firefighters currently in place in the United States. We also gathered details about the implementation, administration, and regulation of wellness programs in the United States. This information was used as a starting point for developing the wellness program.

The literature in the United States included research papers from the National Fire Academy's Executive Officer Program, fire-related journal articles, materials from the Commonwealth of Massachusetts Human Resources Division, and the National Fire Codes. The research papers from the National Fire Academy were relevant because the papers are capstones for multiple years of fire-related education. The fire-related journals included *Fire Chief* and *Fire Engineering,* which have articles from doctors and experts who are knowledgeable about the well-being of firefighters. The Commonwealth of Massachusetts was an important resource because they had recently instituted a statewide wellness program and were able to provide us with the details of the design process, implementation, and components of the program. The National Fire Codes had relevance to our project because they contain the laws for fire-related topics for the United States including firefighter physical fitness. The codes are the same as the guidelines that El Cuerpo de Bomberos uses to design their fire-related regulations.

3.2 Survey Research

Survey research was used to determine the physical condition of a sample of Costa Rican firefighters and their knowledge about physical fitness. This information was used to determine a starting point for the physical fitness training and health

education components of the wellness program. We performed survey research for several reasons, the first of which was that El Cuerpo de Bomberos wanted us to survey firefighters regarding physical fitness. Another reason was that we were not able to access the medical records of the firefighters, so we had to obtain relevant medical information such as height and weight directly from the firefighters. The survey also provided us with more accurate information because it was anonymous. Since it was anonymous, we felt that the firefighters would answer more truthfully, thus improving the quality of the survey.

In order to determine the clarity of our personnel survey questions as well as the accuracy of the translation, we administered a test of the survey before distributing the survey to the fire stations. We distributed the test survey to ten employees of El Instituto Nacional de Seguros and received nine of them back. After reading through the nine and identifying questions that were difficult to understand, we modified the survey. A sample of the survey we distributed at the fire stations can be found in Appendix F.

At the fire stations we visited, we explained to the firefighters that the surveys would help us to design a wellness program. They were given as much time as they needed to complete the survey, which included open-ended questions to obtain information about their physical fitness knowledge and personal questions to determine their physical fitness level. The open-ended questions were optimal in determining the firefighters' knowledge of physical fitness because it allowed them to express their true opinions without the influence of choices to bias their answers.

Some of the personal questions were about habits such as smoking and exercise. Others were answered on a scale of 1-5 so the firefighters could rate their own aerobic

capacity, muscular strength, and flexibility. Our reasoning for including open-ended, personal habits, and perceived fitness questions was that we could obtain all the data we needed by asking similar questions through different formats.

We distributed the surveys to all the members of twenty-one fire stations which were chosen by el Cuerpo de Bomberos: the Ten Initial Stations that will be used in the pilot physical training program and eleven other stations, which represent a Sample of the Remaining forty-five stations in the country (see Table 1). We sampled all of the Ten Initial Stations so that the pilot program would sufficiently satisfy the physical fitness needs of the firefighters at those stations. The Sample of the Remaining Stations was chosen to obtain data about the physical fitness needs for the rest of the firefighters in the country. The results for the two different groups of firefighters were compared to see if there would have to be any modifications in the wellness program before it was expanded to the rest of the country. We included volunteer firefighters in the sample since they would eventually be included in the program.

We hand-delivered surveys to the firefighters on duty at the Ten Initial Stations and four of the eleven Sample of the Remaining Stations. We also left surveys at the stations we visited for the firefighters not on duty and mailed out surveys for all of the firefighters at the seven other stations. When we hand-delivered the surveys, the firefighters completed them and returned them to us. The surveys that were left at stations were returned to us via the inter-office mail at El Instituto Nacional de Seguros.

Table 1 – Sampled Fire Stations

Number	Station Name	Number	Station Name
1	Central	11	Cañas
2	Barrio Luján	12	Turrialba
3	Barrio México	13	Alajuela
4	Guadalupe	14	Liberia
5	Desemparados	15	Nicoya
6	Pavas	16	Ciudad Neilly
7	Tibás	17	Buenos Aires
8	Heredia	18	San Pedro de Poas
9	Cartago	19	Puntarenas
10	Santo Domingo / OCO	20	Limón
		21	Naranjo

Ten Initial Stations **Sample of Remaining Stations**

The number of firefighters surveyed from the eleven stations represented about twenty-four percent of the firefighters from the remaining forty-five stations. According to Salant and Dillman (1994), a sample of twenty-four percent of a population should be sufficient for obtaining accurate results. The validity of our sample meant that we could obtain conclusive results about the similarities of the two groups of firefighters as long as we received a large enough response to the survey.

However, the sample consisted of firefighters from a set of consciously chosen fire stations. If we did not have to use the sample that El Cuerpo de Bomberos chose for us, we would have selected our sample by randomly choosing names of firefighters from the forty-five stations. The random selection of names would have provided us with a sample that was less biased toward firefighters from certain stations. Since we could not randomly select our sample, the results are biased toward the stations we did sample.

3.3 Field Research

Another important component of our methodology was our field research in Costa Rica to determine the equipment available for task-related training at each fire station and to record the facilities available for the physical fitness testing. When we visited the fire stations to distribute the personnel surveys, we completed equipment surveys of the training equipment available to the firefighters. To record the testing facilities, we visited El Centro de Recreación del Instituto Nacional de Seguros for the purpose of taking pictures and recording measurements.

At the stations, we recorded the available equipment and rated its condition. The condition and availability of the equipment were recorded as presented in Appendix J. Examples of equipment that we looked for include physical fitness machines, free weights, athletic fields, and sports-related equipment such as basketball hoops.

There was a benefit to compiling the lists ourselves instead of having the fire departments compile the lists. By personally viewing and cataloguing the equipment, we were able to categorize all of the equipment in the same way. If we had allowed the firefighters to record the equipment, they might have had varying opinions on what equipment should be recorded and the condition of the equipment. From the completed lists and a list of necessary equipment, we completed a list of equipment that should be purchased for the wellness program.

El Cuerpo de Bomberos planned to use El Centro de Recreación for the fitness testing part of the wellness program. To determine if the facilities were sufficient, we visited the center to take pictures and record distances on a map of the facilities. We examined the facilities ourselves to make sure there was nothing that would present a

problem for the testing. From the distances on the map, we designed the layout for the events of the fitness test, which can be found in Appendix Z.

3.4 Interview Research

We conducted interview research in Costa Rica and in the United States to obtain more information about physical fitness testing, existing wellness program components in Costa Rica, and physical fitness training interests of Costa Rican firefighters. We used interviews to gain background information on task-related testing and existing wellness program components because we needed to know specific information that could not be found in any literature. We interviewed firefighters during our visits to the fire stations and distributed written copies of the interview to the firefighters we could not interview in person.

We conducted interviews with Esteban Ramos to find out more information about Costa Rican fire fighting specifics. The specifics included fire department organization, firefighter tasks, common firefighter equipment used, and types of fires. All of these aspects were important to our research because if a firefighter's duties varied with position, task, equipment, and type of fire, then the wellness program would vary for each firefighter.

We also used interviews to determine the extent of the medical exams that are currently in place for firefighters in Costa Rica. We conducted a semi-formal interview with Dr. José Miguel García at El Instituto Nacional de Seguros to find out the content and frequency of the exams. We chose a semi-formal interview to allow Dr. García to

provide all the information that he knew about the topic of our research. By determining what is included with a medical exam, we made sure that the physical testing part of the wellness program was not redundant. For example, if the medical examination included testing the aerobic capacity of a firefighter with a treadmill test, we would not have included this in another part of the wellness program, such as in the task-related test. We also asked Dr. García to provide us with information about diet and nutrition for the firefighters, or to refer us to someone who could provide the information to the firefighters once the program is in place.

We conducted structured personal interviews with firefighters to determine their interests in activities for the wellness program (see Appendix H). We also used the results of the interviews to determine their interest in educational classes about health and fitness. Based on the interests of the firefighters, we were able to determine the content for the health education and physical fitness training components of the wellness program.

The sample of firefighters for the interviews was the same as for the surveys. The interviews were completed when we visited the fire stations to conduct the personnel surveys and equipment surveys. We also distributed written copies of the interview to be completed by the firefighters we could not visit at the remaining stations.

We conducted personal interviews in order to include the firefighters in the program development process. From our background research, we learned that if firefighters are included in the development of a physical fitness program, there is a greater chance of success for the program. We also wanted to meet as many firefighters as possible to get a general idea of their physical condition based on appearance.

4 Data Presentation and Analysis

The surveys and interviews described in our methodology provided us with data that are presented and analyzed in this chapter. We combined the data presentation and analysis into the same section because it is easier to trace the correlations between data and analyses if the two are presented simultaneously. However, the data and analyses from the Ten Initial Stations and the Sample of Remaining Stations are presented separately to determine if there are differences in results between the two groups of stations. From the analyses, we determined conclusions and recommendations, which we describe in the subsequent chapter.

4.1 Personnel Surveys

The personnel surveys were distributed to all members of the Ten Initial Stations as well as four other stations that we visited. The remaining surveys were mailed to seven other stations described in our methodology and then returned to us so we could process the data. Our sample size explained in the methodology yielded 179 personnel surveys, 123 from the Ten Initial Stations and 56 from the Sample of Remaining Stations. Of the personnel surveys, 121 were permanent firefighters, 89 being from the Ten Initial Stations and 32 from the Sample of Remaining Stations. The volunteers at the fire stations completed the remaining fifty-eight surveys.

The surveys returned from the Ten Initial Stations were from forty percent of the firefighters at those stations. Our background research has shown that forty percent is a sufficient sample. However, the surveys returned from the eleven stations were from six

percent of the other firefighters in the country. A six percent sample might provide accurate results, but there is the possibility that there was insufficient data to make accurate comparisons between the two groups of stations.

After conducting the personnel surveys, several biases were discovered. One of the biases of the personnel survey occurred during the administration of the survey. Some of the firefighters discussed the open-ended questions amongst each other when they were unclear about the answer to a particular question. We tried to limit the discussions between firefighters when we were present by explaining to them that if they did not know an answer, they should leave the question blank. However, discussions still occurred, and may have occurred more often with the surveys that were administered without our presence. The inter-firefighter discussions had a negative effect on our survey because the survey was designed to investigate an individual's knowledge and opinion of physical fitness. If the firefighters share their knowledge and opinions with other firefighters, the individuality of the survey is decreased.

The order in which we presented the data and analyses follows the order of the personnel survey (see Appendix F) except when it was more logical to present non-consecutive questions together. Therefore, the first question that we analyzed was question number one. Question one of the personnel survey asks what the firefighter's concept is of physical training. The graphs of the results can be seen in Figure 3.

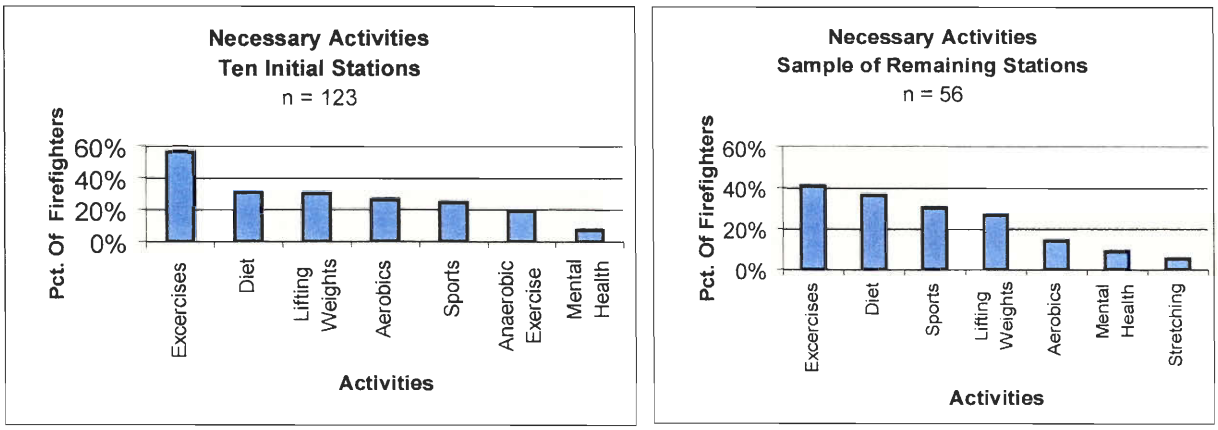
Figure 3 – Graphs of Physical Fitness Definition

The graphs in Figure 3 illustrate the breakdown of responses of 179 firefighters, permanent and volunteer, to the first question of the personnel survey. The graph on the left represents a percent graph of the responses given by the firefighters at the Ten Initial Stations. The graph on the right corresponds to the responses given by the 56 firefighters at the Sample of Remaining Stations. Based on research we found in the U.S., we graded the responses using the definition of physical fitness found in Section 2.2.3. A quality of one meant that the firefighter either left the question blank or the answer did not contain any of the components of our predefined definition, indicating no understanding of the concept. A quality of two indicated that the firefighter's response demonstrated a basic idea of the concept, but did not clearly show a definite understanding of the concept. A quality of three meant that the response included all of the main points of the definition with clarity, indicating that the firefighter was knowledgeable about the concept. This grading system is the same for questions six, seven and eight of the personnel survey.

The graphs of both the Ten Initial Stations and the Sample of Remaining Stations are very similar. They both indicate that about one-third of the firefighters surveyed have little or no concept of the definition of physical fitness found in Section 2.2.3. However, the results do not necessarily mean that Costa Rican firefighters have no knowledge of physical fitness. In fact, the remaining two-thirds surveyed have either good or excellent knowledge of the subject. There are several possibilities for the high percentage of firefighters who gave either no response or a poor response to question one. With this question as well as with questions six, seven, and eight, our translation from English to Spanish may have created a bias if the concepts were not translated properly. Another bias may have been created when we translated their responses into English.

Question two asks the firefighters what activities they think should be required in a physical conditioning program. Figure 4 shows the results of 123 firefighters from the Ten Initial Stations and 56 firefighters from the Sample of Remaining Stations.

Figure 4 – Graphs of Perceived Necessary Activities for a Training Program



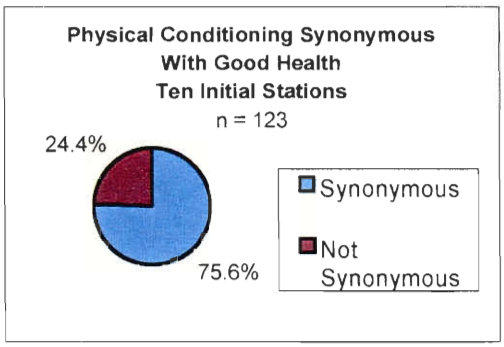
The graphs in Figure 4 indicate that for both the Ten Initial Stations and the Sample of Remaining Stations, exercises were chosen as the most necessary activity for a

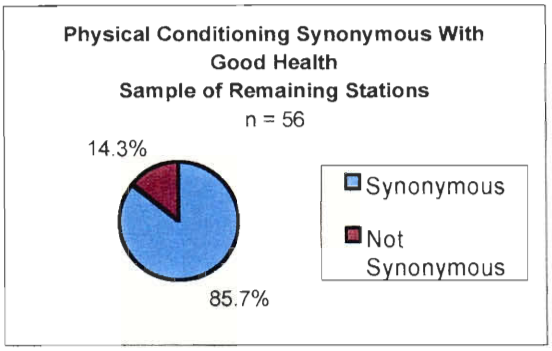
physical conditioning program. In addition, dieting was chosen as the second most popular activity for the two samples of fire departments. Other popular activities that the firefighters felt were necessary include sports, lifting weights, and aerobics. The answers to the question demonstrate a good understanding that physical fitness is based on many important components in addition to exercise, indicating that the firefighters had a good knowledge of physical fitness, which supports the results of question one.

Figure 5 shows the percentage of firefighters from the Ten Initial Stations and the Sample of Remaining Stations who felt that physical conditioning is synonymous with health and those who felt it was not, which was question nine on our survey. This question was recommended by our liaison because he wanted to know how many firefighters felt that physical conditioning was the only component that determined a person's health. The response we were looking for was that they are not synonymous because there are many aspects in addition to physical conditioning that determine a person's health, including a good diet and sufficient rest. Approximately 20% of all the firefighters surveyed answered that physical conditioning is not synonymous with good health and explained that there were other components that determined someone's health. This is the answer that our team was expecting. About 80% answered that they were synonymous which shows that the firefighters might be unaware of all of the different segments that decide a person's health.

However, the results to question two demonstrate that the firefighters do have a concept of important health-related activities besides physical training. The difference in results could indicate that the firefighters have good knowledge of the important factors of health, but they do not fully express their knowledge.

Figure 5 – Graphs of Physical Conditioning and Good Health Comparison

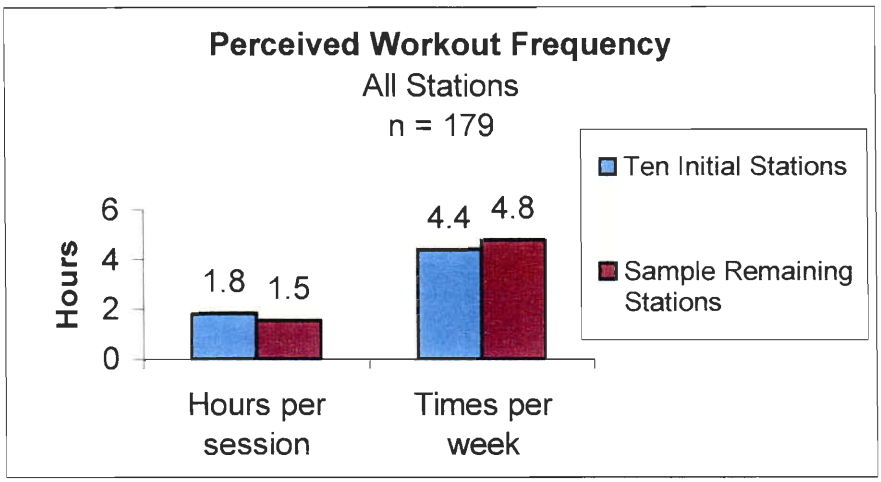




Question three involves the opinion of the firefighters on the number of times per week and hours per training session on average that a person should train to be in good physical form. One of the biases of this question involved the wording of the question. By asking for the amount of time per day specifically in hours, they may have thought we were looking for at least one hour. To counteract this bias in future surveys, the question should be worded to ask only the amount of time per day that one needs to train, rather than asking for the number of hours specifically.

The average number of hours per training session, collected from 123 permanent and volunteer firefighters from the Ten Initial Stations, was 1.8 while the average times per week was 4.4. The average number of hours per day for the firefighters at the Sample of Remaining Stations was 1.5 while the average times per week was 4.8. The results are shown in Figure 6.

Figure 6 – Graphs of How Often Firefighters Perceive They Should Work Out



According to our background research, the responses from the firefighters at both the Ten Initial Stations and the Sample of Remaining Stations are good answers for frequency to maintain good physical form. However, when asked in question thirteen how many times and hours they actually did some form of training, the results differed slightly. From 106 responses from the Ten Initial Stations, the average number of hours per session was 1.4, and the average number of days per week was 3.0. From 56 responses from the Sample of Remaining Stations, the average number of hours per session was 1.6, and the average number of days per week was 2.6. The results from questions three and thirteen demonstrate that on average, most firefighters feel that in order to be in good physical form, they have to work out more frequently than they currently do.

Question five asks the firefighter if he or she has ever received information about health education from their fire station. When we designed our survey, we designed this question with the educational component of the wellness program in mind. We wanted to

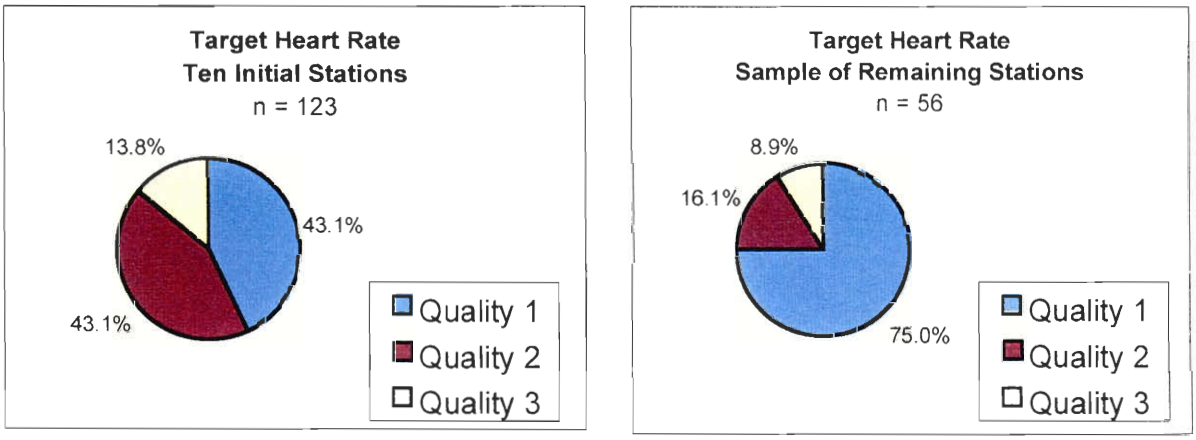
ask if fire departments offered informative classes to their firefighters to see if there was already a health-related education component of a wellness program. However, through an interview with Dr. García at El Instituto Nacional de Seguros, we learned that mandatory health talks already exist for the Costa Rican firefighters as part of their bi-annual medical examination. Therefore, many of the fire departments have never offered health information to the firefighters since health talks are already administered every six months.

The data that we obtained from question five are based on the results taken from 122 permanents and volunteers from the Ten Initial Stations and 56 firefighters from the Sample of Remaining Stations. When asked if they have ever received information regarding health issues from their fire station, 8.2% of the firefighters from the Ten Initial Stations and 5.4% from the Sample of Remaining Stations responded they had. Therefore, over 90% responded that they had not received information from their fire station. The results illustrate that there is a lack of health information readily available to the firefighters at the fire stations. This is most likely due to the talks that are administered every six months as part of the medical exam as mentioned earlier.

Figure 7 show the responses of 113 firefighters from the Ten Initial Stations and 56 from the Sample of Remaining Stations for the definition of target heart rate, which was question six. The analysis of this question uses the same scale as question one. As shown here, more than 40% of the responses of the Ten Initial Stations and 75% of the Sample of Remaining Stations were of quality one, indicating little to no knowledge of the topic. Though this may be an indicator that the firefighters have never learned the

meaning of target heart rate, from the responses in each of the surveys, we have concluded that at least part of the problem may have been our translation.

Figure 7 – Graphs of Target Heart Rate Definition



The Muscular Strength and Endurance graphs in Figure 8 illustrate the knowledge that the 179 firefighters have about the definition of muscular strength and endurance. The graphs related to the results of question seven on the survey. Though more than half of the responses indicate an average to excellent knowledge of the concept, more than 36% of firefighters of the Ten Initial Stations have little or no knowledge of the topic. The results could indicate that the firefighters need more instruction on muscular strength and endurance.

Figure 8 – Graphs of Muscular Strength and Endurance Definition

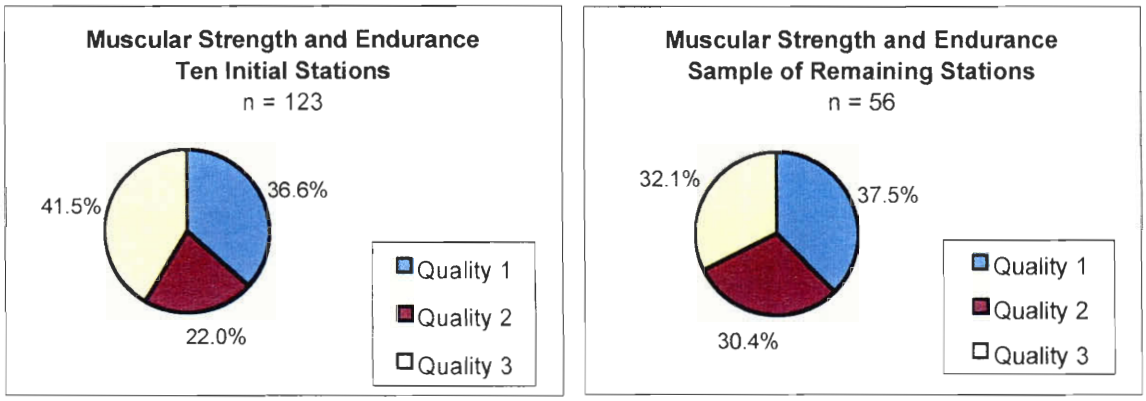


Figure 9 illustrates the firefighters' concept of flexibility based on 169 responses to question eight of the survey. The graphs show that there is a greater number of responses in the average to excellent range than in the Muscular Strength and Endurance graphs. However, in the Ten Initial Stations graph approximately one-third of the responses were of quality one. The Sample of Remaining Stations graph has almost 43% of quality one, which indicates that the current health education program might not be sufficient.

Figure 9 – Graphs of Flexibility Definition

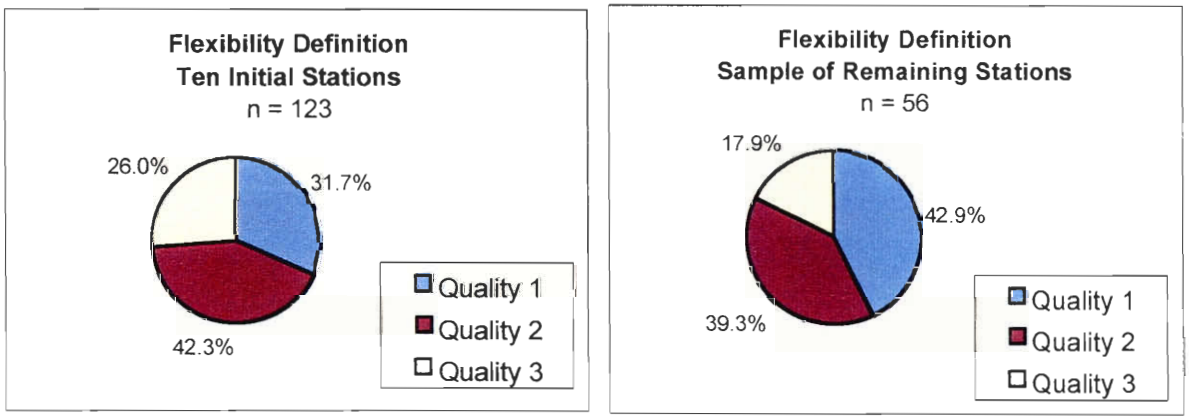


Figure 10 illustrates the percentages of the smokers and the non-smokers out of 179 firefighters, 123 from the Ten Initial Stations and 56 from the Sample of Remaining Stations that we surveyed. The information was obtained from question ten of the survey. Although almost three-quarters of the sample of the Ten Initial Stations are non-smokers, there is still the one-quarter that does smoke an average of 7.3 cigarettes per day. One-third of the firefighters of the Sample of Remaining Stations smoke, with an average of 5.9 cigarettes per day. Since smoking decreases lung and cardiovascular capacity, the data can represent a problem because a firefighter's job includes many aspects that require a high cardiovascular and lung capacity.

Figure 10 – Graphs of Smokers vs. Non-smokers

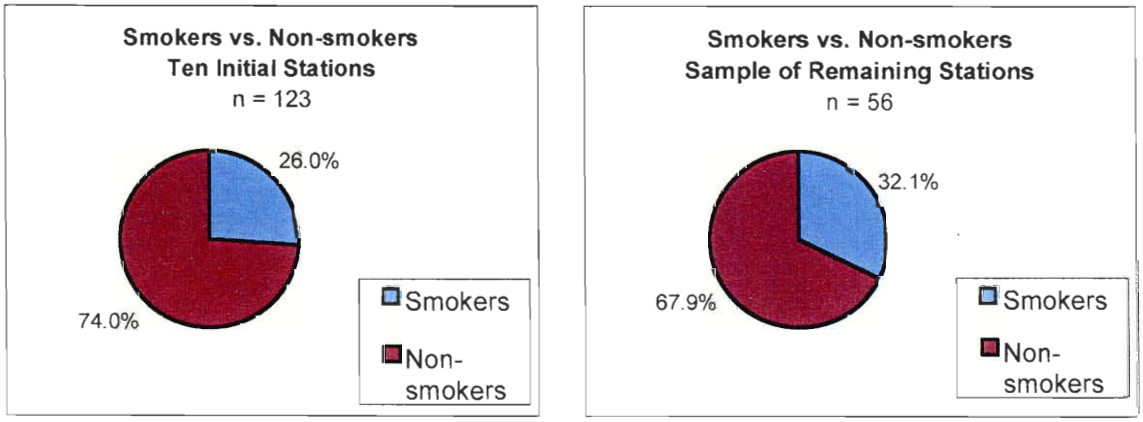


Figure 11 shows the percentage of firefighters who drink compared to the percentage of those who do not. The data were obtained from question eleven of the survey. The results for the Ten Initial Stations show that there are more drinkers than non-drinkers. However, the average number of drinks per week consumed for those who drink is 4.4, which is less than one alcoholic beverage per day. The results for the Sample of Remaining Stations show that there are fewer drinkers than non-drinkers, but

those who do drink consume an average of 5.0 beverages per week. The average is less than one drink per day, so the firefighters' ability to perform the tasks of their job should not be affected by alcohol consumption.

Figure 11 – Graphs of Drinkers vs. Non-drinkers

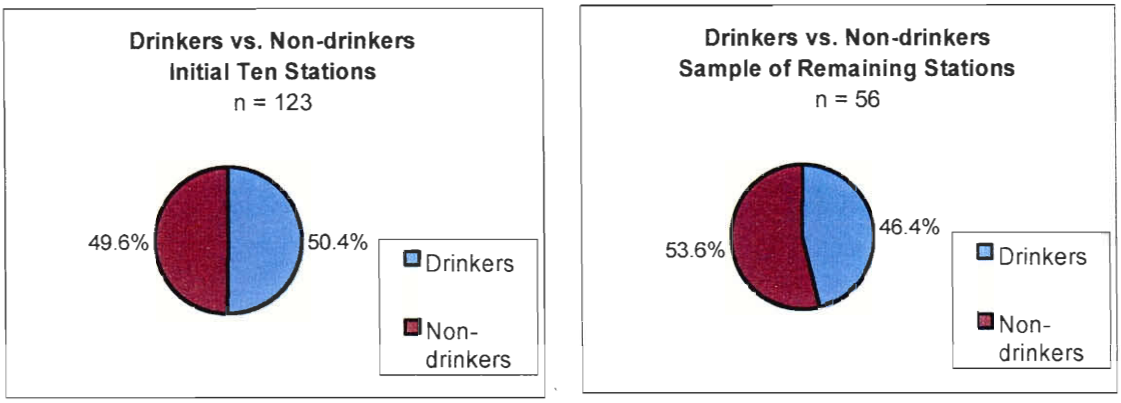


Figure 12 shows the results of question fourteen, the firefighters who lift weights and those who do not. From the Ten Initial Stations, firefighters who do lift weights do so with an average of 2.4 times per week. However, as the graph illustrates, there are about two-thirds who do not lift weights. From the Sample of Remaining Stations, over three-quarters of the firefighter population does not lift weights. Those who do lift weights do so with an average of 2.1 times per week.

Figure 12 – Graphs of Weight Lifters vs. Non-Weight Lifters

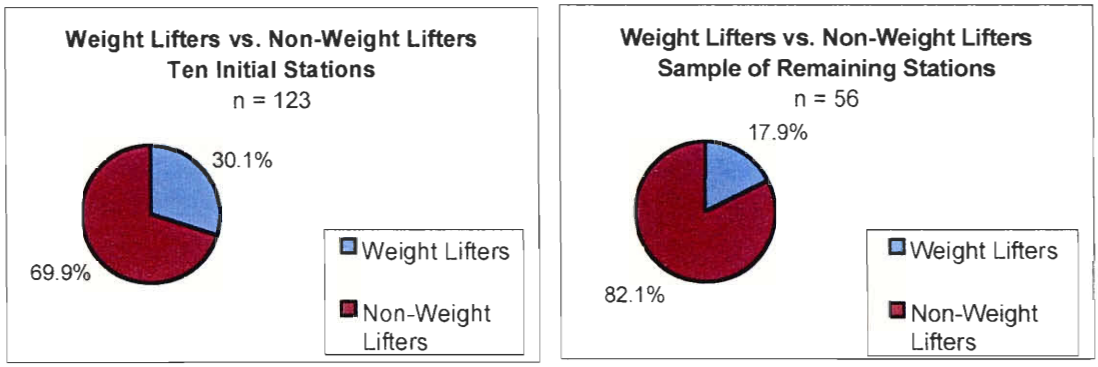


Figure 13 shows the firefighters' response to question fifteen, their perceived cardiovascular fitness level. This question, as well as questions sixteen and seventeen, was rated on a scale of 1-5. The scale was explained on the survey to the firefighter. A response of one represents that the firefighter has problems completing the requirements of his job in reference to the aspect of health in each of the questions. Five represents that the firefighter has no problems completing the requirements of his job in relation to the health aspect mentioned, and numbers two through four represent the variances in between. As the graphs illustrate, most firefighters consider themselves in the three to four range, which is acceptable since this indicates that they feel they can perform the duties of their job. However, it is still subjective to each firefighter, and is not an exact indication of whether or not the firefighter can perform his or her job adequately. Also, a possible bias of this question is the assumption that every firefighter knows what it means to be in good cardiovascular condition.

Figure 13 – Graphs of Perceived Cardiovascular Fitness

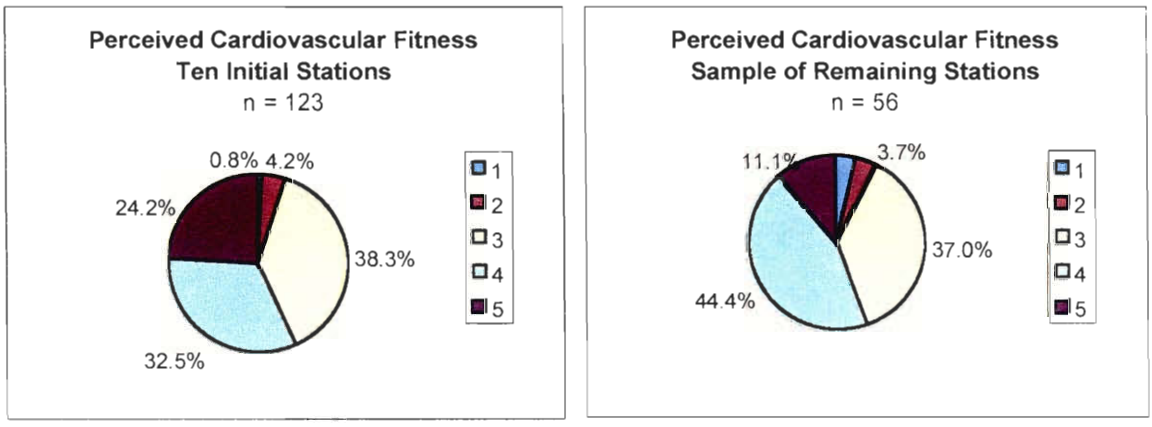


Figure 14 shows how 177 firefighters perceived their muscular strength and endurance. There were 121 responses from the Ten Initial Stations and 56 from the

Sample of Remaining Stations. The data were collected from question sixteen. Again, most firefighters fall in the three to four range, which is acceptable, but still falls under the same biases of subjectivity and lack of knowledge as in the last graph (see Figure 13).

Figure 14 – Graphs of Perceived Muscular Strength and Endurance

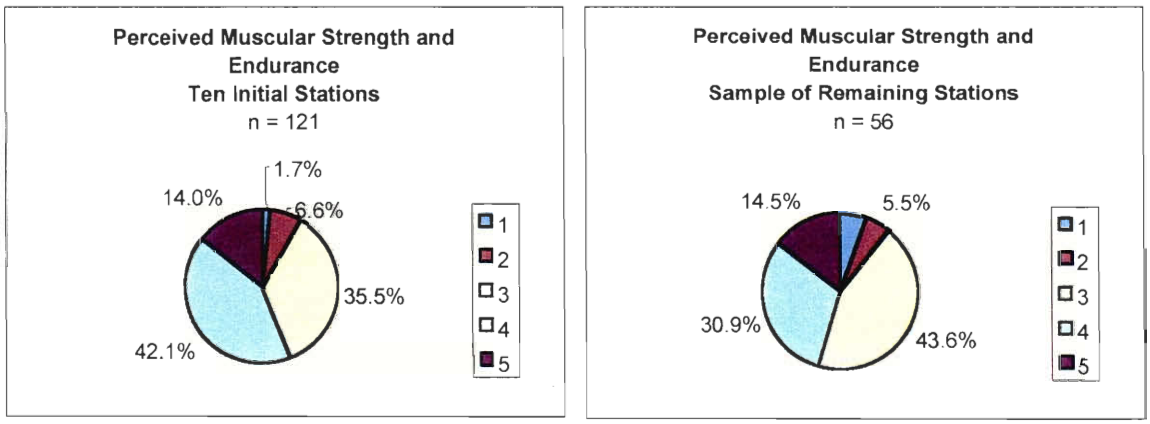


Figure 15 illustrates how 178 firefighters perceived their own flexibility. The data were from question seventeen. Just as in the other two graphs, most firefighters are between the three and four range, with the same biases taken into consideration as in the previous two sets of graphs (Figures 13 & 14).

Figure 15 – Graphs of Perceived Flexibility

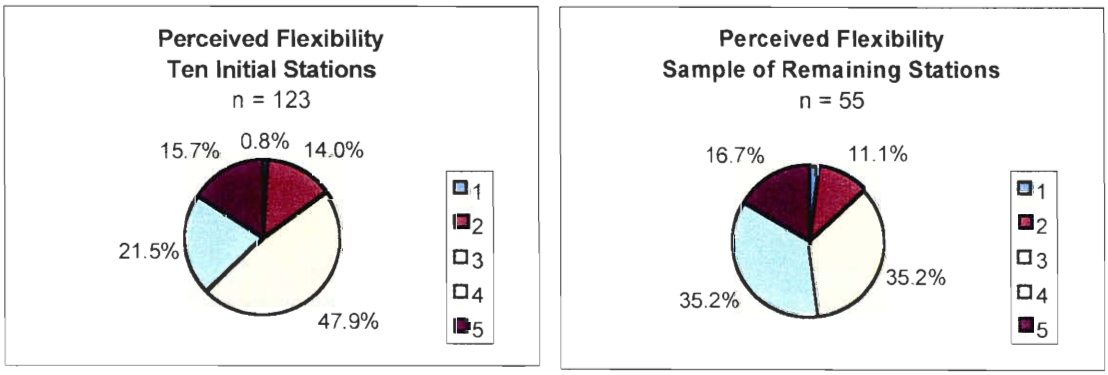


Figure 16 illustrates 179 firefighters' responses to question eighteen of the survey. The first set of graphs shows the percentage of firefighters who are allowed to exercise during their shift. The second graph shows the percentage of firefighters who actually exercise during their shift out of those who are allowed to.

As the first graph illustrates, 71.5% are allowed to exercise at the Ten Initial Stations and 71.4% are allowed at the Sample of Remaining Stations. However, as the second set of graphs shows, only 51.2% of the 71.5% do exercise during their shift at the Ten Initial Stations and 51.8% of the 71.4% exercise during their shift at the Sample of Remaining Stations. There are a couple possibilities for the low number of those who actually exercise. One is that there is no equipment available to them with which to work out. A second reason is that perhaps some of them have equipment available to them but are unaware of how to train with it, in which case they need a trained instructor.

Figure 17 shows the percentage of 179 firefighters who suffer from some type of physical pain. The data are from question nineteen on the survey. Examples of physical pain include problems with shoulders, knees, and backs. Only 19.5% from the Ten Initial Stations and 16.1% from Sample of Remaining Stations suffer from physical pain, however we do not know if it is work-related and if it inhibits their ability to perform their job. Regardless, physical fitness activities will help strengthen muscles and prevent injuries.

Figure 16 – Graphs of Permitted Exercise and Those That Do Exercise

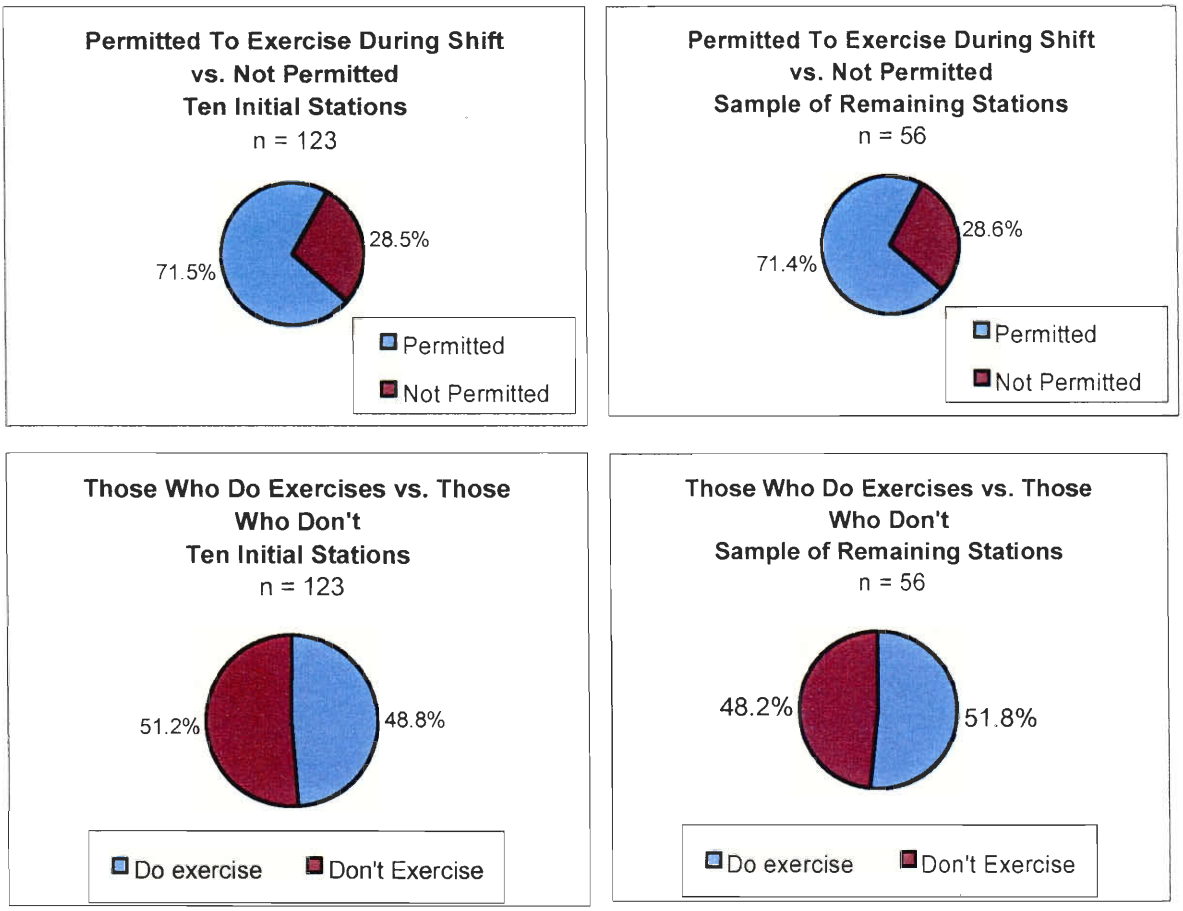
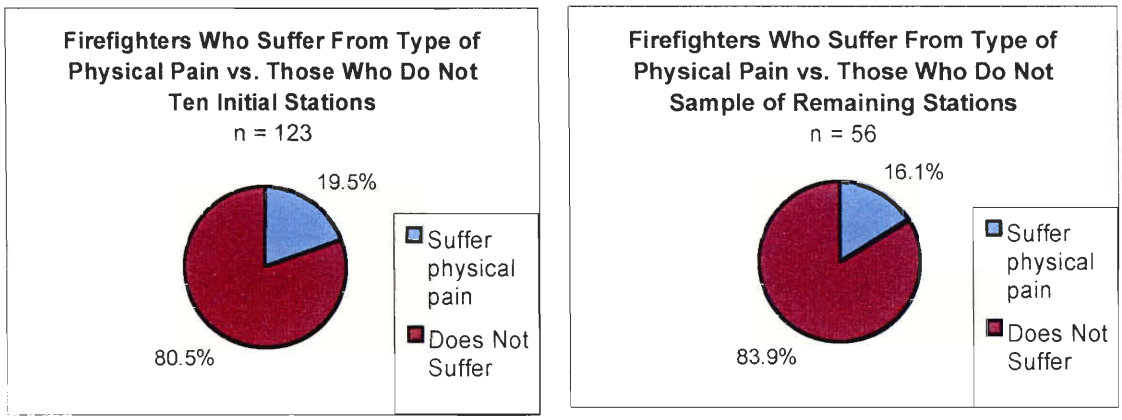


Figure 17 – Graphs of Firefighters Who Suffer From Injury



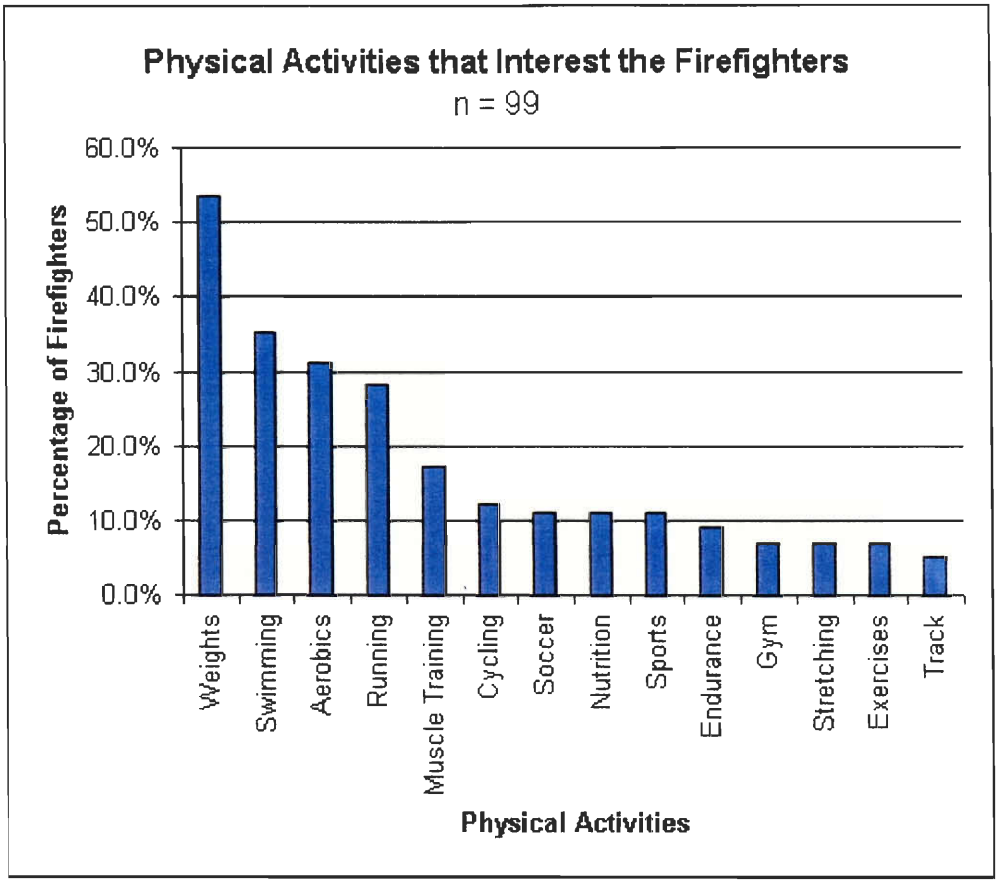
4.2 Personal Interviews

Of the 307 interview sheets we distributed (see Appendix H) at the Ten Initial Stations, we received 99 of them back. Of the 207 we distributed to the Sample of Remaining Stations, we received 56. The percentage of the firefighters represented from the Ten Initial Stations was 32.2%. The return rate for the Ten Initial Stations is adequate because for a sampling error of ±10%, 28.0% of the surveys need to be returned (Dillman, et. al., 1997). The interviews from the Sample of Remaining Stations represented 6.6% of the remaining firefighters in the country. However, the sample size might be inconclusive, as mentioned in Section 4.1.

Question one was used to determine the physical training activities that interested the firefighters in order to establish fitness activities for the wellness program. The activities that received votes from more than five percent of the firefighters are included in Figure 18. The graph contains information from the Ten Initial Stations since they are going to be participating in the program first.

After interviewing the physician at INS regarding the content of the firefighter medical exams, we learned that the firefighters are obligated to attend talks on health-related issues in addition to their medical exams. For this reason, the second question on our interview, regarding the health topics that interested the firefighters, is irrelevant because they are already required to attend the talks. Our team was not aware that the talks were already offered until after we had administered all of the interviews. Therefore, we have disregarded the information we gathered from the second interview question.

Figure 18 – Graph of Activities that Interest the Firefighters



Regardless of the redundancy of question two, we concluded that the wording of the question biased the results. By giving the firefighter examples of the health topics of which we were speaking, we instilled preconceived ideas in them and none of the responses included topics other than those for which we gave examples. Furthermore, in most cases with the interviews, since all of the questions were in written form to facilitate their administration in our absence, many firefighters glanced over at the question for topic ideas. Therefore, the biases created even more compelling reasons, in addition to the information we received from the physician, that led us to disregard the question altogether.

When asked in question three whether or not they would use weight-lifting equipment if it were available at the fire stations, most firefighters responded that they would. Many firefighters also added that they would like proper training for how to use the equipment from a trainer. Some firefighters answered that they would not use the equipment unless there was a trainer to show them how to use it.

The last question in the interview was meant to determine the interest of the firefighters in attending informative classes regarding health-related issues. Again, this question was developed and administered before our knowledge of the mandatory talks that the firefighters attend every six months. Therefore we decided to disregard the results from this question as well. Nevertheless, all the responses we received indicated that the firefighters do have an interest in the health-related classes.

4.3 Field Research

The equipment survey was conducted at the Ten Initial Stations. Many of the stations had some form of physical fitness training equipment including weights, basketball hoops, and exercise bicycles. However, much of the equipment was in poor condition, or there was no space for it to be used. The weights were in decent shape and could be used for training. The complete results of the equipment survey are in Appendix L.

During our field research at the recreation center, we recorded information about four locations that could be used for the task-related testing. A map of the center is

located in Appendix V. The first location was a grass soccer field that was 95 m (314 ft) by 59 m (195 ft). A picture of the field is shown in Figure 19.

Figure 19 – Recreation Center Soccer Field

The second location was an asphalt track that encompassed the soccer field. The track, which can be seen in Figure 19, is 3.1 m (10.2 ft) wide and over 100 m (330 ft) long. The third and fourth locations are two concrete courts used for basketball and soccer. The dimensions of each are 30.5 m (100.7 ft) by 17.5 m (52.5 ft). Figures 20 and 21 contain pictures of the courts. With the large amount of space available and the various types of surfaces, there should not be a problem conducting a task-related test at the recreation center.

Figure 20 – Recreation Center Basketball Court

Figure 21 – Recreation Center Soccer Court

Having analyzed the data presented in this chapter as well as using information from our background chapter, we provided INS with a set of recommendations presented in the next chapter.

5 Conclusions and Recommendations

The following chapter contains the conclusions and recommendations based on the data and analysis presented in the previous chapter of our report. The conclusions and recommendations are presented simultaneously, but the chapter is divided into sections by different topics of the wellness program. Within each section, we have described what parts of the program are currently in place and the changes and additions we recommended based on our research.

Based on the return rate of our surveys and interviews at the Ten Initial Stations, we have determined that there is sufficient data to support our recommendations for a wellness program. With our recommendations, El Cuerpo de Bomberos can proceed with their plans to institute the wellness program at the ten fire stations in the San José area in July 2000. The initial program will be administrated to all of the permanent firefighters, and the volunteer firefighters will have the opportunity to take part in the program as soon as their participation is feasible and the permanent firefighters have fully adopted the program.

However, since we only received a sample of six percent of firefighters from the rest of the country, we recommend that El Cuerpo de Bomberos continues background research at the remaining forty-five fire stations before fully implementing the wellness program in January 2001. Research shows that a sample size of less than ten percent may not be an accurate representation of the data. Therefore, INS should conduct further research into the remaining stations to determine if the trends we noted in the six percent we analyzed are accurate. The results we received from the Sample of Remaining

Stations indicate that there are no major differences between the Ten Initial Stations and the rest of the country.

5.1 Physical Fitness Training

From our background research, we conclude that an important part of a physical fitness training program is to have a program administrator. Part of the physical fitness training program of El Cuerpo de Bomberos will be to hire a physical fitness trainer who will be responsible for administering the physical fitness training and health-related education sections of the wellness program. The trainer will be responsible for these sections since he or she will have a degree in physical education and at least five years experience in the development and implementation of a physical fitness program, which demonstrates his or her ample ability.

El Cuerpo de Bomberos is planning to hire one trainer for the Ten Initial Stations in the San José area and three more trainers once all of the stations in Costa Rica are participating in the program. We agree with the implementation schedule because the six-month trial between July 2000 and January 2001 will provide an opportunity to make any necessary changes to the program before every firefighter in the country is involved. The fire stations, for which each trainer is responsible, will be grouped geographically. The trainers will receive information about their duties from our wellness program administration guide (see Appendix N).

During the first two weeks of the pilot program, the trainer will visit two stations a day, for two hours each, in order to introduce the program to the firefighters. The

trainer will visit each station for two consecutive days in order to educate both shifts of firefighters. The objective at this stage is that all ten stations will have begun the program in two weeks.

The first two visits to each station are crucial. If the firefighters can properly begin their training, there is a greater chance of success for the program. During the initial two hours with each shift of firefighters, the trainer will explain the wellness program and its purpose. The trainer will explain the components of the firefighters' individual exercise programs, which will consist of a warm-up, stretching, aerobic exercise, muscular training, and a cool-down. The components are based on our background research of physical fitness training and will address every aspect of physical fitness including body composition, flexibility, cardiovascular fitness, muscular strength, and muscular endurance.

The trainer will also determine and explain how often the firefighters will participate in the program. The trainer is going to visit stations from nine until eleven in the morning, which will be the two hours devoted to physical fitness training. We suggest that the exercise program be conducted in the morning since the firefighters begin their twenty-four-hour shift at eight in the morning, and performing exercise at the beginning of their shifts will invigorate the firefighters for the rest of their shift. Since the firefighters are at the station every other day, they will be able to perform their exercise routine three to four times a week, which our background research showed is sufficient.

After the introduction, the trainer will lead the firefighters through a five- to ten-minute warm-up exercise, which will be some form of light activity such as jogging. The trainer should participate in the exercises to set an example for the firefighters.

Once the firefighters are warmed up, the trainer will demonstrate a stretching routine that the firefighters will use at the beginning and end of each exercise session. The stretching should help prevent injuries and will increase flexibility. The choice of stretching exercises will be left to the trainer since he or she will have many years of experience with physical fitness training and is likely to have a particular routine that he or she teaches. However, if the trainer would like some examples of appropriate stretches, he or she can look at the stretches from the Massachusetts firefighter physical training manual that we will leave with El Cuerpo de Bomberos. Regardless of what the specific exercises are, the stretching routine should focus on stretching the entire body. As the trainer goes through each exercise, he should explain the connection between the types of exercise and its effect on that part of the body.

After the stretching routine, the trainer will introduce the aerobic exercise component of the physical fitness program. During the first visit to each station, the trainer will go through a list of activities that can be used for aerobic exercise. The trainer will help each firefighter select an activity that would fit well into his training routine. During the first visit, the trainer can conduct a game of indoor soccer as a demonstration of aerobic exercise.

The firefighters will have forty-five minutes to an hour as part of their routine to perform aerobic exercise. The amount of time for aerobic exercise is sufficient according to our background research. The program of exercises should be based on the interests of

the firefighters that we gathered from our personal interviews. Our results showed that firefighters had high interest in swimming, aerobics, running, cycling, and soccer. However, the firefighters will not be limited to this set of exercises, and if they have an interest in other aerobic exercise, they can talk with the trainer to fit their favorite exercise into their program.

Many firefighters also expressed interest in doing exercises in groups. This interest could be met by creating workout groups or by forming teams for competitive sports such as soccer and basketball. We recommend that if there are facilities near a fire station that can accommodate exercise such as a soccer field or a basketball court, the firefighters should be able to use them. If the firefighters want to swim as part of their program, they should be able to use the facilities at the recreation center mentioned in Section 4.3 at least once a week. These facilities are open to all employees of El Instituto Nacional de Seguros, including the firefighters.

After the aerobic exercise part of the program, the trainer will conduct a brief class on strength training, which will include an opportunity to try the strength training exercises. The exercises will include calisthenics and weight lifting because a combination of the two provides a well-rounded weight training program. Also, more than ninety percent of the firefighters we interviewed said they would lift weights if the equipment were available. Like the stretching exercises, the trainer will choose the strength training exercises since he will be knowledgeable about different exercises. Also like the stretching exercises, the trainer will have the guide from Massachusetts to refer to if he needs help choosing exercises.

The trainer will supervise the trial exercises to ensure proper form and to answer any questions the firefighters may have. We recommend that the trainer observe each firefighter's use of the equipment to correct any problems with form so the firefighters won't injure themselves. We also recommend that the trainer leaves a set of charts that explain the exercises in case the firefighters need clarification. Each firefighter's weight training program will be recorded on the training sheets, which can be found in Appendix P. The trainer will explain the concepts of weight training such as gradually increasing the amount of weight. The trainer will also monitor each firefighter's progress by examining the training charts.

The charts are important because they can show how firefighters progress over time. Therefore, we suggest that the trainer file every training chart so El Cuerpo de Bomberos can see if there are benefits to the training program. A future project of El Cuerpo de Bomberos could be to monitor the effectiveness of the training program by comparing former and current training records. The charts will also help the trainer to determine if each firefighter is making sufficient progress. If there is a problem with the individual's progress, the trainer will assign an exercise prescription to the firefighter, which will consist of how to modify his program in terms of amount, type, and frequency of exercise. The trainer will conclude his first visit to each station by leading a cool-down, which can consist of a 5-minute walk, and by using the same stretching exercises that were used after the warm-up.

After the first two weeks, the trainer will still spend two hours a day for two consecutive days at each station but will only visit one station a day. As soon as the trainer visits all ten stations, the cycle of stations will be repeated. Since the trainer is

only available to each firefighter once every four weeks, there should be a way for the firefighters to contact the trainer between visits. One solution would be to provide E-mail access for both the trainer and the firefighters so that the firefighters can communicate easily with the trainer. When we visited the fire stations, we noticed that there were computers at many of the stations. Depending on the availability of computers at each fire station, establishing E-mail contact could involve acquiring new computers for the stations.

Once the issue of computer availability has been solved, the issue of computer training for both the firefighters and the trainer should be addressed. Along with E-mail access, the trainer should have a Web page with a listing of alternative contact methods, frequently asked training questions, a message board for firefighter discussion, links to health-related Web pages, additional training information, and forms that the firefighters can print and complete to record their training progress. An advanced feature that could be added to the future Web page is data entry by each firefighter from their individual exercise program so the trainer can monitor progress between visits to stations. A future project team could investigate the means of communication between the physical fitness trainer and the firefighters.

Another solution to the infrequency of contact between the trainer and the firefighters would be to train one firefighter at each station to serve as a wellness director. The wellness director would be able to answer commonly asked physical fitness questions and monitor the progress of each exercise program. The wellness director at each station would be selected by the chief of that station and would complete training from the trainer provided the firefighter had interest in becoming the wellness director.

The trainer would continue to visit stations every four weeks to introduce new exercises and provide further input on each individualized exercise program.

A way to supplement the visits from the trainer would be to include a column from the trainer in the newsletter of El Cuerpo de Bomberos, *Prueba de Fuego*. The column can include information about the progress of the program, health trivia, and a personal message from the trainer.

To conduct the weight lifting program, the firefighters will need access to training equipment. There are two types of equipment that can be used: machines and free weights. Machines provide a simplistic approach to weight lifting since each machine usually performs only one or a few types of exercise. Changing the amount of weight on a machine involves moving a peg to add or subtract weights. However, weight machines are bulky, which could be a problem since the fire stations do not have a lot of space for equipment.

Free weights are less bulky, cost less, and can be used for more exercises than machines. Free weights work the smaller muscles between the larger muscle groups because the smaller muscles are used to balance the weights during lifting. Our research has shown that many stations already have some free weights (see Appendix L). For these reasons, we recommend using free weights over machines.

A set of free weights should consist of barbells, dumbbells, plates, and a bench. The barbells and dumbbells should include two short bars, a long bar, and a set of weights that totals at least 50 kilograms or 110 pound weights. There should be a pair of two-and-a-half-pound or one-kilogram weights included with the set in order to increase weights in small increments. The bench should have a bench press rack and an

attachment for doing leg extensions. The equipment should also include an adjustable bar that can fit in doorways and be used for pull-ups. Another piece of useful equipment is an inclined board, which can be used for sit-ups of varying difficulty. About half of the fire stations already have an inclined sit-up board. The list of available equipment at each fire department is listed in Appendix L.

We compared the lists of available equipment with the recommended equipment listed previously to make Appendix R, a list of training equipment needed for each station. By contacting Costa Rican exercise equipment vendors, we determined that the cost of the equipment in Appendix R will be about 2,000,000 Colones ($7000 U.S.) for the Ten Initial Stations. El Instituto Nacional de Seguros will be buying the equipment in 2001. Until that time, the fire stations should have access to weight lifting facilities such as health clubs. By calling clubs in San José, we determined the average cost of a monthly membership is about 3,000 Colones ($10 U.S.). Based on the membership cost, El Instituto Nacional de Seguros might spend more money on memberships from July until December than they would spend in total on the equipment. Therefore, we recommended that El Instituto Nacional de Seguros purchases the equipment as soon as possible in order to save money.

5.2 Health-Related Education

Along with monitoring the progress of the firefighters in their individual exercise programs, the trainer will devote time to conduct educational support activities in the form of classes. The classes will be related to the most popular topics selected by the

firefighters in the survey that we distributed to the sample of fire stations in Costa Rica (see Appendix F). Some of the more popular topics included stress management, nutrition, mental health such as handling depression and balanced diets. About twenty-five percent of the firefighters smoke, which indicates that smoking risks should also be a topic. The trainer will decide if there is a need for any additional topics.

At the request of El Cuerpo de Bomberos, the classes will be held every two months on two consecutive days so every firefighter can attend. During each day, the firefighters who are not on duty will attend the hour-long class. The classes will take place in San José at a location to be determined by El Cuerpo de Bomberos. When the rest of the country is introduced to the program, El Cuerpo de Bomberos will decide on other sites in different regions of Costa Rica. Attendance is mandatory, and after completing a class, the firefighters will not have to repeat that topic. After a year, the classes will be repeated for new firefighters.

The fire chiefs should hold monthly, informal meetings with all their firefighters to discuss the information they have learned and retained in the classes. If El Cuerpo de Bomberos thinks that the firefighters are not retaining the information, the firefighters can take a test that tests the knowledge they should have learned in the classes. If the firefighters score poorly on the test, they can be required to retake at least one of the classes. However, we don't recommend examinations because as our survey results showed, firefighters might know the information but not know how to demonstrate their knowledge. The results of questions one, two, and nine on the survey illustrate this point. Therefore, we recommended that instead of tests, the trainer should periodically verbally quiz each firefighter on various topics covered in the classes while the trainer is working

on the firefighter's routine. Through the verbal quizzes, the firefighter has the chance to fully explain what he or she has learned and the trainer can determine if he or she needs to retake certain classes.

5.3 Task-Related Testing

Using the three task-related tests we found in the United States and information from Ing. Ramos, we designed the physical fitness test found in Appendix V. The test will be implemented at the Initial Ten Stations in and around San José and eventually expanded to all the fire stations in Costa Rica.

The test will be held at the recreation center of El Instituto Nacional de Seguros near San José since there are soccer fields and basketball courts where the test can be held. A map of the center and the layout of each event are located in Appendix Z. The equipment will need to be portable since there is no roof to protect the equipment from the weather and since the facilities are used regularly by INS employees for recreation. We recommend that El Cuerpo de Bomberos conducts a future project, such as another IQP, to develop new testing centers throughout the country so the firefighters far from San José do not have to travel great distances.

The first official run of the complete test will begin in December 2000 and will be administered to all the permanent firefighters at the Ten Initial Stations. We recommend that the firefighters of Costa Rica take the test annually. This will give them time to train for the events in which they are weakest, as well as give all of the stations time in which to schedule each of their firefighters to take the test. Also, if the test were

given more frequently, there would not be enough time to administer the test to every firefighter in Costa Rica once the program is expanded to all fifty-five stations.

Conducting the test less frequently than annually would present problems as well. More than a year would give the firefighters too much time in which their physical condition can change. Therefore, conducting the test every year is the most efficient frequency.

The fire chiefs at each station will be given the responsibility of administering and evaluating the test to the firefighters from their station once a year. The physical trainer will not be administering the test because with only one trainer, or even when INS hires three more, administering the test to approximately 310 firefighters a year would be extremely difficult for one or even four trainers. Also, adding this responsibility to the trainer's job description would most likely increase the amount that the trainer would expect for a salary. The fire chiefs will be sufficient in administering the tests because they need only supervise the firefighter during the test and time each event. However, since there is currently only one test site, which is situated near San José, fire chiefs in the San José area will be allowed to administer the test to firefighters coming from stations far from San José. This is justifiable since, under the infrastructure of INS, the firefighters don't actually belong to one particular station as described in section 2.1.2 of the report.

Before the first test is administered, el Cuerpo de Bomberos and the physical trainer should hold a meeting with all the fire chiefs to explain the test and the details that accompany it so that they are capable of administering the test properly. For example, the chief will need to be instructed on how to detect signs of physical or mental distress

of the firefighter during the test, so that they may stop the firefighter from continuing and possibly causing injury to himself. Also, the fire chief will need to know the exact times of each event and will need to be informed of such details as when to start the timing for each event. The meeting should be about two hours, during which the layout of the test at the recreation center is explained so that the chiefs have a good understanding of how they will need to conduct the test.

We devised the test using the list of common tasks that a Costa Rican firefighter may be called upon to perform, as outlined to us by Ing. Esteban Ramos. We have presented each event separately in this section, which the justification of each part of the event following. In Costa Rica the crucial firefighting tasks are the initial reaction to an alarm, moving ventilation fans to burning buildings, dragging hoses, forced entry, positioning and climbing ladders, using a ceiling hook, searching for fire victims and dragging them to safety.

The task-related test consists of eight events. Any more than eight would make the test too long, and since it is such a physically and mentally stressful test, lengthening it would make it difficult for the firefighters to pass. Any less than eight and it would not be a good representation of the tasks the firefighters must perform during their job. If the firefighter does not complete one of the tasks in the allotted time, the administrator will stop the test and the firefighter will fail that event. Failure of one event does not constitute failure of the entire test. Nevertheless, the firefighter must pass six out of the eight events in order to pass the entire test. The rationale for not failing the firefighters who do not pass all eight events is that during an actual fire, it is not common for one

firefighter to have to perform every one of the eight events by himself or in sequence in such a short period of time.

In taking the test, each firefighter will be wearing a 7.7 kg (17 lb) vest, an air tank, a helmet, and gloves. The weight of the vest that the firefighters wear was determined by weighing the equipment that each firefighter must wear when combating a fire. The 7.7 kg does not include the weight of the air tank, which the firefighter will be wearing that for all except the last event.

As stipulated by INS, failure of the test does not constitute loss of employment. However, if a firefighter does fail, he or she will be required to modify his or her personal training program with the personal trainer to improve in the areas of difficulty. In approximately three years, INS hopes that every firefighter will have a level of physical fitness where they can require that every firefighter take and pass this test in order to become or remain a firefighter.

There will be a five-minute rest period following the first and seventh event since both of these events are aerobically strenuous. A resting period will aid in preventing firefighter injuries. However the firefighters will only be allowed thirty seconds between all other events for travel time from station to station. The administrator should not start the next station until the thirty seconds has elapsed.

Though we have included times for each of the events, a majority of them were taken from one of the three tests from the U.S. We feel confident in the times we propose for two reasons. The first is that the three tests from which we took the times were developed after many years of extensive testing for firefighters in the U.S. who have to perform many of the same duties as those in Costa Rica. Our second reason is that we

have recommended to INS that they conduct a pre-test of the task-related test using two firefighters from each of the ten initial stations who are in the best physical shape. The average of the times accomplished in each event from these twenty firefighters will determine the times for each of the events for the actual test. The chief of each fire station will choose the two firefighters from their respective station. We have sent out letters to each of the fire chiefs at the Ten Initial Stations explaining the format of the pre-test. We have asked them to return to INS the included form naming their two most physically fit firefighters so that INS will have the twenty firefighters on record for the pre-test. The pre-test will occur in August or September 2000, and the first official administration of the task-related test will be in December 2000.

Below we have presented a description of each event of the task-related test followed by its justification.

Pre-event

This event is designed to simulate the adrenaline rush a firefighter experiences when a fire alarm sounds. The firefighter will begin this event seated in a chair, without any equipment on. At some time, unknown to the firefighter, an alarm or horn will sound and the firefighter will be required to jump out of the chair, put on the 7.7 kg (17 lb) weighted vest, the air tank, the gloves and the helmet, and then run to the first event. This event will not be timed, however a sense of urgency is pertinent in order to simulate the events in a real situation.

The pre-event was added because during the interviews, many firefighters expressed concerns about the physical and mental stresses of the initial period following the alarm. Therefore, we designed this event to aid them in acclimating their bodies to the sudden rush of adrenaline.

Event 1 – Stair Climb
This event is designed to give the firefighter a chance to warm up his or her muscles as well as to measure the firefighter's aerobic capacity. This event will last for 5 minutes during which the firefighter will be required to ascend and descend a mock staircase of 13 stairs, 11 times without using the handrails. Use of the handrails will constitute failure of the event. At the conclusion of this event, the firefighter will have a 5-minute rest-period, during which water will be available.

The number of times that a firefighter has to ascend and descend the staircase in event one was determined from several factors. The tallest building in Costa Rica is El Banco Nacional, having twenty-two stories. Since this is the most a firefighter in Costa Rica will have to climb during a fire, we used twenty-two flights as a baseline. There are approximately thirteen stairs in one flight of stairs so we multiplied these two amounts together to determine the total number of stairs the firefighter would have to climb. Using the pace at which a firefighter taking the New York test would have to climb during the stepmill event, we determined that ascending and descending the staircase eleven times in five minutes would sufficiently simulate the stairs in the tallest building in the country.

Event 2 – Weight carry
This event is designed to simulate the actions a firefighter would need to take to position a generator or a smoke ventilator during a fire. At the start of this event, the firefighter will be required to move a 43 kg (94.8 lb) weighted apparatus 50 m (164 ft). The firefighter will do this by lifting the apparatus by the handle provided and dragging it with the assistance of the wheels the set distance. The wheels are meant to simulate the other firefighter who would normally be assisting in this action. This event will last for 40 seconds. The firefighter will have 30 seconds to proceed to the next event.

Event two was included because a firefighter in Costa Rica is required to carry and set up a ventilator and/or generator during a fire. We determined the 43-kg (94.6-lb)

weight by weighing the generator that the firefighters use. Our team suggests that an apparatus with wheels on one side be used to simulate the second firefighter who would normally be helping with the task during the fire. The wheels should be large enough that the firefighter need not crouch over to drag the apparatus the fifty meters. In this manner, during the task-related test, the firefighter is actually only supporting half of the forty-three kilograms. We chose 50 m because it was a reasonable distance according to our liaison. The actual distance a firefighter has to carry the equipment may be more or less, depending on where the fire truck is parked and where the ventilator or generator needs to be positioned.

Event 3 – Hose drag

This event is designed to simulate the actions necessary to drag a charged hose to a fire. The firefighter will be required to drag 15.2 m (50 ft) of charged 4.4 cm (1¾ in) hose through a 15.2-meter (50-foot) U-shaped tunnel with a 1.2-m (4-ft) ceiling within 46.33 seconds. The pressure of the hose will be set at 100 psi. Once outside the tunnel, the firefighter will need to pull the leading edge of the hose 15.2m (50 ft) past the exit of the tunnel, past the marked line. The firefighter will have 30 seconds to proceed to the next event.

Event three is taken from the New York test since the test is a good simulation of the tasks a firefighter must perform when working with a hose. The dimensions of the hose are the same because it is the same equipment in both countries, however the pressure that the hose is set at is different because our liaison told us that 100 psi is the average pressure of a charged hose in Costa Rica. The pressure in the hose is simulated by filling the hose with water and clamping off each end for the test.

Event 4 – Forced entry
This event simulates the actions necessary to break through an outside gate and a door to gain entrance to a burning building. The firefighter will use a 5.4-kg (12-lb) sledgehammer to hit a 34.9-kg (77-lb) tire across a 3.8-m (12½-ft) metal surface table and back using his critical side (for example, if left-handed, he stands so that the left side of his body is perpendicular to the tire with the sledgehammer starting around his right shoulder). The sledgehammer must be swung with one continuous motion. The tire must be struck, not pushed. The firefighter will have 30 seconds to proceed to the next event.

The dimensions of the table in event four as well as the weight of the tire are taken from the New York test while the 5.45-kg (12-lb) sledgehammer is from the Massachusetts test. Though the New York test requires the firefighter to move the tire only to the other side of the table, the test we recommended requires the firefighter to move it back as well. This is to simulate the force required not only to break down a door, but also to break through a metal gate that is typical of most houses and buildings in Costa Rica. Also, we specified that the firefighter must use his critical side because if he can do it with his weaker side, his stronger side will not be a problem. This is to take into account if space is restricted in which case the firefighter would have to compromise his strong side in order to swing the sledgehammer.

Event 5 – Ladder event
This event simulates a firefighter's ability to position a 6.1-m (20-ft) ladder against a wall and then extend and lower a 7.3-m (24-ft) extension ladder within 22 seconds. At the start of the event, the firefighter will grasp the end of the 6.1-m (20-ft) ladder (which will be positioned on the ground, perpendicular to the wall) and walk it up until it leans against the wall. He will then proceed to the extension ladder, which will be positioned against the wall before the test begins. The firefighter will then extend the 7.3-m (24-ft) ladder to its fullest extension and then lower it immediately following. Both activities must be completed in 22 seconds or it will constitute failure of the event. The firefighter then has 30 seconds to proceed to the next event.

The ladder event described in event five was taken from the New York test except for the time of the event. We decided upon twenty-two seconds rather than the 15.81 seconds in the New York test. We did this because in the New York test, the firefighter is required only to raise the extension ladder, and we are requiring the firefighter to raise and lower the ladder since he or she will be required perform both actions in a real fire. Since this adds to the time that it will take the firefighter to accomplish the task, we needed to increase the time limit. We figured that the 15.81 seconds allowed in the New York test could be assumed to be split evenly between the two parts of the ladder event, so we added seven seconds to the fifteen, and arrived at twenty-two. However, as mentioned above, the times that we propose are not critical since INS will most likely change all of them after their pre-test.

Event 6 – Search

This event is designed to simulate looking for victims of fires. The firefighter is required to navigate through a 24.4-m (80-ft) dark enclosed tunnel within 95.66 seconds. The tunnel is approximately .9 m (3 ft) high and 1.5 m (5 ft) wide. At two locations in the tunnel there are obstacles on the floor. In addition to the obstacles, at two locations, the tunnel will be reduced from 1.5 m (5 ft) wide to .9 m (3 ft) wide. The firefighter is required to move through the tunnel on his hands and knees. The firefighter will have 30 seconds to proceed to the next event.

Event 7 – Rescue

This event simulates the actions necessary to drag an unconscious victim weighing 59.1 kg (130 lb) from a burning building or other emergency scene. The firefighter will have 23.80 seconds to complete this event. Using the tunnel from the hose drag event, at the start of the event, the firefighter will grasp the dummy by the handle behind the neck and drag it through the tunnel to the end of the course. The dummy must be out of the tunnel for time to stop. After this event, the firefighter will be given a 5-minute rest period following this event during which water will be available.

Events six and seven are both taken from the New York test. Though for all three tests in the U.S. for the rescue event the weight of the dummy varies, we decided on 59.1 kg (130 lb) because it is a reasonable weight and there is no way to determine the average weight of a person in Costa Rica since it depends on height and age. The way in which the weight was decided upon in the U.S. was by surveying the firefighters on the average weight of a fire victim who they had to carry from a fire. If INS wants a more exact number than 59.1 kg, we recommend they survey the firefighters in the same manner.

Event 8 – Ceiling hook

This event simulates the actions necessary to use a ceiling hook to pull down a ceiling after a fire. The firefighter will only need to wear the weighted vest and gloves for this event. The firefighter will have to complete 20 repetitions in four one-minute sets.

At the start of the event, the firefighter will grab the first pole laying on the ground and place the tip of the pole on the hinged door in the 2.4-m (8-ft) ceiling of the apparatus. He or she will then push up the hinged door, weighing 27.2 kg (60 lb), lifting the door 15.2 cm (6 in). He or she will then return the pole to the ground and immediately move over to the second pole suspended from the ceiling. The pole is attached to a counter balance that weighs 36.3 kg (80 lb). He or she must pull the pole down 15.2 cm (6 in) in order for the pull to count. He or she must perform one push and five pulls in a sequence. The firefighter will be required to perform four one-minute periods of work, in which he or she will try to do as many push-pull sequences as possible. Each work period will be followed by a 30-second rest period. The firefighter must complete a total of 20 repetitions at the conclusion of the fourth set. He or she may not complete more than 7 repetitions during one of the four sets. If he or she does more than 7, he or she will only be credited for 7.

We have taken the details for event eight from the Massachusetts test except for the limitation of seven repetitions per set. This information was taken from the New York test, which we feel is justified because a firefighter who accomplishes most of the twenty required repetitions in the first couple of sets is not demonstrating his or her endurance.

We have chosen to use a lot of information from the New York test because it was developed over many years through extensive research. Also, Massachusetts based their test heavily on the New York test, adding to its credibility. The sequence we chose for our test, however, differs from all of the U.S. tests. The sequence that we recommended was determined by an interview with our liaison in Costa Rica on the typical tasks a firefighter must perform and the typical order in which they are performed.

The schedule of the administration of the tests will need to be worked out among all the stations depending on their availability. This aspect will be more important when all fifty-five stations are involved since all 310 permanents, and eventually 850 volunteers will need to be scheduled within each year. We recommend that once a schedule is established for all the firefighters in the country, that the schedule remains fixed to avoid the same problem each year with scheduling.

5.4 Medical Examinations

Currently, a complete medical examination is administered to the firefighters by the Riesgos de Trabajo (or Job Risks) division of INS every six months. The medical examination is very complete, and includes:

- Spirometer test: to test the lung capacity of the firefighter
- Psychological exam: to verify that the firefighter is mentally fit to do his job
- Densitometry exam: to determine the firefighter's body composition of fat, bones, muscle, and cholesterol
- Muscular capacity test

- Blood test
- Spinal column test
- Informative talks on health and fitness issues

Since the current medical examination is so comprehensive, we recommended that El Cuerpo de Bomberos keeps the existing components of the medical exam. The reasoning behind this was that every aspect of the individual's health that is addressed in the current medical exam is important to determine the firefighter's ability to perform the duties of his or her job.

In addition, we recommended that the six-month frequency of the exams remains the same. Since fire fighting is such a physically and mentally demanding occupation, it is not uncommon for a firefighter to get injured or mentally stressed within a six-month period. The six-month period is also a sufficient interval because the firefighter's weight and health can be closely monitored if the medical exams are given twice a year instead of annually.

In addition, we recommended that the informative talks be removed from the medical examinations because the wellness program will include health-related classes taught by the physical fitness trainer. The physical fitness trainer will offer more educational and organized classes than the informative talks.

The one component to the medical exams that needs to be added is a health risk assessment. The firefighters will complete a questionnaire similar to the one in Appendix T during every medical exam. The purpose of the questionnaire is to determine if the firefighters are at any medical risk. The data from each questionnaire should be kept to obtain data about each individual firefighter and the population as a whole.

Since we recommended that El Cuerpo de Bomberos keeps track of information from fitness training, testing, and medical examinations, it might be worthwhile to El Cuerpo de Bomberos to establish an electronic data management system for firefighter records. Currently, there is a database located at the communications center for El Cuerpo de Bomberos. There might be a possibility of using the database to store firefighter records. If the same database can't be used, then it could be possible to purchase new hardware for the firefighter records and use the existing computer communications between El Instituto Nacional de Seguros and the communications center. El Cuerpo de Bomberos can analyze the data to obtain information about the general health of firefighters, to discover trends in firefighter physical fitness, and to monitor the benefits of the wellness program.

6 Sumario de la Introducción, el Fondo, y la Metodología

Combatir los incendios es un trabajo muy peligroso y los bomberos tienen la responsabilidad de salvar vidas. También, hay muchos aspectos vigorosos del trabajo. Por estas razones, los bomberos necesitan estar en buena forma todo el tiempo. Este proyecto detalla un programa de acondicionamiento físico y bienestar.

Realizamos una investigación en los Estados Unidos sobre los programas de acondicionamiento físico de los bomberos, a petición del Instituto Nacional de Seguros. Los bomberos en los Estados Unidos hacen tareas similares a los bomberos en Costa Rica. Por eso, la información que encontramos sobre los programas en los Estados Unidos es muy útil para Costa Rica.

Sin embargo, algunas condiciones para combatir los incendios en Costa Rica son diferentes que en los Estados Unidos. Por ejemplo, en Costa Rica, muchas casas y edificios tienen portones afuera de las puertas. Por eso, modificamos algunas cosas sobre el programa que recomendamos para Costa Rica.

Un programa de bienestar está diseñado para tratar todos los aspectos sobre la salud. Los componentes de un programa de bienestar incluyen evaluaciones de riesgos a la salud, exámenes médicos, pruebas de tareas bomberiles, actividades de educación sobre la salud, y programas de acondicionamiento físico. Los programas de bienestar reducen el nivel de riesgo personal a los bomberos y los ayudan hacer mejor sus trabajos. Los bomberos que están en buena forma pueden disipar calor más fácil, y por eso, hay menos posibilidades que los bomberos sufran problemas de la salud. Con menos

problemas de salud, el INS puede disminuir los egresos por conceptos de gastos médicos.

Un componente de un programa de bienestar es el acondicionamiento físico. Los aspectos que están incluidos en acondicionamiento físico incluyen acondicionamiento cardiovascular, fuerza y resistencia muscular, y flexibilidad. Para incluir todos aspectos de acondicionamiento físico, un programa de entrenamiento debe tener ejercicios de calentar, estiramientos, aeróbicos, y levantar pesas. Cada bombero debe tener un programa individual para trabajar los partes del cuerpo que lo necesitan.

Otro componente de un programa de bienestar es la prueba de tareas bomberiles. Estas pruebas están deseñadas para determinar si el bombero puede hacer las tareas de su trabajo sin problemas. Las pruebas usualmente tienen siete u ocho eventos, basados en las tareas bomberiles, como arrastrar una manguera o usar una escalera de mano. Hay tres pruebas de los Estados Unidos que escogimos para el diseñar una prueba para Costa Rica. Las tres pruebas son de Nueva York, Massachussets, y Washington D.C.

Usualmente, hay administradores para cronometrar los eventos. También, los administradores aseguran que los bomberos no sufran demasiado estrés físico. Una mayoría de las pruebas en los Estados Unidos están administradas a cada bombero cada año.

Los exámenes médicos son otro componente del programa de acondicionamiento físico. En los Estados Unidos, los exámenes médicos para los bomberos incluyen pruebas para todo el cuerpo. La frecuencia de los exámenes depende de la edad del bombero; los bomberos más viejos tienen exámenes más frecuentes. En Costa Rica, los

exámenes también incluyen pruebas para todo el cuerpo y están administrados cada seis meses.

Las evaluaciones de la salud son herramientas para evaluar los riesgos, los bomberos están propensos ha desarrollar ciertas enfermedades. Por ejemplo, una persona que no hace ejercicios, tiene una historia familiar de enfermedades del corazón, y tiene colesterol alto tiene el riesgo de desarrollar una enfermedad del corazón. Las evaluaciones de riesgos a la salud son un aspecto importante en entender la salud y forma de los bomberos.

Las actividades educacionales sobre la salud provee una oportunidad a los bomberos para mejorar su conocimiento sobre salud y para cambiar sus conductas de salud. Los cambios pueden ayudar a los bomberos para vivir con mejor salud. Hay muchas maneras de administrar las actividades como videos, clases, y artículos en periódicos. Se necesita una persona para conducir las actividades con los bomberos.

Cuando un programa de bienestar se lleva a cabo, hay ciertos componentes que ayudarían a su éxito. Se necesita un grupo de personas para planear y llevar a cabo el programa, el presupuesto, una póliza formal escrita, un entrenador, y las pruebas. También, investigaciones han mostrado que cuando los bomberos están incluidos en el proceso de llevar a cabo el programa, la posibilidad de éxito aumenta.

Para obtener la información que necesitamos para desarrollar un programa de bienestar, desarrollamos una metodología comprensiva. Condujimos una investigación en los Estados Unidos para aprender más sobre los programas de bienestar. Usamos trabajos de la Academia Nacional de Incendios, artículos en periódicos como *Fire Chief* y

Fire Engineering, libros sobre los detalles de combatir incendios en los Estados Unidos, y sitios de la Red de estaciones de bomberos y sitios sobre acondicionamiento físico.

Usamos encuestas y entrevistas para aprender más sobre los intereses y el conocimiento sobre salud y acondicionamiento físico de los bomberos. Esta información nos ayudó ha determinar ciertos aspectos del programa que quisimos recomendar. Por ejemplo, si los bomberos conocieron mucho sobre la salud, el programa no incluya muchos componentes que enseñarían a los bomberos tópicos sobre salud. También, usamos las encuestas y entrevistas para determinar sus intereses para diseñar un programa que les gusta.

La encuesta tuvo preguntas abiertas, preguntas de "sí" o "no", y preguntas de una escala de 1-5. Las preguntas abiertas determinaron el conocimiento sobre salud y acondicionamiento físico de los bomberos. Las preguntas de "sí" o "no" determinaron las prácticas de salud de los bomberos, por ejemplo si fuman o no. Las preguntas de la escala determinaron la forma percibida de los bomberos. La encuesta puede ser encontrada en Apéndice G y la entrevista puede ser encontrada en Apéndice I.

Distribuimos las encuestas a todos los bomberos de veintiuno estaciones escogidas por INS. Las Diez Estaciones Iniciales serán parte de un programa piloto y las otras once estaciones representan una Muestra del Resto de las Estaciones. Les entregamos las encuestas a las diez estaciones para que el programa inicial satisfaga las necesidades de los bomberos de estas estaciones. La muestra del resto de las estaciones representa las necesidades del resto de los bomberos en Costa Rica.

Enviamos algunas encuestas y entrevistas a las estaciones que no pudimos visitar. También, cuando visitamos las estaciones, dejamos algunas encuestas y entrevistas para los bomberos que no estuvieron trabajando ese día.

También, cuando visitamos las estaciones, completamos encuestas del equipo (Apéndice K) de entrenamiento para determinar el equipo disponible para cada estación. Incluimos en esta encuesta la condición del equipo para determinar si el equipo debe ser reemplazado.

Visitamos el Centro de Recreos del INS para determinar si hay bastante espacio para conducir la prueba de tareas bomberiles. Sacamos fotos y tomamos medidas de las canchas de fútbol, papifútbol, y básquetbol. Usando esta información, diseñamos un plan para los eventos de la prueba.

Usando toda la información que encontramos por las maneras descritas, acumulamos información que presentamos en la próxima sección del trabajo.

7 Análisis y Presentación de los Datos

Las encuestas y las entrevistas descritas en nuestra metodología nos suministraron los datos que se presentan (y serán analizados) en éste capítulo. Combinamos la presentación y el análisis de los datos en la misma sección porque es más fácil para el lector, ver correlaciones entre los datos y el análisis si ambos son presentados simultáneamente. Los datos y análisis de las Diez Estaciones Iniciales, y la Muestra de las Estaciones Restantes son presentadas separadamente para determinar si hay diferencias en los resultados entre los dos grupos de estaciones. Del análisis, determinamos conclusiones y recomendaciones, que describiremos en el siguiente capítulo.

7.1 Encuestas al Personal

Las encuestas al personal fueron distribuidas a todos los miembros de las Diez Estaciones Iniciales así como a otras cuatro estaciones que fueron visitadas. Las encuestas restantes fueron enviadas por correo a otras siete estaciones descritas en nuestra metodología y luego éstas fueron reenviadas a nosotros para procesar la información. El tamaño de nuestra muestra (explicado en la metodología) conllevó a 179 encuestas al personal: 123 provenientes de las Primeras Diez Estaciones y 56 de la Muestra de las Estaciones Restantes. De las encuestas al personal, 121 eran bomberos permanentes, 89 de las Diez Estaciones Iniciales y 32 de la Muestra de las Estaciones Restantes. Los voluntarios en las estaciones de bomberos completaron las cincuenta y ocho encuestas que faltaban.

Las encuestas devueltas de las Diez Estaciones Iniciales eran del cuarenta por ciento de los bomberos que laboran en la estación. Nuestra previa investigación demostró que cuarenta por ciento es una muestra suficiente. Aunque, las encuestas devueltas de las once estaciones eran del seis por ciento de los demás bomberos en el país. Una muestra del seis por ciento podría proveer resultados precisos, pero existe la posibilidad de que no exista suficiente información para hacer comparaciones precisas entre los dos grupos de estaciones.

Después de haber realizado las encuestas al personal, varios sesgos fueron encontrados. Uno de los sesgos de la encuesta al personal ocurrió durante la administración de la encuesta. Algunos de los bomberos discutieron entre sí, las preguntas abiertas cuando no tenían muy clara la respuesta a alguna pregunta en particular. Tratamos de limitar las discusiones entre los bomberos cuando estuvimos presentes, explicándoles que si no conocían alguna respuesta, que la dejaran en blanco. Sin embargo, las discusiones se siguieron dando y podrían haber ocurrido más frecuentemente con las encuestas que fueron administradas sin nuestra presencia. Las conversaciones entre bomberos tienen un efecto negativo en nuestra encuesta porque la encuesta fue diseñada para investigar el conocimiento y la opinión del individuo sobre la condición física. Si los bomberos compartan su conocimiento y opinión con otros bomberos, la individualidad de la encuesta será reducida.

El orden en el cual la información y el análisis fueron presentados, corresponde al orden de la encuesta al personal (refiera a Apéndice G) excepto cuando fue más lógico no presentar las preguntas en el orden consecutivo. Por tanto, la primera pregunta que analizamos fue la pregunta número uno. En la pregunta número uno se preguntaba sobre

el concepto que los bomberos tienen acerca del entrenamiento físico. Los gráficos de los resultados obtenidos pueden ser vistos en la Figura 22.

Figura 22 – Gráfico Sobre la Definición de la Condición Física

Los gráficos en la Figura 22 ilustran la respuesta de 179 bomberos, permanentes y voluntarios, la primera pregunta de la encuesta. El gráfico de la izquierda es un gráfico de porcentaje de las respuestas obtenidas de las Diez Estaciones Iniciales. El gráfico de la derecha corresponde a las respuestas de 56 bomberos de la Muestra de las Estaciones Restantes. Basado en la investigación que encontramos en Estados Unidos, se calificaron las respuestas utilizando la definición de condición física encontrada en la Sección 2.2.3. Una calidad de uno significaba que el bombero dejó las respuestas en blanco o que las respuestas no contenía ninguno de los componentes de la definición predeterminada; indicando así el no entendimiento del concepto. Una calidad de dos indicaba que la respuesta del bombero demostraba una idea básica del concepto, pero no su total comprensión. Una calidad de tres significaba que la respuesta incluía todos los puntos principales de la definición con claridad, indicando así que el bombero era conocedor del concepto. Este sistema de calificación es el mismo para las preguntas 6, 7 y 8 de la encuesta al personal.

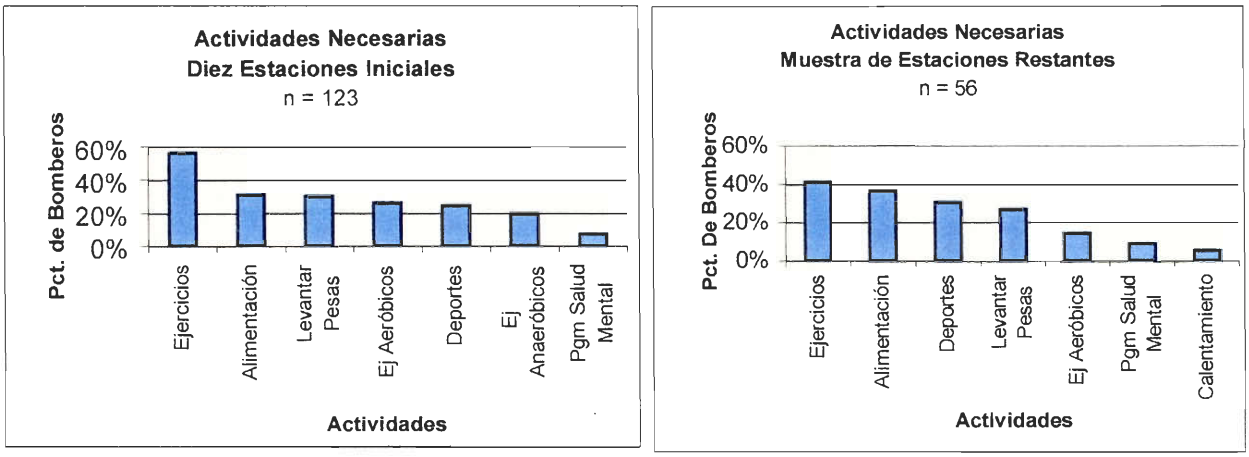
Ambos gráficos: Diez Estaciones Iniciales y la Muestra de las Estaciones Restantes son muy similares. Ambos indican que aproximadamente un tercio de los bomberos encuestados tienen poco o ningún concepto de la definición de condición física entrada en la Sección 2.2.3. Sin embargo, los resultados no necesariamente significan que los bomberos costarricenses no tienen conocimiento de la condición física. En efecto, los dos tercios encuestados restantes tienen buen o excelente conocimiento del tema. Hay varias posibilidades para el alto porcentaje de bomberos que tienen ninguna respuesta o una respuesta pobre a la pregunta uno. Con ésta pregunta así como con las preguntas 6, 7 y 8, nuestra traducción de inglés a español puede causar un sesgo si los conceptos no fueron traducidos adecuadamente. Otro sesgo pudo haber sido creado cuando nosotros tradujimos sus respuestas al inglés.

La pregunta dos, preguntaba a los bomberos cuales actividades ellos pensaban que debían ser requeridas en un programa de condición física. La Figura 23 muestra los resultados de 123 bomberos de las Diez Estaciones Iniciales y 56 bomberos de la Muestra de las Estaciones Restantes.

Los gráficos en la Figura 23 indicaron que para ambas: Diez Estaciones Iniciales y la Muestra de las Estaciones Restantes, ejercicios fue escogida como la actividad más necesaria para un programa de acondicionamiento físico. La dieta fue escogida como la segunda actividad más popular para las dos muestras de estaciones de bomberos. Otras actividades populares que los bomberos sintieron como necesarias incluyeron deportes, levantamiento de pesas y aeróbicos. La respuesta a la pregunta demostró un buen entendimiento de que la condición física está basada en muchos componentes

importantes además de ejercicio, indicando así que los bomberos tienen un buen conocimiento de la condición física, lo que apoya los resultados de la pregunta uno.

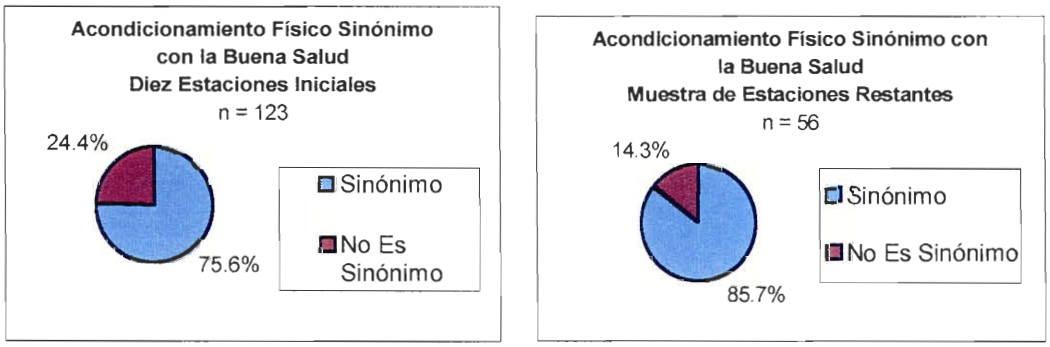
Figura 23 – Gráficos de las Actividades Necesarias Percibidas para un Programa de Entrenamiento



La Figura 24 muestra el porcentaje de bomberos de las Diez Estaciones Iniciales y la Muestra de las Estaciones Restantes que sintieron que el acondicionamiento físico es sinónimo de salud y aquellos que sintieron que no, que es la pregunta nueve de nuestra encuesta. Esta pregunta fue recomendada por nuestro oficial de intercomunicación porque él quería saber cuantos bomberos sentían que el acondicionamiento físico era el único componente que determinaba la salud de una persona. La respuesta que nosotros andábamos buscando era que ellos no eran sinónimos porque existen muchos aspectos adicionales para un acondicionamiento físico que determinan la salud de una persona, incluyendo una buena dieta y descanso suficiente. Aproximadamente el 20% de todos los bomberos encuestados respondieron que el acondicionamiento físico no era sinónimo de buena salud y explicaron que existían otros componentes que determinaban la salud de alguien. Esta es la respuesta que nuestro equipo andaba buscando. Cerca del 80%

respondió que eran sinónimos, lo que demuestra que los bomberos posiblemente desconocen todos los diferentes segmentos que comprenden la salud de una persona.

Figura 24 – Gráficos de Comparación Entre Acondicionamiento Físico y Buena Salud



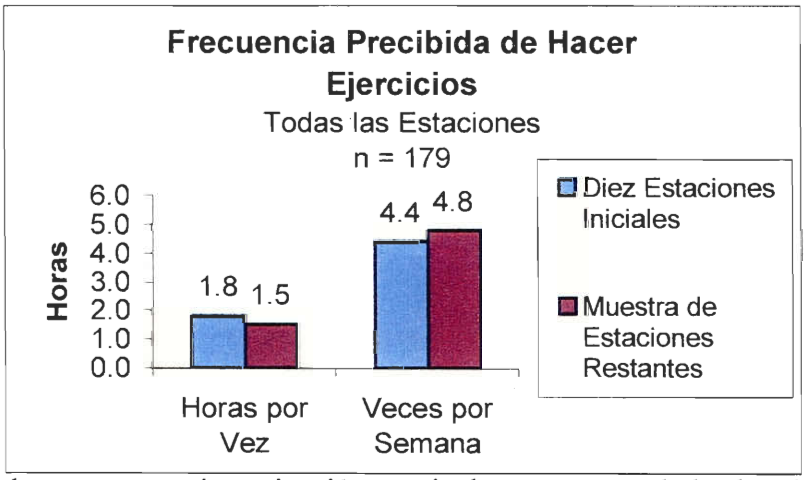
Sin embargo la pregunta dos demuestra que los bomberos tienen el concepto de la importancia que tienen las actividades relacionadas con la salud además del entrenamiento físico. La diferencia entre los resultados podría indicar que los bomberos tienen un buen conocimiento de los factores importantes de la salud, pero ellos no expresan completamente su conocimiento.

La pregunta número tres comprende la opinión de los bomberos acerca del número y las horas, de veces por semana que una persona debe realizar de entrenamiento físico, en promedio, para estar en buena forma. Uno de los sesgos de ésta pregunta envuelven la redacción de la pregunta. Al preguntar por la cantidad de tiempo por día, especialmente en horas, pudieron haber pensado que nosotros esperábamos al menos una hora. Para contrarrestar éste sesgo en futuras encuestas, la pregunta debe reformularse como cuanta es la cantidad de tiempo por día que alguien necesita entrenar, en lugar de preguntar específicamente por un número de horas determinado.

El promedio de horas por sesión de entrenamiento, tomadas de 123 permanentes y voluntarios de las Diez Estaciones Iniciales, fue de 1,8, mientras que el promedio de veces por semana fue de 4,4.

El promedio de horas por día para los bomberos de la Muestra de las Estaciones Restantes, fue de 1,5, mientras que el promedio de veces por semana fue de 4,8. Los resultados se muestran en la Figura 25.

Figura 25 – Gráficos de con Cuanta Más Frecuencia los Bomberos Sienten que Ellos Deberían Entrenar



De acuerdo con nuestra investigación previa, las respuestas de los bomberos en ambas, Diez Estaciones Iniciales y Muestra de las Estaciones Restantes, son buenas respuestas para frecuencia para mantener una buena condición física. Sin embargo, cuando se les hizo la pregunta trece, cuantas veces y qué cantidad de horas ellos hacían alguna forma de entrenamiento, los resultados variaron un poco.

De 106 respuestas provenientes de las Diez Estaciones Iniciales, el promedio del número de horas por sesión fue de 1,4, y el promedio de número de veces por semana fue de 3.0. De 56 respuestas de la Muestra de las Estaciones Restantes, el promedio del número de horas por sesión fue de 1,6, y el promedio del número de días por semana fue

de 2,6. Los resultados de las preguntas tres y trece demuestran que en promedio, la mayoría de los bomberos siente que debería entrenar más frecuentemente con el fin de tener una mejor condición física.

La pregunta número cinco cuestiona al bombero si alguna vez ha recibido información acerca de educación en la salud proveniente de su estación de bomberos.

Cuando diseñamos la encuesta, diseñamos ésta pregunta teniendo presente la componente educacional del programa de beneficio. Quisimos averiguar si los departamentos de bomberos suministraban clases informativas a sus bomberos para ver si ya residía algún componente de salud educacional de algún plan de mejoramiento en el lugar. Sin embargo, mediante una entrevista con el Dr. García en el Instituto Nacional de Seguros, aprendimos que existen clases sobre salud, obligatorias para los bomberos costarricenses como parte de su revisión médica bi-anual. De ésta manera, muchos de los departamentos nunca han ofrecido información sobre salud a los bomberos puesto que las clases sobre salud ya son suministradas cada seis meses.

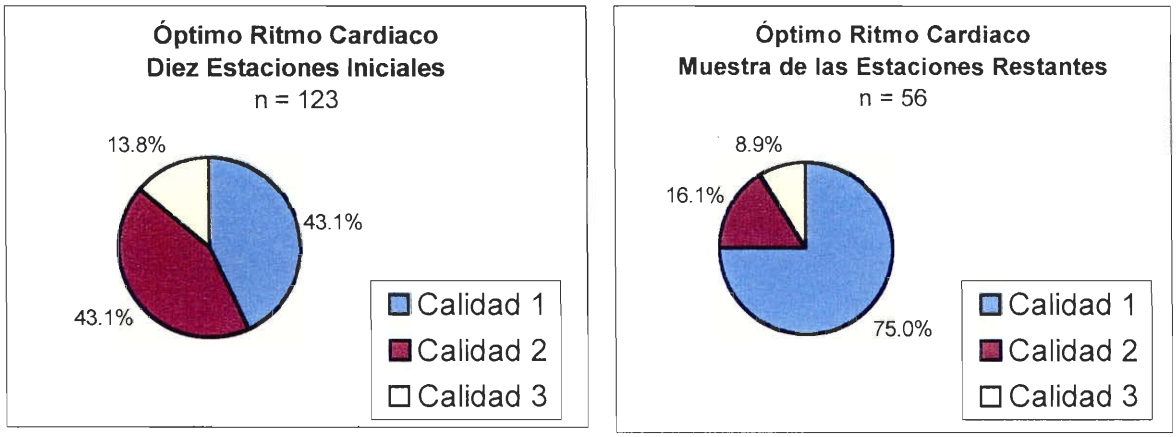
La información que obtuvimos de la pregunta cinco, está basada en los resultados tomados de 122 permanentes y voluntarios de las Diez Estaciones Iniciales y 56 bomberos de la Muestra de las Restantes Estaciones. Cuando se les preguntó si en alguna ocasión habían recibido información proveniente de su estación de servicio, que tuvieran que ver con asuntos de salud, 8,2% de los bomberos de la las Diez Estaciones Iniciales y un 5,4% de la Muestra de las Estaciones Restantes respondieron que sí.

Así, más del 90% respondió que nunca han recibido información de ésta clase, desde su estación. Los resultados demuestran que hay una escasez de información en materia de salud asequible a los bomberos en las estaciones de bomberos. Esto se debe

aparentemente a las clases que se toman únicamente semestralmente como parte de un examen médica, como se mencionó antes.

La Figura 26 muestra las respuestas de 113 bomberos de las Diez Estaciones Iniciales y 56 de la Muestra de las Estaciones Restantes para la definición del ritmo cardiaco esperado, que fue la pregunta seis. El análisis de ésta pregunta usa la misma escala que la pregunta uno. Como se muestra aquí, más del 40% de las respuestas de las Diez Estaciones Iniciales y 75% de la Muestra de las Estaciones Restantes fueron de calidad uno, indicando pequeño o ningún conocimiento sobre el tema. Esto podría ser un indicador de que los bomberos nunca hayan aprendido el significado de "ritmo cardiaco esperado," de las respuestas en cada una de las encuestas, nosotros concluimos que al menos parte del problema pudo haber sido nuestra traducción.

Figura 26 – Gráficos de la Definición de Ritmo Cardiaco Esperado



Los gráficos de Fortaleza y Duración Muscular en la Figura 27 ilustran el conocimiento que los 129 bomberos sabían sobre la definición de fortaleza y duración muscular. Los gráficos se relacionan con los resultados de la pregunta siete de la encuesta. Más de la mitad de las respuestas, indican un promedio de un excelente

conocimiento del concepto, más del 36% de los bomberos de las Diez Estaciones Iniciales tienen poco o ningún conocimiento sobre el tema. Los resultados podrían indicar que los bomberos necesitan más instrucción en fortaleza y duración muscular.

Figura 27 – Gráficos de Fuerza y Resistencia Muscular

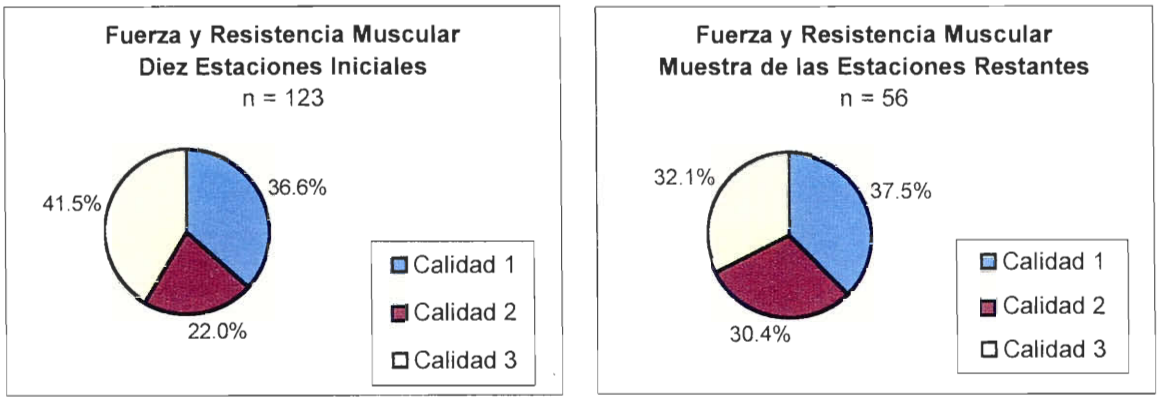
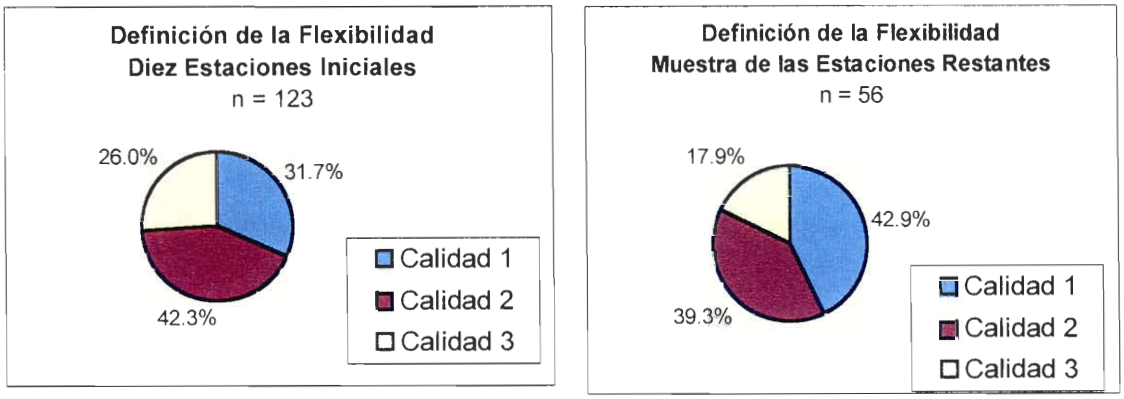


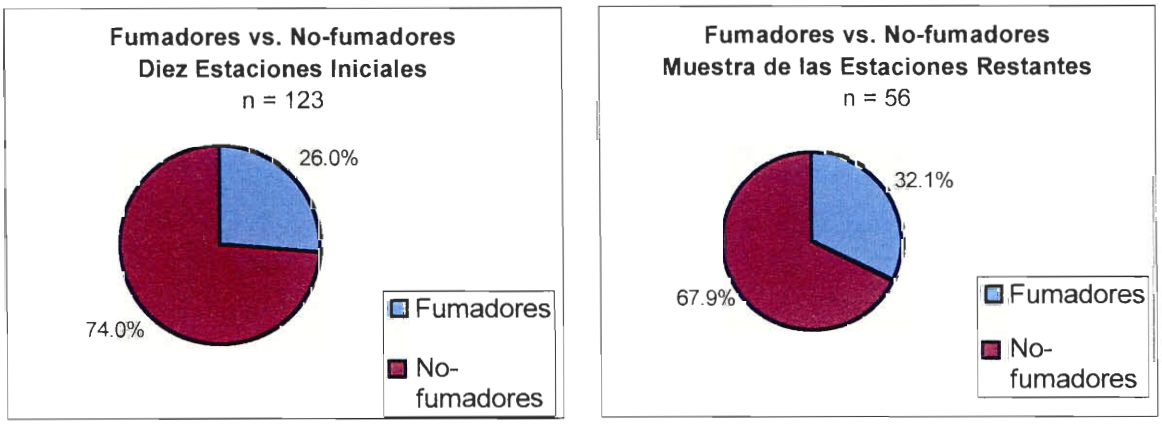
Figura 28 ilustra el concepto que los bomberos tienen de flexibilidad basado en 169 respuestas a la pregunta ocho. Los gráficos demuestran que hay una gran cantidad de respuestas en el rango de la excelencia que en los gráficos de fortaleza y duración muscular. Sin embargo, en el gráfico de las Diez Estaciones Iniciales aproximadamente un tercio de las respuestas fue de calidad uno. El gráfico de la Muestra de las Estaciones Restantes tiene al menos 43% de la calidad uno, lo cual indica que el programa de salud educacional actual podría no ser suficiente.

Figura 28 – Gráficos de la Definición de Flexibilidad



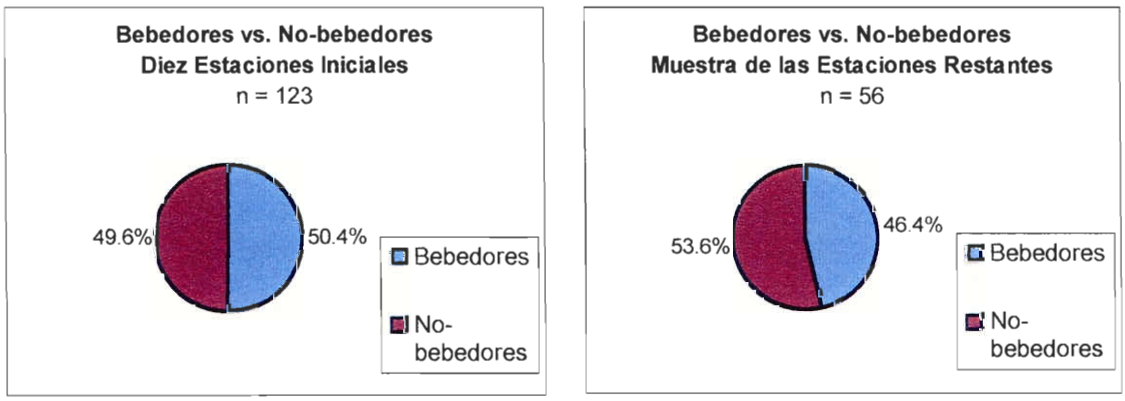
La Figura 29 muestra los porcentajes de los fumadores y los no fumadores de 179 bomberos, 123 de las Diez Estaciones Iniciales y 56 de la Muestra de las Estaciones Restantes que fueron encuestados. La información se obtuvo de la pregunta diez de la encuesta. Si bien es cierto, casi tres cuartos de la Muestra de Las Estaciones Restantes son no-fumadores, queda el cuarto restante que fuma en promedio 7,3 cigarrillos al día. Un tercio de los bomberos de la Muestra de las Estaciones Restantes fuma, con un promedio de 5,9 cigarrillos al día. Puesto que fumar reduce la capacidad cardiovascular y pulmonar, ésta información puede presentar un problema pues el trabajo de un bombero incluye muchos aspectos que requieren una capacidad cardiovascular y pulmonar alta.

Figura 29 – Gráficos de Fumadores vs. No-fumadores.



La Figura 30 muestra el porcentaje de bomberos que toma comparado con el porcentaje que no. La información se obtuvo de la pregunta once de la encuesta. Los resultados para las Diez Estaciones Iniciales muestra que hay más bebedores que no bebedores. Sin embargo el promedio de bebidas por semana consumida por aquellos que beben es de 4,4, lo cual es menos de una bebida alcohólica por día. Los resultados para la Muestra de las Estaciones Restantes muestra que hay menos bebedores que no bebedores, pero aquellos que beben, consumen cerca de 5,0 bebidas por semana. El promedio es menos que una bebida por día, que es una cantidad pequeña, así que el desempeño de los bomberos en su trabajo no debería ser afectado por el consumo de alcohol.

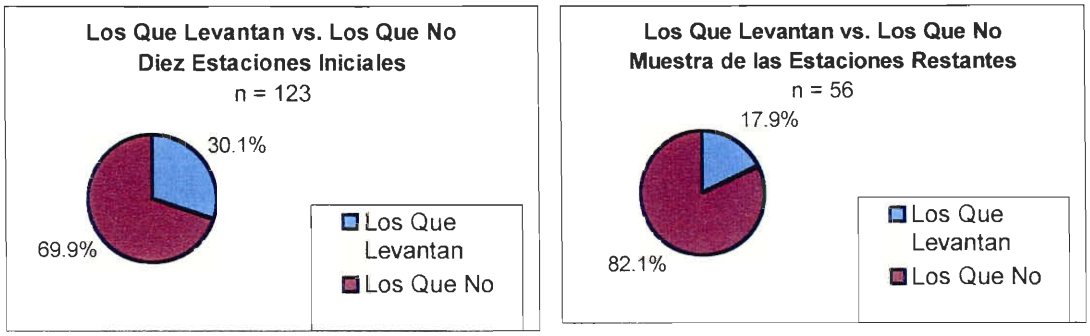
Figura 30 – Gráfico de Bebedores vs. No-bebedores



La Figura 31 muestra los resultados de la pregunta catorce, los bomberos que levantan pesas y aquellos que no. De las Diez Estaciones Iniciales, los bomberos que levantan pesas, lo hacen en un promedio de 2,4 veces por semana. Sin embargo, como muestra el gráfico, existen cerca de dos tercios que no levantan pesas. De la Muestra de

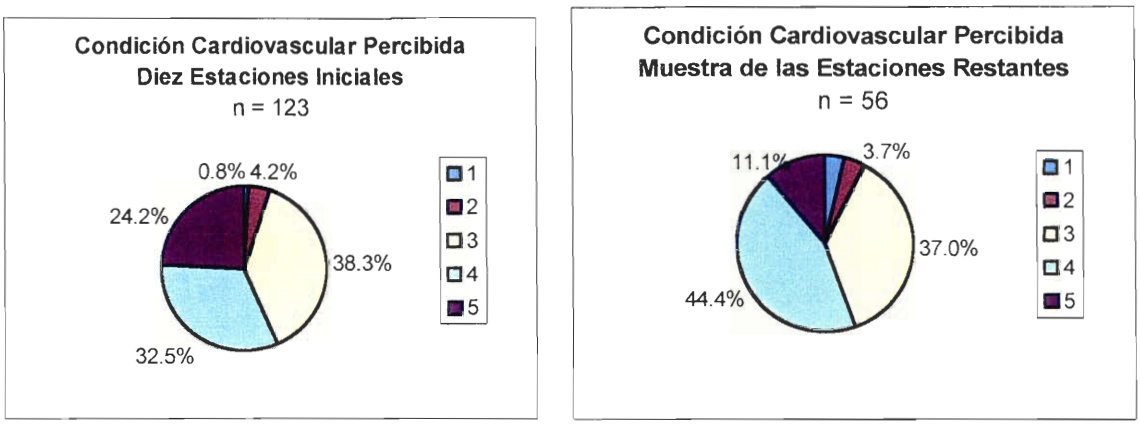
las Estaciones Restantes, más de tres cuartos de la población de bomberos no levantan pesas. Aquellos que sí lo hacen, lo consiguen en un promedio de 2,1 veces por semana.

Figura 31 – Gráficos de los Que Levantan Pesas y los Que No



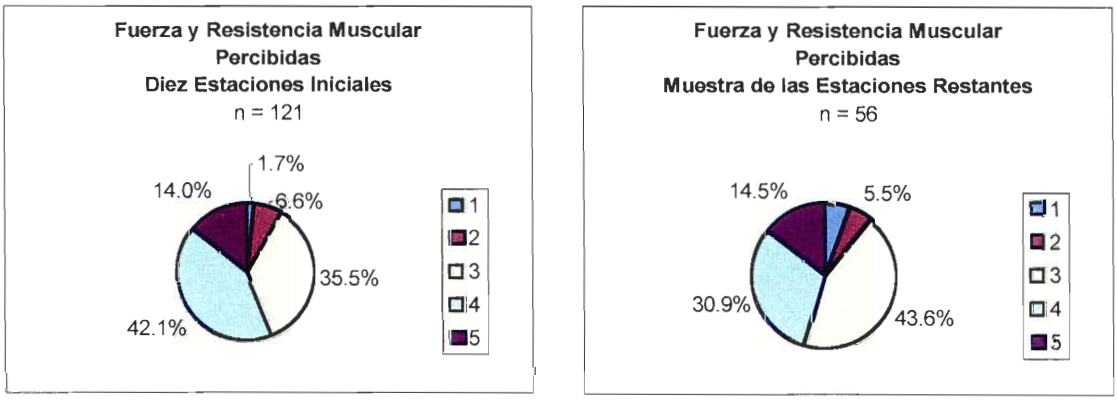
La Figura 32 muestra la respuesta de los bomberos a la pregunta quince, su nivel de acondicionamiento cardiovascular. Esta pregunta así como la 16 y la 17, fueron tasadas en la escala de 1-5. La escala fue explicada a cada bombero en cada encuesta. Una respuesta de uno significa que el bombero tiene problemas para llenar los requerimientos de su trabajo en referencia al aspecto de la salud en cada una de las preguntas. Cinco representa que el bombero no tiene problemas para llenar los requerimientos de su trabajo en referencia al aspecto de la salud, y los números del dos al cuatro representan las variaciones intermedias. Como el gráfico ilustra, la mayoría de los bomberos se consideran en el 3 o 4 de la escala, lo cual es aceptable puesto que esto indica que se sienten capaces de realizar su labor. Si embargo, sigue siendo subjetivo a cada bombero, y no es un indicativo exacto de si el bombero puede hacer su trabajo adecuadamente o no. Además, otro sesgo de ésta pregunta es asumir que todo bombero sabe lo que significa estar en buenas condiciones cardiovasculares.

Figura 32 – Gráficos de Condición Cardiovascular Percibida



La Figura 33 muestra cómo 177 bomberos perciben su fortaleza muscular y su rendimiento. Hubo 121 respuestas de las Diez Estaciones Iniciales y 56 de la Muestra de las Restantes Estaciones. La información se tomó de la pregunta dieciséis. De nuevo, el grueso quedó en el rango del 3 al 4, lo cual es aceptable, pero sigue cayendo (en el sesgo) con respecto a la subjetividad y conocimiento tal y como en el último gráfico (ver Figura 32).

Figura 33 – Gráficos de Fuerza y Resistencia Muscular Percibidas



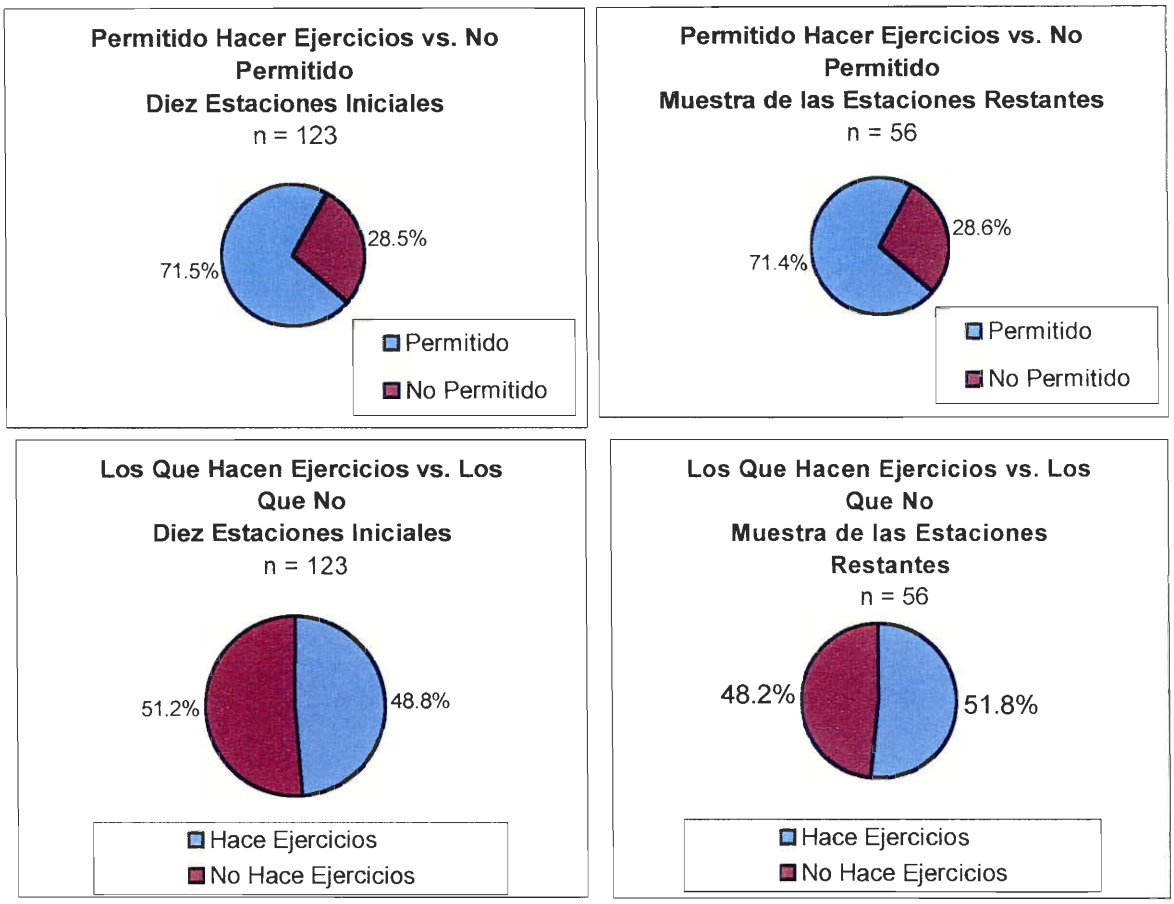
La Figura 34 ilustra cómo 178 bomberos perciben su flexibilidad. La información se tomó de la pregunta diecisiete. Como en los otros dos gráficos anteriores, el grueso quedó en el rango del 3 al 4, con los mismos sesgos tomados en consideración en los dos gráficos anteriores (ver Figuras 30 y 31).

Figura 34 – Gráficos de la Flexibilidad Percibida

La Figura 35 ilustra las respuestas de 179 bomberos a la pregunta dieciocho de la encuesta. El primer arreglo de gráficos muestra el porcentaje de bomberos que les es permitido hacer ejercicio durante su jornada. El segundo gráfico muestra el porcentaje de bomberos actualmente hacen ejercicio durante su jornada por aparte de aquellos que les es permitido.

Como el gráfico lo muestra, a 71,5% les es permitido ejercitarse en las Diez Estaciones Iniciales y otro 71,4% en la Muestra de las Estaciones Restantes. Sin embargo, según el segundo arreglo de gráficos lo demuestra, sólo 51,2% del 71,5% hace ejercicio durante su jornada en las Diez Estaciones Iniciales y 51,8% del 71,4% de la Muestra de las Estaciones Restantes.

Figura 35 – Gráficos de Ejercicios Permitidos y Cuantos Realmente los Hacen

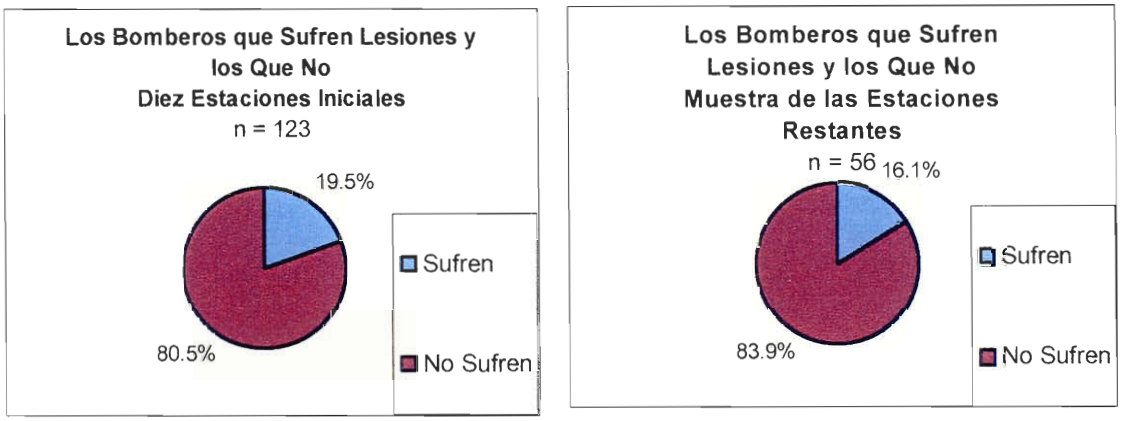


Hay un par de posibilidades para el pequeño número de aquellos que se ejercitan. Una es que no hay equipo a la mano de ellos con el cual hacer ejercicio. Una segunda razón es que a pesar de que algunos tengan el equipo a mano no saben cómo entrenar con él, en cuyo caso ellos necesitarían un instructor entrenado.

La Figura 36 muestra el porcentaje sobre 179 bomberos de aquellos que sufren de algún tipo de dolor físico. La información fue tomada de la pregunta diecinueve de la encuesta. Ejemplos de dolor físico incluyen problemas en los hombros, rodillas, y espaldas. Sólo 19,5% de las Diez Estaciones Iniciales y 16,1% de la Muestra de las Estaciones Restantes sufren de dolor físico, de todas formas no podemos saber si está

relacionado con el trabajo y si inhibe su habilidad para realizar su trabajo. A pesar de todo, actividades de acondicionamiento físico ayudarían a fortalecer los músculos y a prevenir lesiones.

Figura 36 – Gráficos de los Bomberos que Sufren Lesiones



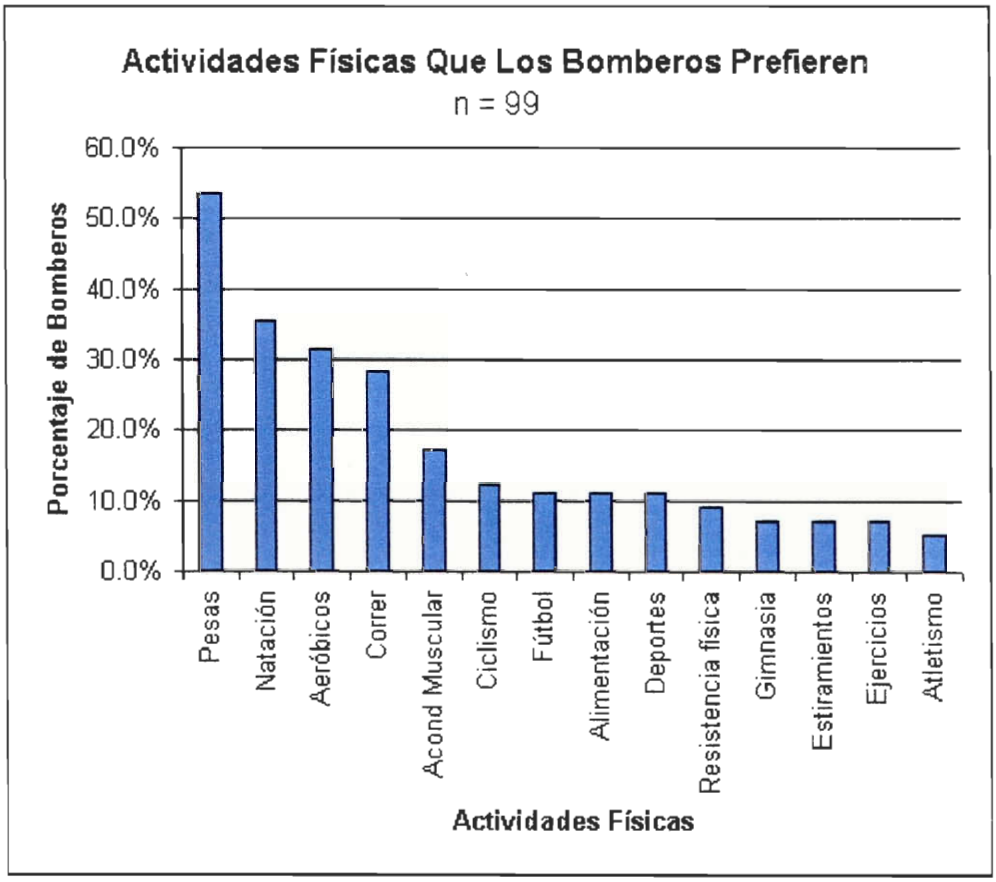
7.2 Entrevistas Personales

De las 307 entrevistas que distribuimos en las Diez Estaciones Iniciales, recibimos 99 de vuelta. De las 207 que distribuimos en la Muestra de las Estaciones Restantes, recuperamos 56. El porcentaje de los bomberos representados de las Diez Estaciones Iniciales fue 32,2%. La tasa de retorno para las Diez Estaciones Iniciales es adecuada porque para un error de muestreo de ±10%, 28,0% de las encuestas debían ser devueltas (Dillman, et. al., 1997). Las entrevistas de la Muestra de las Estaciones Restantes representaron 6,6% de los restantes bomberos del país. El tamaño de la muestra podría llevar a conclusiones erróneas, como se mencionó en la Sección 7.1.

La pregunta uno fue usada para determinar las actividades de entrenamiento físico que más les interesan a los bomberos con el fin de establecer actividades de

acondicionamiento para el programa de mejoramiento. Las actividades que recibieron, por encima del 5%, la aprobación de los bomberos se incluyen en la Figura 37. El gráfico contiene información de las Diez Estaciones Iniciales debida a que ellos van a participar en el programa primero.

Figura 37 – Gráfico de las Actividades que les Interesan a los Bomberos



Después de haber entrevistado al médico del INS, tomando en consideración el contenido de los exámenes suministrados cada seis meses a los bomberos, aprendimos que los bomberos están obligados a atender a clases relacionadas con asuntos de la salud además de su examen médico. Por ésta razón, la segunda pregunta de la entrevista, tomando en cuenta los intereses -en aspectos de la salud- de los bomberos, es irrelevante

pues ellos ya están obligados a asistir a éstas clases. Nuestro equipo no tenía conocimiento de que las clases ya eran ofrecidas sino hasta que habíamos suministrado las entrevistas. Por eso, no tomamos en cuenta la información que habíamos obtenido de la segunda pregunta.

No tomando en cuenta la redundancia de la pregunta dos, concluimos que la redacción de la pregunta sesgó los resultados. Entregándoles ejemplos a los bomberos sobre los tópicos de salud sobre los cuales nosotros estábamos hablando, nosotros insinuamos ideas preconcebidas en ellos, y ninguna de las respuestas incluyó otros temas más que para aquellos que habíamos dado ejemplos.

Además de todo, en la mayoría de los casos con las entrevistas, como todas las preguntas estaban hechas de forma escrita para facilitar el suministro en nuestra ausencia, muchos de los bomberos vacilaron en la pregunta sobre ideas de temas.

Por eso los sesgos crearon razones inclusive más aseverativas, además de la información que recibimos del médico, de por qué debíamos desechar la información proveniente de dicha pregunta.

Cuando se les preguntó en la pregunta tres si usarían o no equipo para levantamiento de pesas si estuviera asequible en las estaciones de bomberos, la mayoría de los bomberos respondió que sí.

Muchos añadieron que también les gustaría recibir un entrenamiento apropiado sobre cómo usar el equipo, impartido por una persona capacitada. Algunos respondieron que no usarían el equipo si no hubiese un entrenador que les enseñe cómo hacerlo.

La última pregunta de la entrevista tenía como fin, determinar el interés que tienen los bomberos en asistir a clases informativas sobre asuntos relacionados con la salud.

De nuevo ésta pregunta fue suministrada sin el previo conocimiento de las clases obligatorias a las que los bomberos asisten cada seis meses. Debido a esto decidimos no tomar en cuenta los resultados de ésta pregunta también. Sin embargo, todas las respuestas que recibimos indicaron que los bomberos tienen interés en las clases.

7.3 Estudio de Campo

La entrevista sobre el equipo se realizó en cada una de las catorce estaciones que visitamos. Doce de las estaciones tenían algún tipo de equipo para entrenamiento físico incluyendo pesas, aros de basketball y bicicletas estacionarias. La mayoría del equipo estaba en malas condiciones o no había espacio para que se pudiera usar. Las pesas estaban en buen estado y podían ser usadas para entrenar. Los resultados completos de la encuesta sobre el equipo están en el Apéndice M.

Durante nuestro estudio de campo en el centro de recreación, recolectamos información sobre cuatro lugares que podrían ser utilizados para pruebas de acondicionamiento físico. Un mapa del centro se encuentra en el Apéndice Z. El primer lugar fue una cancha de fútbol que era de 95 m (314 pies) y 59 m (195 pies). Una foto del campo se encuentra en la Figura 38.

La segunda localización fue una pista de asfalto que cercaba la cancha de fútbol. La pista (que puede ser vista en la Figura 38), es de 3.1 m (10,2 pies) de ancho y de más de 100 m (330 pies) de largo.

Figura 38 – Cancha de Fútbol en el Centro de Recreación

El segundo y tercer lugar son dos canchas: de basketball y fútbol pavimentadas. Las dimensiones de cada una son de 30,5 m (100,7 pies) por 17,5 m (52,5 pies). Las Figuras 39 y 40 contienen fotos de las canchas.

Con mucho campo libre y con diferentes tipos de superficies, no debería haber problema al conducir un examen de acondicionamiento físico en el centro de recreación.

Figura 39 – Cancha de Basketball en el Centro de Recreación

Figura 40 – Cancha de Fútbol en el Centro de Recreación

8 Conclusiones y Recomendaciones

El capítulo siguiente contiene las conclusiones y recomendaciones alcanzadas, basadas estas en los datos y en el análisis presentado en el capítulo anterior de nuestro informe. Las conclusiones y las recomendaciones se presentan simultáneamente, pero el capítulo es dividido en secciones por diversos asuntos del programa de la salud. Dentro de cada sección, hemos descrito qué partes del programa ya están implementadas y los cambios que recomendamos con base en nuestra investigación.

De acuerdo con nuestras encuestas y las entrevistas en las diez estaciones iniciales, hemos determinado que existen suficientes datos para validar nuestras recomendaciones para un programa de la salud. Con nuestras recomendaciones, El Cuerpo de Bomberos puede proceder con sus planes para instituir el programa de salud en los diez parques de bomberos en el área del San José en julio 2000. El programa inicial será dirigido a todos los bomberos permanentes, y los bomberos voluntarios tendrán la oportunidad de participar en el programa tan pronto como sea posible y cuando los bomberos permanentes han adoptado completamente el programa.

Sin embargo, puesto que recibimos solamente una muestra de seis por ciento de bomberos del resto del país, recomendamos que El Cuerpo de Bomberos continúe una investigación más a fondo en los cuarenta y cinco parques de bomberos restantes antes de ejecutar completamente el programa de salud en el enero 2001. La investigación muestra que al tener un tamaño de muestra de menos del diez por ciento, esta puede no ser una representación exacta de los datos. Por lo tanto, el INS debe conducir la investigación

adicional en las estaciones restantes para determinarse si las tendencias que observamos en los seis por ciento que analizamos es exacto.

8.1 Entrenamiento Físico

A partir de nuestra investigación, concluimos que tener un administrador del programa es una parte importante del programa en sí. Parte del programa de entrenamiento físico de El Cuerpo de Bomberos será emplear a un entrenador físico que sea responsable del entrenamiento y de la educación sobre la salud. El entrenador será responsable de estas secciones puesto que él o ella tendrá un título en educación física y por lo menos cinco años de experiencia en el desarrollo y la puesta en práctica de un programa bienestar de salud, que demuestre su capacidad.

El Cuerpo de Bomberos está planeando emplear a un entrenador para las diez estaciones iniciales en el área del San José y tres más una vez que todas las estaciones en Costa Rica estén participando en el programa. Convenimos con el horario de la puesta en práctica porque el ensayo de seis meses entre julio 2000 y enero 2001 proporcionará a una oportunidad de realizar cualquier cambio necesario al programa antes de que este haya sido completamente implementado. Los parques de bomberos, de los cuales cada entrenador es responsable, serán agrupados geográficamente. Los entrenadores recibirán la información sobre sus deberes a partir de nuestra guía de la administración del programa de la salud (refiera a Apéndice O).

Durante las primeras dos semanas del programa experimental, el entrenador visitará dos estaciones al día, por dos horas cada una, para presentar el programa a los

bomberos. El entrenador visitará cada estación por dos días consecutivos para educar ambas rotaciones de bomberos. El objetivo en esta etapa es que las diez estaciones comiencen el programa en dos semanas.

Las primeras dos visitas a cada estación son cruciales. Si los bomberos pueden comenzar correctamente su entrenamiento, hay una mayor probabilidad de éxito para el programa. Durante las dos horas iniciales con cada rotación de bomberos, el entrenador explicará el programa de salud y su propósito. El entrenador explicará los componentes de los programas individuales del ejercicio de los bomberos, que consistirán en un calentamiento, estiramiento, ejercicio aeróbico, entrenamiento muscular, y un relajamiento. Los pasos se basan en nuestra investigación del entrenamiento físico y tratarán cada aspecto del bienestar de la salud incluyendo la composición del cuerpo, la flexibilidad, la aptitud cardiovascular, la fuerza muscular, y la resistencia muscular. El entrenador también determinará y explicará qué tan frecuentemente y cómo los bomberos participarán en el programa.

El entrenador va a visitar estaciones de las nueve hasta las once de la mañana, que serán las dos horas dedicadas al físico. Sugerimos que el programa de ejercicio esté conducido durante la mañana puesto que los bomberos comienzan su rotación de las veinticuatro horas hasta las ocho de la mañana; y el ejercicio al inicio de sus rotaciones vigorizará a los bomberos para el resto de su rotación. Puesto que los bomberos están en la estación de día por medio, podrán realizar su rutina de tres a cuatro veces por semana, lo que significa que nuestra investigación mostrada es suficiente.

Después de la introducción, el entrenador conducirá a los bomberos con un ejercicio minucioso de calentamiento de cinco a diez minutos, que será una cierta forma

de actividad ligera para activarse. El entrenador debe participar en los ejercicios para servir de ejemplo para los bomberos.

Una vez que se termine el calentamiento, el entrenador demostrará una rutina de estiramiento que los bomberos deben practicar al principio y fin de cada sesión del ejercicio. El estirar ayuda a prevenir lesiones y aumenta la flexibilidad. La escogencia de estos ejercicios estará en manos del entrenador puesto que él tendrá muchos años de experiencia con respecto al entrenamiento físico y es recomendable practicar una rutina determinada que él o ella enseñe. Sin embargo, si el entrenador quisiera algunos ejemplos de estiramientos apropiados, él o ella puede utilizar los ejemplos de estiramientos del manual de entrenamiento físico del bombero de Massachusetts que dejaremos con El Cuerpo de Bomberos. Sin importar cuáles son los ejercicios específicos, la rutina de estiramiento debe centrarse en estirar el cuerpo entero. Mientras que se efectúan los ejercicios, el entrenador debe explicar los efectos de los ejercicios sobre las parte del cuerpo.

Después de la rutina de estiramiento, el entrenador introducirá el componente aeróbico del. Durante la primera visita a cada estación, el entrenador pasará una lista de las actividades que se pueden realizar para el ejercicio aeróbico. El entrenador ayudará a cada bombero a seleccionar una actividad que calce bien con su rutina de entrenamiento. Durante la primera visita, el entrenador puede conducir un juego de fútbol como demostración del ejercicio aeróbico.

Los bomberos tendrán de cuarenta y cinco minutos a una hora para realizar ejercicio aeróbico. El tiempo para el ejercicio aeróbico es suficiente según nuestra investigación. El programa de ejercicios se debe basar en los intereses de los bomberos

los cuales concluimos a partir de las entrevistas personales que realizamos. Nuestros resultados mostraron que los bomberos tenían alto interés en la natación, los aeróbicos, el correr, el ciclismo, y el fútbol. Sin embargo, no limitarán a los bomberos a este conjunto de ejercicios, y si tienen un interés en otro ejercicio aeróbico, pueden hablar con el amaestrador para incorporar su ejercicio preferido en su programa.

Muchos bomberos también expresaron interés en realizar ejercicios en grupos. Este interés podía ser resuelto creando grupos de entrenamiento según interés o formando a equipos para los deportes competitivos tales como fútbol y baloncesto. Recomendamos que si hay recursos cerca de un parque de bomberos en el cual puedan realizar tal tipo de ejercicio, como un campo del fútbol o una cancha de baloncesto, los bomberos puede utilizarlos. Si los bomberos desean nadar como parte de su programa, deben poder utilizar los recursos en el centro de reconstrucción mencionado en la Sección 7.3 por lo menos una vez por semana. Estos recursos están abiertos a todos los empleados del Instituto Nacional de Seguros, incluyendo los bomberos.

Después de la rutina aeróbica del programa, el entrenador conducirá una clase corta en el entrenamiento de la fuerza, que incluirá una oportunidad de intentar los ejercicios del entrenamiento de la fuerza. Los ejercicios incluirán el calisténico y el levantamiento de pesas porque una combinación de los dos proporciona a un programa de entrenamiento bien-redondeado del peso. Más del noventa por ciento de los bomberos que entrevistamos afirmaron levantarían pesas si el equipo estuviera disponible. Como con los ejercicios de estiramiento, el entrenador elegirá los ejercicios del entrenamiento de la fuerza puesto que él estará bien informado sobre diversos ejercicios. También

como con los ejercicios de estiramiento, el entrenador tendrá la guía de Massachusetts para referirse a ella si él necesita ejercicios adicionales.

El entrenador supervisará los ejercicios de ensayo para asegurar que se lleven a cabo de la forma apropiada y contestar cualquier pregunta que los bomberos puedan tener. Recomendamos que el entrenador observe el uso que cada bombero le de al equipo con el fin de corregir cualquier problema para que los bomberos no se lesionen. También recomendamos que el entrenador deje un conjunto de tablas que expliquen los ejercicios en caso de que los bomberos necesiten la clarificación. El programa de entrenamiento del peso de cada bombero será registrado en las hojas del entrenamiento, que se pueden encontrar en el Apéndice Q. El entrenador explicará los conceptos del entrenamiento del peso tales como aumento gradual en peso y vigilará el progreso de cada bombero examinando las tablas del entrenamiento.

Las tablas son importantes porque pueden mostrar cómo los bomberos progresan en un cierto plazo. Por lo tanto, sugerimos que el fichero del entrenador este al alcance del El Cuerpo de Bomberos, para que este pueda observar los avances en el programa de entrenamiento. Un proyecto futuro de El Cuerpo de Bomberos podía ser vigilar la eficacia del programa de entrenamiento comparándolo con expedientes anteriores y actuales del entrenamiento. Las tablas también ayudarán al entrenador a determinarse si cada bombero está haciendo suficiente progreso. Si hay un problema con el progreso del individuo, el entrenador asignará una prescripción del ejercicio al bombero, que consistirá en cómo modificar su programa en términos de la cantidad, del tipo, y de la frecuencia del ejercicio. El entrenador concluirá su primera visita a cada estación conduciendo un estiramiento que puede consistir en una caminata corta de cinco a diez

minutos, y usando además los mismos ejercicios de estiramiento que fueron utilizados después del calentamiento.

Después de las primeras dos semanas, el entrenador pasará dos horas al día por dos días consecutivos en cada estación pero visitará solamente una estación un día. Tan pronto como el entrenador visite las diez estaciones, el ciclo de estaciones será relanzado. Puesto que el entrenador está solamente disponible para cada bombero una vez cada cuatro semanas, debe haber una manera para que los bomberos entren en contacto con al entrenador entre las visitas. Una solución sería proporcionar al acceso a E-mail tanto para el entrenador como para los bomberos de modo que los bomberos puedan comunicarse fácilmente con el entrenador. Cuando visitamos los parques de bomberos, notamos que habían computadoras en muchas de las estaciones. Dependiendo de la disponibilidad de estas en cada parque de bomberos, proporcionar E-mail a los bomberos podría implicar adquirir nuevas computadoras para las estaciones.

Una vez que la disponibilidad de las computadoras se haya solucionado, la aplicación el entrenamiento vía Internet los bomberos y el entrenador debe ser puesta en práctica. Junto con el acceso del E-mail, el entrenador debe tener una página en Internet con un listado de los métodos alternativos del para contactarlo, preguntas frecuentes acerca del entrenamiento, un espacio para discusión entre bomberos, conexiones a las paginas relacionadas con la salud, la información adicional del entrenamiento, y una fórmula que los bomberos pueden imprimir y llenar para registrar su progreso del entrenamiento. Una característica avanzada que se podría agregar a la página de Internet es la facilidad de introducir los datos de cada bombero a la página, y llevar mediante un servidor el progreso de los bomberos.

Otra solución a la infrecuencia del contacto entre el entrenador y los bomberos sería entrenar a un bombero en cada estación para servir como sub-entrenador. Este podría contestar preguntas sobre el bienestar y vigilar el progreso de cada programa de ejercicio. El jefe de esa estación seleccionaría y determinaría al sub-entrenador del entrenamiento en cada estación, el entrenador proporcionaría para este el entrenamiento necesario. El entrenador continuaría visitando estaciones cada cuatro semanas para introducir nuevos ejercicios y para proporcionar información adicional en cada programa individualizado del ejercicio. Una manera de suplir las visitas del amaestrador sería incluir una columna del entrenador en el boletín de noticias de El Cuerpo de Bomberos, Prueba de Fuego. La columna puede incluir la información sobre el progreso del programa, trivia de la salud, y un mensaje personal del entrenador.

Conducir el programa del levantamiento de pesas, los bomberos quieren necesitan el acceso al equipo de entrenamiento. Hay dos tipos de equipo que pueden ser utilizados: máquinas y pesos libres. Las máquinas proporcionan a un acercamiento simplista al levantamiento de pesas puesto que cada máquina realiza generalmente solamente un o algún tipos de ejercicio. Cambiar la cantidad de peso en una máquina implica el mover de una clavija para agregar o para restar pesos. Sin embargo, las máquinas del peso son abultadas, que podrían ser un problema puesto que los parques de bomberos no tienen muchos de espacio para el equipo. Los pesos libres son menos abultados, coste menos, y se pueden utilizar para más ejercicios que las máquinas. Los pesos libres trabajan los músculos más pequeños entre los grupos más grandes del músculo porque los músculos más pequeños se utilizan para balancear los pesos durante la elevación. Nuestra investigación ha mostrado que muchas estaciones tienen ya algunos pesos libres

(Apéndice M). Por estas razones, recomendamos el usar de pesos libres al de las máquinas. Un conjunto de pesos libres debe consistir en barbells, halterios, placas, y un banco. Los barbells y los halterios deben incluir dos barras cortas, una barra larga, y un conjunto de pesos que sume por lo menos 50 kilogramos o pesos de 110 libras. Debe haber un par de pesos de la dos y media libras o del un-kilogramo incluidos con el conjunto para aumentar pesos en incrementos pequeños. El banco debe tener un estante de la prensa del banco y una conexión para hacer extensiones de la pierna. El equipo debe también incluir una barra ajustable que pueda caber en umbrales y ser utilizado realizar lagartijas. Otro equipo útil es una tarjeta inclinada, para realizar abdominales de diferentes dificultades. En alrededor de la mitad de los parques de bomberos existe ya una tabla para realizar abdominales. La lista del equipo disponible en cada cuerpo de bomberos se enumera en el Apéndice M.

Comparamos las listas del equipo disponible con el equipo recomendado enumerado previamente para hacer el Apéndice S, una lista del equipo de entrenamiento necesitada para cada estación. Entrando en contacto con a vendedores del equipo del ejercicio de Costa Rica, nos dimos cuenta que el costo del equipo en el Apéndice S será cerca de 2.000.000 Colones ($7000) para las diez estaciones iniciales. El Instituto Nacional de Seguros comprará el equipo en 2001. Hasta ese tiempo, los parques de bomberos deben tener acceso a los recursos del levantamiento de pesas tales como clubs de la salud. Llamando a clubs en San José, determinamos el costo para un miembro mensual es cerca de 3.000 Colones ($10). De acuerdo con el costo para los miembros, El Instituto Nacional de Seguros pudo desviar más dinero para los miembros de los clubes a partir de julio hasta diciembre, cuando tendrían el del equipo. Por lo tanto,

recomendamos que El Instituto Nacional de Seguros compre el equipo cuanto antes para ahorrar el dinero.

8.2 Las Actividades Relacionadas con la Salud

Además de vigilar el progreso de los bomberos en sus programas del ejercicio del individuo, el entrenador dedicará algunas horas para conducir actividades educativas en la forma de clases. Las clases serán relacionadas con los asuntos más populares seleccionados por los bomberos en la encuesta que distribuimos a la muestra de los parques de bomberos en Costa Rica (refiera a Apéndice G). Algunos de los asuntos más populares incluyeron el manejo de la tensión, nutrición, salud mental tal como manipulación de la depresión y balancear dietas. Cerca de veinticinco por ciento de los bomberos fuman, lo que indica que los riesgos del cigarro debe también ser un asunto.

El entrenador decidirá si hay una necesidad de cualquiera asunto adicional. A petición de El Cuerpo de Bomberos, las clases serán llevadas a cabo cada dos meses en dos días consecutivos así que cada bombero puede atender. Durante cada día, los bomberos que no están en deber atenderán a la clase. Las clases ocurrirán en San José en un lugar que determinará El Cuerpo de Bomberos. Cuando en el resto del país se implemente el programa, El Cuerpo de Bomberos decidirá sobre otros sitios en diversas regiones de Costa Rica. La atención es obligatoria, y después de terminar una clase, los bomberos no tendrán que volver a llevarla. Después de un año, las clases serán relanzadas para los nuevos bomberos.

Los jefes de los bomberos deben llevar a cabo reuniones mensuales, con todos sus bomberos para discutir la información que han aprendido y retenido luego de las clases. Si El Cuerpo de Bomberos piensa que los bomberos no están reteniendo la información, los bomberos pueden tomar una prueba que pruebe el conocimiento que deben haber aprendido en las clases. Si los bomberos salen mal en la prueba, pueden ser requeridos volver a tomar por lo menos una de las clases. Sin embargo, no recomendamos exámenes porque como nuestros resultados de la encuesta mostraron, los bomberos pueden saber la información pero no saben demostrar su conocimiento. Los resultados de preguntas una, dos, y nueve en la encuesta ilustran este punto. Por lo tanto, recomendamos que en vez de pruebas, el entrenador realice concursos periódicamente en los que cada bombero exprese los varios asuntos cubrió en las clases mientras que están trabajando en la rutina de ejercicios. Con los concursos, el bombero tiene la oportunidad de explicar completamente lo que él o ella ha aprendido y el entrenador puede determinarse si él o ella necesita volver a tomar ciertas clases.

8.3 Pruebas de las Tareas Bomberiles

Usando las tres pruebas de tareas bomberiles que encontramos en los Estados Unidos e información de Ing. Ramos, diseñamos la prueba de las tareas bomberiles encontrada en el Apéndice X. La prueba será puesta en ejecución en las diez estaciones iniciales en y alrededor de San José y ampliada eventualmente a todos los parques de bomberos en Costa Rica.

La prueba será llevada a cabo en el centro de recreación del El Instituto Nacional de Seguros cerca de San José puesto que hay campos del fútbol y las canchas del baloncesto donde la prueba pueda ser llevada a cabo. Un mapa del lugar y de los eventos se encuentra en el Apéndice Z. El equipo necesitará ser portátil puesto que no hay techo para proteger el equipo contra la lluvia y puesto que el equipo es utilizado regularmente por los empleados de INS para la recreación. Recomendamos que El Cuerpo de Bomberos conduzca un proyecto futuro, para desarrollar nuevos centros de prueba a través del país así que los bomberos lejos de San José no tengan que viajar grandes distancias.

El primer funcionamiento de la prueba completa comenzará en diciembre y será impartido a todos los bomberos permanentes en las diez estaciones iniciales. Recomendamos que los bomberos de Costa Rica toman la prueba anualmente. Esto les dará oportunidad de entrenar para los acontecimientos ante los cuales son más débiles. También, si la prueba fuera dada más con frecuencia, no habría bastante tiempo de impartir la prueba a cada bombero en Costa Rica una vez que el programa se amplíe a las cincuenta y cinco estaciones.

Conduciendo la prueba con menos frecuencia presentaría problemas también. Más que un año darían a los bomberos demasiado tiempo para evaluar mientras tanto sus capacidades en todos los acontecimientos, que se relacionan directamente con sus trabajos. Por lo tanto, conducir la prueba cada año es la frecuencia más eficiente. Darán los jefes de bomberos en cada estación la responsabilidad de administrar y de evaluar la prueba a los bomberos de su estación una vez al año.

El entrenador físico no administrará la prueba porque con solamente un entrenador, o aún cuando el INS emplea tres más, administrando la prueba a aproximadamente 310 bomberos al año sería extremadamente difícil para uno o aún cuatro entrenadores. También, la adición de esta responsabilidad a la descripción de las funciones del entrenador aumentaría muy probablemente la cantidad que el entrenador esperaría para un sueldo. Los jefes de bomberos serán suficientes para administrar las pruebas porque necesitan solamente supervisar al bombero durante la prueba y medir el tiempo de cada acontecimiento. Sin embargo, puesto que hay actualmente solamente un sitio de prueba, que se sitúa cerca de San José, se permitirá a los jefes de bomberos en el área del San José administrar la prueba a los bomberos que vienen de estaciones lejos de San José. Esto es justificable puesto que, bajo la infraestructura del INS, los bomberos no pertenecen realmente a una estación determinada según lo descrito en la Sección 2.1.2 del informe.

Antes de que se administre la primera prueba, el INS y el entrenador físico deben llevar a cabo una reunión con todos los jefes de bomberos para explicar la prueba y los detalles que la acompañan de modo que sean capaces de administrar la prueba correctamente. Por ejemplo, el jefe necesitará ser mandado en cómo detectar muestras de la señal de socorro física o mental del bombero durante la prueba, de modo que puedan detener al bombero de continuar y posiblemente de causarse una lesión. También, el jefe de bomberos necesitará saber los tiempos exactos de cada acontecimiento y necesitará ser informado los detalles tales como cuándo comenzar la sincronización para cada acontecimiento. La reunión debe ser cerca de dos horas, durante las cuales la disposición

de la prueba en el centro de reconstrucción se explica de modo que los jefes tengan una buena comprensión de cómo necesitarán conducir la prueba.

Ideamos la prueba usando la lista de las tareas comunes que un bombero de Costa Rica puede necesitar, según lo establecido a nosotros por Ing. Esteban Ramos. Hemos presentado cada acontecimiento por separado en esta sección, la cual alineamos a continuación. En Costa Rica las tareas más importantes para los bomberos son: la reacción inicial ante una alarma, mover ventiladores a los edificios ardientes, mover mangueras, escalar escaleras, entradas forzadas, el subir, usando un gancho del techo, buscar a las víctimas del fuego y arrastrarlas a la seguridad.

La prueba de habilidad consiste en ocho pasos. Más de ocho harían la prueba demasiado larga, y puesto que es tal prueba físicamente y mentalmente agotadora, alargarla haría difícil para que los bomberos pasen. Menos de ocho no serían una buena representación de las tareas que los bomberos deben realizar durante su trabajo. Si el bombero no termina una de las tareas en el tiempo asignado, el administrador parará la prueba y el bombero fallará ese acontecimiento. El incidente de un acontecimiento no constituye el incidente de la prueba entera. Sin embargo, el bombero debe pasar seis de los ocho acontecimientos para pasar la prueba entera. El análisis razonado para no fallar a los bomberos que no pasan los ocho acontecimientos es que durante un fuego real, no es común que un bombero tenga que realizar cada uno de los ocho eventos por los que se establecen en la prueba.

Para tomar la prueba, cada bombero utilizará un chaleco de 7,7 kilogramos (17 libras), un tanque del aire, un casco, y guantes. El peso del chaleco que el desgaste de los bomberos fue determinado pesando el equipo que cada bombero debe desgastar al

combatir un fuego. Los 7,7 kilogramos no incluyen el peso del tanque del aire puesto que el bombero desgastará eso para todos excepto el acontecimiento pasado. Según lo estipulado por INS, el incidente de la prueba no constituye la pérdida de empleo. Sin embargo, si un bombero falla, lo o la requerirán modificar su programa de entrenamiento personal con el entrenador personal para mejorar en las áreas de la dificultad.

En aproximadamente tres años, el INS espera que cada bombero tenga un nivel de bienestar de la salud y de condición física donde se pueda requerir que cada bombero tome la prueba para seguir siendo un bombero. Habrá un periodo de descanso de cinco minutos que sigue el primer y séptimo acontecimiento puesto que ambos acontecimientos son aeróbicos fuertes. Un periodo de descanso ayudará a prevenir lesiones en los bomberos. Sin embargo no se permitirá a los bomberos más de treinta segundos entre el resto de los acontecimientos por tiempo del recorrido de la estación a la estación. El administrador no debe comenzar la estación siguiente hasta que hayan transcurrido los treinta segundos.

Aunque hemos incluido los tiempos para cada una de las pruebas, estos fueron tomados a partir de la una de las tres pruebas de los EEUU. Nos sentimos seguros en los tiempos que proponemos por dos razones. La primera es que las tres pruebas de las cuales tomamos los tiempos fueron desarrolladas después de muchos años de comprobar que los bomberos en EEUU tienen las mismas tareas que aquellos en Costa Rica. Nuestra segunda razón es que hemos recomendado al INS que conduzca una prueba de la prueba de habilidad usando a dos bomberos de cada uno de las diez estaciones iniciales que estén en la mejor condición física. El promedio de los tiempos logrados en cada acontecimiento de estos veinte bomberos determinará los tiempos para cada uno de los

acontecimientos para la prueba real. El jefe de cada parque de bomberos elegirá a los dos bomberos de su estación respectiva. Hemos enviado cartas a cada uno de los jefes de bomberos en las diez estaciones iniciales que explicaban el formato de la prueba. Hemos pedido que vuelvan al INS la forma incluida que nombraba a sus dos bomberos con la mejor condición física. De modo que el INS tenga los veinte bomberos en el expediente para la prueba. La prueba ocurrirá en agosto o septiembre 2000, y la primera administración oficial de la prueba de habilidad será en diciembre 2000.

A continuación presentamos una descripción de cada acontecimiento de la prueba de habilidad seguida por su descripción.

El Pre-evento

Este acontecimiento se diseña para simular los efectos de la adrenalina en un bombero cuando una alarma de incendio suena. El bombero comenzará este acontecimiento sentado en una silla, sin ningún equipo de encendido. En una cierta hora, desconocida al bombero, un alarmar o un cuerno sonará y requerirán saltar de la silla, ponerse el chaleco cargado de 7,7 kilogramos (17 libras), el tanque del aire, los guantes y el casco, y después se ejecuta al bombero al primer acontecimiento. En este acontecimiento no será medido el tiempo, no obstante un sentido de la urgencia es pertinente para simular los acontecimientos en una situación verdadera.

El pre-acontecimiento fue agregado porque durante las entrevistas, muchos bomberos expresaron preocupación por los estréses físicos y mentales del período inicial que seguía el alarmar. Por lo tanto, diseñamos este acontecimiento para ayudarles a aclimatarse a los efectos repentinos de la adrenalina.

Evento 1 – Subir Escaleras
En este evento, subir la escalera se diseña para dar al bombero una oportunidad de calentar sus músculos así como para medir la capacidad aeróbica del bombero. Este evento dura por lo menos 5 minutos durante los cuales requieran al bombero ascender y descender una escalera falsa de 13 escaleras, 11 veces sin usar las barandillas. El uso de las barandillas constituirá la pérdida del evento. En la conclusión de este evento, el bombero tendrá cinco minutos de descanso, durante los cuales el agua estará disponible.

El tiempo que un bombero tiene que ascender y desciende la escalera en el acontecimiento uno fue determinado de varios factores. El edificio más alto de Costa Rica es El Banco Nacional, teniendo veintidós pisos. Puesto que éste es la mayor cantidad de pisos que deberá subir un bombero en Costa Rica durante un incendio, nosotros utilizamos veintidós pisos como base. Hay aproximadamente trece escaleras en un tramo de escaleras así que multiplicamos estas dos cantidades para determinar el número total de escaleras que el bombero tendría que subir. Usando el paso en el cual un bombero que toma la prueba de Nueva York tendría que subir durante el evento del stepmill, nos determinamos que ascendente y descendiendo la escalera once veces en cinco minutos simularía las escaleras en el edificio más alto del país.

Evento 2 – Lleva Pesas
El peso que lleva este evento se diseña para simular las acciones que un bombero necesitaría tomar para colocar el generador o un ventilador del humo durante un fuego. En el comienzo de este acontecimiento, requerirán al bombero mover un aparato cargado 50 m (164 pies) de 43 kilogramos (94,8 libras). El bombero hará esto levantando el aparato por la manija proporcionada y arrastrándolo con la ayuda de las ruedas la distancia del conjunto. Las ruedas se significan para simular al otro bombero que estaría asistiendo normalmente a esta acción. Esta voluntad del acontecimiento dura 40 segundos. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.

El acontecimiento dos era incluido porque requieren a un bombero en Costa Rica llevar e instalar un ventilador y/o un generador durante un fuego. Determinamos el peso

43 kg (94,6 lb) pesando el generador que los bomberos utilizan. Nuestro equipo sugiere que un aparato con las ruedas en una cara esté utilizado para simular al segundo bombero que estaría ayudando normalmente con la tarea durante el fuego. Las ruedas deben ser bastante grandes para que el bombero no necesite agacharse para arrastrar el aparato cincuenta metros. De este modo, durante la prueba de habilidad el bombero realmente está utilizando la mitad de los cuarenta y tres kilogramos. Elegimos 50 m porque era una distancia razonable según nuestro análisis. La distancia real que un bombero tiene que llevar el equipo puede ser más o menos, dependiendo de donde se parquee el carro de los bomberos y de donde el ventilador o el generador necesita ser colocado.

Evento 3 – Arrastra una Manguera
Este acontecimiento consiste en movilizar la manguera. Se diseña para simular las acciones necesarias para arrastrar una manguera. Requerirán al bombero arrastrar a lo largo de 15,2 m (50 pies) de la manguera cargada de 4,4 centímetros (1¾ adentro) a través de un túnel en forma de "U" 15,2 m (50 pies) con un techo del 1.2 m (4 pies) en el plazo de 46,33 segundos. La presión de la manguera será fijada en 100 PSI. Una vez fuera del túnel, el bombero necesitará tirar del borde principal de la manguera el 15,2 m (50 pies) más allá de la salida del túnel, más allá de la línea marcada. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.

El evento tres se toma de la prueba de Nueva York puesto que la prueba es una buena simulación de las tareas que un bombero debe realizar al trabajar con una manguera. Las dimensiones de la manguera son iguales porque es el mismo equipo en ambos países, no obstante la presión que la manguera está fijada en es diferente porque nos informaron que 100 PSI es la presión media de una manguera cargada en Costa Rica. La presión en la manguera es simulada llenando la manguera de agua y afianzándola con abrazadera de cada extremo para la prueba.

Evento 4 – Entrada Forzada
Este evento consiste en la entrada forzada a través de una puerta exterior y de para entrar a un edificio ardiente. El bombero utilizará una almádena 5.4-kg (12-lb) para golpear un neumático 34,9 kg (77 lb) a través de un vector y de una parte posterior de la superficie del metal de los 3,8 m (12½ pie) usando su cara crítica (por ejemplo, si es zurdo, él está parado de modo que el izquierdo de su cuerpo sea perpendicular al neumático con la almádena que comienza alrededor de su hombro derecho). La almádena se debe hacer rotar con un movimiento continuo. El neumático no debe ser empujado. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.

Las dimensiones del vector en el evento cuatro tan bien como el peso del neumático se toman de la prueba de Nueva York mientras que la almádena 5,45 kg (12 lb) es de la prueba de Massachusetts. Aunque la prueba de Nueva York requiere al bombero mover el neumático solamente a la otra cara del vector, la prueba que recomendamos requiere al bombero moverlo hacia atrás también. Éste debe simular la fuerza requerida analiza no solamente una puerta, pero también romperse a través de una verja del metal que sea típica de la mayoría de las casas y de los edificios en Costa Rica. También, especificamos que el bombero debe utilizar su lado izquierdo si es derecho y viceversa porque si él puede hacerlo luego no será un problema

Evento 5 – Evento con Escaleras de Mano
En este evento se simula la capacidad de un bombero de colocar una escalera de 6,1 m (20 pies) contra una pared y de subir y de bajar una escalera de la extensión de los 7,3 m (24 pie) en el plazo de 22 segundos. En el comienzo del acontecimiento, el bombero agarrará el extremo de la escala de los 6,1 m (20 pie) (que será colocada en la tierra, perpendicular a la pared) y recorrerá él para arriba hasta que se inclina contra la pared. Él entonces procederá a la escala de la extensión, que será colocada contra la pared antes de que la prueba comience. El bombero después extenderá la escala de los 7,3 m (24 pie) a su extensión más completa y después la bajará inmediatamente. Ambas actividades se deben terminar en 22 segundos o constituirá la pérdida del evento. El bombero entonces tiene 30 segundos a proceder al evento siguiente.

El evento de la escalera descrito en el evento cinco fue tomado de la prueba de Nueva York a excepción de la tiempo de la prueba. Decidimos tomar veintidós segundos más que los 15,81 segundos en la prueba de Nueva York. Hicimos esto porque en la prueba de Nueva York, requiere al bombero levantar solamente la escalera de la extensión, y estamos requiriendo al bombero levantar y bajar la escala puesto que requerirán realice ambas acciones en un fuego verdadero. Puesto que esto agrega al tiempo que tomará al bombero para lograr la tarea, necesitamos aumentar el límite de tiempo. Calculamos que los 15,81 segundos dados un plazo en la prueba de Nueva York se podrían asumir para ser partido uniformemente entre las dos partes del acontecimiento de la escalera, así que nosotros agregamos siete segundos a los quince, y llegamos veintidós. Sin embargo, según lo mencionado arriba, los tiempos que proponemos no son críticos puesto que el INS cambiará muy probablemente estos después de su preprueba.

Evento 6 – Búsqueda

En este evento se busca simular la búsqueda de víctimas del incendio. Requieren al bombero navegar a través de un túnel oscuro de 24.4-m (80-pies) en el plazo de 95,66 segundos. El túnel es aproximadamente de 9 m (3 pies) y 1,5 m (5 pies) de par en par. En dos localizaciones en el túnel hay obstáculos en el suelo. Además de los obstáculos, en dos localizaciones, el túnel será reducido a partir de 1,5 m (5 pies) de par en par al 9 m (3 pies) de par en par. Requieren al bombero moverse a través del túnel en sus manos y rodillas. El bombero tendrá 30 segundos a proceder al evento siguiente.

Evento 7 – Rescate

Este evento simula las acciones necesarias para arrastrar a una víctima inconsciente que pesa 59,0 kilogramos (130 libras) del edificio ardiente o de la otra escena de la emergencia. El bombero tendrá 23,80 segundos para terminar este acontecimiento. Usando el túnel y la prueba de la manguera, el bombero agarrará el maniquí por la manija detrás del cuello y lo arrastrará a través del túnel al final del curso. El maniquí debe estar fuera del cuando finalice el tiempo. Después de este acontecimiento, darán el bombero cinco minutos un periodo de descanso que sigue este acontecimiento durante el cual habrá agua disponible.

Acontecimientos seis y siete son ambos tomados de la prueba de Nueva York. Sin embargo para las tres pruebas en los EEUU para el evento del rescate el peso del maniquí varía, decidíamos tomar 59,1 kilogramos (130 libras) porque es un peso razonable y no hay manera de determinar al peso medio de una persona en Costa Rica puesto que depende de altura y de edad. La manera como se decidió en EEUU fue examinando a los bomberos en el peso medio de una víctima del fuego a que tuvieron que llevar de un incendio. Si el INS desea un número más exacto que 59,1 kilogramos (130 libras), los recomendamos examinar a los bomberos de manera semejante.

Evento 8 – Gancho del Techo

En este evento, se simularan las acciones necesarias para utilizar un gancho del techo para tirar hacia abajo un techo después de un incendio. El bombero necesitará solamente desgastar el chaleco y los guantes cargados para este acontecimiento. El bombero tendrá que terminar 20 repeticiones en cuatro conjuntos del un-minuto.

En el comienzo del evento, el bombero asirá el primer poste que pone en la tierra y pondrá la extremidad del poste en la puerta con bisagras en el techo de los 2,4 m (8 pies) del aparato. Él o ella entonces empujará hacia arriba la puerta con bisagras, pesando 27,2 kilogramos (60 libras), levantando la puerta 15,2 centímetro (6 adentro). Él o ella después volverá el poste a la tierra y se trasladará inmediatamente encima al segundo poste suspendido desde el techo. El poste se asocia a un equilibrio contrario que pese 36,3 kilogramos (80 libras). Él o ella debe tirar del poste abajo de 15,2 centímetros (6 adentro) en el orden para el tirón a la cuenta. Él o ella debe empujar y cinco veces y tirar hacia adentro en forma de una secuencia. Requerirán al bombero realizar cuatro períodos del un-minuto de trabajo, en los cuales él intentará hacer tantas secuencias de movimiento como posible. Cada período del trabajo será seguido por un 30-segundo periodo de descanso. El bombero debe terminar un total de 20 repeticiones en la conclusión del cuarto conjunto. Él o ella puede no terminar más de 7 repeticiones durante uno de los cuatro conjuntos. Si él o ella hace más de 7, le o le acreditarán solamente para 7.

Hemos tomado los detalles para el acontecimiento ocho de la prueba de Massachusetts a excepción de la limitación de siete repeticiones por conjunto. Hemos utilizado mucha de información de la prueba de Nueva York porque fue desarrollada

luego de muchos años de extensa investigación. También, Massachusetts basó su prueba en la prueba de Nueva York, agregando a su credibilidad. La secuencia que elegimos para nuestra prueba, sin embargo, diferencia de todas las pruebas de los EEUU. La secuencia que recomendamos fue determinada por una entrevista con el Ingeniero Ramos en Costa Rica en las tareas típicas que un bombero debe realizar y la orden típica en la cual se realizan. El horario de la administración de las pruebas necesitará ser resuelto entre todas las estaciones dependiendo de su disponibilidad. Este aspecto será más importante cuando las cincuenta y cinco estaciones están implicadas desde las 310 permanentes, y 850 voluntarios necesitarán eventual programar dentro de cada año. Recomendamos eso una vez que un horario se establezca para todos los bomberos en el país, de que el resto del horario fijado para evitar el mismo problema cada año.

8.3 Las Examinaciones Médicas Actualmente

Una examinación médica completa es realizada a los bomberos por la división de Riesgos de Trabajo del INS cada seis meses. La examinación médica es muy completa, e incluye:

- Prueba del espirómetro del para probar la capacidad pulmonar
- Examen psicológico del bombero para verificar que el bombero está mentalmente apto para realizar su trabajo.
- La densitometría, para determinar la composición del cuerpo del bombero de la grasa, los huesos, músculo, y el colesterol.
- Capacidad muscular

- La prueba de sangre del
- Análisis de la columna vertebral

Puesto que la examinación médica actual es tan completa, recomendamos que El Cuerpo de Bomberos mantenga el examen médico. Esto se debe a que cada aspecto de la salud del individuo que se trata en el examen médico actual es importante para determinar la capacidad del bombero de realizar los deberes de su o su trabajo. Además, recomendamos que la frecuencia de seis meses de los exámenes siga siendo igual. Puesto que la lucha contra el fuego es tal, la condición física y mental de un bombero debe ser revisada semestralmente. El semestre es también un intervalo suficiente porque el peso y la salud del bombero pueden ser vigilados de cerca. El entrenador físico ofrecerá clases más educativas y ordenadas que las negociaciones informativas. Un componente que deberá ser agregado a los exámenes médicos es un gravamen de riesgo de salud. Los bomberos completaran un cuestionario similar al que está en el Apéndice U durante cada examen médico. El propósito del cuestionario es determinarse si los bomberos están en cualquier riesgo médico. Los datos de cada cuestionario se deben guardar para obtener datos sobre cada bombero individual y la población en su totalidad.

Recomendamos que El Cuerpo de Bomberos no pierda de vista la información y establezca un sistema de gerencia de datos electrónicos para los expedientes del bombero. Actualmente, hay una base de datos situada en el centro de comunicaciones para El Cuerpo de Bomberos. Si la misma base de datos no puede ser utilizada, después podría comprarse otra localidad para mantener los expedientes del bombero y utilizar las comunicaciones existentes del ordenador entre El Instituto Nacional de Seguros y el centro de comunicaciones. El Cuerpo de Bomberos puede analizar los datos para obtener

la información sobre la salud general de bomberos, para descubrir tendencias en el bienestar del bombero, y para vigilar las ventajas del programa de la salud.

Appendices

The following appendices provide additional information for the report. The information is located here so as not to disrupt the flow of the paper.

Appendix A – Mission and Organization of INS

El Instituto Nacional de Seguros, or INS, is responsible for selling all of the insurance policies in Costa Rica. INS serves the public with 11 agencies, 3 offices, and 21 dispatch locations throughout Costa Rica, and its headquarters is located in San José. Founded on October 30, 1924 by Tomas Soley Güel, INS is under the control of the executive branch of the government. However, it has remained a financially self-sustaining company through income from the sale of policies. Along with selling the actual policies, INS has the responsibility of reducing insurance claims and keeping costs to a minimum through preventative measures such as education, regulations, and investigations.

One of the branches of INS is El Cuerpo de Bomberos, which is responsible for all fire-related topics in Costa Rica including the administration of the firefighters. There are five departments in El Cuerpo de Bomberos: operations, administration, general services, engineering, and volunteer firefighters. For our project, we worked in San José with Juan Esteban Ramos González, assistant to the chief of the engineering department. Responsibilities of the department include fire investigations, revision of architectural plans for fire safety compliance, fire prevention education, and firefighter preparation. The engineering department had an interest in developing a physical training and

examination program to be included with firefighter preparation and as a preventative measure to keep costs to a minimum.

The Costa Rican Fire Department consists of 55 fire stations, approximately 310 paid and 850 volunteer firefighters, 13 paramedics, and 10 fire investigators. INS pays for a fraction of the fire department costs, and the rest of the funding comes from the government. The first fire department in Costa Rica was approved on July 27, 1865 after receiving its first fire pump from the United States. The fire department was eventually merged with the police department due to a lack of firefighters. However, the fire department grew in years to come as a result of insurance fraud. In 1921, some merchants with financial difficulties began burning their businesses in order to collect insurance money. In an effort to dissuade merchants from committing fraud, the government passed the Law of Insurance on October 2, 1922, which was meant to end fraud and apportion money to the fire service for purchasing equipment. As a result of this law and the population growth of San José, more fire fighting equipment was obtained, more firefighters was hired, and more trucks were purchased.

The fire department is responsible for extinguishing fires and providing relief from natural disasters such as floods and earthquakes. The fire department also administers programs for fire prevention and protection such as educating school children about the dangers of fires and giving the children tours of fire stations. The Costa Rican fire department strives for excellence, living by the motto of "Abnegation, honor, and discipline."

Appendix B – Physical Trainer Contract Letter (English)

San José, 29 May 2000
BOING – 419 - 2000

Señor
Juan Rafael Hidalgo
Administrative Chief of Firefighters
Present.

Estimado Señor:

The strategy for developing the Firefighter Physical Conditioning Program has been redefined in accordance with the Chief of Operations and the Chief of the Technical Subdivision. It is for this reason that we immediately request the Direct Contract of Firefighters 027-2000 that we have drafted with the intention of contracting the services of the Universidad Nacional.

It is for this political change and considering that to this date an offer has not been received, on top of the fact that the time limit of April 28 has expired with the University, that a draft of a new contract is requested with the following conditions:

OBJECTIVE OF THE CONTRACT:
To contract the professional services of a physical trainer to offer his services, according to the following details, to the firefighters of the stations noted with the objectives of:

- To contribute to the augmentation of the health and general well-being of the firefighter
- To prepare the firefighter to physically perform in accordance with the necessities of his own labors
- To enable the firefighter of INS to manage his own physical maintenance and functioning

ABOUT THE PHYSICAL TRAINER:

1. The minimum academic requirement is a bachelor's degree in Physical Education.

2. Experience of 5 years in the development and implementation of physical fitness programs.

ABOUT THE SERVICES THAT SHOULD BE OFFERED:

1. To establish a program of individual physical preparation for each of the firefighters in the following stations:

Station	Number of Firefighters
➢ 1. Central y paramedics	30
➢ 2. Barrio Luján	10
➢ 3. Barrio México	10
➢ 4. Guadalupe	8
➢ 5. Desamparados	11
➢ 6. Pavas	21
➢ 7. Tibás	14
➢ 8. Heredia	13
➢ 9. Cartago	10
➢ 10. Santo Domingo/OCO	15

For a total of 142 firefighters.

This program should include activities that develop the following capacities:

- ➢ Aerobic capacity
- ➢ Anaerobic capacity
- ➢ Flexibility
- ➢ Muscular strength and endurance
- ➢ Reaction time
- ➢ Agility

2. To conduct a daily visit in sequential form (one station each day, Monday through Friday) to fulfill a training session so that all members of the station participate actively. This activity should last 2 hours, during the morning at an agreeable time, can be carried out at the station or in a nearby location and should include activities that fulfill the following objectives:

    - ➢ Techniques that demonstrate the proper form for exercises
    - ➢ Instruction about hydration, nutrition, stress management, etc.
    - ➢ Motivational and recreational activities
    - ➢ Control and maintenance of the firefighters

3. To conduct meetings with each firefighter in which he will record the progress in the physical preparation.

4. To apply the physical preparation test every six months to each of the firefighters, according to what the Engineering Department of Prevention has established. The first test has been scheduled for December 2000.

BUDGET AND ECONOMIC CONTENT

The budget to be used is 02-58, payment to the honorary professionals, of 700,000 colones. However, it is possible to increase said sum if it is available in the general services budget.

It is important to solicit a quote for a monthly amount so that with this there is the option of carrying out the contract for the maximum time within the allowable budget.

Se despide atentamente,

Engineering in Prevention

Engineer Héctor Chaves León
Chief.

Cc: Eng. Héctor Monge Montero, Director of Firefighters
Sr. Dagoberto Arias, Technical Subdirector
Sr. Apolonio Rodriguez
Consecutivo / archivo
Expediente del Programa de preparación física.

Appendix C – Carta del Contrato de un Entrenador Físico (Español)

San José, 29 de mayo de 2000
BOING - 419 - 2000

Señor
Juan Rafael Hidalgo
Jefe Administrativo de Bomberos
Presente.

Estimado Señor :

La estrategia para desarrollar el Programa de Acondicionamiento Físico del Bombero ha sido redefinida en común acuerdo con la Jefatura de Operaciones y la Subdirección Técnica. Es por ello que le solicitamos dejar sin efecto el Contrato Directo de Bomberos 027-2000 el cual se confeccionó con la intensión de contratar los servicios de la Universidad Nacional.

Es por este cambio de política y considerando que hasta la fecha no se ha recibido la oferta de la Universidad, pese a que el plazo expiró el pasado 28 de abril, que se solicita la confección de un nuevo contrato con las siguientes condiciones:

OBJETIVO DEL CONTRATO:
Contratar los servicios profesionales de un preparador físico que brinde sus servicios, según se detalla adelante, dirigido a los Bomberos Permanente de las Estaciones señaladas y con el objetivo de:

- Contribuir en el mejoramiento de la salud y bienestar general del Bombero
- Preparar al bombero para que se desempeñe físicamente de acuerdo a las necesidades propias de las labores propias.
- Capacitar al bombero del INS para que sea gestor de su propio mantenimiento físico - funcional.

SOBRE EL PREPARADOR FISICO:

1. El grado académico mínimo es el de bachiller en Educación Física.

2. Experiencia de cinco años en el desarrollo e implementación de programas de preparación física.

SOBRE LOS SERVICIOS QUE SE DEBERÁN BRINDAR:

1. Establecer un programa de preparación física individual para cada uno de los bomberos de las siguientes Estaciones:

ESTACION	CANTIDAD
➢ 1. Central y paramédicos	30
➢ 2. Bario Luján	10
➢ 3. Barrio México	10
➢ 4. Guadalupe	8
➢ 5. Desamparados	11
➢ 6. Pavas	21
➢ 7. Tibás	14
➢ 8. Heredia	13
➢ 9. Cartago	10
➢ 10. Santo Domingo y OCO.	15

Para un total de 142 bomberos.

Este programa deberá contemplar actividades para el desarrollo de las siguientes capacidades:

- Capacidad aeróbica
- Capacidad anaeróbica
- Flexibilidad
- Fuerza y resistencia muscular
- Velocidad de reacción
- Agilidad

2. Efectuar una visita diaria en forma secuencial (una estación cada día de lunes a viernes) para realizar una sesión de entrenamiento. De forma tal que todos los miembros de la Estación participen activamente. Esta actividad tendrá una duración de dos horas, será durante la mañana según se convenga en un programa, se podrá

efectuar en la Estación o en un sitio cercano y deberá contemplar actividades tendientes a lograr los siguientes objetivos:

- Técnicos para que se enseñe la forma correcta de efectuar los ejercicios.
- Instructivos. hidratación, nutrición, manejo, etc.
- Motivacionales y recreativos
- Control y seguimiento.

3. Confeccionar una ficha técnica de cada bombero, en donde se registre los cambios en el estado de preparación física.

4. Aplicar la prueba semestral de preparación física a cada uno de los bomberos, según los lineamientos que el Departamento de Ingeniería en Prevención establezca. La primer prueba se ha previsto para el mes de diciembre del 2000.

PARTIDA PREPUESTRARÍA Y CONTENIDO ECONÓMICO

La partida presupuestaria a utilizar es la 02-58, pago de honorarios profesionales, con la cuál podríamos afrontar un gasto de hasta 700.000.oo colones para este año.

Es importante solicitar en el cartel que la cotización sea por un monto mensual para que de esta forma se pueda tener la opción de efectuar el contrato por el máximo de tiempo en función del presupuesto que se logre tener disponible.

Se despide atentamente,

INGENIERIA EN PREVENCION

Ing. Héctor Chaves León.
Jefe.

cc: Ing. Héctor Monge Montero, Director de Bomberos
Sr. Dagoberto Arias, Subdirector Técnico
Sr. Apolonio Rodríguez
consecutivo / archivo.
Expediente del Programa de preparación física.

Objective of the Test	Massachusetts	New York	Washington
	General: Must wear a weighted vest, equipment, and breathing apparatus.	***General:*** Must wear 25 lb. vest and gloves. No knee pads. Water available during 5 minute breaks. Usually 30 second breaks which must be taken exactly: no more, no less.	***General:*** Turnout coat (5.5 lb), hardhat, gloves, and full SCBA (34 lb) will be worn for every test except for the aerial ladder climb which only has a hardhat, gloves, and safety harness. A blackened facepiece is worn for the victim rescue.
To demonstrate the ability of a firefighter to climb stairs during a fire and to test aerobic capacity.	***Stair climb:*** One minute warm-up. Step on a stepmill for 200 seconds with a 5 minute rest period following. Can't hold the rail.	***Stepmill event:*** Walk on the stepmill at 59 steps/min for 5 minutes and 12 seconds. A one-minute warm-up period at a slower pace will be allowed before the test begins. A one-minute rest period will follow the warm-up to allow for adjustments. Can't hold the rail.	***Stair climb with equipment:*** Pick up a 1.5" wrapped hose weighting 57 lb and carry it up six flights of stairs. Place it on the floor at the top. Pick it up and carry it back down to the bottom of the stairs.
To demonstrate the ability of a firefighter to work with a ladder.	***Ladder event:*** Remove a ladder from a rack, carry it some distance, raise a weight of approximately 45 lbs attached to a rope that simulates raising an extension ladder, lower that weight,and return the ladder to the rack from which it was taken. Time limit is 35.56 seconds.	***Ladder raise:*** Raise a 20-foot ladder hinged at the base form its horizontal position on the floor to a vertical position. Extend a 24-foot ladder vertically. Time limit is 15.81 seconds.	***Ladder operations - carry:*** Remove a 12-foot ladder from a truck and carry it a distance of 50 feet, placing it against the Drill Tower so that the ladder tip is within the painted area. The ladder is then picked up, carried back and replaced onto the truck in its original position.
To test ladder extension ability.			***Ladder operations - extension:*** Extend a 30-foot ladder up the side of the drill tower and lower it without dropping it.
To test ability to relay hose to another firefighter.		***Hose feed:*** Advance 50 feet of "charged" 1.75 inch hose across a circular roller bed within 18.19 seconds.	
To demonstrate the ability of a firefighter to maneuver a fully-charged hose through obstacles.	***Hose advance:*** Pull 50 feet of hose through a U-shaped course with several turns. There will be a ceiling to prevent standing upright. Time limit is 20.00 seconds.	***Hose advance:*** Advance 50 feet of "charged" 1.75 inch hose through a u-shaped tunnel with 4-foot ceilings in 46.33 seconds or less.	***Charged line advance:*** Pick up and advance a charged 1.5" hoseline with a playpipe attached for a distance of 100 feet. The pump pressure is set at 130 psi.

Objective of the Test	Massachusetts	New York	Washington
To demonstrate the ability of a firefighter to ascend and descend a ladder without difficulty.			***Aerial ladder climb:*** Wearing a hardhat, gloves and harness attached to a safety line, candidate must climb to top of aerial ladder set at 60 degrees to a height of 50 feet and return to the turntable. Climbing up and down will be nonstop, and is an untimed event.
To simulate the ability and strength necessary to forcibly enter through a door.	***Forcible Entry:*** Strike a rubber pad mounted on a moveable post. Use a 12 lb sledge hammer to move the post 10 inches. Time limit is 13.91 seconds.	***Forcible entry:*** Pick up the 12-pound sledgehammer and hit a rubber pad that measures force. Continue to hit the pad until sufficient force has been applied. The time limit is 10.95 seconds	
To simulate searching for a victim in a fire.	***Search:*** Crawl through a dark wooden tunnel with obstructions and turns. The tunnel is approx. 65 feet long. The tunnel is 4 feet high and 4 feet wide. At one location there is an obstacle on the floor, and at another there is an obstacle on the ceiling. At two locations the tunnel is reduced from 4 to 3 feet in width. Time limit is 39.00 seconds.	***Search:*** Navigate a 3-foot high, 5-foot wide, 80-foot long tunnel in 95.66 seconds or less. There are two obstacles and two points where the tunnel width narrows to 3 feet. The test is completed when the other end of the tunnel is successfully reached.	***Victim rescue - confined space:*** Wearing a blackened face piece to block vision, navigate through the maze on hands and knees and exit at opposite end.
To simulate rescuing a victim in a fire.	***Rescue through a doorway:*** Drag a 125-pound dummy approx. 30 feet, along a zigzag course to a designated area at the end of the course. There is a low ceiling to prevent standing upright. Time limit is 36.00 seconds.	***Rescue:*** Drag a 130-pound dummy through a tunnel to safety in 23.80 seconds or less.	***Victim rescue - dummy drag:*** Drag a 165-pound human form dummy for a distance of 50 feet.

Objective of the Test	Massachusetts	New York	Washington
To demonstrate the ability of a firefighter to tear down ceilings or open walls while looking for hidden fires.	***Ceiling hook:*** Take a pike pole, tipped with an industrial hammer head, and thrust it upward at a metal plate in an 8 foot ceiling. The plate weighs approx. 60 lbs and must be lifted six inches in order for the strike to count. Step over to the next part of the event where a pike pole handle is suspended from a ceiling height. The pole is attached to a counter balance that weighs approx. 80 lbs. Pull the pole down 6 inches in order for the pull to count. Perform one push and 5 pulls in sequence. Perform four one-minute periods of work, in which you will do as many sequences as possible. Each work period will be followed by a 30-second rest period. Must complete 25 full repetitions.	***Ceiling hook:*** Take a pike pole, tipped with an industrial hammer head, and thrust it upward at a metal plate in a ceiling. The plate weighs approx. 60 lbs. and must be lifted a certain distance to count. Step over to the next part of the event where a pike pole handle is suspended from a ceiling height. The pole is attached to a counter balance that weighs approx. 80 lbs. Pull the pole down a certain distance in order for the pull to count. Perform one push and 5 pulls in sequence. Perform four one-minute periods of work, in which you will do as many sequences as possible. Each work period will be followed by a 30-second rest period. Must complete 20 full repetitions with no more than 7 counting per 1-minute session.	***Ceiling hook:*** Must complete 2 sets of repetitions on both 75-lb ceiling hook simulators (up and down). A complete stroke will emit a sound. The station monitor will count aloud each completed stroke. There are four sets each of six repetitions.
To demonstrate the ability of a firefighter to open and close a hydrant.			***Hydrant opening:*** Candidates use a hydrant wrench to open a hydrant completely (approx. 17 turns counterclockwise) and close it completely (approx. 17 turns clockwise).

Test Order: Same as above for MA and NY; Washington is 5, 9, 2, 3, 4, 1, 8, 6, 7

Objetivo de la prueba	Massachusetts	New York	Washington
	General: Se tiene que llevar un chaleco pesado, equipo y aparato de respirar.	***General:*** Se tiene que llevar un chaleco de 25 lb y guantes. Agua está disponible durante las pausas de 5 minutos.	***General:*** Se lleva una chaqueta (5.5 lb), casca, guantes, y SCBA (34 lb) para todos eventos salvo del evento de subir y bajar donde se tiene que llevar una casca, guantes, y un jaez de seguridad. Se lleva una máscara negra para el rescate
Para demostrar la capacidad del bombero subir escaleras durante un incendio.	***Subir escaleras:*** Se necesita subir un stairmaster por 200 segundos con 5 minutos de descansa	***Subir escaleras:*** Se necesita subir escaleras en un stairmaster con un ritmo de 59 escaleras por minuto en 5 minutos y 12 segundos. Hay un minuto para calentar y un minuto de descanso antes de empezar el evento. No se puede usar la barandilla.	
Para demostrar la agilidad del bombero manipular una escalera.	***Escalera de mano:*** Se tiene 35.56 segundos para llevar una escalera de manos alguna distancia. Entonces se tiene que levantar peso de 45 libras para simular el subir de un escalera de mano de extension.	***Escalera de mano:*** Se tiene que posicionar una escalera de mano de 20 pies en un pared. También, se tiene que extender y bajar una escalera de mano de 24 pies. Se tiene 15.81 segundos.	***Escalera de mano:*** Se necesita remover la escalera de mano de 12 pies de un maquina, llevarla por 50 pies, y ponerla contra del Torre Taladro. Entonces, se necesita devolverla al camion.
Para demostrar la capacidad del bombero manipular una manguero por un edificio llenado de fumo.	***Arrastrar una manguera:*** Se necesita halar una manguera de 50 pies a traves de un curso en forma de "U". Hay cielo para que no se pueda levantar. Se tiene 20 segundos.	***Arrastrar una manguera:*** Se tiene que arrastrar una manguera de 50 pies por un tunel con un techo de 4 pies en 46.33 segundos.	***Arrastrar una manguera:*** Se necesita arrastrar una manguera de diámetro de 1.5 pulgadas por 100 pies. La presion es 130 libras por pulgadas en cuadro.
Para demostrar la agilidad del bombero subir las escaleras con una manguera durante un incendio.		***Evento con una manguera:*** Se tiene que adelantar una manguera de 50 pies a través de una mesa con rodillos circulares en 18.19 segundos.	***Subir escaleras con una manguera:*** Se necesita llevar una manguera que pesa 57 libras de 1.5 pulgadas 6 pisos entonces ponerla en el piso. Después, se necesita bajar los 6 pisos con la manguera.
Para demostrar la capadidad del bombero manipular una escalera de mano.			***Apollar y bajar la escalera de mano:*** Se necesita apollarar la escalera de mano de 30 pies y entonces bajarla en una manera controlada sin dejar caerla.

Objetivo de la prueba	Massachusetts	New York	Washington
Para demostrar la agilidad del bombero subir y bajar una escalera de mano sin dificultad.			***Subir y bajar:*** Se lleva un casco, guantes, y guarniciones atado a una línea de seguridad. Se necesita subir la escalera de mano de 50 pies y entonces bajar sin ayuda. No se puede parar entre subir y bajar y esta prueba no tiene un cierto tiempo.
Para simular la capacidad y fuerza necesaria para entrar través de una puerta.	***Entrada forzada:*** Se usa un mazo de 12 libras para mover una plataforma de goma para simular la fuerza se necesita para entrar a traves de una puerta.	***Entrada forzada:*** Se necesita golpear un aparato que mide fuerza con un mazo de 12 libras. Se necesita continuar golpear el aparato hasta se usa la fuerza correcta. Se tiene 10.95 segundos.	
Para simular buscar por una víctima de un incendio.	***Busca:*** Requiere que se gatee a traves de un tunel oscuro con obstáculos y vueltas. El túnel es de 65 pies y tiene 4 pies de altura. Es ancho de 4 pies. Se tiene 39 segundos para completar.	***Busca:*** Se tiene que navegar por un tunel de 80 pies que está 3 pies de altura y 5 pies de anchura en 95.66 segundos. Hay dos obstáculos y dos puntos donde el tunel reduce a 3 pies.	***Busca:*** Se necesita navegar por un laberinto en los manos y rodillos hasta la salida.
Para simular rescatar una víctima de un incendio.	***Rescate:*** Se necesita arrastrar un manequí de 125 libras 50 pies a través de un curso en zigzag. Hay un cielo para prevenir levantarse y se tiene 36 segundos.	***Rescate:*** Se tiene que arrastrar un manequí de 130 libras por un tunel en 23.80 segundos.	***Rescate:*** Se necesita arrastrar un manequí de 165 libras por 50 pies.
Para demostrar la capacidad del bombero abrir camino después de un incendio.	***Gancho de cielo:*** Se necesita empujar un plato metálico de 60 libras que tiene 8 pies de altura con el gancho unas 6 pulgadas. Entonces, se necesita derribar un pértiga de 80 libras, 5 veces. Entonces, se repite estos ejercicios por un minuto, cuatro veces, con un descanso de 30 segundos despues de cada minuto. Se necesita completar 25 repeticiones.	***Gancho de cielo:*** El mismo como Massachusetts salvo que hay un límite de 7 repeticiones por juego.	***Gancho de cielo:*** Se necesita empujar y derribar el cielo que pesa 75 libras para simular el gancho de cielo. Se necesita completar dos repeticiones de cada. Hay 4 grupos de 6 repeticiones.

Objetivo de la prueba	Massachusetts	New York	Washington
Para demostrar la agilidad del bombero abrir y cerrar un hidrante. 17 veces es un promedio de veces para abrir o cerrar un hidrante.			***Abrir un hidrante:*** Se necesita abrir un hidrante con un llave de hidrante (aproximadente 17 turnos en el sentido de las agujas del reloj) y entonces se necesita cerrar el hidrante (aproximadente 17 turnos en el sentido contrario al de las agujas del reloj).

Orden de la Prueba: Como arriba para MA y NY; Washington es 5, 9, 2, 3, 4, 1, 8, 6, 7

Appendix F – Firefighter Survey (English)

Name of station: _____ Circle one: Permanent / Volunteer

Age: _____ Years of experience as a firefighter: _____

Height (in meters): _____

Weight (in kilograms): _____

Gender: male _____ female _____

1. What is your concept of physical conditioning?

2. In your opinion, what should be included in a physical conditioning program?

3. How many times and for how many hours a week should one train to be in good shape?

4. Instead of training, what are some other methods that improve health?

5. In your station, have you received information about health? Explain.

6. How would you define "target heart rate"?

7. How would you define muscular strength and muscular endurance?

8. How would you define flexibility?

9. Do you think that physical conditioning is synonymous with good health? Explain.

10. Do you smoke? Yes ____ No ____
If yes, how many cigarettes per day? _____

11. Do you drink alcoholic beverages? Yes ____ No ____
If yes, how many drinks per week? _____

12. Circle the activities in which you participate:

Running	Swimming
Walking	Tennis
Riding a bicycle	Racquetball
Climbing stairs	Soccer
Volleyball	Indoor soccer
Aerobics	Other(s) _____ __
Basketball	None

13. How many times and for how many hours per week do you participate in some kind of exercise? Times _____ Hours _____

14. Do you lift weights? Yes _____ No _____
If yes, how many times per week? _____

The following questions (15-17) involve the most important components of physical conditioning. En the scale, 1 represents that you have problems completing the requirements of your job while 5 represents that you have no problems completing the requirements of your job, in relation to the health aspect mentioned.

15. On a scale of 1-5, how is your cardiovascular condition? _____

16. On a scale of 1-5, how is your muscular strength and endurance? _____

17. On a scale of 1-5, how is your flexibility? _____

18. Does your job permit you to exercise during your shift? Yes _____ No _____
If yes, do you exercise? Yes _____ No _____
If yes, how many times per week? _____

19. Do you suffer any physical pain? Yes _____ No _____
If yes, explain the type of pain you suffer as well as the part of your body that suffers.

Appendix G – Encuesta de los Bomberos (Español)

Nombre de estación: _____ Dibuje un círculo: Permanente / Voluntario

Edad: _____ Años de experiencia como bombero: _____

Estatura (en metros): _____

Peso (en kilogramos): _____

Género: hombre _____ mujer _____

1. ¿Cuál es su concepto de acondicionamiento físico?

2. En su opinión, ¿qué se debe estar incluido en un programa de acondicionamiento físico?

3. ¿Cuántas veces y por cuántas horas por semana se debe entrenar para estar en buena forma?

4. En vez de entrenamiento, ¿cuáles son otros métodos para mejorar el nivel de salud?

5. En su estación, ¿ha recibido información sobre la educación de la salud? Explique.

6. ¿Cómo definiría usted un "óptimo ritmo cardiaco"?

7. ¿Cómo definiría usted la fuerza muscular y la resistencia muscular?

8. ¿Cómo definiría usted la flexibilidad?

9. ¿Cree usted que el acondicionamiento físico es sinónimo con la buena salud? Explique.

10. ¿Usted fuma? Sí _____ No _____
Si responde sí, ¿cuántos cigarrillos por día? _____

11. ¿Usted consume bebidas alcohólicas? Sí _____ No _____
Si responde sí, ¿cuántas bebidas por semana? _____

12. Dibuje un círculo sobre las actividades en que usted participa:

Correr	La natación
Caminar	El tenis
Montar bicicleta	Racquetbol
Subir escaleras	Fútbol
Volibol	Papifútbol
Los aeróbicos	Otra(s) _____
El basquetbol	Ningunas

13. ¿Cuántas veces y por cuántas horas por semana participa usted en algun tipo de ejercicio? veces_____ horas_____

14. ¿Usted levanta pesas? Sí____ No_____
Si responde sí, ¿cuántas veces por semana? _____

Las siguientes preguntas (15-17) se tratan de los components más importantes del acondicionamiento físico. En la escala, 1 representa que usted tiene problemas en completar los requisitos de su trabajo mientras 5 representa que usted no tiene ningunos problemas en completar los requisitos de su trabajo, en relación con el aspecto de la salud mencionado.

15. En una escala de 1-5, ¿cómo es su acondicionamiento cardiovascular? _____

16. En una escala de 1-5, ¿cómo es su resistencia y fuerza muscular? _____

17. En una escala de 1-5, ¿cómo es su flexibilidad? _____

18. ¿Le permite su trabajo hacer ejercicios durante su turno? Sí ____ No _____
Si responde sí, ¿hace ejercicios? Sí____ No _____
Si responde sí, ¿cuántas horas por semana? _____

19. ¿Sufre Ud. de alguna dolencia física? Sí _____ No_____
Si responde sí, explique qué tipo de dolor tiene usted y que parte del cuerpo la sufre.

Appendix H – Personal Interview (English)

Station: _____

Gender: male ____ female _____

Circle one: Permanent or Volunteer

What activities would you like to see in a physical conditioning program?

Would you like to learn more about health, such as nutrition, mental health, stress management, and things like this? Something in particular?

If the station offered access to weight lifting equipment, would you use it?

If the station offered informative classes about health, would you attend them?

Appendix I – Entrevista Personal (Español)

Estación: _____

Género: hombre ____ mujer ____

Dibuje un circulo: Permanente o Voluntario

¿Cuáles actividades quisiera ver en un programa de acondicionamiento físico?

¿Quisiera aprender más sobre la salud, como nutrición, la salud de la mente, el manejo de la tensión y cosas así? Algo en particular?

Si la estación ofrece acceso a equipo para levantar pesas, ¿lo usaría?

Si la estación ofrezca clases informativas sobre la salud, ¿asistiría?

Appendix J – Equipment Survey (English)

General Information:

Name of Fire Department: _____

Number of Employees: _____

Equipment Information:

Number	Desciption	Condition	Other
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

KEY

Description: include name of equipment along with the quantity of the equipment

Options for **Condition**:
1 = not usable or repairable
2 = not usable but repairable
3 = heavily used and in need of replacement
4 = moderately used but not in need of replacement
5 = like new

Options for **Other**: special circumstances, such as off-site equipment, temporarily available equipment

Appendix K – Encuesta del Equipo (Español)

Información general:

Nombre de la estación: _____

Número de empleados: Permanentes_____ Voluntarios_____

Información del equipo:

Número	Descripción	Condición	Otro
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Observaciones

Descripción: incluye el nombre del equipo con la cantidad de equipo

Opciones para **Condición**:
1 = no funciona ni se puede reparar
2 = no funciona pero se puede reparar
3 = está muy usado y necesita ser reemplazado
4 = es usado pero no necesita ser reemplazado
5 = es nuevo

Opciones para **Otro**: circunstancias especiales, como equipo afuera de la estación y disponible por tiempo limitado

Appendix L – Summary of Available Fitness Training Equipment (English)

	Perm.	Vol.	Weight Lifting Equipment			Cardiovascular Equipment			Other		
Barrio Luján	10	6								No equipment	
Barrio México	10	12								No equipment No space available Firefighters bring own equipment	
Cartago	10	27	Bench press/leg bench C=4	Weights: 15lb (4) 10lb (4) 5lb (2) C=4		Stairmaster C=4	Exercise bicycle C=4	Ping pong table (w/o paddles or ball) C=4	Inclined situp rack (w/o board)	Ab machine C=4	Indoor soccer goals (20m x 15m) (2) C=4
									Basketball hoop (needs net) 7m radius to play C=4		
Central	15	20	Universal machine C=3	Weight benches (need pads) (3) C=3	Inclined weight bench C=3		Exercise bicycle C=3		Mirrors (.5m x 1.30m) (2) C=4	Inclined situp bench C=4	Basketball hoop (needs net, backboard) 5m radius to play C=3
			Weight bench (w/o rack, needs seat) C=3	Preacher curl machine (needs pad) C=4	Squat rack C=3						
			Tricep machine C=4	Weights: 35kg (8) 25kg (2) 10kg (6) 5kg (5) 9.2kg (1) C=4	Weight bar (5) C=4						
Desamparados	11	10							Basketball hoop, 5m radius to play C=4	Indoor and outdoor soccer fields	Pool
									Exercise club		
Guadalupe	8	15		Shoulder/universal machine C=5					Soccer field C=4	Basketball court (full court) C=4	
Heredia	13	14	Lat pulldown C=3	Weights: 20kg (2) 30kg (2) 50kg (2) 2.3kg (8) 4.6kg (6) C=4	Barbell bar (2) C=4 Barbells (3) C=4	Treadmill C=1	Exercise bicycle C=4		Jumprope C=1	Basketball court (1 hoop), 5m radius to play C=4	

	Perm.	Vol.	Weight Lifting Equipment			Cardiovascular Equipment			Other		
			Squat rack C=4	Dumbbells 5kg (2) Dumbbells 5lb (1) C=4	Benchpress (2) C=4						
Pavas	21	25	Universal machine C=4	Benches (3) C=4	Bench press (2 bars) C=4					Soccer/hockey goals (1m x 1m) (2) C=4	
			Dumbbell 10lb C=4	Weights: 5lb (2) 25lb (2) 35lb (2) 45lb (2) C=4							
Santo Domingo/OCO	15	21	Dumbbells 7.5lb (2) C=5	Weights: 4.6kg (2) 9.2kg (14) 12.4kg (4) C=4	Bars (2) C=4	Treadmill (missing band) C=1	Stationary bike C=3		Multi-setting sit-up board w/padding C=4		
Tibas	14	25								No equipment	

**Note: "C" represents condition of each set of equipment.
1: Does not function and cannot be repaired
2: Does not function but can be repaired
3: Used frequenly and needs to be replaced
4: Used but does not need to be replaced
5: New

Numbers in parenthesis represent quantity and/or dimensions
"Other" category represents equipment other than weight lifting and cardiovascular that is either in the station or relatively close by

	Perm.	Vol.	Equipo para Levantar Pesas			Equipo Cardiovascular			Otra		
Barrio Luján	10	6								No hay equipo	
Barrio México	10	12								No hay equipo No hay espacio Los bomberos traen equipo para entrenar	
Cartago	10	27	Un sillón de empujar/piernas C=4	Pesas: 15lb (4) 10lb (4) 5lb (2) C=4		Una máquina para subir escaleras C=4	Una bicicleta estacionaria C=4	Una mesa de ping pong (sin pedales y bola) C=4	Un sillón inclinado de abdominales	Una máquina para los músculos del abdomen C=4	Metas de papifútbol (20m x 15m) (2) C=4
									Un aro de baloncesto (necesita un neto) redonda de 7m para jugar C=4		
Central	15	20	Una máquina universal C=3	Sillones de pesas (nececsitan conjincillos) (3) C=3	Un sillón inclinado de pesas C=3		Una bicicleta estacionaria C=3		Espejos (.5m x 1.30m) (2) C=4	Un sillón inclinado de abdominales C=4	Un aro de baloncesto (necesita un neto, backboard) redonda de 5m para jugar C=3
			Un sillón de pesas (sin estante, necesita conjincillos) C=3	Curl inclinado para biceps (necesita cojincillos) C=4	Un estante en cuclillas C=3						
			Una máquina de triceps C=4	Pesas: 35kg (8) 25kg (2) 10kg (6) 5kg (5) 9.2kg (1) C=4	Una barra de pesas (5) C=4						
Desamparados	11	10							Un aro de baloncesto, redonda de 5m para jugar C=4	Canchas de fútbol y papifútbol	Piscina
									Un club de ejercicios		

	Perm.	Vol.	Equipo para Levantar Pesas			Equipo Cardiovascular			Otra		
Guadalupe	8	15		Una máquina universal/de hombros C=5					Una cancha de fútbol C=4	Una cancha de baloncesto (de talla amplia) C=4	
Heredia	13	14	Lat pulldown C=3	Pesas: 20kg (2) 30kg (2) 50kg (2) 2.3kg (8) 4.6kg (6) C=4	Una barra para levantar pesas (2) C=4 Halterios (3) C=4	Rueda de andar C=1	Una bicicleta estacionaria C=4		Saltar a la comba C=1	Una cancha de baloncesto (1 aro), redonda de 5m para jugar C=4	
			Un estante en cuclillas C=4	Halterios 5kg (2) Halterios 5lb (1) C=4	Sillones de empujar (2) C=4						
Pavas	21	25	Una máquina universal C=4	Sillones (3) C=4	Un sillón de empujar (2 barras) C=4					Metas de fútbol/hockey (1m x 1m) (2) C=4	
			Halterio 10lb C=4	Pesas: 5lb (2) 25lb (2) 35lb (2) 45lb (2) C=4							
Santo Domingo/OCO	15	21	Halterios 7.5lb (2) C=5	Pesas: 4.6kg (2) 9.2kg (14) 12.4kg (4) C=4	Barras (2) C=4	Rueda de andar (sin banda) C=1	Una bicicleta estacionaria C=3		Un sillón de abdominales C=4		
Tibas	14	25								No hay equipo	

**Nota: "C" representa la condición de cada grupo de equipo.
1: No funciona ni puede ser reparado
2: No funciona pero puede ser reparado
3: Usado y necesita ser repuesto
4: Usado per no necesita ser repuesto
5: Nuevo

Los números en los paréntesis representar la cantidad y/o las dimensiones
La "Otra" categoría representa el equipo otra de levantar pesas y cardiovascular que está en la estación o cerca de la estación

Appendix N – Administrative Guide for Physical Fitness Trainer (English)

Physical Fitness Training

Responsibilities of the trainer:

- For the first two weeks, visit two stations a day for two hours each; visit each station for two consecutive days to introduce the program to all firefighters

- Visits will be from 9-11 in the morning
    - During these visits:
        - Introduce yourself
        - Explain the wellness program and its purpose
        - Explain the components of the individual exercise programs
            Warm-up
            Stretching
            Aerobic exercises
            Muscular training
            Cool-down
        - Explain how often the firefighters will exercise

- After the introduction, lead them through a sample regimen (performing the exercises yourself to set an example):
    - 5-10 minutes of warm-up exercises (such as jogging)
    - Stretching routine (refer to Massachusetts physical training manual for ideas)
        -Explain which muscles each stretch focuses on
    - Aerobic exercises
        - Give them a list of acceptable aerobic exercises
        - Help them choose an activity that they like and that will fit into their training schedule
        - For the first visit, as an example, conduct a game of indoor soccer
        - Firefighters should perform aerobic exercises for 45 minutes to an hour
    - Strength training (calisthenics and weight lifting)
        - Refer to Massachusetts physical training manual for ideas
        - Demonstrate proper form of each exercise
        - Supervise to insure proper form and to answer questions
    - Leave a set of training charts (see Appendix P) that explain the exercises
        - Explain the concept of gradually increasing weights
        - Monitor each firefighter's progress through the charts
        - File every training chart with El Cuerpo de Bomberos to monitor progress over time
        - When problems arise, assign individualized exercises to

firefighters to focus on weak areas
- Cool-down (for example, a short walk)
- Use stretches from warm-up

- After the first two weeks, spend two hours a day for two consecutive days at each station, but only one station per day

- To increase communication:
  - Establish E-mail
  - Establish web site
  - Train a firefighter at each station (a wellness director) that can assist in the physical training of firefighters and answer any questions that they might have
  - Write health and fitness related articles for *Prueba de Fuego*

Health-Related Activities

Responsibilities of the trainer:

- Conduct classes related to topics selected by firefighters
  - Example topics include:
    Stress management
    Nutrition
    Balanced diets
    Mental health (for example, handling depression)
  - Classes held every two months on two consecutive days so all firefighters can attend
  - Firefighters will attend the hour-long class on their free day

Task-Related Testing

Responsibilities of the trainer:

- Hold a meeting with El Cuerpo de Bomberos and all the fire chiefs to train the fire chiefs on how to administer the test

- Details of the test:
  - Held at el Centro de Recreos (see Appendix Z for layout)
  - Given annually to all firefighters
  - Be aware of signs of physical or mental distress of the firefighter during the test
    - Discontinue the test if any signs are noted to prevent injury to the firefighter
  - Take note of exact times of each event
    - Exceeding the time limit constitutes failure of the event
    - Firefighter must pass 6 out of 8 events to pass overall
    - There is a 5-minute rest period following events 1 and 7 (timing

for the next event should not begin until the 5 minutes has expired)
    - There is a 30-second delay between all other events for travel time (timing for next event should not being until the 30 seconds has expired)
- Firefighter will wear a 7.7 kg vest, air tank, helmet and gloves for all except the last event (he will not wear the air tank for the last event)
- Failure of the test does not constitute loss of employment
    - Trainer should take note of events that were failed and modify the firefighter's training program accordingly

- A pre-test should be administered before the first official administration of the test to determine the times of each event (refer to the recommendations chapter of the report for details)

Appendix O – Guía Administrativa para el Entrenador Físico (Español)

Acondicionamiento Físico

Responsabilidades del entrenador:

- Para las primeras dos semanas, visite cada estación por dos días consecutivos; visite dos estaciones por día por dos horas cada una para introducir el programa a todos los bomberos

- Las visitas tendrán lugar desde las 9 hasta las 11 de la mañana
    - Durante estas visitas:
        - Se presente
        - Explique el programa de bienestar y el propósito
        - Explique los componentes de los programas individuales de ejercicios
            Calentamiento
            Estiramiento
            Ejercicios aeróbicos
            Entrenamiento de los músculos
            Enfriamiento
        - Explique con que frecuencia los bomberos harán ejercicios

- Después de la introducción, el entrenador demonstrará con un ejemplo de ejercicios (debe hacer los ejercicios para que los bomberos vean la forma correcta):
    - 5-10 minutos de calentamiento (por ejemplo, trotar)
    - Estiramiento (refiera a la guía de acondicionamiento físico de Massachusetts para ejemplos)
        -Explique cuáles músculos trabajar con cada estiramiento
    - Ejercicios aeróbicos
        - Dar una lista de ejercicios aeróbicos
        - Ayudar a escoger una actividad que les gusta y que llevará bien en el horario de entrenamiento
        - Para la primera visita, por ejemplo, puede hacer un juego de papifútbol
        - Los bomberos deben hacer ejercicios aeróbicos entre 45-60 minutos
        - Entrenamiento de fuerza (calisténicos y levantamiento de pesas)
        - Refiera a la guía de acondicionamiento físico de Massachusetts para ejemplos
        - Demuestre la forma correcta de cada ejercicio

- Supervise para asegurar la forma correcta y para responder a preguntas
- Deje un juego de reportes de entrenamiento que explique los ejercicios
- Explique el concepto de aumentar las pesas para levantar pesas
- Supervise el progreso de cada bombero con los reportes
- Archive todos los reportes en la estación de Bomberos para monitorear el progreso del bombero
- Cuando aparecen problemas, asigne ejercicios individuales a los bomberos para enfocar en los áreas débiles de los bomberos
- Enfriamiento (por ejemplo, caminata)
- Use los estiramientos del Calentamiento

- Después de las primeras dos semanas, pase dos horas un día por dos días consecutivos en cada estación, pero solamente una estación por día

- Para mejorar comunicación entre el entrenador y los bomberos:
  - Establezca correo electrónico
  - Establezca una página del Internet
  - Entrene un bombero en cada estación (un director de bienestar) que puede ayudar en el entrenamiento físico de los bomberos y responder a cualquiera preguntas que ellos tienen
  - Escriba artículos sobre la salud y acondicionamiento físico para *Prueba de Fuego*

Actividades Sobre la Salud

Responsabilidades del entrenador:

- Enseñe clases relacionadas con los tópicos escogidos por los bomberos
  - Ejemplos de tópicos incluye:
    - Manejo de estrés
    - Nutrición
    - Alimentación
    - Salud mental (por ejemplo, la depresión)
  - Clases tendrán cada dos meses en dos días consecutivos para que todos los bomberos puedan asistirlas
  - Los bomberos asistirán a clase (de una hora) en su día libre

La Prueba de Tareas Bomberiles

Responsabilidades del entrenador

- Tenga una reunión con El Cuerpo de Bomberos y todos los jefes para entrenarlos en administrar la prueba

- Detalles de la prueba:
    - Tendrá lugar en el Centro de Recreación
    - Administrado cada año a todos los bomberos
    - Cuidado con las señales de agotamiento físico y mental del bombero durante la prueba
    - Descontinúe la prueba si el bombero da muestras de fatiga para prevenir dolencias al bombero
    - Note los tiempos exactos de cada evento
        - Sobrepasar el límite de tiempo constituye malogro del evento
    - El bombero necesita tener éxito en 6 de los 8 eventos para ser aprobado en la prueba
    - Hay un descanso de 5 minutos después de los eventos 1 y 7 (el tiempo para el próximo evento no debe empezar hasta que termina los 5 minutos)
    - Hay un descanso de 30 segundos entre los otros eventos para llegar al próximo evento (el tiempo para el próximo evento no debe empezar hasta que termina los 30 segundos)
    - El bombero llevará un chaleco de 7.7 kg, un cilindro de aire, casco, y guantes por todos los eventos a excepción del último (no llevará el tanque de aire)
    - Malograr la prueba no constituye perder el trabajo
    - El entrenador debe anotar los eventos en que el bombero no tuvo éxito y modificar el programa de entrenamiento para ese bombero

- Realizar una práctica de la prueba antes de la oficial para determinar los tiempos de cada evento (refiere al capítulo de recomendaciones del informe para detalles)

Appendix P – Fitness Training Chart (English)

Weekly Log: Calisthenics and Aerobics

Date of First Day of Week: _____ Weight: _____

Training Week Number: _____

Number of Repetitions (#) or Time (T)				
Exercise	Session 1 Date:	Session 2 Date:	Session 3 Date:	Session 4 Date:

Note: From "Massachusetts Fire Departments Physical Ability Test Preparation Guide" by the Commonwealth of Massachusetts Human Resources Division, 1998.

Appendix Q – Reporte del Acondicionamiento (Español)

Registrar Semanario: Calisténticos y Aeróbicos

Fecha del primer día de la semana: _____ Pesa: _____

Número de la semana de entranamiento: _____

Número de Repeticiones (#) o Tiempo (T)				
Ejercicio	Sesión 1 Fecha:	Sesión 2 Fecha:	Sesión 3 Fecha:	Sesión 4 Fecha:

Nota: De "Massachusetts Fire Departments Physical Ability Test Preparation Guide" por el Commonwealth of Massachusetts Human Resources Division, 1998.

Appendix R – Recommended Fitness Training Equipment (English)

Barrio Luján:
1 kg - 50 kg weight set
Barbells – 1 bar
Dumbbells – 2
Bench press rack w/leg extensions
Pull-up bar
Inclined sit-up bench

Barrio México:
1 kg - 50 kg weight set
Barbells – 1 bar
Dumbbells – 2
Bench press rack w/leg extensions
Pull-up bar
Inclined sit-up bench

Cartago:
1 kg - 50 kg weight set
Barbells – 1 bar
Dumbbells – 2
Pull-up bar
Board for inclined sit-up bench

Central:
1 kg - 50 kg weight set
Dumbbells – 2
Pull-up bar
Rack, pads and seat for weight bench

Desamparados:
1 kg - 50 kg weight set
Barbells – 1 bar
Dumbbells – 2
Bench press rack w/leg extensions
Pull-up bar
Inclined sit-up bench

Guadalupe:
1 kg - 50 kg weight set
Barbells – 1 bar
Dumbbells – 2
Pull-up bar
Inclined sit-up bench

Heredia:
1 kg weight set
Pull-up bar
Inclined sit-up bench

Pavas:	1 kg - 50 kg weight set Pull-up bar Inclined sit-up bench
Santo Domingo/ OCO:	1 kg - 50 kg weight set Leg extension machine Pull-up bar
Tibas:	1 kg - 50 kg weight set Barbells – 1 bar Dumbbells – 2 Bench press rack w/leg extensions Pull-up bar Inclined sit-up bench

Appendix S – Equipo Recomendado para Entrenar (Español)

Barrio Luján:
Juego de pesas de 1 kg a 50 kg
Una barra para levantar pesas – 1 bar
Halterios – 2
Un sillón de empujar/piernas
Una barra para dominadas en barra fija para dorsales
Un sillón inclinado de abdominales

Barrio México:
Juego de pesas de 1 1 kg a 50 kg
Una barra para levantar pesas – 1 bar
Halterios – 2
Un sillón de empujar/piernas
Una barra para dominadas en barra fija para dorsales
Un sillón inclinado de abdominales

Cartago:
Juego de pesas de 1 kg a 50 kg
Una barra para levantar pesas – 1 bar
Halterios – 2
Una barra para dominadas en barra fija para dorsales
Board for Un sillón inclinado de abdominales

Central:
Juego de pesas de 1 kg a 50 kg
Halterios – 2
Una barra para dominadas en barra fija para dorsales
Rack, pads and seat for weight bench

Desamparados:
Juego de pesas de 1 kg a 50 kg
Una barra para levantar pesas – 1 bar
Halterios – 2
Un sillón de empujar/piernas
Una barra para dominadas en barra fija para dorsales
Un sillón inclinado de abdominales

Guadalupe:
Juego de pesas de 1 kg a 50 kg
Una barra para levantar pesas – 1 bar
Halterios – 2
Una barra para dominadas en barra fija para dorsales
Un sillón inclinado de abdominales

Heredia:
Juego de pesas de 1 kg
Una barra para dominadas en barra fija para dorsales
Un sillón inclinado de abdominales

Pavas:	Juego de pesas de 1 kg a 50 kg Una barra para dominadas en barra fija para dorsales Un sillón inclinado de abdominales
Santo Domingo/ OCO:	Juego de pesas de 1 kg a 50 kg Máquina de extensión de las piernas Una barra para dominadas en barra fija para dorsales
Tibas:	Juego de pesas de 1 kg a 50 kg Una barra para levantar pesas – 1 bar Halterios – 2 Un sillón de empujar/piernas Una barra para dominadas en barra fija para dorsales Un sillón inclinado de abdominales

Appendix T – Health Risk Questionnaire (English)

Name _____

Station _____

Age _____ Weight _____

Height _____

Do you smoke? Yes ____ No _____

If so, how many cigarettes per day? _____

Do you drink alcoholic beverages? Yes ____ No ____

If so, how many drinks per week? _____

How many times a week do you participate in some exercise/activity/sport each week? _____

For how long each time do you participate in this exercise/activity/sport? _____

Do you suffer from a type of physical pain? Yes ____ No____

If yes, what part of your body?

Has anyone in your family ever suffered from any of the following? Circle any that apply:

Heart problems
Asthma
Epilepsy
High cholesterol
High blood pressure

Explanation:

Appendix U – Cuestionario de Riesgos de la Salud (Español)

Nombre _____

Estación _____

Edad _____ Pesa _____

Estatura _____

¿Ud. fuma? Sí ____ No _____
Si responde sí, ¿cuántos cigarillos por día? _____

¿Ud. consuma bebidas alcohólicas? Sí ____ No ____
Si responde sí, ¿cuántas bebidas por semana? _____

¿Cuántas veces por semana participa en un tipo de ejercicio/actividad/deporte cada semana? _____

¿Por cuánto tiempo participa en este ejercicio/actividad/deporte cada vez? _____

¿Sufre Ud. de alguna dolencia física? Sí _____ No _____
Si responde sí, ¿qué parte del cuerpo la sufre?

¿Hay una persona en su familia que sufre ahora o en el pasado cualquier problema de esta lista? (Haga un círculo sobre los que aplican)

Problemas del corazón
Asma
Epilepsia
Colesterol alto
Presión arterial alto

Explicación:

Appendix V – Task-Related Test (English)

Pre-event

This event is designed to simulate the adrenaline rush a firefighter experiences when a fire alarm sounds. The firefighter will begin this event seated in a chair, without any equipment on. At some time, unknown to the firefighter, an alarm or horn will sound and the firefighter will be required to jump out of the chair, put on the 7.7 kg (17 lb) weighted vest, the air tank, the gloves and the helmet, and then run to the first event. This event will not be timed, however a sense of urgency is pertinent in order to simulate the events in a real situation.

Event 1 – Stair Climb

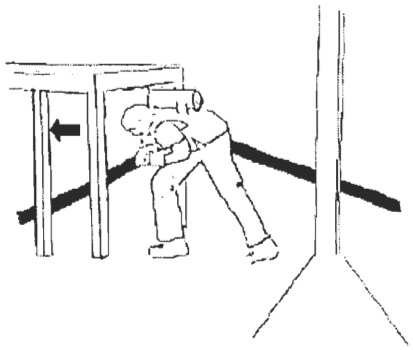
This event is designed to give the firefighter a chance to warm up his or her muscles as well as to measure the firefighter's aerobic capacity. This event will last for 5 minutes during which the firefighter will be required to ascend and descend a mock staircase of 13 stairs, 11 times without using the handrails. Use of the handrails will constitute failure of the event. At the conclusion of this event, the firefighter will have a 5-minute rest-period, during which water will be available.

Event 2 – Weight carry

This event is designed to simulate the actions a firefighter would need to take to position a generator or a smoke ventilator during a fire. At the start of this event, the firefighter will be required to move a 43 kg (94.8 lb) weighted apparatus 50 m (164 ft). He or she will do this by lifting the apparatus by the handle provided and dragging it with the assistance of the wheels the set distance. The wheels are meant to simulate the other firefighter who would normally be assisting in this action. This event will last for 40 seconds. The firefighter will have 30 seconds to proceed to the next event.

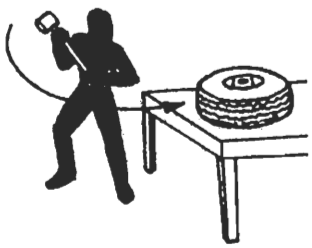
Event 3 – Hose drag

This event is designed to simulate the actions necessary to drag a charged hose to a fire. The firefighter will be required to drag 15.2 m (50 ft) of charged 4.4 cm (1¾ in) hose through a 15.2-meter (50-foot) U-shaped tunnel with a 1.2-m (4-ft) ceiling within 46.33 seconds. The pressure of the hose will be set at 100 psi. Once outside the tunnel, the firefighter will need to pull the leading edge of the hose 15.2m (50 ft) past the exit of the tunnel, past the marked line. The firefighter will have 30 seconds to proceed to the next event.



Event 4 – Forced entry

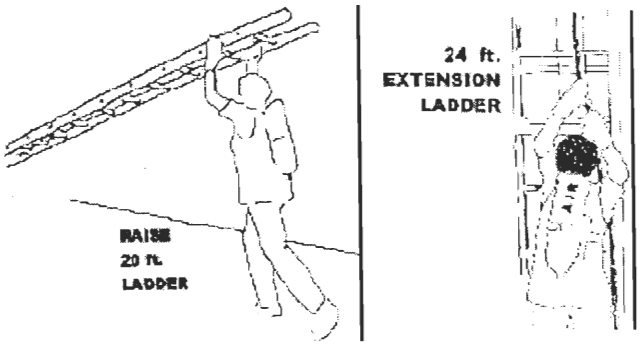
This event simulates the actions necessary to break through an outside gate and a door to gain entrance to a burning building. The firefighter will use a 5.4-kg (12-lb) sledgehammer to hit a 34.9-kg (77-lb) tire across a 3.8-m (12½-ft) metal surface table and back using his or her critical side (for example, if left-handed, he or she stands so that the left side of his or her body is perpendicular to the tire with the sledgehammer starting around his or her right shoulder). The sledgehammer must be swung with one continuous motion. The tire must be struck, not pushed. The firefighter will have 30 seconds to proceed to the next event.



Event 5 – Ladder event

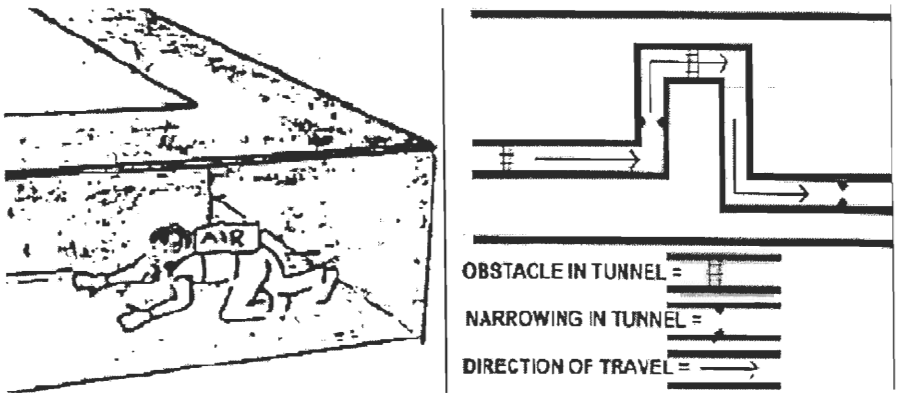
This event simulates a firefighter's ability to position a 6.1-m (20-ft) ladder against a wall and then extend and lower a 7.3-m (24-ft) extension ladder within 22 seconds. At the start of the event, the firefighter will grasp the end of the 6.1-m (20-ft) ladder (which will

be positioned on the ground, perpendicular to the wall) and walk it up until it leans against the wall. He or she will then proceed to the extension ladder, which will be positioned against the wall before the test begins. The firefighter will then extend the 7.3-m (24-ft) ladder to its fullest extension and then lower it immediately following. Both activities must be completed in 22 seconds or it will constitute failure of the event. The firefighter then has 30 seconds to proceed to the next event.



Event 6 – Search

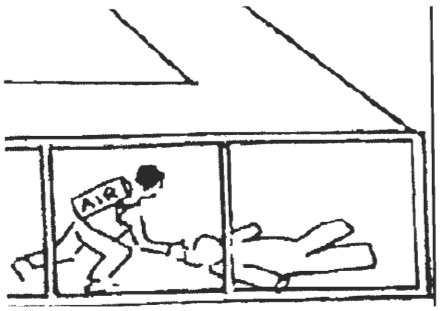
This event is designed to simulate looking for victims of fires. The firefighter is required to navigate through a 24.4-m (80-ft) dark enclosed tunnel within 95.66 seconds. The tunnel is approximately .9 m (3 ft) high and 1.5 m (5 ft) wide. At two locations in the tunnel there are obstacles on the floor. In addition to the obstacles, at two locations, the tunnel will be reduced from 1.5 m (5 ft) wide to .9 m (3 ft) wide. The firefighter is required to move through the tunnel on his or her hands and knees. The firefighter will have 30 seconds to proceed to the next event.



Event 7 – Rescue

This event simulates the actions necessary to drag an unconscious victim weighing 59.1 kg (130 lb) from a burning building or other emergency scene. The firefighter will have 23.80 seconds to complete this event. Using the tunnel from the hose drag event, at the

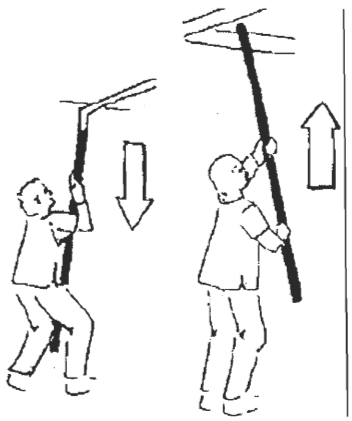
start of the event, the firefighter will grasp the dummy by the handle behind the neck and drag it through the tunnel to the end of the course. The dummy must be out of the tunnel for time to stop. After this event, the firefighter will be given a 5-minute rest period following this event during which water will be available.



Event 8 – Ceiling hook

This event simulates the actions necessary to use a ceiling hook to pull down a ceiling after a fire. The firefighter will only need to wear the weighted vest and gloves for this event. The firefighter will have to complete 20 repetitions in four one-minute sets.

At the start of the event, the firefighter will grab the first pole laying on the ground and place the tip of the pole on the hinged door in the 2.4-m (8-ft) ceiling of the apparatus. He or she will then push up the hinged door, weighing 27.2 kg (60 lb), lifting the door 15.2 cm (6 in). He or she will then return the pole to the ground and immediately move over to the second pole suspended from the ceiling. The pole is attached to a counter balance that weighs 36.3 kg (80 lb). He or she must pull the pole down 15.2 cm (6 in) in order for the pull to count. He or she must perform one push and five pulls in a sequence. The firefighter will be required to perform four one-minute periods of work, in which he or she will try to do as many push-pull sequences as possible. Each work period will be followed by a 30-second rest period. The firefighter must complete a total of 20 repetitions at the conclusion of the fourth set. He or she may not complete more than 7 repetitions during one of the four sets. If he or she does more than 7, he or she will only be credited for 7.



Appendix W – Prueba de las Tareas Bomberiles (Español)

El Pre-evento

Este acontecimiento se diseña para simular los efectos de la adrenalina en un bombero cuando una alarma de incendio suena. El bombero comenzará este acontecimiento sentado en una silla, sin ningún equipo de encendido. En una cierta hora, desconocida al bombero, un alarmar o un cuerno sonará y requerirán saltar de la silla, ponerse el chaleco cargado de 7,7 kilogramos (17 libras), el tanque del aire, los guantes y el casco, y después se ejecuta al bombero al primer acontecimiento. En este acontecimiento no será medido el tiempo, no obstante un sentido de la urgencia es pertinente para simular los acontecimientos en una situación verdadera.

Evento 1 – Subir Escaleras

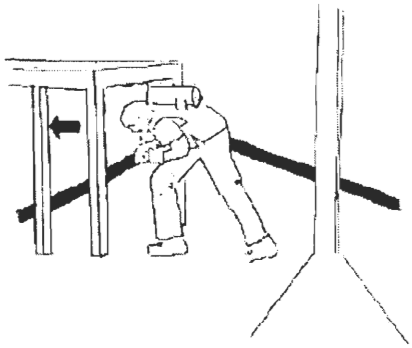
En este evento, subir la escalera se diseña para dar al bombero una oportunidad de calentar sus músculos así como para medir la capacidad aeróbica del bombero. Este evento dura por lo menos 5 minutos durante los cuales requieran al bombero ascender y descender una escalera falsa de 13 escaleras, 11 veces sin usar las barandillas. El uso de las barandillas constituirá la pérdida del evento. En la conclusión de este evento, el bombero tendrá cinco minutos de descanso, durante los cuales el agua estará disponible.

Evento 2 – Lleva Pesas

El peso que lleva este evento se diseña para simular las acciones que un bombero necesitaría tomar para colocar el generador o un ventilador del humo durante un fuego. En el comienzo de este acontecimiento, requerirán al bombero mover un aparato cargado 50 m (164 pies) de 43 kilogramos (94,8 libras). El bombero hará esto levantando el aparato por la manija proporcionada y arrastrándolo con la ayuda de las ruedas la distancia del conjunto. Las ruedas se significan para simular al otro bombero que estaría asistiendo normalmente a esta acción. Esta voluntad del acontecimiento dura 40 segundos. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.

Evento 3 – Arrastra una Manguera

Este acontecimiento consiste en movilizar la manguera. Se diseña para simular las acciones necesarias para arrastrar una manguera. Requerirán al bombero arrastrar a lo largo de 15,2 m (50 pies) de la manguera cargada de 4,4 centímetros (1¾ adentro) a través de un túnel en forma de "U" 15,2 m (50 pies) con un techo del 1.2 m (4 pies) en el plazo de 46,33 segundos. La presión de la manguera será fijada en 100 PSI. Una vez fuera del túnel, el bombero necesitará tirar del borde principal de la manguera el 15,2 m (50 pies) más allá de la salida del túnel, más allá de la línea marcada. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.



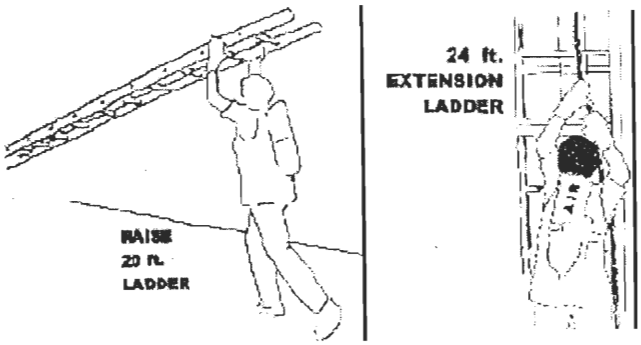
Evento 4 – Entrada Forzada

Este evento consiste en la entrada forzada a través de una puerta exterior y de para entrar a un edificio ardiente. El bombero utilizará una almádena 5.4-kg (12-lb) para golpear un neumático 34,9 kg (77 lb) a través de un vector y de una parte posterior de la superficie del metal de los 3,8 m (12½ pie) usando su cara crítica (por ejemplo, si es zurdo, él está parado de modo que el izquierdo de su cuerpo sea perpendicular al neumático con la almádena que comienza alrededor de su hombro derecho). La almádena se debe hacer rotar con un movimiento continuo. El neumático no debe ser empujado. El bombero tendrá 30 segundos a proceder al acontecimiento siguiente.

Evento 5 – Evento con Escaleras de Mano

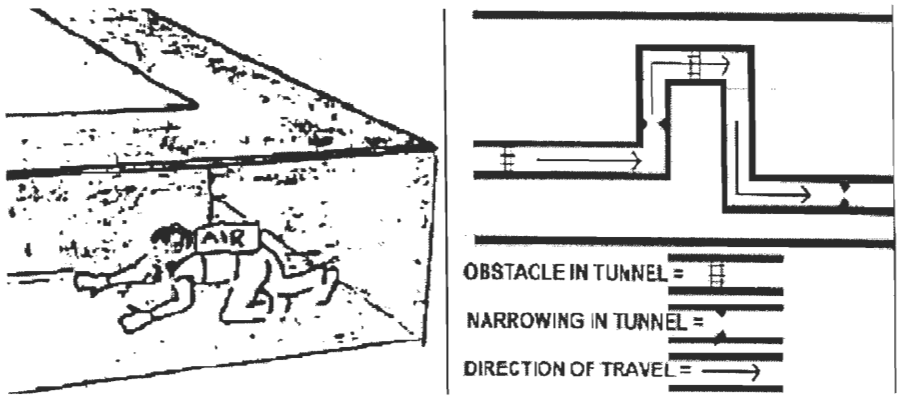
En este evento se simula la capacidad de un bombero de colocar una escalera de 6,1 m (20 pies) contra una pared y de subir y de bajar una escalera de la extensión de los 7,3 m (24 pie) en el plazo de 22 segundos. En el comienzo del acontecimiento, el bombero

agarrará el extremo de la escala de los 6,1 m (20 pie) (que será colocada en la tierra, perpendicular a la pared) y recorrerá él para arriba hasta que se inclina contra la pared. Él entonces procederá a la escala de la extensión, que será colocada contra la pared antes de que la prueba comience. El bombero después extenderá la escala de los 7,3 m (24 pie) a su extensión más completa y después la bajará inmediatamente. Ambas actividades se deben terminar en 22 segundos o constituirá la pérdida del evento. El bombero entonces tiene 30 segundos a proceder al evento siguiente.



Evento 6 – Búsqueda

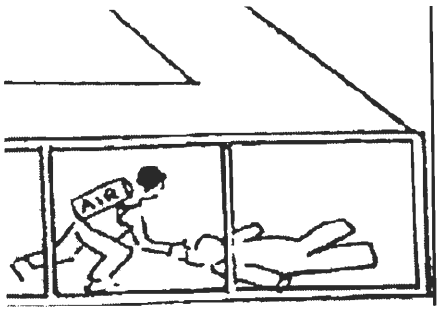
En este evento se busca simular la búsqueda de víctimas del incendio. Requieren al bombero navegar a través de un túnel oscuro de 24.4-m (80-pies) en el plazo de 95,66 segundos. El túnel es aproximadamente de 9 m (3 pies) y 1,5 m (5 pies) de par en par. En dos localizaciones en el túnel hay obstáculos en el suelo. Además de los obstáculos, en dos localizaciones, el túnel será reducido a partir de 1,5 m (5 pies) de par en par al 9 m (3 pies) de par en par. Requieren al bombero moverse a través del túnel en sus manos y rodillas. El bombero tendrá 30 segundos a proceder al evento siguiente.



Evento 7 – Rescate

Este evento simula las acciones necesarias para arrastrar a una víctima inconsciente que pesa 59,0 kilogramos (130 libras) del edificio ardiente o de la otra escena de la

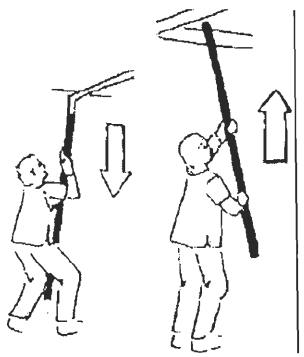
emergencia. El bombero tendrá 23,80 segundos para terminar este acontecimiento. Usando el túnel y la prueba de la manguera, el bombero agarrará el maniquí por la manija detrás del cuello y lo arrastrará a través del túnel al final del curso. El maniquí debe estar fuera del cuando finalice el tiempo. Después de este acontecimiento, darán el bombero cinco minutos un periodo de descanso que sigue este acontecimiento durante el cual habrá agua disponible.



Evento 8 – Gancho del Techo

En este evento, se simularan las acciones necesarias para utilizar un gancho del techo para tirar hacia abajo un techo después de un incendio. El bombero necesitará solamente desgastar el chaleco y los guantes cargados para este acontecimiento. El bombero tendrá que terminar 20 repeticiones en cuatro conjuntos del un-minuto.

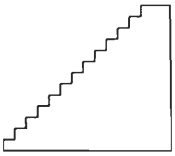
En el comienzo del evento, el bombero asirá el primer poste que pone en la tierra y pondrá la extremidad del poste en la puerta con bisagras en el techo de los 2,4 m (8 pies) del aparato. Él o ella entonces empujará hacia arriba la puerta con bisagras, pesando 27,2 kilogramos (60 libras), levantando la puerta 15,2 centímetro (6 adentro). Él o ella después volverá el poste a la tierra y se trasladará inmediatamente encima al segundo poste suspendido desde el techo. El poste se asocia a un equilibrio contrario que pese 36,3 kilogramos (80 libras). Él o ella debe tirar del poste abajo de 15,2 centímetros (6 adentro) en el orden para el tirón a la cuenta. Él o ella debe empujar y cinco veces y tirar hacia adentro en forma de una secuencia. Requerirán al bombero realizar cuatro períodos del un-minuto de trabajo, en los cuales él intentará hacer tantas secuencias de movimiento como posible. Cada período del trabajo será seguido por un 30-segundo periodo de descanso. El bombero debe terminar un total de 20 repeticiones en la conclusión del cuarto conjunto. Él o ella puede no terminar más de 7 repeticiones durante uno de los cuatro conjuntos. Si él o ella hace más de 7, le o le acreditarán solamente para 7.



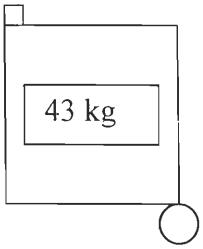
Appendix X – Task-Related Test Equipment (English)

Pre-event – Alarm sound: Chair
Alarm/horn
Equipment for firefighter – 17-lb vest, air tank, helmet and gloves

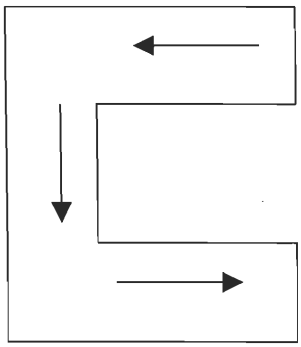
Event 1 – Stair climb: Construct a one-flight set of stairs (13 stairs)



Event 2 – Weight carry: 43 kg weight mounted with wheels on one side and a handle on the other



Event 3 – Hose drag: 50 feet of 1¾" charged hose
50-foot U-shaped tunnel with 4-foot ceiling

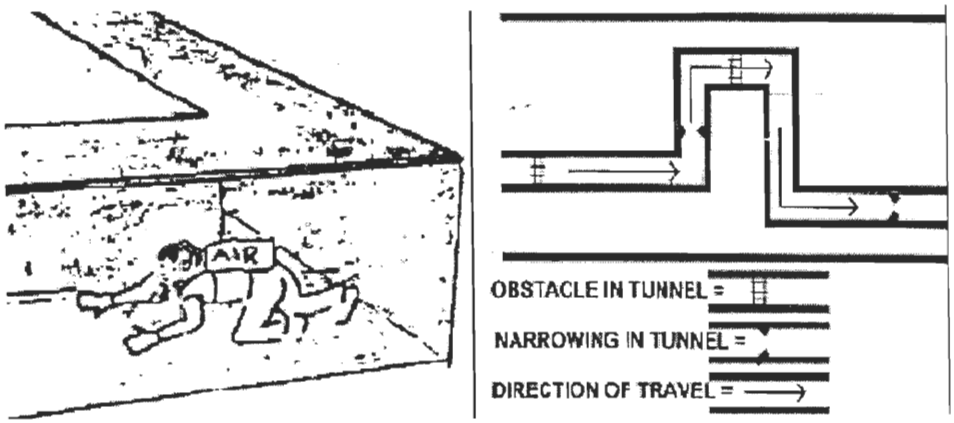


Event 4 – Forced entry: 12-lb sledgehammer
77-lb tire
12½-foot metal surface table

Event 5 – Ladder raise: 20-foot ladder

24-foot extension ladder
2 cinder blocks (to hold extension ladder in place)

Event 6 – Search: 80-foot darkened tunnel, 3 feet high, 5 feet wide



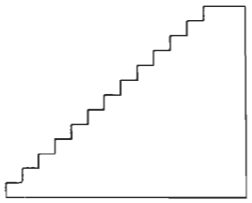
Event 7 – Rescue: Use tunnel from hose drag
130-pound dummy

Event 8 – Ceiling hook: Apparatus with an 8-foot ceiling
Door in ceiling with a 60-lb weight attached
Pike pole attached to a counter balance weighing 80 lb
Unattached pole tipped with an industrial hammer head

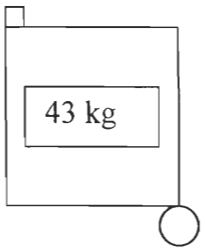
Appendix Y – Equipo de la Prueba de Tareas Bomberiles (Español)

Pre-evento – Suena el timbre: Silla
Timbre
Equipo para el bombero – chaleco de 7.7 kg (17lb), tanque de aire, casca, y guantes

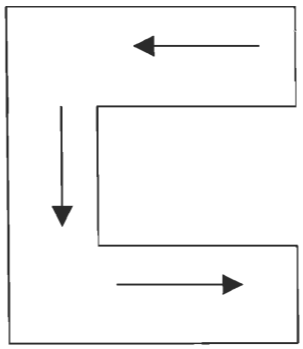
Evento 1 – Subir escaleras: Construya un tramo de escaleras (13 escaleras)

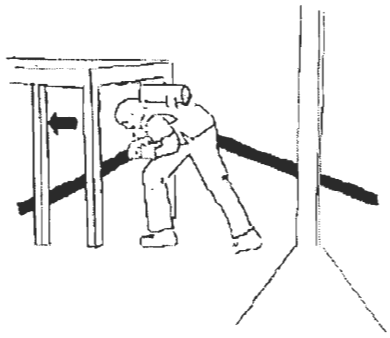


Evento 2 – Lleva pesas: Un aparato de 43 kg con ruedas en un lado y un tirador en el otro lado



Evento 3 – Arrastra una manguera: Una manguera de 50 pies de longitud y un diámetro de 1¾ pulgadas
Un tunel de la forma de "U" de 50 pies y con un techo de 4 pies de altura

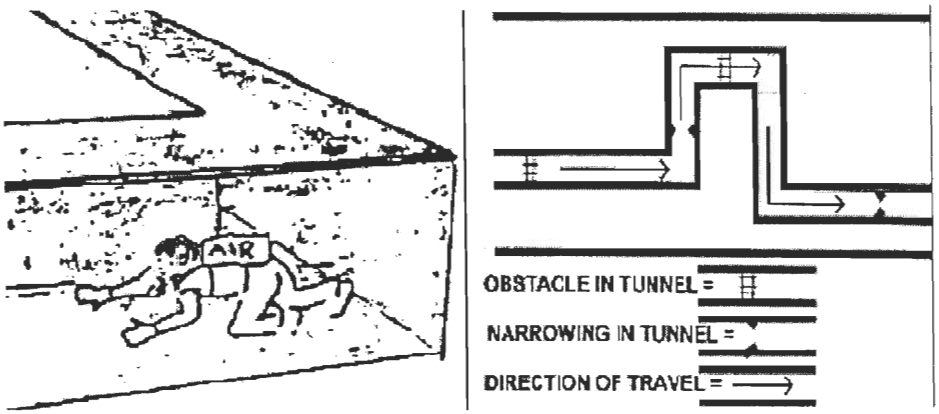




Evento 4 – Entrada forzada: Un mazo de 12 libras
Una llanta de 77 libras
Una mesa metálica de 12½ pies

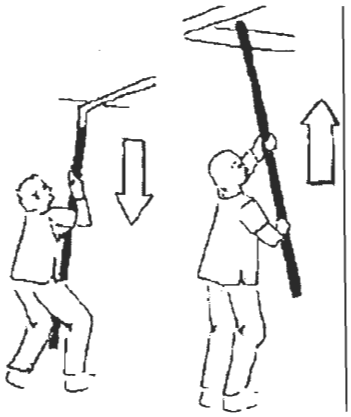
Evento 5 – Evento con escaleras de mano: Una escalera de mano de 20 pies
Una escalera de mano extensión de 24 pies
2 pesas grandes (para ancorar la escalera)

Evento 6 – Búsqueda: Un tunel oscuro de 80 pies que está 3 pies de altura y 5 pies de anchura
El tunel necesita tener obstáculos y reducciones de anchura

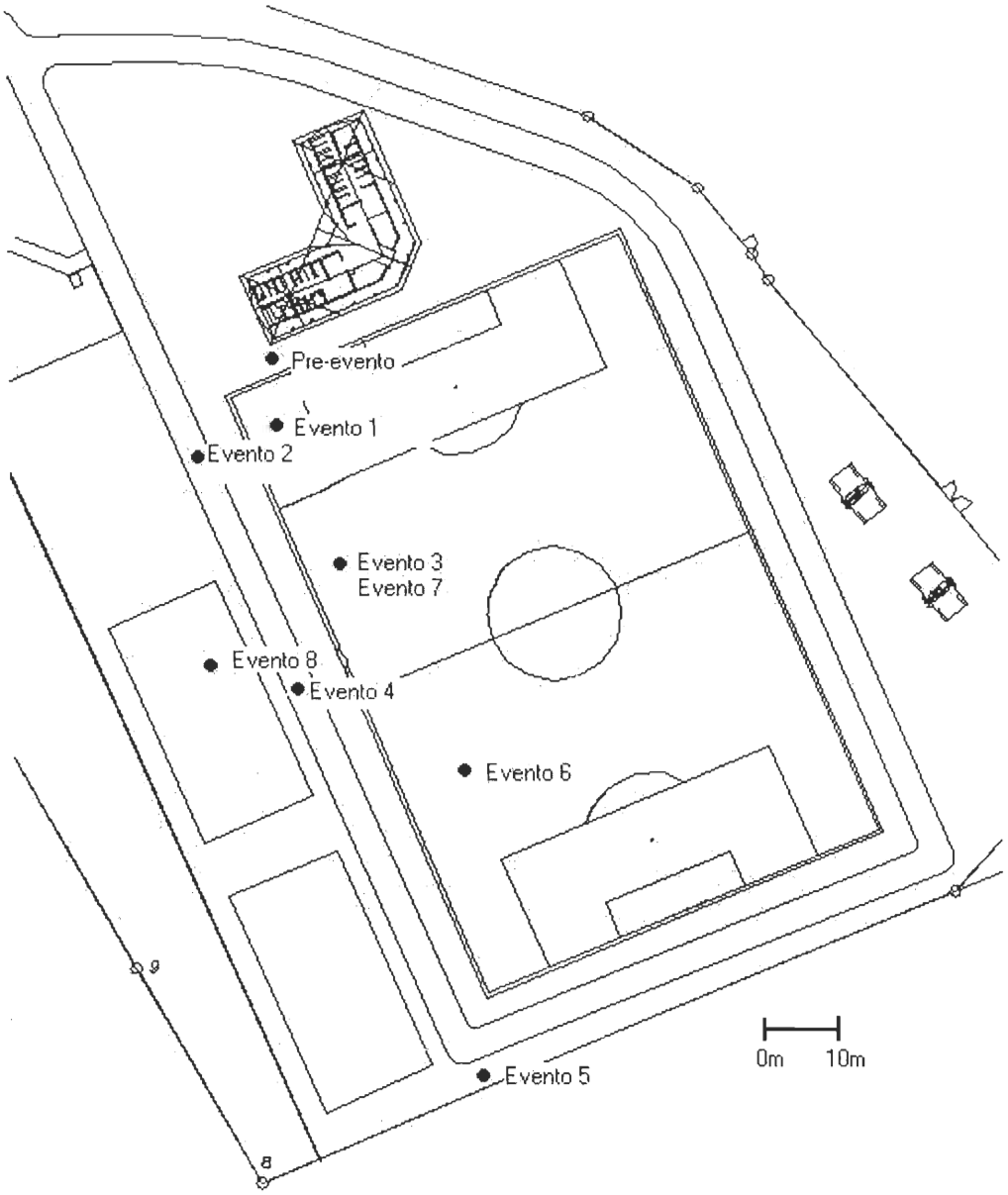


Evento 7 – Rescate: Use el tunel del evento 3
Un manequí de 130 libras

Evento 8 – Gancho del techo: Aparato con un techo de 8 pies de altura
Una puerta en el techo con una pesa de 60 libras atada
Una pértiga atada a una contrabalanza de 80 libras
Otra pértiga (no atada) con una tapa de un martillo industrial



Appendix Z – Mapa de las Facilidades para la Prueba (Español)



Appendix AA – Task-Related Test Results Chart (English)

Name _____ Station _____

Event	**Time**
Pre-event	
1 – Stair climb	_____
2 – Weight carry	_____
3 – Hose drag	_____
4 – Forced entry	_____
5 – Ladder event	_____
6 – Search	_____
7 – Rescue	_____
8 – Ceiling Hook	_____

Appendix BB – Reporte de los Resultados de la Prueba (Español)

Nombre _____ 'Estación _____

Evento	**Tiempo**
Pre-evento	_____
1 – Subir escaleras	_____
2 – Lleva pesas	_____
3 – Arrastra una manguera	_____
4 – Entrada forzada	_____
5 – El evento con la escalera de mano	_____
6 – Búsqueda	_____
7 – Rescate	_____
8 – Gancho del techo	_____

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