

EFFECT OF FIREFIGHTER COMPLIANCE IN A
WORKSITE EXERCISE PROGRAM

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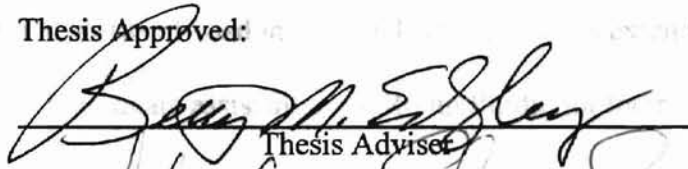
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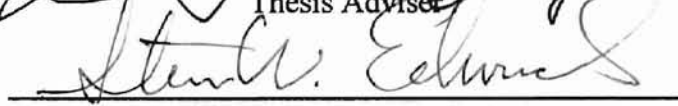
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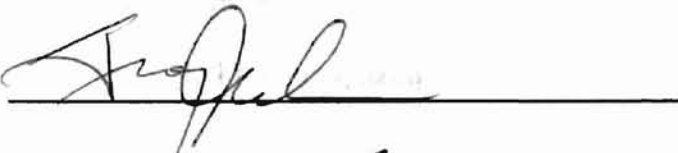
Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 1998

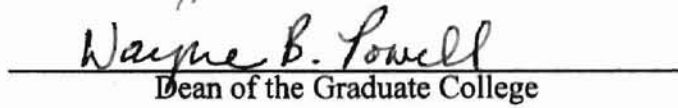
EFFECT OF FIREFIGHTER COMPLIANCE IN A
WORKSITE EXERCISE PROGRAM

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ACKNOWLEDGEMENTS

I would like to thank my committee chairperson, Dr. Betty Edgley, for her supervision and persistence in helping me complete my degree and project. I am also thankful to the other members of my committee, Dr. Steve Edwards, and Dr. Troy Adams for their guidance and words of wisdom. Special appreciation is extended to the OSU Wellness Center staff, graduate assistants, and Robin Purdie for their assistance in data collection.

Thanks to the Stillwater Fire Department for their desire to establish a worksite wellness program, Chief Chris Neil for recognizing the need for a healthy workforce, and the FireFit Instructors for their delivery of exercise prescriptions and educational classes. This program would not have been possible without Eric Seeliger's determination in seeing an idea for a wellness program in his fire department become reality. Deep appreciation is extended to the Stillwater Fire Fighters who participated in this study. They have been a humorous and gracious group with which to work.

I am grateful to my friend and confidant Jennifer DeGeorge for her open heart and philanthropic personality. Her thoughtful words and insights are admired by all.

A special thanks is extended to my parents, John and Sue Cooper, for their endless love and encouragement. Finally this thesis is dedicated to my fiance and best friend, Wade Beach. His faith and enthusiasm in all my pursuits serve as an inspiration to me.

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a critical concern of public health. Side effects of these

processes include increased morbidity and

CHAPTER I **INTRODUCTION**

EFFECT OF FIREFIGHTER COMPLIANCE IN A WORKSITE EXERCISE PROGRAM

Studies have demonstrated physical activity has numerous benefits in maintaining overall health and well-being (Kellett, 1991; ACSM, 1995; Beaton, 1996). The evidence suggests an inverse relationship between quantity of physical activity and mortality risks (Blair, 1993; Paffenbarger et al., 1993). Therefore, as one becomes more active the risk of death decreases. According to the *American College of Sports Medicine* (1995), the benefits of regular physical activity include:

1. Improvement in cardiorespiratory function
2. Reduced Coronary Artery Disease risk factors
3. Decreased mortality and morbidity
4. Decreased anxiety and depression
5. Enhanced feelings of well being
6. Enhanced performance at work, recreational, and sport.

While the majority of studies endorse exercise as a means of improving health, people in general are not willing to make lifestyle changes. Since technology makes it easier to live, Americans today are embracing a more sedentary lifestyle. However,

improved technology is not without its costs on public health. Side effects of these technological advances include cancer, work related injuries, and increased morbidity and mortality from cardiovascular disease (Anspaugh, 1995).

Coronary Artery Disease (CAD), a type of cardiovascular disease (CVD), affects the arteries in the heart causing reduced oxygen (blood) flow and nutrients into the myocardium. Atherosclerosis is one common result of this disease, and develops when plaque is deposited into the arteries. This deposition causes narrowing of the arteries that transport blood and oxygen. When the arterial lumen becomes blocked, irreversible tissue death occurs within the heart muscle.

Epidemiologists have determined that CAD is generally not the result of one risk factor, but rather results from a combination of risk factors. The more positive (detrimental) risk factors that are present the greater the chance an individual has for developing the disease. The positive factors that influence CAD are:

Positive Risk Factors

1. Family History
2. Age
3. Diabetes Mellitus
4. Hypertension
5. Hypercholesterolemia
6. Current Cigarette Smoking
7. Physical Inactivity

As the nation's number one killer CAD causes one million deaths each year (Golding, 1989). The prevalence of CAD is one reason preventive measures such as reducing cholesterol, lowering salt and fat intake, smoking cessation, decreasing stress, and participating in regular exercise are vital. These preventive measures are the basis of

most CAD risk reduction programs.

Firefighters are not without exception to health risks. The health status of an emergency responder is an important safety issue both on and off the job. When compared with other occupational groups firefighting is one of the most stressful and dangerous careers (Beaton, 1996). Firefighters as a group have a high incidence of heart disease and premature death due in part to the rapid transition from a sleeping state to performing heavy workloads within minutes (Ostrow, 1997). Some investigators hypothesize the increased disease rates are the result of sudden strenuous exercise without warmup, thermal stress, and pollution inhalation (Gledhill and Jamnik, 1992b).

While it is well established an active lifestyle decreases the risks of disease and illness, even more important is keeping these individuals adherent to their exercise program. One can not reap the benefits of exercise if the individual does not participate in the program on a regular basis. It is therefore crucial to determine which compliance methods work best for encouraging specific groups to remain physically active.

JUSTIFICATION

Fire service wellness programs have begun to recognize the need for fit firefighters. In order to deliver effective programs wellness administrators need to know which incentive methods are most effective in helping to motivate firefighters to exercise. The purpose of this study was to determine firefighter compliance to an exercise program utilizing two different incentive techniques through monitoring exercise and sign in logs.

While it is long proven that sedentary lifestyles contribute to poor health, the illnesses and diseases that result are costly. The aim of health promotion programs is to

provide education to the public so they can make healthy and wise preventive choices regarding their health. Firefighters can benefit from worksite health promotion programs that are geared toward their specific needs. In order to encourage firefighters worksite health promotion program studies need to be conducted that prove their effectiveness.

Appendix A provides a case study of how a fire department in the midwest developed and implemented a fire service wellness program in their department. This study could provide beneficial knowledge to other fire departments throughout the country in implementing and assessing fire service wellness programs. Fire departments trying to implement similar programs will be asked by their city government to provide justification for their program's effectiveness. This study illustrates how one fire department was able to track the progress and compliance/noncompliance of the exercise program and its participants. Relapse tendencies identified for the subjects in this program could allow for a more tailored program for each individual. Finally results provided to the firefighter could be a useful tool for him to appraise his strengths and weaknesses throughout the program, as well as quantify improved fitness and reduction in injuries.

STATEMENT OF PROBLEM

The statement of the problem is to determine firefighter compliance to an eight week exercise program through the use of two different incentive methods after monitoring exercise and sign in logs.

HYPOTHESIS

The following null hypotheses will be tested at the .05 level of significance:

Hypothesis 1: Following an eight week exercise program there will be no significant difference between compliance and noncompliance to the exercise program between the control and experimental groups.

Hypothesis 2: There will be no significant difference between the two experimental groups.

EXTENT OF STUDY

■ DELIMITATIONS

1. All subjects involved in the eight week exercise program were volunteer male firefighters from a fire department in the midwest.

■ LIMITATIONS

1. Subjects self-reported their workouts on exercise logs.
2. It was impossible to control how the FireFit Instructors affected the firefighters' exercise program.
3. There was no attempt to control for interference (encouragement to exercise) between the experimental and control groups.
4. No attempt was made to determine if subjects exercised according to their individual exercise program. This included exercising within target intensity, mode of exercise, and working out according to the recommended frequency, intensity, and duration.

■ ASSUMPTIONS

1. It is assumed each subject kept truthful, accurate exercise logs.
2. With periodic consultation it is assumed the FireFit Instructors helped each subject adapt to their individual exercise program as the subject improved fitness.
3. It is assumed each subject who logged in at the exercise facility participated in exercise.

DEFINITION OF TERMS

Adherence Habitually participating in an exercise program that includes the recommended frequency, duration, and intensity required for health benefits. (Blue, Conrad, 1995)

Body Composition The relative percentages of fat mass to lean body tissue. (ACSM, 1995)

Compliance The degree to which a person's behavior follows the recommended health practices. (Ruffalo, Garabedian-Ruffalo, Pawsson, 1985)

Exercise Logs A written method of recording type, duration, frequency, and intensity of exercise.

Health Promotion The process of increasing awareness, influencing attitudes, and identifying alternatives so that individuals can have informed choices to alter their behaviors. The goal is to achieve an optimum level of physical and mental health and improve their physical and social environment. (Butler, 1997)

Positive CAD Risk Factors (ACSM, 1995)

- ◆ Family History For father or other male first-degree relative myocardial infarction or sudden death before the age of 55. For mother or other female first-degree relative myocardial infarction or sudden death before 65 years.
- ◆ Age Men over 45 years of age; women older than 55 years or are experiencing premature menopause without estrogen replacement therapy.
- ◆ Hypertension Blood pressure \geq 140/90 mm Hg, on at least two separate occasions, or on antihypertensive medication.
- ◆ Hypercholesterolemia Total serum cholesterol over 200 mg/dl (5.2 mmol/L) or HDL less than 35 mg/dl (0.9 mmol/L)
- ◆ Diabetes Mellitus Patients with disease include: insulin dependent diabetes mellitus (IDDM) who are $>$ 30 years of age, or have had IDDM for $>$ 15 years, and persons with noninsulin dependent diabetes mellitus (NIDDM) who are $>$ 35 years of age.
- ◆ Sedentary Lifestyle/Physical Inactivity Persons comprising the least active 25% of the population. This involves individuals with sedentary jobs who sit much of the day and do not experience regular exercise or active recreational activities.

Sign In Logs A method of recording subject arrival and departure from the exercise facility.

VO² max measures cardiorespiratory endurance expressed relative to the amount of air expired in one minute in relation to body weight (ml/kg/min). (ACSM, 1995)

CHAPTER II

LITERATURE REVIEW

INTRODUCTION

As healthcare moves in the direction of managed care the expansion of health promotion, occupational health, and employee assistance programs will be the result (Woods, 1996). It has been well documented the impact wellness programs have had on society at large. Anspaugh (1995) recorded that with increased health a number of variables are altered. Improved health enhances decision making, stamina, work performance, concentration, time management, morale and commitment, overall health, attracts better workers, and gratifies employees. Additional benefits of health also decrease job related injuries, illnesses, lost wages, and reduces the need for temporary help and the associated training costs. As medical services are reduced through managed care, those that are available must be efficiently delivered to be effective. Medical services can be minimized through the effective use of wellness programs. Industry is composed of people with a number of similar needs; thus, it is an ideal market to reach individuals through the implementation of worksite health promotion programs (Blue, 1995). Because an active lifestyle is important it is necessary to develop methods that increase adherence to exercise. In the long run these methods will be beneficial to program administrators and the public.

THE COSTS OF POOR HEALTH

Poor employee health is costly for industry. Of 45,976 employees who completed health risk assessments over a four year period illness costs were significantly higher for

smokers (\$160.04/person/year), obese individuals (\$400.60/person/year), hypertensives (\$343.39/person/year), and those with hypercholesterolemia (\$369.74/person/year) (Bertera, 1991). In a two year study Bertera (1990) determined a cost benefit ratio for companies with health promotion programs. After only one year companies with wellness programs decreased disability days 10.5%. Sites without wellness programs had disability days increase by 1.9%. The total investment return was a decrease of \$1.42 in disability for every \$1.00 invested in health promotion.

Several studies have conducted cost analyses of health promotion programs. The amount of money returned by health promotion programs prove more beneficial than if the company does not invest money in the health of its workers. Therefore companies will experience a cost benefit ratio when it is determined what methods most encourage employees to comply with worksite health promotion programs.

PHYSICAL AND MENTAL FACTORS

The International Association of Firefighters' (IAFF) annual death and survey report claims back injury to be the number one cause of job related injury, subsequently forcing firefighters to leave their job. When a firefighter is more fit and a back injury occurs, the cost associated with the injury is less. The least fit firefighter suffers from back injuries at ten times the rate of their most fit counterpart (Cady, 1979). Kellett (1991) evaluated the effect of exercise intervention on sick leave due to back pain. His results demonstrated that firefighters engaging in an exercise group decreased sick leave by 51.2%, while nonexercisers raised sick leave 65%.

Firefighting is without question a dangerous occupation. The danger is heightened

further when the employee suffers from work related stressors and poor physical fitness. In one study (Beaton, 1996) 2,050 firefighters responded to a survey concerning chronic pain and its impact on mood. The stressors found to be significantly related to pain included sleep disturbance, management/labor conflicts, coworker conflicts, wage/benefit concerns, and past critical incidences. The older the firefighter the higher the Symptom of Stress Inventory (SOSI) score. These authors felt worksite counseling interventions in conjunction with preventive programs that target musculoskeletal pain will decrease the stressors related to pain (Beaton, 1996).

Because firefighting is a dangerous occupation, injury is inevitable. However, when firefighters participate regularly in exercise programs the degree of these injuries can be lessened. It is thus important for fire service wellness programs to utilize the methods that encourage and motivate firefighters to comply with exercise programs.

AEROBIC CAPACITY

When a firefighter has low aerobic capacity his/her ability to efficiently and safely complete job requirements is limited. It is therefore crucial to the safety of the firefighter, coworkers, and the community for the firefighter to be physically fit. Matticks, et al. (1992) conducted several studies to simulate the job tasks of firefighters. They found these simulations require 97% of predicted VO^2_{max} . Several researchers have agreed on the necessary VO^2_{max} for firefighters to do the job. The mean aerobic capacity necessary for the most frequent and demanding tasks in this occupation is 41 ml/kg/min (Gledhill, 1992a), and a minimum range of 33.5-42.0 ml/kg/min is recommended (Sothman, 1992).

It has further been determined that worksite exercise programs are beneficial to

improving cardiovascular (CDV) endurance. Putterbaugh and Lawyer (1983) analyzed post alarm heart rates on 27 firefighters aged 22-48 years old. One minute after the alarm sounded heart rate increased another 69 bpm (73% max heart rate). Further, the firefighter's VO^2_{max} increased 20% when the employee participated in a 12 week program 3-4 times a week for one hour. It should be noted that as aerobic capacity increases, greater workloads are met at lower heart rates. This is beneficial in firefighting because an aerobic reserve helps to meet new work demands.

Another study reported a lower heart rate response to fire alarms. For the 35 firefighters responding to 189 alarms Barnard (1975) related a mean heart rate increase of 47 bpm 15-30 seconds after fire alarms. Before getting off the truck heart rates were 150 bpm which indicated a state of high anxiety before the firefighters even reached the alarm location.

When an individual is fit their resting heart rate is lower. For health and safety reasons it is crucial for firefighters to meet the recommended levels of CDV endurance. Techniques that encourage adherence to endurance training will be beneficial for the firefighter, his coworkers, and the public.

FIREFIGHTER WELLNESS PROGRAMS

In a recent meeting of ten fire chiefs and union presidents firefighter fitness was of concern. The symposium, cosponsored by the International Association of Fire Chiefs (IAFC) and the International Association of Fire Fighters (IAFF), sought to establish and implement fitness and wellness programs in their departments. Recommendations from this meeting for testing included measuring strength, flexibility, endurance, and aerobic

capacity. The commitment of equipment, facilities, trainers, and computerized data to measure follow-up and effectiveness was also unanimous (Dezelan, 1997).

A handful of Fire Departments throughout the country have already taken the step to ensure a more physically fit department. In 1996 the Phoenix Fire Department spent \$1.3 million of their healthcare budget to convert a station house into a wellness center. Employees participated on a voluntary basis. Firefighters in the Virginia Beach Fire Department are required to participate in physical activity one hour each working day. If an employee fails the annual mandatory fitness assessments, he/she is assigned to limited duty. With the aid of a hospital's rehabilitation program the employee is given six months to meet fitness standards (Ostrow, 1997).

Firefighter fitness standards have been developed by Gledhill and Jamnik (1992b). Based on their findings it is recommended that fitness testing include physical examinations, pulmonary function, visual acuity, audiometry, body composition, cardiovascular-respiratory testing, and musculoskeletal fitness tests (Sit-Up and Sit-Reach). These researchers also provided minimum and mean standards for age, service years, weight, Sit-Up, and Sit-Reach.

Fire departments must be leaders in establishing fitness and wellness programs in their stations. The way these departments will have fit firefighters is for their employees to regularly participate in fire service wellness programs. Therefore administrators must develop ongoing ways to increase longterm participation in wellness programs among firefighters.

FIREFIGHTER CARDIOVASCULAR DISEASE INCIDENCES

There are mixed research results on whether or not firefighters have higher incidence of CVD than the general population. In 1985, 425 Dallas/Ft. Worth firefighters had mandated health/fitness assessments. Researchers analyzed history and physical exams, lipid profiles, electrocardiogram (ECG), and anthropometric measurements. Body composition, systolic blood pressure (SBP), diastolic blood pressure (DBP), total serum cholesterol (TSC), ratio of total cholesterol to HDL, and glucose increased linearly with increasing age. Occupational factors such as physical exertion, stress, and respiratory exposure were unlikely to cause an increase in CVD risk factors and CVD incidences over the following eight years (Licciardone, 1989). One limitation of this study was high risk individuals were previously ruled out. These firefighters had previously been screened by strict entrance exams. Additionally they had undergone periodic health/fitness assessments with risk factor consultation.

Another study found independent CVD predictor events were significantly positive for age, family history, cigarette smoking, and DBP. According to Glueck (1996) known, conventional, modifiable CVD risk factors are primarily responsible for firefighter CVD. When recommendations for CVD modifications were not given, CVD risk factors gradually rose (Glueck, 1996). This is another justification for fire service health promotion programs.

COMPLIANCE ISSUES

While it is well documented that a physically fit individual has a lower incidence of mortality and morbidity from all causes and enhanced quality of life, the majority of

the population does not exercise (USDHHS, 1996). As a result, health promotion programs are challenged to reach beyond the 10-15% of society who are already aware of the health benefits of exercise and a healthy lifestyle (Woods, 1996). Adherence is the key to a successful risk reduction program.

It is suggested that studies should focus on reasons why individuals are not compliant rather than how to achieve compliance (Dishman, 1982). In order to increase compliance program administrators must understand clients and the reasons for noncompliance. Some reasons noted in the literature are: (1) fatalistic viewpoint--subject feels disease has control (2) pleasure principle--do not want to quit the things they enjoy (3) stress--relinquishing responsibilities to others, or a change is too costly (4) normal development processes--can not acknowledge normal responses to the aging process (5) defense mechanisms--denies seriousness of the situation and (6) hidden "benefits" of illness--receives family care, family feels needed (Bernstein, 1989).

To combat noncompliance public displays (posters or bulletin boards) and personal contact are effective reminders for the person beginning a program (Dishman, 1982). When the individual drops out of a program it is beneficial to analyze what the cause was, and then develop strategies to counter the problem for the future (Redland, 1993). While there are a number of variables that affect compliance/adherence, the optimal goal is to develop strategies that utilize the subject's medical, family, and work community (Rimer, 1991). With these strategies in place the subject will be able to experience the dynamically changing benefits of health.

In order to achieve more efficient programming administrators and researchers

should identify and implement different incentives that motivate distinct groups and people (Dishman, 1982). For health promotion programs to be successful they must:

- decrease employee health risks (smoking, high blood pressure, hypercholesterolemia, and musculoskeletal pain)
- help employees understand how to efficiently use the healthcare system
- acknowledge common, expensive healthcare claims
- provide the type of programs employees desire (Chenoweth, 1995).

STUDIES DETERMINING COMPLIANCE

Studies have been conducted to determine the compliance of participants in worksite wellness programs. Follow-up was conducted on 153 subjects every six weeks in a one year unsupervised exercise program. A physiotherapist conducted personal visits, telephone contact, and consultations. While compliance to the program gradually decreased through the months a 75-80% reduction in absenteeism remained through the end of the twelve month study (Ljunggren, 1997).

Several studies utilized exercise diaries/logs, personal exercise prescription, study administrator consultation with the subjects, recording exercises performed, and/or pain rating levels to determine adherence. In one study individualized exercise programs were developed for participants in a six month program. Participants received telephone contact at 1, 3, 8, and 16 weeks and a follow-up meeting at 4, 12, and 20 weeks. Exercise diaries and consultation found those who were more compliant enjoyed the activities more than those who did not comply with the exercise program. As a result compliers participated in three times more activities (Linton, 1996). The short period of study time is a limitation to the program because studies less than six months have higher adherence

rates than those longer than six months. Therefore, future research should focus on who drops out of the program. This will identify if the subject is exercising on their own or is just not recording activity (Blue, 1995).

One study examined how three different approaches to promote healthy behavior affected workers at four manufacturing factories (Heirich et al., 1993). One factory established an onsite fitness facility fully staffed with certified athletic trainers. The second site employed two wellness counselors who provided one to one counseling and outreach services for CVD risks. The third location provided organized physical fitness activities (buddy system teams and a marked walking course inside the plant) in addition to a limited amount of exercise equipment, one to one counseling, and outreach services. A fourth manufacturing location served as the control group. The results of this study illustrated those sites with outreach programs were more effective (frequency of exercise, blood pressure control, weight loss, and smoking cessation) than the location with only a fitness center. Furthermore, the manufacturing location with outreach services and organized fitness activities proved the most effective in improving CVD risk factors. Program administrators felt these programs were successful because the employees received direct contact which encouraged them to evaluate their health risks and make periodic changes to reduce CVD risks factors. Furthermore, the authors feel without such outreach programs attrition rates increase without longterm improvement in exercise frequency (Heirich, et al., 1993).

Another study also demonstrated behavioral approaches to be the most effective method in managing CVD risk factors. Employees in one ambulance station received

general information on CVD risk factors and a videotape. The second station received ongoing, personalized assessments and feedback on the employee's risk factors in addition to a lifestyle change manual based on the subject's readiness to change. The third group of ambulance workers received behavior counseling plus monetary incentives. The final group only received a health risk assessment. The two groups implementing behavior counseling conditions saw a significantly higher decrease in smoking cessation, body mass index, and percent body composition than the health risk assessment and risk factor education groups. Thus the authors feel interventions utilizing behavior approaches will have longer lasting effects at reducing CVD risk factors (Gomel, et al., 1993).

One aim of wellness programs is to get more people, more active, more of the time. The only way to reach this goal is to determine the methods that have the most impact on compliance for longterm benefits.

SUMMARY

In conclusion, corporate wellness programs are aimed at insuring a healthier, safer workforce; while at the same time decreasing health care costs. When employees are working more days due to improved overall health, industry profits.

Benefits have also been found with firefighters who engage in exercise programs. While the incidence of CVD among firefighters remain controversial, justification can be made for fire service health promotion programs. These programs have been shown to decrease sick leave due to chronic back injuries, stressors related to musculoskeletal pain, as well as increasing aerobic capacity and cardiovascular endurance. Since health/fitness

assessments are common components in these programs, individuals may be identified and counseled in regards to CAD risk factors.

Several fire departments have already recognized the need for physically fit firefighters. These departments have committed resources and money to implement wellness programs within their organizations.

Studies have utilized different incentive techniques in administering exercise programs to program participants. These techniques range from small to large amounts of time and effort on the part of the program administrator. Some of the more common methods involve examining exercise logs/diaries, telephone contact, and behavioral risk factor consultation.

The recent literature suggests the most effective way to combat noncompliance is to analyze the cause of noncompliance in order to refine future program strategies. The challenge is reaching those high risk individuals who use the healthcare system the most and are most resistant to change.

CHAPTER III

EXPERIMENTAL AND METHODS AND PROCEDURES

The purpose of this chapter is to explain the methods and procedures used in this study. The study was designed to determine compliance through the use of two different incentive methods by analyzing exercise and sign in logs among firefighters following an eight week exercise program.

PRELIMINARY PROCEDURES

POPULATION

The sample was composed of 46 volunteer male firefighters employed by a community in the midwest. The age range was 22-52 years with a mean age of 36 years old. The various musculoskeletal problems observed with the firefighters include: lower back, knee, shoulder, and neck pain. After the Exercise Treadmill Test (ETT) was conducted on the firefighters five were further referred to the cardiologist for more extensive testing. For those individuals further tests demonstrated false-positive treadmill tests. Each was released to begin an exercise program, and were included in the study sample (N=46). Six firefighters were excluded from the study due to the incompleteness of the ETT and physical examination, and are not included in the study sample.

Based on the employee's present fitness level from baseline tests, an individualized exercise prescription was recommended in an attempt to develop a healthier and safer workforce (Appendix B). The wellness exercise program involved the development and monitoring of a fitness program, motivation, and ongoing evaluation. For a more complete description of the history and development of this department's

program refer to Appendix A: *Group (Station # 1)*: Firefighters assigned to this station received encouragement to
EXPERIMENTAL AND CONTROL GROUPS the mail. Information was included on

In assigning experimental and control groups attention was paid to the job assignments of this city's firefighters. Each firefighter functions in a group with two other firefighters. The three firefighters are required to work and travel together as a unit. Subjects were randomly assigned to treatment or no treatment groups according to their assigned fire station. Experimental and control groups were divided according to incentive methods (nutrition, mail, and no incentive).

Two of the four fire stations in this community were combined in order to maintain similar numbers in the experimental groups. There were six subjects assigned to the control group (Station #4), 23 assigned to the mail experimental group (Station #1), and 17 subjects to the nutrition experimental group (Station #2 and #3). All participants in both the control and experimental groups participated in the exercise program and utilized exercise logs.

Incentive Methods

The difference in the groups was the absence or presence (type) of an incentive method. The experimental group was divided into two groups with two different incentive methods (mail and nutrition). Every two weeks the experimental groups received contact (encouragement/incentive) to motivate the subjects and make necessary adjustments to the exercise prescriptions. This was achieved by administering a nutritional component or through information mailings from the investigator. The control group did not receive a treatment. The control and experimental groups were as follows:

1. ***Mailing Experimental Group (Station # 1)***
Firefighters assigned to this station received encouragement to continue with the program through the mail. Information was included on mailed handouts, letters, and *Vitality* magazine. Information was sent during the 2, 4, 6, and 8th weeks of the study. (N=23)
2. ***Nutritional Experimental Group (Station #2 & 3)***
Firefighters at Station #2 and #3 received a more personal degree of contact. During the second week, these employees received a *Healthy Cuisine Cookbook* with recipes used by the university's Wellness Center staff in their nutritional education classes. During the 4, 6, and 8th weeks a "Spotlight Recipe" out of the cookbook was prepared and delivered to the station. (N=17)
3. ***Control Group (Station #4)***
Firefighters in Station #4 did not receive an incentive. Contact with these subjects was only made during the pre test measurements and post test follow-up. (N=6)

Because the city's Fire Department periodically reassigns firefighters to different stations, the original group or station assignment was used throughout the entirety of the program. In other words, just because a subject changed job locations he did not move into or out of control or experimental groups.

Pre Test and Post Test Variables

Several variables were measured before and following the eight week exercise program. The pre and post tests that were analyzed included body composition, muscular strength and endurance as measured through the Sit-Up/Push-Up test, and flexibility as measured by the Sit-Reach test. An explanation of these tests can be found in Appendix A.

After the pre tests were conducted, the Wellness Center personnel examined each firefighter's medical file in order to compose an individualized exercise prescription.

Each has a personalized recommendation for training within their target heart rate, the contraindications for exercise, and recommended exercises. These prescriptions are maintained in the firefighter's exercise file at the exercise program facility.

EXERCISE PROGRAM

For light to moderate exercise levels each subject's target intensity was determined using Karvonen's Formula at 60-70% intensity. Those subjects deemed more fit were encouraged to exercise at moderate to high intensities. This target intensity was again based on Karvonen's Formula, but used a different intensity (65-85%).

The FireFit Instructors were instrumental in delivering the exercise program to the subjects, as well as provide assistance and supervision. The role of these instructors will be explained in the next section of this chapter, as well as in Appendix A.

During the eight week program both the control and experimental groups' completion of weekly exercise was monitored through their exercise logs (Appendix G). These exercise records were divided into cardiovascular and resistance training sections. For cardiovascular exercise the subject recorded duration, distance, speed, and mode of cardiovascular exercise performed for each day. Subjects chose as few or as many cardiovascular exercises they wished to perform. For each resistance training day the subject recorded the number of sets, repetitions, and amount of weight for the particular exercise. Subjects were able to pick and choose from the recommended strength exercises recommended by the FireFit Instructors. The program facility had a designated stretching area with a stretch chart posted on the wall. On the days the subjects performed these stretches they recorded it on the exercise log. Even though the firefighter may have had

other personalized stretches according to their history of injury and flexibility needs, the general recommended exercises for the subjects included:

Neck:

1. Neck rotation (looking over each shoulder)
2. Side to Side flexion
3. Flexion
4. Neck retraction

Wrist:

1. Wrist flexion
2. Wrist extension

Shoulder/Arm:

1. Posterior stretch (arm around body)
2. Inferior overhead (tricep) stretch
3. Anterior stretch with broom stick at waist

Chest:

1. Broom stick behind neck

Upper and Lower Back:

1. Cat stretch
2. Pelvic tilt
3. Single knee to chest
4. Double knee to chest

Anterior and Posterior Thigh:

1. Standing quadricep stretch with foot on chair
2. Modified hurdler

Groin:

1. Butterfly stretch

Calf:

1. Lunge with back leg straight
2. Lunge with back leg bent

Firefit Instructors required each firefighter who used the exercise facility to sign in

There are currently six graduates of the FireFit Instructor program that were members of this city's Fire Department. These FireFit Instructors conduct weekly classes within their department on those topics covered by the Wellness Center during FireFit Instructor training. Each firefighter participating in this study has learned proper lifting technique and other safety issues, stretching exercises, resistance training, stress management tools, and nutrition guidelines through these classes.

Four fire stations comprise the city's Fire Department. Each FireFit Instructor is assigned to the employees in one of the stations. There was more than one instructor in some stations. The FireFit Instructor and his participants (assigned station) are encouraged to exercise together. This allows the FireFit Instructor to provide assistance and supervision when needed. The stations have assigned blocks of time they may use their fitness facility which prevents understaffing and continued service to the community. If the employee chooses to exercise while off duty he may use the facility at any time and without a FireFit Instructor. Because most of the employees use the facility according to the time allotted for their station, random selection for the study was according to fire station number. Appendix A contains a more in depth explanation of the FireFit Instructors and their training.

MEASURING COMPLIANCE

In order for a subject to be compliant he must exercise three times a week for at least one hour. Both the control and experimental groups participated in the exercise program prescribed by the Wellness Center staff.

Because the city required each firefighter who used the exercise facility to sign in on each visit and maintain an exercise log, these tools assisted in determining each subject's compliance. Compliance was assessed through analyzing the exercise and sign in logs. Those who are most compliant should receive higher sums in the "Compliance Point System." This was an arbitrary point system devised by the investigator. Points were awarded for each component of the study. Every two weeks the study investigator examined each firefighter's exercise and sign in log. Points were awarded according to their participation in the following areas: weight training, CDV, flexibility, abdominal, and exercise logs. This was necessary in order to compute a value to determine differences in compliance. The "Compliance Point System" was as follows:

<u>Component</u>	<u>Points</u>	<u>Criteria</u>
• <i>Weight Training</i>	0	no weight training during the week
	5	1-2x/week, less than 1 hour
	10	3x/week, 1 hour
• <i>CDV</i>	0	no cardiovascular training during the week
	5	1-2x/week, less than 1 hour
	10	3x/week, 1 hour
• <i>Flexibility</i>	0	no stretching during the week
	5	1-2x/week
	10	3x/week
• <i>Abdominal</i>	0	no abdominal exercises during the week
	5	1-2x/week
	10	3x/week
• <i>Exercise Logs</i>	0	did not fill out for the week
	5	completed 1-2x/week, or incomplete
	10	completed 3x/week

These points were tabulated on a weekly basis and entered into a computer. At the completion of the eight week study the computer divided the point totals for each subject by one-third and assigned them to a "Low Participation," "Moderate Participation," or "High Participation" compliance group.

While the study progressed over the eight weeks periodic evaluations were conducted. These evaluations involved examining the subjects' exercise logs. Through periodic interviews the investigator was able to reassess exercise prescriptions and identify program dropouts.

OPERATIONAL PROCEDURES

Each firefighter completed several consent forms before the study began (Appendix C). These consent forms are in each fireman's medical file, and are locked in the medical file office at the Wellness Center. Following the initial screening the firefighters also received consultation by the Wellness Center staff concerning their health risk assessment. After pre testing was completed an individualized exercise prescription was prepared for each firefighter. Firefighters participated in the exercise program whether on duty or off duty. Each firefighter was assigned to a FireFit Instructor who was available to answer questions, or alter exercise prescriptions as the firefighter became fit. Fire stations were randomly assigned to either the control or experimental groups. Subjects in these stations received various types of incentive/encouragement to exercise (experimental group) or no treatment (control group). Both the experimental and control groups participated in the voluntary exercise program held at the local community center. Each subject performed warmup, cardiovascular exercise, resistance training,

stretching, and cooldown exercises as recommended according to present fitness levels in their exercise prescription and by the FireFit Instructors. Subjects kept weekly exercise logs. The study investigator awarded points to the subjects for frequency of exercise and type of activity.

Firefighters at Station #1 received information mailed to their home address. At the end of the first two weeks subjects received the April 1998 issue of *Vitality* magazine provided by the local university. This magazine has small bits of information concerning many health issues. Topics often discussed relate to stress management, resolving work conflicts, exercise, nutrition, home and car safety, and childcare. A cover letter explaining the mailout was sent in each envelope (Appendix D).

At the end of the nutritional group's first two weeks (Station #2 and #3), firefighters received a cookbook of recipes often used during the university Wellness Center's cooking classes. This was intended to provide subjects with easy to read and prepare meal ideas for home and work. Both of the stations that comprise this group received a cookbook. Recipe ideas were for pasta, chicken, casseroles, fish, vegetables, and appetizers. For a list of recipes included in the cookbook see Appendix E. Along with the cookbook each station received a letter encouraging them to prepare these recipes as well as informing them a spotlighted meal from the cookbook would follow (Appendix F).

During the fourth week of the study the investigator again mailed information to the firefighter's home address (Station #1). Material contained in this mailout concentrated on fat intake, common exercise myths, and a fitness pyramid. The fat IQ

quiz was intended to serve as a reinforcer from the nutrition classes previously conducted by the FireFit Instructors. The exercise myths handout helped address ideas to which the firefighters had been exposed. This information was important to the firefighters because it concentrated on why they should stop exercising if an activity is painful, importance of stretching for joint flexibility, salt and protein intake, and weight training as a component to an overall fitness program. It was important for subjects to receive these bits of information from another source since each of the topics were explained during the educational classes conducted prior to the start of this study. The fitness pyramid served as a visual aid demonstrating how an active lifestyle, stretching, strength, and cardiovascular activity, should fit into one's life.

For the nutritional group's fourth week, the investigator prepared layered enchilada casserole and delivered the spotlighted meal to Stations #2 and #3. The letter sent with the meal explained what the meal was, and reminded the firefighters it could be located in their *Healthy Cuisine Cookbook*. To ensure each shift received a bite of the casserole the meal was delivered near the end of shift A and the beginning of shift B. Both shifts were encouraged to only take a sample so the final shift, shift C, would also receive a sample.

At the end of the sixth week the mailing experimental group (Station #1) received May 1998's issue of *Vitality* magazine. Similar subjects and refereed journal findings were again topics for the magazine. This magazine and a cover letter were again mailed to home addresses.

The spotlighted meal and recipe for the nutritional group's sixth week was low-fat

spinach lasagna. Again this meal could be found in the *Healthy Cuisine Cookbook* and was prepared and delivered to both Stations #2 and #3 with a cover letter.

Because the weather was getting warmer by the eighth week there was an increased probability of heat illnesses while on the job. Issues in this mailing (for Station #1) concentrated on the necessity of water replacement and danger signs of hyperthermia. The other topic that was covered focused on ways to maintain a low-cholesterol lifestyle. Again these topics served as reinforcers to subjects previously covered by the FireFit Instructors in their educational classes.

The nutritional group in the eighth week received black bean, corn, and pepper salsa with a bag of low fat no salt chips. This was delivered at the end of shift B and the beginning of shift C.

The investigator checked subjects' exercise logs every two weeks. At the end of the eight weeks points were totaled for the control and experimental groups in order to determine a level of compliance. Subjects were deemed compliant to the exercise program if they exercised three times per week for one hour.

STATISTICAL ANALYSIS

The hypotheses were tested at the 0.05 level. A one-way ANOVA was used to assess log-in hours. The investigator examined each of the three groups using a total score across the eight week period. Compliance and noncompliance was determined at the end of the program after examining the statistical results.

CHAPTER IV

RESULTS AND DISCUSSIONS

The purpose of this study was to determine firefighter compliance to an exercise program utilizing two different incentives after analyzing exercise and sign in logs. For the incentive methods the firefighters either received program encouragement through the mail or by means of a nutritional component. Subjects in the study were required by the Fire Department to log-in and log-out of the exercise facility each time they came to the facility. As a part of the study design firefighters were encouraged to keep an exercise log.

There were three dropouts from the study. After undergoing pre tests and consenting to participate in the study two subjects did not log-in any hours at the facility and chose not to undergo post test follow-up. Neither subject would offer a reason for dropping out of the study. Because he was on vacation one subject was unable to be located during post test followup.

Two hypotheses were tested in this research study. The first hypothesis stated that after an eight week exercise program there will be no significant difference between compliance and noncompliance to the exercise program between the control and experimental groups. The experimental groups participated in the exercise program at a far greater rate than did the control group.

A one-way ANOVA assessing compliance totals for log-in hours was used to compare the three groups. As can be seen in Table 1, the eight week means for the mail and nutrition groups (67.708 and 66.111 respectively) were significantly higher than the

control group (3.571) with $F_{2,46} = 3.35$, $p < 0.05$. This comparison illustrates that firefighters did participate in an exercise program to a greater degree when an incentive or encouragement to exercise was offered. After the mean for compliance log-in hours was determined the investigator was able to calculate how many hours per week of exercise each group averaged at the program facility. The control group was not compliant to the exercise program because they did not exercise the required three times per week for one hour (0.446 hrs/week). Both experimental groups were compliant with the program since their weekly average exceeded that which was required (mail 8.464 hrs/week, nutrition 8.264 hrs/week).

It was the intention of the investigator to use both exercise logs and sign-in log to help demonstrate degree of compliance. The use of exercise logs and its corresponding "Compliance Point System" proved to be an ineffective record of compliance for this study. Because many subjects failed to keep an exercise log a 0 indicated the subject did not participate in exercise that week, even though the subject logged in and out of the exercise facility and did participate in the activity. Thus using the log-in system proved to be a better reflection of compliance and noncompliance in this study. Based on this data the first hypothesis was rejected.

SUMMARY OF CONCLUSIONS
AND RECOMMENDATIONS

TABLE I

Compliance Totals Across Weeks
(Log-In Hours)

GROUP		
1 Mail	2 Nutrition	3 Control
Mean = 67.708 hrs	Mean = 66.111 hrs	Mean = 3.571 hrs
Average Weekly Hours Log-In 8.464	Average Weekly Hours Log-In 8.264	Average Weekly Hours Log-In 0.446

The second hypothesis stated there will be no significant difference between the two experimental groups. Following the ANOVA F-test, the Newman Keuls test was used to determine if one group benefited more than the other. Results from this test did not prove the group receiving the nutrition component benefited more than the mail experimental group or vice versa. There was no significant difference between the mail and nutrition groups, thus both incentive methods were beneficial. The second hypothesis was accepted. Based on these results it appears an eight week exercise program for firefighters was not long enough to determine the effect an exercise program has on physiologic variables, yet it was determined that the use of incentives greatly enhanced exercise compliance rates.

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes a brief summary of findings, conclusions, and recommendations for further research.

SUMMARY OF FINDINGS

The following hypotheses were tested at the 0.05 level:

Hypothesis 1: Following an eight week exercise program there will be no significant difference between compliance and noncompliance to the exercise program between the control and experimental groups. The first hypothesis was rejected.

Hypothesis 2: There will be no significant difference between the two experimental groups. The second hypothesis was accepted.

CONCLUSIONS

Based upon the findings of the study the following conclusions were submitted. Firefighters receiving an incentive/encouragement to exercise participated in an exercise program at higher rates than those who received no encouragement to exercise. Therefore, fire departments should determine which incentive methods work best for each firefighter, thus ensuring greater adherence to the worksite wellness program. Firefighters were determined to be compliant to this exercise program if they exercised at least three times per week for one hour. Even though this eight week exercise program did not impact the change in physiological measurements on firefighters, individuals should engage daily in an activity that focuses on all components of a sound exercise program.

Fire Departments employing worksite health promotion programs should continue

applying risk factor consultation with their employees. This risk factor reduction program is a necessary component in order to prevent modifiable risks from gradually rising. The messages offered in the risk factor consultation session should be tailored to meet the individual's readiness to change. For those firefighters not contemplating a lifestyle change, they are unaware of how the behavior may be affecting their life. Thus the health/wellness consultant must concentrate on building a trusting relationship with the firefighter. When the firefighter recognizes the need for a behavior change they will then seek out the consultant for assistance. While on the other hand the firefighter who is in the maintenance stage has already incorporated the behavior change in their life. The beneficial message for this individual must be centered on ways to maintain enthusiasm and motivation in the program in order to prevent relapse. To increase and maintain adherence individuals must learn how to control their behaviors. By helping these individuals learn self-efficacy, they will be more committed to their lifestyle change.

As a part of the consultation, this and other fire departments should continue with the investigator's fitness testing. This will help the firefighter to assess his strengths, weaknesses, and program progression. In addition the fire department will be provided with information that could help direct the worksite health promotion program. Peer firefighter fitness trainers trained by nationally certified exercise professionals could perform these fitness assessments. This in-house service could provide the department the expense of having to hire a third party for service delivery. In addition, these peer firefighter fitness trainers would be easily accessible by firefighters who may have a question or need advice concerning their fitness and wellness program.

For those departments who are having difficulty with employees participating in physical evaluations or problems designing worksite health promotion programs, a local wellness center should be able to meet the department's needs. Wellness centers frequently have the equipment, expertise, and personnel needed to conduct the department's physical and fitness assessments.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should focus on the most effective incentive method for different age groups of firefighters. Because different age groups have different needs, incentive methods must be tailored to these groups. As a firefighter becomes older, age-related illnesses and concerns may need to be addressed. A one on one interview may be the best approach to design a rehabilitative fitness program for older firefighters. This will help the older firefighter learn how to manage complex health related issues. Younger firefighters may still feel immortal and not pay attention to how a negative behavior affects their life. An appropriate approach to use with this group may simply be focusing on how positive behaviors help maintain present activity levels.

Because this study only lasted for eight weeks, a longitudinal study of at least six months should analyze the effect of firefighter compliance in a worksite exercise program. Even though physiologic measurements slightly decreased in this study's subjects, eight weeks was not long enough to determine significant differences in these measurements. With a longer study other parameters to investigate might include assessing firefighter workers' compensation claims, disability, and sick leave. Furthermore, a more intense study would make it possible to compare the health status of

fire departments with and without wellness programs.

For the future investigator debating how a personal interview format might effect compliance, the researcher should plan on allotting plenty of time to organize and keep appointments with subjects. In this study personal contact during the eight weeks was not feasible because of the short study time and frequent interventions. Subjects in this study were on duty every three days. Therefore if the firefighter was sick, on vacation, or called out on an emergency, it would be close to another week before the investigator would be able to reach the subject, thus hindering research. As a result it is this investigator's opinion personal contact might be better achieved through peer fitness trainers or by the investigator during pre and post tests.

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INDEX

HISTORY AND DEVELOPMENT OF A
MIDWEST FIRE DEPARTMENT'S
PROMOTION PROGRAM

1981

APPENDIX A

**HISTORY AND DEVELOPMENT OF A
MIDWEST FIRE DEPARTMENT'S
WORKSITE HEALTH PROMOTION PROGRAM**

HISTORY AND DEVELOPMENT OF A MIDWEST FIRE DEPARTMENT'S WORKSITE HEALTH PROMOTION PROGRAM

PROGRAM DEVELOPMENT

The fire department has begun to recognize the potential health benefits a worksite exercise program could offer its employees. In 1986 this community's firefighters and its city government decided to change its annual physicals from an incentive-based program to the entrance physical given by the State Firefighter Pension Board. These physicals are voluntary, and are offered to one-half of the fire department on a yearly basis. Furthermore, in 1996 the city opted to pay for each firefighter to receive a comprehensive physical examination and fitness assessment given by the local university's Wellness Center. With assistance and expertise from the local university's Wellness Center staff, the two have established a comprehensive assessment, physical fitness, health and wellness program for the city's firefighters. During preliminary testing all participants completed several consent forms informing the subjects on blood testing, exercise stress testing, and exercising/study participation (Appendix B). The midwestern fire department developed goals to be achieved by the program and included the following:

1. Better overall fitness for all fire department employees
2. Reduction in injuries both on and off the job
3. Decrease in sick leave
4. Reduce workers compensation claims and expenses
5. Overall cost savings for the city
6. Save the citizens tax dollars
7. Increase morale
8. Achieve 100% voluntary participation
9. Better customer service

After examining the fire department's goals, the university's Wellness Center staff was able to develop an individualized, comprehensive program for the city's Fire Department. The initial cost of the program, \$41,119, included the purchase of workout equipment, FireFit Instructor training and compensation, physical exams and other tests, renovation, and program development consultation. The estimated annual cost for the program is \$25,000.

Three rooms at the local community center were renovated and restructured to allow the firefighters to set up the workout facility. The facility was open to all firefighters who wanted to participate in the program on or off duty hours on a voluntary basis.

PRELIMINARY TESTING

The extensive battery of preliminary tests that were conducted by the Wellness Center on each employee in the city's Fire Department included the following:

1. Blood Pressure
2. Body Composition
3. Lipid profile
4. History and Physical Examination
5. Auditory
6. Pulmonary Function
7. Flexibility
8. Muscular Strength and Endurance
9. Urinalysis
10. Guaiac Stool Test
11. Exercise Treadmill Stress Test (ETT)
12. Chest X-Ray

The results from these annual physicals and assessments made it possible for the investigator to risk stratify subjects in the study, as well as help develop exercise prescriptions. Because several months had elapsed from these measurements to the

beginning of the research, pre tests were conducted again on selected variables. The variables remeasured at the start of the study were body composition, Sit-Reach, and Sit-Up/Push-Up.

Pre Test and Post Test Variables

Physical fitness is a vital component of health and must be treated as such. By doing so the concepts of disease prevention and health promotion take on a more important meaning. The components of health related physical fitness (body composition, muscular strength and endurance, flexibility, and cardiorespiratory endurance) prove to be a necessity in any exercise program (ACSM, 1995).

During pre test examinations each subject's body composition was determined according to ACSM's seven site skinfold measurement guidelines (ACSM, 1993). By determining body composition it is possible to determine the ratio, or percentage of lean muscle mass to total body fat. This method relies on measuring the amount of subcutaneous fat which lies just underneath the skin. Depending on age, gender, and total sum, a percentage can be calculated.

All measurements were taken on the right side of the body with the subject standing. The seven measured sites are as follow:

Chest--a diagonal fold halfway between the anterior axillary line and nipple for men (one-third the distance for women).

Midaxillary--a vertical fold on the midaxillary line at the level of the xiphoid process of the sternum.

Tricep--a vertical fold midway between the acromion process and olecranon process on the midline with the arm hanging straight down.

Subscapular--a diagonal fold just below the inferior angle of the scapula.

Abdomen--a vertical fold measured two centimeters on the right side of the umbilicus.

Suprailiac--a diagonal fold following the natural contour of the ilium above the iliac crest at the anterior axillary line.

Thigh--a vertical fold on the front midline of the thigh midway between the inguinal crease and proximal border of the patella.

After these seven measurements were taken the Jackson and Pollock equation was used to determine the ratio of lean muscle to fat tissue (Jackson, Pollock, 1985). The seven site formula for males is:

$$\text{Body Density} = 1.112 - [(4.399 \times 10^{-4}) \times (\text{Sum } 7)] + [(5.5 \times 10^{-7}) \times (\text{Sum } 7^2)] - [(2.8826 \times 10^{-4}) \times (\text{Age})]$$

$$\% \text{ Body Fat} = (495/\text{Body Density} - 450) \times 100$$

The second variable in this study was the assessment of muscular strength and endurance. For one who has more muscular endurance, the subject is able to complete activities of daily living with greater ease and less fatigue. Because of its practicality in measuring large numbers of subjects, the one minute maximal Sit-Up test was used to measure dynamic muscle endurance of the abdominal muscles. One popular thought among researchers connects poor abdominal strength/endurance to low back pain.

Standards set by ACSM and the YMCA were used in conducting these tests. In the Sit-Up test the subject assumed a supine position with the knees bent to a 90 degree angle and hands interlocked behind the neck. The tester held the subject's ankles for support. In order for a Sit-Up to be correct the subject's elbows have to touch their knees each time. Standard values according to age and gender placed each subject into an Excellent, Good, Average, Fair, or Poor category (Pollock, Wilmore, Fox, 1978) (ACSM, 1993).

For those subjects who were unable to perform the Sit-Up test because of back problems, the maximum Push-Up test was administered. This muscular strength and endurance test is administered with men in the standard "up" position. A tester placed their fist on the floor under the subject's chest. In order for a Push-Up to be counted the subject's chest must touch the tester's fist. The subject was instructed to keep the back straight and to Push-Up to a straight arm position. The maximum number of Push-Ups performed consecutively and without rest was counted as the score. Standard values according to age and gender placed each subject into an Excellent, Good, Average, Fair, or Poor category (ACSM, 1993).

The third pre test measurement was the Sit-Reach test. Flexibility is crucial since it is the body's ability to move through a wide range of motion. Before performing this test each subject was encouraged to stretch the muscle in order to prevent injury. The Sit-Reach test measures the extensibility of the hamstrings, gluteals, shoulders, lower back, and upper back. The subject sat on the floor with his legs extended straight out in front. The feet were placed against a 12" high box. A 15" mark was placed at the edge of the box. The subject overlapped the index fingers and slowly reached as far forward as possible. A tester held the subject's knees straight. The best score of three trials was taken. If the subject bounced into the stretch position the score was not used, and the subject repeated the stretch. Standard values according to age and gender placed the subject into an Excellent, Good, Average, Fair, or Poor category (Golding, Myers, Sinning, 1989) (ACSM, 1993).

Before and following this study measurements on percent body composition, Sit-Reach, and Sit-Up/Push-Up tests were conducted. Over the course of the eight weeks

even though three of the four measurements improved (body composition, Sit-Up, and Push-Up) the variables did not change enough to be significantly different.

A pre and post test mean and standard deviation for each of the three groups was determined. Even though the mean for each group declined between pre and post tests, body composition was not lowered enough to be significantly different. Furthermore, for all groups combined the pre test mean (16.617%) did not decrease enough during post test measurements (15.878%) to be significant. While some subjects maintained greater than optimal levels of body composition (15-18% for men), both pre and post test means for study participants fall within this range (ACSM, 1993). A maintenance program for those individuals with optimal levels of body composition will help control the ratio of fat to lean body tissue, while continued efforts to decrease body composition must be given to those firefighters who do not meet these recommendations.

While the investigator hoped to increase flexibility during this exercise program, there was a general, but insignificant, decline among both experimental groups (mail 18.597" vs. 17.028"; nutrition 18.625" vs. 17.632"). The control group slightly improved their range of motion between pre and post test (17.708" vs. 17.958"). When all groups were combined a decrease in flexibility was also evident between pre and post tests (18.310" vs. 17.539"). Upon briefly examining individual goals and objectives for the exercise program, few stated the desire to improve flexibility. Firefighters in this department must continue to be informed that the most beneficial exercise program also includes stretching.

There were not as many subjects for the Sit-Up test since those who suffered from back problems were allowed to perform the Push-Up test. Because of the drop in subjects

for the Sit-Up and Push-Up groups, greater variances in scores were necessary to be determined significant. Each of these groups improved muscular strength and endurance according to this test but again these improvements were not significant (mail 38.733 vs. 41.000; nutrition 32.600 vs. 34.273; control 38.400 vs. 44.500). While Sit-Up tests are used in many fitness assessments to determine muscular strength/endurance, scores for these subjects might be lower than they actually are because the firefighters did not like this test.

The means for participants in the Push-Up group again increased but not enough to be considered significant. When all groups were combined the mean pre test 31.533 and post test 34.050 results demonstrated this slight improvement.

Even though the investigator recognizes the popularity of the use of Sit-Up tests in fitness evaluations, it still remains a contraindicated exercise to perform in an individual's exercise program. Because of this the investigator feels using this test presents a confusing message to individuals. In place of the Sit-Up test the investigator recommends the Push-Up test for future firefighter assessments on muscular strength and endurance.

FIREFIT INSTRUCTORS

The FireFit Instructors provided assistance and supervision to the firefighters while delivering exercise programs. Semiannually the Wellness Center certifies firefighters throughout the world to be fitness instructors for their fire departments. The fitness instructor training and certification covers five academic areas--Fitness, Exercise Physiology, Biomechanics, Nutrition, and Stress Management. Graduates of the program are proactive leaders within their departments on health, fitness, wellness, and safety

issues in their fire departments. Furthermore, the FireFit Instructors are provided the knowledge, skills, and resources to provide advice to decision makers in implementing fitness/wellness programs within their departments and community.

FURTHER STUDY RESULTS

The investigator was interested in determining if there was a significant difference in the number of program dropouts between experimental and control groups. This was impossible to determine because the control group did not provide any variance between onset and conclusion of the study. However, there were three participants who dropped out of the exercise program. Two firefighters refused to provide a reason for quitting the exercise program. The third firefighter was on vacation during post test followup.

*FIREFIGHTER
EXERCISE PRESCRIPTION*

APPENDIX

APPENDIX B

FIREFIGHTER EXERCISE PRESCRIPTION

FIREFIGHTER EXERCISE PRESCRIPTION

NAME: _____

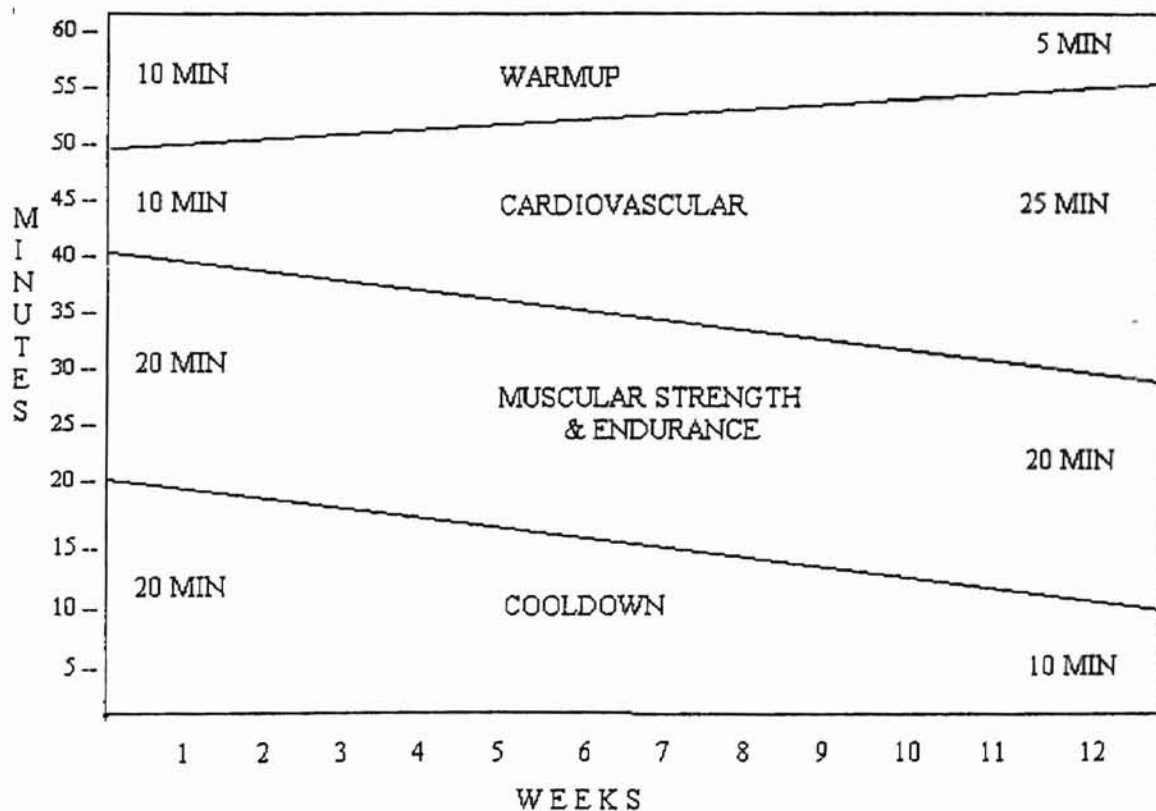
AGE: _____ REST HR: _____ TARGET INTENSITY: _____

PRE-EXERCISE
ACTIVITIES/LEVEL: _____

CONTRAINDICATED
EXERCISE: _____

RECOMMENDED EXERCISES: _____

RISK FACTOR GOALS: _____



WELLNESS CENTER
HEALTH DEPARTMENT FOR HUMAN AND COMMUNITY SERVICES
WELLSVILLE, NY 13845

APPENDIX C

CONSENT FORMS

**WELLNESS CENTER
INFORMED CONSENT FOR HEALTH RISK APPRAISAL
AND HEALTH SCREENING**

EXPLANATION OF PROCEDURE

The screening you are about to undergo is part of the university wellness program. This screening includes completion of the health risk appraisal (HRA) questionnaire and measurement of the following variables: resting blood pressure, percent body fat (as determined by skinfold measurements), height, weight, and selected blood variables analyzed from the fingerstick method or from a venous sample.

It will be determined, prior to testing, that the tests are appropriate and safe for you. All testing will be conducted by trained personnel and procedures will be explained to your satisfaction at the outset.

POSSIBLE RISKS OF BLOOD TESTING

The potential risks associated with the venipuncture/fingerstick are:

- (1) Venipuncture/fingerstick may cause some pain or discomfort. The exact amount, if any, will be dependent upon individual preconceptions and pain threshold levels.
- (2) Possible hematoma (bruising) at the venipuncture/fingerstick site following the procedure. The occurrence or non-occurrence will be dependent upon bleeding/coagulation time and adherence to instructions pertaining to holding a cotton ball against the venipuncture/fingerstick site, with pressure, for five minutes following extraction of the needle or following the fingerstick.
- (3) Slight risk of infection. Any break in the integrity of the skin is associated with a small degree of infection risk. However, if directions are followed, this risk is minimal.

CONFIDENTIALITY AND USE OF INFORMATION

I have been informed that the information which is obtained in the health screening will be treated as privileged and confidential and will consequently not be released or revealed to any person without my express written consent. I do agree to the use of any information for research or statistical purposes in an aggregate manner only. However, I understand that the professional/ medical staff may use my individual data to contact me for follow-up education.

I have read the foregoing, I understand it, and any questions which may have occurred to me have been answered to my satisfaction.

DATE

SIGNATURE

WELLNESS CENTER INFORMED CONSENT FORM BLOOD TESTING

Explanation of Test

The blood test you are about to undergo is part of the university's wellness program. The test includes selected blood variables analyzed from the fingerstick method or from a venous sample.

It will be determined, prior to testing, that this test is appropriate and safe for you. All testing will be conducted by trained personnel and procedures will be explained to your satisfaction at the outset.

Possible Risks

The potential risks associated with the venipuncture/fingerstick are: (1) Venipuncture/fingerstick may cause some pain or discomfort. The exact amount, if any will be dependent upon individual preconceptions and pain threshold levels. (2) Possible hematoma (bruising) at the venipuncture/fingerstick site following the procedure. The occurrence or non-occurrence will be dependent upon bleeding/coagulation times and adherence to instructions pertaining to holding a cotton ball against the venipuncture/fingerstick site, with pressure, for five minutes following extraction of the needle or following the fingerstick. (3) Slight risk of infection. Any break in the integrity of the skin is associated with a small degree of infection risk. However, if directions are followed the risk is very small.

Consent by Subject

The information which is obtained will be treated as privileged and confidential and will not be released or revealed to anyone without your express written consent. Information will, however, be treated in an aggregate manner to provide group information. In addition, if indicated, a small amount of the blood drawn may be used for research in alternative cholesterol testing.

I have read the foregoing, I understand it, and any questions which may have occurred to me have been answered to my satisfaction.

Date _____

Subject Signature _____

Witness Signature _____

WELLNESS CENTER
INFORMED CONSENT FOR EXERCISE TEST

EXPLANATION OF TESTS

The exercise test you are about to undergo is to determine your functional capacity and to aid in the evaluation of your heart and in the diagnosis of any symptoms you may be having that may be related to the function of your heart. It will be determined, prior to testing, that this evaluation is appropriate and safe for you. The test consists of gradually increasing effort and it will be carefully monitored by a physician or by Wellness Center personnel, specially trained in exercise testing.

During exercise testing your blood pressure, heart rate, and electrocardiogram will be constantly monitored. These measurements will provide important information regarding the state of your heart and your cardiovascular fitness. Before you undergo testing you will have an interview and will have completed the screening process.

You will perform the exercise test on a motor-driven treadmill at a comfortable walking speed. Initially your physical effort will be relatively light, but as the treadmill speed and incline are gradually increased, the effort will become harder until fatigue or shortness of breath occur, which are indications to stop exercise. Other symptoms, such as chest pain, muscular discomfort or loss of balance are also indications to stop. In addition, you should not continue the test if you have any other significant feelings of discomfort.

There exists the possibility of certain undesirable changes occurring during the exercise test. They include abnormal blood pressure, pulse rate and electrocardiographic response, and in very rare instances, heart attack or fatality. Every effort will be made to minimize any potential hazard by increasing the work effort slowly, and through continuous observation during testing. Emergency equipment is readily available to deal with unusual situations which may arise.

CONSENT OF PATIENT

The information which is obtained will be treated as privileged and confidential and will not be released or revealed to any non-medical person without your express written consent. The information will, however, be treated in an aggregate manner to provide group information as necessary.

I have read the foregoing and I understand it. Any questions which may have occurred to me have been answered to my satisfaction. I understand I may withdraw from and discontinue this test at any time during its performance.

PATIENT _____ DATE _____

WITNESS _____ DATE _____

**WELLNESS CENTER
Midwest Fire Department's
Informed Consent for Exercise**

EXPLANATION OF PROGRAM

The exercise program you will be participating in is designed to improve your physical work capacity (fitness level) and is individualized based on the results of any/all tests that you have taken at the Wellness Center. The exercise program is on a voluntary basis, thus you may stop with the program at any time. The information that will be obtained from the exercise program will be used for research information or statistical purposes in an aggregate manner only. The professional/medical staff at the Wellness Center may use your individual data to periodically contact you regarding the exercise program.

POSSIBLE RISKS

The potential risks associated with exercise include: exhaustion, fatigue, discomfort, pain, high blood pressure, high heart rate, high respiration rates, and on rare occasions, heart attack, stroke, or death. The occurrence/nonoccurrence of these events depends largely on the participant's ability to recognize his/her own signs/symptoms and take the appropriate action; such as, reducing the intensity of exercise or sitting down to rest.

POTENTIAL BENEFITS

The potential benefits of regular exercise are well documented and can be summarized to include the following: helps control weight, helps you relax, improves your physical work capacity, reduces mortality from all causes, helps you look and feel better, and helps you live longer. However, the benefits may only be available to those who participate in a regular exercise program of sustained intensity.

CONSENT BY SUBJECT

I have read the foregoing, I understand it, and any questions which may have occurred to me have been answered to my satisfaction. If you have any further questions or comments regarding the program, you may contact Dr. Betty Edgley, 110 Colvin Center, 744-7680.

NAME _____
(Print clearly)

SIGNATURE _____

DATE _____

APPENDIX D

**SAMPLE LETTER TO
MAIL GROUP**

March 27, 1998

Dear FireFighter:

Enclosed you will find April's issue of Vitality magazine. Hopefully some little tidbit of information will be useful for you!

Since your fitness center has been open for several months now (and you've been working out hard!), someone will be calling soon for you to pose on the cover on Muscle magazine! Keep up the hard work and you can smash records for the New York marathon!!!

Are you needing a change in your workout? Has an exercise caused you any pain? Are you not sure if you are doing a certain exercise right? Then put your FireFit instructors to work and ask for advice.

Keep on Sweating!
Alissa Cooper

APPENDIX E
HEALTHY CUISINE COOKBOOK
RECIPE LIST

HEALTHY CUISINE COOKBOOK

RECIPE LIST

CHICKEN

Chicken with Artichokes
Chile Cornmeal Chicken Breasts
Maple Glazed Chicken
Marinated Chicken
Parmesan Chicken

FISH

Fish Fillets with Orange Salsa

ITALIAN

Linguine Bella Donna
Low-Fat Spinach Lasagna

MEXICAN

Chilaquile Casserole
Layered Enchilada Casserole

AMERICAN

Market Street Meat Loaf

VEGETABLE/SIDE DISHES

Baked Stuffed Potatoes
Cole Slaw
Glazed Roasted Vegetables
Oven-Baked Potato Fries
Vegetable Couscous Pilaf

DIPS

Black Bean, Corn, and Pepper Salsa
Cannellini Bean Dip

APPENDIX F

**SAMPLE LETTER TO
NUTRITION GROUP**

March 29, 1998

Dear Firefighter:

Your station has been chosen to receive a *Healthy Cuisine Cookbook* featuring recipes used by the Wellness Center in its demonstration classes. Even better though, every several weeks one recipe will be "Spotlighted" and brought already prepared to your station for a sampling. This is intended to help your station with the nutrition component of the wellness program.

In case you have not gotten the chance to read this month's *Speaking of Fire*, you might be interested to know there is an article featuring your department. The midwest fire department is featured because it is one of only a handful of departments throughout the world to have a wellness program for its employees. You can help your department set the direction for others to follow!!!

If you have any questions or comments please feel free to call me at the Wellness Center 744-9355 or 744-7556. Thanks for your help!

Sincerely,

Alissa Cooper

APPENDIX G
FIREFIGHTER EXERCISE LOGS

FIREFIGHTER CARDIOVASCULAR EXERCISE LOG

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Date/Time						
Treadmill						
Recumbant Bike						
Airdyne Bike						
Stair Climber						

◆ **REMEMBER TO RECORD DURATION, SPEED, AND DISTANCE**

FIREFIGHTER RESISTANCE TRAINING EXERCISE LOG

	machine #/holes showing	Session #1	Session #2	Session #3	Session #4	Session #5	Session #6
date/time							
Leg Press							
Leg Ext.							
Leg Curls							
Lunges							
Squats							
Calves							
Straight leg dead lift							
Glute/ham machine							
Bench (db or bar)							
Chest press							
Flat Flys							
Incline Bench (db or bar)							
Lat Pulls							
Seated rows							
Bent over rows							
Military press (db or bar)							
Lat. Raises							
Front Raises							
Upright rows							
Shrugs							
Tricep pressdown							
Tricep Kickback							
Tricep extension							
Overhead press							
Bicep Curls (db or bar)							
Incline Curls							
Isolated Curls							
Abs							
Stretches							

APPENDIX H

OKLAHOMA STATE UNIVERISTY
INSTITUTIONAL REVIEW BOARD PERMISSION

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 04-21-98

IRB #: ED-98-103

Proposal Title: EFFECT OF FIREFIGHTER COMPLIANCE IN A WORKSITE EXERCISE PROGRAM

Principal Investigator(s): Betty Edgley, Alissa Cooper

Reviewed and Processed as: Expedited

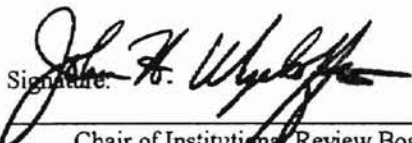
Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING, AS WELL AS ARE SUBJECT TO MONITORING AT ANY TIME DURING THE APPROVAL PERIOD.

APPROVAL STATUS PERIOD VALID FOR DATA COLLECTION FOR A ONE CALENDAR YEAR PERIOD AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.

ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Disapproval are as follows:

Signature: 

Chair of Institutional Review Board

cc: Alissa Cooper

Date: April 24, 1998

VITA

Alissa Cooper

**Candidate for the Degree
of Master of Science**

Thesis: EFFECT OF FIREFIGHTER COMPLIANCE IN A WORKSITE EXERCISE PROGRAM

Major Field: Health, Physical Education, and Leisure

Education: Graduated from Jonesboro High School, Jonesboro, Arkansas, in May 1991; received Bachelor of Science Degree, Exercise Science from Arkansas State University, Jonesboro, Arkansas in May 1996; Completed the Requirements for the Master of Science degree at Oklahoma State University, Stillwater, Oklahoma in July 1998.

Certification: *American College of Sports Medicine* Health Fitness Instructor, CEQ Exercise and the Older Adult; CPR; First Aid

Professional Experience:

■ ***Intern & Graduate Assistant. Oklahoma State University Wellness Center; Jan 96-present.***

Conducted over 2200 wellness screenings for faculty, staff, students, and community. Detected those at risk for coronary heart disease. Guided diabetic, pulmonary, and coronary patients through a phase II and III Cardiac Rehabilitation program. Conducted treadmill stress tests on healthy and at-risk populations. Counseled and treated individuals with eating disorders. Developed and monitored personalized exercise prescriptions for healthy and at-risk populations. Led more than 300 clients aged 14-90 years old in personal fitness programs. Designed and facilitated wellness classes from class sizes of 5-80.

■ ***Oklahoma State University Cooperative Extension Active Living Program Instructor: Spring 97 & Spring 98***

Presented an 8 week program to inspire the community in implementing exercise and nutrition into their lifestyle. Topics covered were the Surgeon General's report on Physical Activity, resistance training stretching, cardiovascular training, health and safety, and adhering to fitness programs.