ABSTRACT

Title of Dissertation: THE EFFECTS OF PREVIOUS ADHERENCE, PHYSICAL FITNESS, BEHAVIORAL INTERVENTION, AND EXERCISE SELF-EFFICACY ON EXERCISE ADHERENCE

Rosalie Veronica Mince, Doctor of Philosophy, 1994

Dissertation directed by: Dr. Stanley Bennett, Associate Professor, Human Development

Since substantial research has shown that a physically active lifestyle is a fundamental component of health, there exists a need to investigate why the majority of individuals do not adhere to an exercise program on a long-term basis. The purpose of this study was to examine the degree to which previous adherence, physical fitness, behavioral intervention, and exercise self-efficacy predict exercise adherence. There were 52 male and 44 female participants in this study ranging in age from 19 to 72 years. All subjects completed the same written and physical evaluations and participated in the same fitness program. Subjects were divided into three groups (experimental: n=34, comparison: n=33, and control: n=29). The experimental group received behavioral intervention aimed at increasing exercise adherence. The comparison group received an intervention which was not aimed at influencing exercise adherence. The

control group did not receive any additional intervention.

Exercise adherence was determined from self-report of exercise activity for 24 weeks. The behavioral intervention took place during weeks 9 through 16. The 24 weeks were divided into 3 adherence periods: "before adherence" (weeks 1-8), "during adherence" (weeks 9-16), and "after adherence" (weeks 17-24). Pre- and post-treatment exercise self-efficacy was determined from subjects' completion of an Exercise Self-Efficacy Scale. Pre- and post-testing physical fitness assessment included body composition and aerobic capacity measures.

The investigator assisted the experimental group participants in identifying realistic goals. These participants met biweekly during the intervention period with the investigator to discuss problems and adjust workouts and goals to adapt to individual progress and personal needs.

The results of this study support research studies which have found that previous exercise adherence is highly predictive of continued adherence. Based on a very stringent definition of adherence, on the average, the subjects were unable or unwilling to perform aerobic exercise the three times per week necessary to substantially improve cardiovascular fitness. This finding is consistent with the majority of previous adherence studies. According to the qualitative analyses, improved physical fitness was the primary reason why subjects adhered to aerobic exercise,

and a loss of fitness was a strong motivator for participants to begin exercising again after a temporary lapse.

THE EFFECTS OF PREVIOUS ADHERENCE, PHYSICAL FITNESS, BEHAVIORAL INTERVENTION AND EXERCISE SELF-EFFICACY ON EXERCISE ADHERENCE

BY

Rosalie Veronica Mince

Dissertation submitted to the Faculty of the Graduate School of The University of Maryland in partial fulfillment of the requirements for the degree of Doctor of Philosophy
1994

Advisory Committee:

Associate Professor Stanley Bennett, Chairman/Advisor
Associate Professor Bradley Hatfield
Associate Professor Charles Johnson
Professor Donald Steel
Associate Professor Allan Wigfield

ACKNOWLEDGEMENTS

This project could not have been completed without the help and support of the following friends ...

Dr. Stan Bennett, my advisor and the director of this study, who kept me going with words of encouragement, and at all times, an understanding attitude. It was your warm welcome that convinced me to begin my doctoral program in human development. Thank you for helping me see it through to its completion.

Michael Mince, my husband and constant support, who spent endless hours in the library and traveling to College Park with me. Thank you for being so understanding of the time I had to devote to this dissertation and for being such a good dad to Stephen.

Robyne Butzner, my outstanding typist and co-worker, who began typing in September of 1991 and made endless changes to this manuscript without one complaint. Thank you for doing such an excellent job. I could not have done this without you.

The members of Dundalk Community College's Circuit Center, and my co-workers in the Health/Life Fitness Division, for participating in this study. It is my hope that the information gathered in this study will help you adhere to your exercise programs. Thank you for your cooperation and support.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

"Although most adults believe in the value of exercise, the majority of adults do not turn their beliefs into action" (Steinhardt & Carrier, 1989, p. 125). The benefits of vigorous aerobic exercise have been well documented, yet only one third of Americans exercise on a regular basis, and as few as 10 to 15 percent participate with sufficient frequency and intensity to obtain cardiovascular benefit (Neale, Singleton, Dupuis, & Hess, 1990; Noland, 1989; Robison, Rogers, Carlson, Mavis, Stachnik, Stoffelmayr, Sprague, McGrew, & VanHuss, 1992). Contrary to the evidence of increased interest in physical fitness and the benefits attributed to regular physical activity, statistics from national surveys indicate that only a small minority of adults exercise on a regular basis (Powell, Spain, Christenson & Mollenkamp, 1986; Yukelson, 1991), and significant numbers of Americans have chosen to maintain a sedentary lifestyle (Oman & McAuley, 1993). While the evidence accumulates in support of the benefits of exercise for physical and psychological health, research shows that the majority of people who begin an exercise program will stop, often within the first few months (Martin, Dubbert, Katell, Thompson, Raczynski, Smith, Webster, Sikora, & Cohen, 1984). "Never before have there been so many sedentary individuals as in our Western World today" (Paffenbarger, Blair, Lee, & Hyde, 1993, p. 61).

King, Blair, Bild, Dishman, Dubbert, Marcus, Oldridge, Paffenbarger, Powell, and Yeager (1992) have said

> "Although a large body of scientific evidence has established the role of physical activity as a major contributor to health and well-being, physical activity levels in the United States are currently suboptimal. A national initiative to improve the health of Americans, Healthy People 2000 (1992), recommends an increase in moderate daily physical activity and cardiorespiratory fitness, and a reduction of sedentary lifestyles in an attempt to reduce coronary heart disease and a number of other prevalent health problems. Increasing regular physical activity among all sectors of the American adult population remains a significant challenge" (p. S221).

Exercise adherence patterns differ somewhat with regard to setting and type of program, yet adherence statistics overall are very similar for healthy adults in a variety of supervised and unsupervised exercise programs (Dubbert & Wilson, 1984; Dishman, 1988). "The typical dropout rate from supervised exercise programs reported around the world has remained at roughly 50% during the last 20 years" (Dishman, 1991, p. 346). "Unfortunately, the quest for physical fitness is plagued by the same problem of inconsistent adherence that characterizes other health

behaviors" (Belisle, Roskies, & Levesque, 1987, p. 159). Specific reasons for dropout may differ, but the rate of dropout for exercise programs is very similar to other behavior-change programs including smoking and alcohol/drug abstinence, weight loss, and psychotherapy (Carmody, Senner, Malinow & Matarazzo, 1980; Dishman, 1988; Marcus, Selby, Niaura, & Rossi, 1992). According to Franklin (1994), "...it appears that exercise is similar to other health-related behaviors, in that typically half or less of those who initiate the behavior will continue" (p. 2). Research on non-compliance exercise patterns are similar across all age groups (Herbert & Teague, 1989).

Statement of the Problem

The incorporation of regular exercise into one's lifestyle is currently being recommended by a large number of health and fitness professionals. "This suggestion is supported by the burgeoning literature documenting the positive association between physical activity and health and longevity in general and coronary heart disease in particular" (Garcia & King, 1991, p. 394). Since substantial research has shown that a physically active lifestyle is a fundamental component of health, there exists a need to investigate why the majority of individuals do not adhere to an exercise program on a long-term basis (Steinhardt & Carrier, 1989). Exercise investigators have applied a number of different approaches to study adherence,

but to date have been unable to provide an accurate description of the person who is most likely to maintain a regular exercise program or the methodology to increase adherence to an exercise program. For the purpose of this study, exercise adherence was defined as the ability to exercise within target heart rate range for a minimum of 20 minutes, at least three days per week. This study attempted to identify predictors of exercise adherence by investigating four variables: previous exercise adherence, physical fitness, behavioral intervention, and exercise self-efficacy.

The physical benefit of regular exercise, physical fitness, was expected to account for some of the variability in exercise adherence because physically fit persons have the prerequisite skills to begin and maintain their program. If participants adhere to an exercise program long enough to realize benefits, they will be more likely to maintain that behavior. Behavioral intervention was employed to help those who had started exercising continue to adhere by helping them set and achieve realistic goals and overcome barriers to exercise. Exercise self-efficacy was expected to contribute to exercise initiation and maintenance because those who believe they have the confidence and skills necessary are most likely to begin and adhere to an exercise program. Once people have received positive reinforcement from exercising regularly, they are more likely to continue

to adhere or begin exercising again after stopping temporarily.

Physical Fitness and Exercise Adherence

A major benefit of adhering to an exercise program is improved physical fitness. According to the American College of Sports Medicine (ACSM) (1990), exercise must be performed a minimum of three days per week in order for cardiovascular fitness enhancement to occur. The majority of people who believe they want to exercise may be unaware that they must be this persistent. When they do not see immediate results, they may become discouraged. Because failure to reach fitness goals has been reported as a correlate of dropping out (Dishman, 1987), flexible goals may help offset the "abstainer's fallacy" in which adherence to a behavior change is impeded by the belief that a temporary lack of adherence inevitably leads to total relapse.

On the other hand, some individuals set excessively rigid and high expectations compared to their skills and thus are doomed to failure at the outset. Excessive exercise can also lead to program attrition due to injury (King, 1991). Depending on the intensity and duration of exercise, consequences may range from minor reactions such as perspiration, fatigue, and discomfort, to outcomes which prohibit exercising, such as pain and injury. These consequences may be considered punishments, and suppress the

frequency, duration and intensity of physical activity (Sallis & Hovell, 1990). The incidence of injury ranges from 10 to 50 percent for both beginning and veteran exercisers (Pollock, Carroll, Graves, Leggett, Braith, Limacher, & Hagberg, 1991).

"Sedentary lifestyle is clearly a behavior that results in increased morbidity and mortality, and numerous physiological and psychological benefits may be accrued from an active lifestyle. The challenge that remains is to better understand the process of exercise initiation, adoption, and maintenance so that successful programs can be developed" (Marcus, et al., 1992, p. 64).

Behavioral Intervention and Exercise Adherence

Studies applying behavioral interventions have resulted in a 60% to 80% adherence rate compared with control group rates of 40% to 60% (Martin & Dubbert, 1982; Martin, et al., 1984). These exceed the adherence rates found in the typical exercise program where behavioral interventions are not employed. Some of the most impressive intervention work completed (Martin, et al., 1984) has relied heavily on a "treatment package" approach that encompasses a variety of behavior management principles (Bernier & Avard, 1986). Martin, et al. (1984) conducted six experiments with a sample of 143 sedentary adults. Crucial in explaining exercise adherence was social support, personalized feedback, praise, modeling (Martin & Dubbert, 1982) and

flexibility in exercise goal-setting (King, 1991). Behavioral contracts appear to increase exercise program participation (Neale, et al., 1990) and various reinforcement techniques have also been effectively used (Dishman, 1991; Noland, 1989; Robison, et al., 1992).

Atkins et al. (1984) and Dishman (1991) noted that it is important to provide subjects with training in how to implement and adhere to an exercise program, and that such an intervention significantly increased exercise adherence when compared to control group adherence. Wellness programs providing repeated intensive intervention have resulted in more substantial risk reduction for cardiovascular disease than one-shot health screening (Erfurt, Foote, & Heirich, 1991).

Several studies suggest that programmatic features may have an impact on exercise behavior. Program inaccessibility and geographic inconvenience have been found to be related to the decision not to enter a program and increase the likelihood of dropout (King, 1991; Steinhardt & Carrier, 1989; Shephard, 1992). Attendance is higher when alternative time schedules for workouts are allowed. Choice in selecting activities also increases adherence. Adherence has been greater in studies that have provided fitness activities at a facility that is convenient and familiar to participants, allows flexibility in time of workouts, and provides people with new information which is explained by

an expert leader (Connell, Davies, Rosenberg & Fisher, 1988; Shephard, 1992). The exercise leader should emphasize the ability of individuals to bring about changes in their environment, rather than simply helping them to cope with and adjust to problems (Fitch & Slivinske, 1988).

Self-Efficacy and Exercise Adherence

Self-efficacy, the belief that one can successfully perform desired behaviors, has been reported as a central determinant of adherence in a number of exercise and health-related studies (Dzewaltowski, 1989). "The concept of self-efficacy assumes that persons who are confident in their ability to perform a specific behavior are more likely to actually perform it. Similarly, those who are confident that they will obtain commonly expected benefits are more likely to perform the behavior. These beliefs are specific to the behavior in question, as opposed to general traits such as self-esteem. Self-efficacy perceptions have been shown to be powerful predictors of many types of behaviors" (Sallis & Hovell, 1990, p. 319). Numerous studies show that the effects of therapeutic interventions on health behaviors are partly mediated by changes in perceived self-efficacy and play a significant role in many forms of health behavior -- including adherence to exercise and preventive health programs (Marcus, et al., 1992; O'Leary, 1985).

People who have maintained a high level of physical activity throughout their lives can be expected to have

higher self-efficacy for exercise than those who have not. In supervised programs where activity can be directly observed, past participation in the exercise program is the most reliable correlate of current participation (Dishman, Sallis, & Orenstein, 1985). Self-efficacy is an important factor in maintaining healthy behaviors because when people practice healthy behaviors, their perceptions of self-efficacy increase (Waller & Bates, 1992).

Bandura's (1977) theory of self-efficacy claims that behavior depends on both outcome expectations and personal efficacy expectations. An outcome expectation is defined as a person's estimate that a given behavior will lead to particular consequences. A personal efficacy expectation is the belief that one can successfully execute the behavior required to produce a particular outcome. Bandura also noted the importance of mastery expectations. When an individual masters an activity they increase their self-efficacy.

According to Bandura, self-efficacy expectations vary in magnitude (task difficulty), generality (to other behaviors) and strength (certainty of ability to perform). Bandura claimed that efficacy expectations develop from four major sources: 1) experience; 2) vicarious learning; 3) verbal persuasion, and 4) physiological information. Whether individuals will attempt a particular action is dependent upon the strength of their convictions about their

likely success in that behavior (Bandura, 1977). In addition, there must be some type of incentive to encourage the individual to maintain the behavior. Exercise self-efficacy is most enhanced by successful adherence to an exercise program, but also is influenced by vicarious modeling, verbal persuasion, and emotional signs of coping ability (Herbert & Teague, 1989).

Limitations of Previous Exercise Adherence Research

Generalizability of findings from exercise adherence research has been limited by a lack of standardization of definitions, instrumentation, and methodology (Blair, Jacobs, & Powell, 1985; Sallis & Hovell, 1990; Shepard, 1988; 1992). "Measurement of physical activity is complicated by variations in type, intensity, frequency, duration, and intermittency. Over 30 different methods for assessing physical activity have been reported ... Few of these measures combine affordability, practicality of use, and high validity, so physical activity is usually measured with considerable error. These definitional and methodological problems have the effect of making the study of exercise determinants an imprecise science" (Sallis & Hovell, 1990, p. 308). Shephard (1988) noted the importance of distinguishing the differences between exercise, sport, and recreation when measuring physical activity.

Another major problem has been a lack of consistency in measuring adherence. Several researchers have equated

adherence with attendance, without quantifying the intensity and duration of a workout session (Tetting, 1989). Researchers sometimes consider participants to be non-adherers if they miss several workouts in succession. This inaccurately excludes temporary lapses due to reasons such as illness or injury. Tetting (1989) reported that a problem with many adherence studies is that they focus on drop-outs instead of studying individuals who adhere to regular exercise programs.

Many studies use a one-time analysis of behavior rather than following the process of exercise initiation and adherence over a period of time (Dishman, 1987). Improvement in fitness often requires many weeks of training; therefore, it is reasonable to believe that results from short-term studies may not predict long-term adherence.

The ACSM (1990) recognizes that it may take middle-aged sedentary and older individuals several weeks to adapt to the initial rigors of an exercise program, and thus they may need a longer period of time to experience the full benefits of an exercise program. They recommend that training experiments be conducted for at least 15 to 20 weeks.

Research reviews (Dishman, 1988; Sonstroem, 1988) indicate that existing information on exercise adherence is largely descriptive (Dzewaltowski, 1989; Noland, 1989). Exercise adherence research needs to be driven by theory to

increase understanding of the exercise adherence process rather than by simply describing characteristics of dropouts and adherers (Garcia & King, 1991). Studies to date have been unable to predict or explain exercise adherence with the precision or reliability required to design systematic interventions aimed at improving adherence to physical activity and exercise (Dishman, 1988). Also lacking are theoretical formulations that can guide new research hypotheses and practical interventions (Duda, Smart, & Tappe, 1988; Godin & Shephard, 1990; Noland, 1989). According to Pollock, et al. (1991), most training research does not report the strategies used to maximize adherence, so comparison among studies is difficult. There is also a need to use multivariate procedures, such as multiple regression, to examine predictors of exercise adherence (Dishman, 1981; Oman & McAuley, 1993). Oman and McAuley recommend the use of treatment and control groups to make accurate assessments of the effects of intervention strategies.

Purpose of the Study

The purpose of this study was to examine the degree to which selected variables promote exercise adherence. The variables that were investigated included previous exercise adherence, physical fitness (aerobic capacity and body composition), behavioral intervention, and exercise self-efficacy.

Research Questions:

1) To what extent do the independent variables (previous exercise adherence, physical fitness {aerobic capacity and body composition}, behavioral intervention, and exercise self-efficacy) predict exercise adherence during the intervention period (weeks 9-16)?

2) To what extent do the independent variables predict exercise adherence after the intervention period (weeks 17-24)?

3) To what extent do the interactions between the treatment and the continuous variables contribute to the variance in "during" and "after adherence?"

Definition of Terms

1) Aerobic Capacity (also called maximal oxygen uptake): The greatest rate of oxygen utilization attainable during heavy work, expressed in ml/kg/min (Howley & Franks, 1986).

2) Aerobic Exercise: Sustained exercise of the whole body that increases the heart rate, done at a level that allows the body to meet its oxygen needs.

3) Behavioral Intervention: An investigator-generated program of conferences and observations to provide written and oral feedback to participants biweekly, involving goal-setting and a contract outlining the guidelines for adhering to a regular exercise program.

4) Body Composition: The percent body fat in relationship to total body weight as measured by Lange Skinfold Calipers and predicted from Brozek and Keys (1951) and Sloan, Burt, and Blyth (1962) formulas for determining body density for men and women, respectively. Women were measured at the tricep and iliac sites. Men were measured at the tricep, subscapular, and pectoral sites.

5) Cardiovascular Endurance: The ability of the heart to pump blood, of the lungs to breathe volumes of air, and of the muscles to utilize oxygen.

6) Exercise Adherence: Exercising at least three times per week, for at least twenty minutes in target heart rate.

7) Exercise Tolerance Test (also called graded exercise test -- GXT): The submaximal exercise tolerance test refers to a specific workload on a motorized treadmill which was correlated with each subject's heart rate to extrapolate a specific maximum oxygen consumption measured in ml/kg/min. The Bruce Protocol (Mead, 1979) was utilized as a standard workload for all participant's predicted aerobic capacity (Astrand & Rodohl, 1977).

8) Modeling: Presenting a behavior to induce an individual to engage in a similar behavior.

9) Physical Fitness: The parameters measured as part of the physical fitness assessment for this study were skinfold measurements (mm), and aerobic capacity (ml/kg/min).

10) Target Heart Rate (THR): The exercise intensity recommended to improve cardiovascular fitness (60-85% of maximum heart rate).

11) Self-Efficacy: The belief that one can successfully perform desired behaviors.

12) Vicarious Learning: Learning through observing others.

REVIEW OF LITERATURE

Previous Exercise Adherence

Dishman, et al. (1985) reported that past participation in a supervised exercise program is a reliable predictor of current participation. Dishman and Steinhardt (1990) also found that a past history of exercise and current physical fitness were predictors of adherence to a supervised exercise program. Once an individual has begun to realize the benefits of exercise they are more likely to continue to adhere, regardless of the time that has to be allotted. Sedentary individuals, however, may respond that they have positive intentions to begin exercise, but they perceive exercise behavior as physically demanding and have difficulty reconciling the time demands of an exercise program into their weekly schedule (Godin, Shephard & Colantonio, 1986). Furthermore, when they do attempt an exercise program, they become aware of the effort that is required to integrate a new behavior into their lifestyle. The dilemma then is that while subjects indicate an interest in beginning a regular exercise program, they see the necessary time commitment as an overwhelming barrier. "To understand why people sometimes lack the motivation for regular physical activity, one must first acknowledge a simple yet important fact: exercise is voluntary and time-consuming. Therefore, it may extend the day or compete with other valued interests and responsibilities of daily life"

(Franklin, 1994, p. 1).

Iverson, Fielding, Crow, and Christenson (1985) reported that previous research indicates that lack of time due to work pressures and laziness are the most frequently mentioned barriers to increasing physical activity, yet questionnaire respondents reported that better facilities, cheaper facilities, increased family, friend, and partner interest, and the availability of fitness classes and organized sports would stimulate them to be more active. Mavis, et al. (1992) investigated issues related to participation in health promotion programs. They found that participants tend to practice more healthy lifestyles than nonparticipants, and perceived lack of time as the most common reason given for nonparticipation.

Godin, Desharnais, Valois, Lepage, Jobin, and Bradet (1994) investigated perceived barriers to exercise. The major barrier identified was time. "Time is a universal barrier for any sedentary individual" (Godin, et al., 1994, p. 284). Consistent with previous literature, lack of time for exercise was a barrier for beginning or maintaining an exercise program. They also found that subjects who had high intentions to exercise reported that barriers were unlikely to keep them from exercising, whereas the subjects with low intentions anticipated more barriers. The five major barriers identified in the study were: time, lack of access to facility, physical health problems, cost, and lack

of an exercise partner.

Dishman (1991), however, reported that claiming lack of time as a barrier to exercise may indicate limited interest or commitment because population surveys indicate that regular exercisers are as likely as sedentary individuals to view time as an activity barrier. According to a poll of aerobic instructors in the Ace (American Council on Exercise) Insider (1993) which asked, "What do you believe to be the number one reason for dropout in your classes and/or your clientele?", 50 percent said boredom/burnout. Lack of time was indicated by 19 percent of the instructors, and a combined response of lack of commitment, lack of motivation, and not enjoying the exercise program accounted for 31 percent of the instructor's responses.

Epstein, et al. (1980) found that injuries increase dropout rates. They said that, "problems in developing good exercise habits may be most difficult for individuals in worse initial physical condition, since these persons must begin slower and may require longer periods to reach desired levels of fitness and may develop more injuries" (p. 467). The duration and intensity of exercise required to increase fitness may produce aversive side effects during initial stages of exercise and lead to early dropout.

Field and Steinhardt (1992) suggest that health and fitness programs should support an active lifestyle as just one aspect of the broader context of wellness. If people

can adopt a wellness perspective to enhance their health they may be more likely to appreciate the role of exercise and therefore have better adherence.

Since many people are unable to maintain lasting adherence after an initial attempt, it is important to allow reversion to a preintervention stage, a circuit from precontemplation, to contemplation, to action, to adherence. Classifying people as program dropouts may not take into account those who intend to and do return, at a later time, to exercise (Sallis & Hovell, 1990). Marcus, et al. (1992) believe that movement through stages of behavior change does not always occur in a linear manner, but may be cyclical. Individuals may make several attempts at behavior change before they achieve their goals. To persist in a program, one must attain satisfaction by realizing their own goals. Since such goals are likely to change over time, process model designs will be most successful in identifying exercise adherence strategies (Dishman, 1987). Organizing existing data around a process model may eventually help explain why previous attempts to predict and control exercise behavior have not been more encouraging.

Little is known about the impact of previous physical activity outside the exercise program setting. Decisions to exercise may largely be influenced by previous lifestyle decisions or behaviors initially untied to exercise. Perusse, et al. (1989) reported that transmissible factors

from one generation to another are involved in determining the level of habitual exercise. They found that children of adults who are physically active are more likely to be physically active themselves. It may be that when a family incorporates exercise into their lifestyle it is easier to adhere to a program even after the familial influence is no longer present. A new or altered behavior is more likely to persist if it exists within a behavioral complex where specific acts facilitate or are compatible with each other and are cued by a range of environmental stimuli and reinforcements (Noland, 1989).

Physical Fitness and Exercise Adherence

"Exercise adherence and maintenance of exercise regimens in the face of barriers and obstacles are serious issues that need to be addressed if the health benefits associated with exercise and physical activity are to be realized" (McAuley & Jacobsen, 1991, p. 186). "While many acknowledge the importance of physical activity to health and well-being, surprisingly few are regularly active enough to receive significant health benefits" (King, 1991, p. 359). Many researchers believe that physical fitness is one component of life which is related to our psychological as well as our physical health (McAuley & Jacobsen, 1991). The physiological and psychological benefits of exercise have been well documented (Harris, Caspersen, DeFries, & Estes, 1989; Herbert & Teague, 1989; McGinnis, 1992; Robison, et

al., 1992).

One of the salient aspects of habitual physical activity is the broad spectrum of conditions upon which it has a favorable influence (Dishman, 1987). "There is abundant epidemiological evidence that from the viewpoint of the cardiovascular system, it is better to be active than to be sedentary" (Shephard, 1988, p. 12). "Meta-analysis from more than 40 studies indicates that coronary heart disease is 1.9 times as likely to develop in physically inactive individuals than in active persons, independent of other risk factors" (Berlin & Colditz, 1990, p. 612). According to Perusse, Tremblay, Leblanc and Bouchard (1989), "epidemiological studies have also shown that physical activity has beneficial effects on several morbid conditions such as coronary heart disease, lipid profile, osteoporosis, cancer, and non-insulin dependent diabetes" (p. 1012). The American Heart Association (AHA) (1993) "reported that scientific evidence confirms that regular aerobic physical activity plays a significant role in preventing heart and blood vessel disease" (p. 31). Lack of exercise has been identified by the AHA as the fourth leading modifiable risk factor for cardiovascular disease (smoking, high blood pressure, and elevated cholesterol are the three more important modifiable risk factors). Exercise promotes cardiovascular health (Sallis, et al., 1988) by improving the circulatory system's ability to carry oxygen- and

nutrient-rich blood through arteries and blood vessels. Resting pulse rate is slowed because the heart becomes a larger and more efficient pump, and resting blood pressure is lowered due to increased flexibility of the vascular system (Blair, et al., 1985; Dubbert & Wilson, 1984; Neale, Singleton, Dupuis, & Hess, 1990; Stanton, 1986). Serum cholesterol is also lowered due to increased levels of high density lipoproteins (Epstein, Wing, Thompson, & Griffin, 1980; Neale, et al., 1990; Sallis, Buono, Roby, Micale, & Nelson, 1993; Tucker & Bagwell, 1991). The American Cancer Society, (Hammond and Garfinkel, 1969), published the results of a study about the effects of exercise and coronary heart disease. Over one million subjects were followed for a period of six years. Coronary heart disease death rates were lowest for subjects who participated in intense exercise, and highest for those who did no exercise. The same results were found for deaths from stroke and nonsyphilitic aortic aneurysm.

Exercise relieves muscular stress caused by psychological stressors and promotes restorative sleep which allows the muscles to rejuvenate themselves (Connell, et al., 1988, Dishman 1985; Lobstein, Ismail, & Rasmussen, 1989). It also improves muscular strength and endurance, and bone density (Franklin, 1994), and increases glycogen storage in the muscles. Aerobic exercise increases metabolism and helps lower body fat (Blair, et al., 1985;

Carmody, et al., 1980; Shephard, 1988). Exercise also indirectly influences health by controlling other behaviors such as smoking and overeating (Blair, et al., 1985; Schneider & Greenberg, 1992).

In an extensive review of exercise and lifestyle change, Shephard (1988) highlighted the following psychological benefits of exercise: increased well-being, self-image, and emotional well-being. Sonstroem (1986) reported that exercise builds self-esteem. It also has been reported that exercise promotes sociability, and a healthy competitive nature (Benyo, 1990; Neale, et al., 1990). Exercise increases overall emotional stability (Lobstein, et al., 1989) and decreases psychological depression (Carmody, et al., 1980; Dishman, 1991).

Participation in an exercise program results in reduced disability days from work (Bertera, 1991), and increased life satisfaction (Connell, et al., 1988). Worksite fitness programs are associated with less employee turnover, absenteeism, and health care costs, along with an increase in productivity (Mavis, Stachnik, Gibson, & Stoffelmayr, 1992; Wood, Olmstead, & Craig, 1989).

The aforementioned benefits will continue to be present as long as individuals continue their exercise program. Significant losses in fitness can be noted within two weeks after the exercise program has ended. Maintaining personal health and fitness is largely a matter of individual

initiative and action. "Perseverance is a critical problem in preventive and rehabilitative medicine programs which require adherence to an habitual behavior pattern" (Dishman & Ickes, 1981, p. 422). According to the National Health Interview Survey conducted in 1985, only 7.6% of persons in the United States exercised at the level necessary to achieve cardiovascular benefits (Caspersen, Christenson, & Pollard, 1986). Despite all of the research citing the benefits of a regular aerobic exercise program, "at a given time about 40% of Americans do not exercise during leisure time, another 40% are active at levels probably too low and infrequent for fitness and health gains, while just 20% exercise regularly and intensely enough to meet current guidelines for fitness or reduced risk for several chronic diseases and premature death" (Dishman, 1988, p. 3). According to Dishman (1982) "...a critical question facing health care professionals no longer relates exclusively to the potential benefits of exercise, but now also encompasses the problem of ensuring that exercise behavior becomes habitual for those who might benefit from it" (p. 238). Albohm (1993) reported that the largest number of participants drop out of an exercise program within the first twelve weeks. She claims that those who drop out have not stayed with their program long enough to realize the positive benefits of physical activity.

Fitness Enhancement

Wilmore (1991) defined fitness as the ability to perform moderate to vigorous levels of physical activity without undue fatigue and the capability of maintaining this lifestyle. According to the American College of Sports Medicine (ACSM) (1990), the recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults involves a prescription of the frequency (3 to 5 days per week), intensity (60-85% of maximum heart rate) and duration (20-60 minutes of continuous aerobic activity) of training. A number of exercise adherence studies have suggested using this criteria in adherence research studies (Duncan & Stoolmiller, 1993; Dzewaltowski, 1989; Noland, 1989; Tetting, 1989). Albohm (1993) stressed the importance of explaining this criteria to subjects so that they begin a program slowly and only gradually increase the intensity of their workout, thus decreasing the risk of injury.

Because heart rate increases proportionately with an increase in workload (Bar-Or, 1983; Taylor, et al., 1969), heart rate can indicate the stress placed on the cardiovascular system. Monitoring and adjusting exercise intensity is essential to both the safety and effectiveness of an aerobic exercise program (Oman & McAuley, 1993). If the intensity is too low, there is little or no improvement, and if the intensity is too high, the participant may be

overly fatigued or injured. When one exercises within their prescribed intensity (target heart rate) they are most likely to improve their cardiovascular fitness and decrease the likelihood of injury (Dzewaltowski, 1989). This is also most likely to increase motivation to continue an exercise program due to positive physiological feedback and achievement of fitness goals.

Body Composition and Exercise Adherence

Body composition, the ratio of lean to fat body weight, has been a consistent predictor of exercise adherence in previous research (Dishman, 1982). Based on a sample size of 362 males, Dishman (1981) reported that individuals with greater adherence to exercise were both lighter and leaner than those who did not adhere. The explanation for this result may be that it is easier to exercise when there is less body fat. Leaner individuals also report a lower degree of perceived effort. Thus, "it might be expected that exposure to aversive perceptual consequences of excessive metabolic stress might more probably occur in less fit individuals who are overweight. As a result, exercise might become less attractive and dropping out would be facilitated" (Dishman, 1981, p. 155). Since most exercise involves weight-bearing activities, it may be harder for the heavier individual to participate, from both a physiological and psychological perspective (Dishman, 1982).

A low body weight and percent body fat may be

indicative of previous exercise behavior and/or a prior active lifestyle. A high level of pre-program fitness would seem to be a major benefit; however, some fit individuals set excessively high goals. The unfit individual has more room for improvement, and will see benefits more quickly and reach goals with less effort than a more fit individual. Attainment of initial training goals is very influential in promoting exercise adherence.

"Despite the potential health benefits associated with regular exercise and physical activity and the fact that about 85% of those surveyed reported they feel better when exercising, nearly half of the people who begin a health-related exercise program typically discontinue it within the first 3 to 12 months" (Yukelson, 1991, p. 7). Among volunteers who enter a supervised exercise setting, a 50% dropout rate is common within 6 months (Marcus, et al., 1992). Only 20% of eligible employees enroll in worksite based programs, and 50% of those have dropped out by the end of the first year (Neale, et al., 1990; Robison, et al., 1992). These figures closely approximate the dropout percentage for a variety of exercise programs, and some follow-up studies have shown that many individuals who participate in informal exercise programs fail to maintain a regular exercise schedule after their program ends (Martin & Dubbert, 1985). Since exercise is such a valuable tool for affecting change in risk factor variables related to

heart disease, and for controlling or maintaining a large number of other physiological and psychological health factors, it is pertinent to question why more people do not exercise on a regular basis (Martin, et al., 1984; McGinnis, 1992; Sopko, Obarzanek, & Stone, 1992).

Behavioral Intervention and Exercise Adherence

King, et al. (1992) define intervention as "a set of targeted activities designed to foster increased physical activity in a population" (p. S227). According to Sallis and Hovell (1990), "virtually all behavioral intervention studies have been conducted with small select groups, but some of the principles derived from these studies may be applicable to larger samples or entire communities" (p. 316). Behavioral intervention studies have demonstrated that several strategies may increase exercise adherence over short periods of time. In an extensive review, King, et al. (1992) reported that behavior modification resulted in a 10 to 75% increase in frequency of physical activity when compared with no treatment control groups. Behavioral strategies that have significantly increased adherence to exercise in experimental studies have been in the forms of contracts, lotteries, self-monitored logs (Noland, 1989), personalized feedback, and goals (Sallis & Hovell, 1990). A number of studies support the effectiveness of interventions that include goal-setting, feedback, self-monitoring, and self-reinforcement (King, et al., 1992).

Behavioral contracting has been shown to be effective in increasing activity frequency and reducing exercise program drop-outs (Epstein, et al., 1980; Neale, et al., 1990). Willingness to sign a behavioral contract may be a strong predictor of program participation and compliance. The use of behavioral contracts has resulted in a 10 to 20 percent increase in exercise adherence in the few studies where it has been employed (Neale, et al., 1990). Robison, et al. (1992) also advocate the use of contracts in exercise settings, and recommend that they be both specific and realistic. They suggest that aerobic exercise plans should include the frequency, intensity, and duration of the intended activities and should be signed by a witness. Their study of exercise adherence resulted in a 96% adherence rate for those subjects who completed a behavioral contract compared to a 23% adherence rate for those who did not.

Robinson (1992) experimented with having subjects "bet" 40 dollars that they could stay with an exercise program for six months. Participants were divided into teams of four to six people. When a team member failed to adhere to their contracted exercise program, half of his or her 40 dollars was divided among the teams that achieved 100% adherence to their exercise plans. Adherence to an aerobic activity for 30 minutes, four days a week, was 97% for the 117 subjects. A second group of subjects who did not invest money in an

exercise program had an adherence rate of only 20%. Robinson attributed the success of his program to the following factors: 1) the program was offered at the subjects' workplace; 2) participants received positive support from co-workers, and 3) the cash incentive was a powerful motivator.

Knowledge of health risks may increase exercise adherence, but it only serves as a short-term motivational effect. Marcus, Banspach, Lefebvre, Rossi, Carleton, and Abrams (1992) suggest that in order for interventions to be successful, the intervention must have a behavioral and motivational focus instead of a purely educational focus. According to Godin, Desharnais, Jobin, and Cook (1987), individuals rationalize their fear of health risks after an initial emotional response and do not make long-term behavioral changes. Godin, et al. (1987) contend that modification of behavior to increase physical activity requires major changes in lifestyle and that individuals need some type of repeated intervention to maximize the probability of exercise participation which is sufficient to decrease health risks. Lindsay-Reid and Osborn (1980) found that feeling at risk for coronary heart disease and other illnesses did not increase adherence to exercise. They concluded that the people in their study who were not at risk for heart disease chose to exercise to stay fit, to continue to control their health risks, and to receive

benefits from exercise.

Albohm (1993) reported that research on exercise adherence shows that health improvement is a reason for initiating exercise, but it is a poor predictor of activity maintenance. She concluded that convenience and a reasonable level of exercise intensity will encourage short-term adherence, but self-motivation is the best predictor of long-term adherence.

Godin, et al. (1986) recommend that perception of control over health outcome is a key variable that should be investigated in order to help subjects overcome their perceived barriers to exercise. Dishman and Steinhardt (1990) also concluded that in order for changes in health behavior to occur, people must believe that their health outcomes can be personally controlled by their behavior.

Albohm (1993) and Belisle, Roskies, and Levesque (1987) suggest that intervention should focus on increasing awareness of obstacles to exercise and to help subjects develop appropriate techniques for coping with these obstacles. According to King, et al. (1992), teaching relapse strategies can increase short and long-term exercise adherence. In their research they found small, but consistently superior, short- and long-term adherence for the group that received intervention compared to a control group. They recommend realistic goal-setting and positive self-talk as two techniques to help subjects overcome

exercise adherence obstacles. They stress the fact that the intervention should be tailored to focus on critical dropout periods, such as the end of a program, in order to be most beneficial.

Goal-Setting and Feedback

Since self-efficacy is dependent upon successful completion, or mastery, of tasks, it is vital that participants set attainable goals. Bandura and Schunk (1981) tested the effects of proximal versus distal goal-setting. They found that self-motivation through proximal goal setting serves as an effective mechanism for cultivating competencies, self-efficacy, and intrinsic interest. "Proximal subgoals provide immediate incentives and guides for performance, whereas distal goals are too far removed in time to effectively mobilize effort or to direct what one does in the here and now. Focus on the distant future makes it easy to temporize and to slacken efforts in the present" (Bandura & Schunk, 1981, p. 587). "Other things being equal, proximal influences are expected to be more important determinants of exercise. For example, the climate may affect the overall probability of exercise, but the weather would be expected to have a stronger effect on exercise for a given day. While a distal reinforcer such as compliments for losing weight may be very important to an individual, such events that are separated in time from the exercise behavior are likely to have much less influence on

exercise than encouragement from an exercise partner during or just after the exercise session" (Sallis & Hovell, 1990, p. 321). "Despite the best of intentions, if the immediate or short-term benefits of exercise do not outweigh the time and effort required, it is likely that drop-out or relapse to being sedentary will result" (King, 1991, p. 367).

Goals can be used as standards for people to measure their performance (Dubbert & Wilson, 1984). Attainment of subgoals can encourage participants to continue striving towards mastery. The resultant success and satisfaction can enhance intrinsic motivation. If there is too great a disparity between current performance and distal goals, the participant may become disappointed and self-efficacy may suffer. There should be a moderate discrepancy between current performance and future goals. Whether people become discouraged or motivated by this discrepancy is influenced by their self-efficacy to attain performance standards (Bandura & Cervone, 1983). Optimal motivation will occur when people are dissatisfied with a standard, but believe it can be achieved. The expectation of future satisfaction influences motivation. Thus, if people are moderately dissatisfied with their fitness they may be motivated to improve by participating in physical activity (Dzewaltowski, Noble, & Shaw, 1990).

Bandura and Cervone (1983) reported that the motivational effects of setting goals have been well

documented in different types of research conducted in both controlled and naturalistic conditions. Their evidence suggests that explicit, challenging goals enhance performance motivation.

According to Schunk (1989) goals will not enhance performance without an individual's commitment to them. If individuals are allowed to set their own goals, their commitment and performance may be enhanced (King, 1991). Gaa (1973) recommended the use of goal-setting conferences for helping participants learn how to set more realistic and accurate goals. This can also help participants have a more realistic appraisal of their chances for success. Gaa (1973) found that the goal-setting group in his study had significantly higher achievement, and their subsequent goal-setting behavior was significantly different from that of non-goal-setting groups. Specific, quantitative goals that were mildly challenging resulted in the highest achievement gains. Weinberg (1993) recommends the following four factors for setting and keeping goals: 1) goals must be realistic and the participant must have the skills necessary to achieve them; 2) the participant must have a high level of personal commitment to the goals they have set; 3) goals must be very specific; and 4) goals should be shared with others. According to Weinberg, lack of time and other pressures often cause people to lose sight of their goals, but publicly sharing specific, challenging goals will help

participants keep their focus.

According to Oman and McAuley (1993), "... a person might engage in an exercise program for highly controlling reasons which undermines feelings of self-determination and decreases intrinsic motivation. Unless the participant develops other motives for participation in the program that enhances self-determination, the possibility of dropping out is imminent" (p. 237).

During goal-setting conferences, instructors should provide attributional feedback, which links performance outcomes with causes. Feedback is most important when participants cannot evaluate their own performance (Schunk, 1989). Performance feedback can signal that participants are making progress, which raises self-efficacy. Feedback should be positive and highlight progress towards goals (King, 1991). Albohm (1993) recommends providing individualized fitness programs with reinforcement, supervision and periodic fitness testing so that subjects can receive specific feedback from instructors. Previous experience with a specific task can greatly assist an individual in setting subsequent realistic performance goals (Boyce, 1993).

Instructor enthusiasm and support can also significantly impact adherence to exercise regimens. An instructor can provide considerable information regarding progress and improvement, which influences self-efficacy

(McAuley & Jacobsen, 1991). Instructor influence resulted in significantly greater attendance for subjects in exercise programs compared with subjects in control groups in a study completed by McAuley and Jacobsen (1991). Noland (1989) found that positive reinforcement enhanced exercise adherence and physical fitness.

Modeling and Vicarious Learning

Learning can occur on a vicarious basis by observing other people's behavior and the consequences that result from that behavior (Bandura, 1977). Through observing others, individuals can shorten their own learning process by having an example or guide to imitate. This shortens the learning process because people can learn from the mistakes that they see the model make. "People usually achieve a close approximation of the new behavior by modeling and they refine it through self-corrective adjustments on the basis of informative feedback from performance ..." (Bandura, 1977, p. 22).

Similarity between the observer and model allows the observer to feel that they too can achieve what the model has accomplished. In order for the observer to act on what they have seen, they must consider the model to be a trustworthy and credible source. To assist the observer, multiple models can be used. Models can exhibit behavior perfectly, or demonstrate typical responses that lead to mastery or perfection (coping model).

Coping models exhibit the typical deficiencies of a beginner. They attest to the fact that determined effort and positive thoughts can overcome difficulties (Schunk, 1987). By viewing a peer succeeding on a task, an observer can also experience vicarious success and positive feedback. Models who are similar in age, background, and perceived competence facilitate performance most. Participants can also benefit from observing symbolic models such as videos of themselves and others.

Self-Efficacy

Perceived self-efficacy involves beliefs about one's capabilities to organize and implement actions necessary to attain designated levels of performance (Bandura, 1982). This can determine whether one will even try to cope with difficult situations. According to Bandura (1977), performance accomplishments are the most dependable source of efficacy expectations because they are based on one's own personal experiences. Success in an activity will increase self-efficacy for that activity as well as increasing motivation for and effort expended in that activity (Schunk, 1989). Failure may lead individuals to doubt their abilities and detract from efficacy expectations.

Schunk (1989) found that a variety of factors affect self-efficacy including: general abilities, skills, strategies, interests, attitudes, personality characteristics, and prior experiences. Once a participant

is engaged in an activity, there are numerous task engagement variables that can impact learning, including: the purpose of instruction, content difficulty, instructional context, instructional events, strategy instruction, performance feedback, models, goal setting, attributional feedback and rewards (Schunk, 1989). Schunk has also identified which types of cues can contribute to self-efficacy for continued learning. These efficacy cues are: performance outcomes, outcome patterns, attributions, social comparisons, persuader credibility, and bodily symptoms. Subjects acquire information about their self-efficacy from performance accomplishments, vicarious (observational) experiences, forms of persuasion, and inferences from physiological states (Bandura, 1982).

Self-efficacy exerts an important influence on motivation to acquire skills and knowledge rather than merely to complete activities (Schunk, 1987). Participants who have a high sense of efficacy for learning should expend greater effort and persist longer than those who doubt their capabilities. "Bandura proposed that self-perception of efficacy, in concert with self-evaluation and goal-setting, determines what people choose to do, how much effort they invest, and how long they persevere in the face of disappointing results" (Stotland & Zuroff, 1991, p. 48). Self-efficacy has been associated with physical activity of healthy individuals in supervised and free-living settings.

Self-efficacy has been a significant predictor of adoption and maintenance of physical activity (King, et al., 1992).

Self-Efficacy and Exercise Adherence

McAuley and Jacobsen (1991) reported that there is a growing body of literature that supports the importance of self-efficacy in exercise behaviors. Self-efficacy beliefs have predicted treadmill exertion, compliance with home-based exercise programs, and cardiac rehabilitation. Sallis, Pinski, Grossman, Patterson, and Nader, (1988) reported self-efficacy as a significant predictor of adherence to physical activity. Desharnais, Bouillon, and Godin (1986) found self-efficacy to be a significant predictor of continued exercise adherence after a period of intervention. They suggested that exercise adherence would be enhanced if self-efficacy was improved. Garcia and King (1991) compared the predictive power of self-motivation and self-efficacy. Analyses indicated that self-efficacy, defined as belief at a particular point in time that one can perform a specific behavior, was strongly related to exercise adherence whereas self-motivation was not. King, et al. (1992) also reported that self-efficacy is a more powerful predictor of long-term exercise adherence than self-motivation.

"The initial interest and desire which encourage individuals to begin exercising may not be sufficiently strong to ensure maintenance over time. As initial

motivation wanes, a number of real and perceived barriers including inconvenience, inaccessible program locations, work conflicts, lack of time and energy, and medical problems can hinder long-term exercise participation" (McAuley & Jacobsen, 1991, p. 185). Results from a study completed by Dzewaltowski (1989) indicated that "individuals who were confident that they could continue to participate in an exercise program in spite of barriers to participate exercised more days per week" (p. 265). In this study of exercise motivation, self-efficacy was the only significant predictor of exercise participation.

devries, Dijkstra, and Kuhlman (1988) found that self-efficacy expectations added significantly to the prediction of intention to begin a health-related behavior. Marcus, et al. (1992) reported that subjects who were contemplating beginning an exercise program scored very low in exercise self-efficacy while subjects who were already involved in exercise (maintenance group) scored very high. Sallis and Hovell (1990) conducted a study to assess the relationships between 24 potential determinants of exercise behavior and frequency of vigorous exercise (duration of at least 20 minutes per session). Bivariate correlations indicated that self-efficacy had the highest correlation with frequency of vigorous exercise. In a second study, Sallis and Hovell (1990) assessed the relationship between the same determinants and walking. Only three significant correlates

were identified from multiple regression analyses: self-efficacy for exercise, a heart-healthy diet, and age.

A third study by Sallis and Hovell (1990) examined correlates of relapse from vigorous exercise. Subjects reported the number of times they had exercised for six months and then stopped exercising for three or more months. Relapse patterns were identical in both current exercisers and current nonexercisers. This finding reveals that many people who are identified in cross-sectional studies as sedentary may have been regular exercisers in the past. Among those who currently adhered to exercise, negative self-efficacy, injury, and education were significant correlates of relapse.

Hofstetter, Hovell, Macera, Sallis, Spry, Barrington, Callender, Hackley, and Rauh (1991) designed a study to compare persons with temporary and long-term illnesses or injuries to healthy individuals with respect to determinants of walking and/or vigorous exercise behavior. Based on a sample size of over 2,000, they found that even when age, education, income, and gender were controlled, self-efficacy was the most powerful and statistically significant correlate of both walking and vigorous exercise. They further reported that people who had limited physical skills due to injury or illness still reported that they enjoyed walking, and therefore they advocated programs that are specifically designed for people with special needs. They

suggested increasing exercise participation by exploring ways to increase confidence or self-efficacy in one's ability to exercise.

When examining the effects of self-efficacy on the exercise participation of previously sedentary adult females, McAuley and Jacobsen (1991) found that exercise self-efficacy, defined as participants' beliefs in being able to regularly exercise in spite of real or perceived barriers, was an important component of adherence to exercise programs. Individuals who exercised on a regular basis perceived themselves to be more capable of exercising in the face of barriers to participation. McAuley, Duncan, and Wraith (1991) found that subjects who perceived themselves as being more competent and exerting more effort were those who indicated greater confidence in intentions to continue exercising. These results were associated with increased attendance and a greater self-efficacy for exercise adherence.

Dzewaltowski, et al. (1990) compared the value of three theories for predicting exercise behavior: reasoned action, planned behavior, and social cognitive theory. They found that social cognitive theory constructs were the best predictors of physical activity, with self-efficacy and self-evaluation of behavior significantly contributing to the prediction. The greater the confidence in participation in physical activity and the greater the satisfaction with

present physical activity, the more physical activity performed.

Self-efficacy has been the primary theory used to investigate self-confidence in sport performance. It has been repeatedly reported that self-efficacy predicts sports performance (Fitzsimmons, Landers, Thomas, & Van der Mars, 1991). Self-efficacy theory has also been useful to researchers interested in understanding and predicting health-related behavior change (Marcus, et al., 1992; Rodgers & Brawley, 1991).

Marcus, et al. (1992) employed self-efficacy theory to examine stages of exercise behavior change. Their results indicated that employees who had not yet begun to exercise, in contrast with those who exercised regularly, had little confidence in their ability to exercise. Individuals at various stages of exercise behavior could benefit from interventions that differ in their focus on enhancing efficacy expectations. Those who are just beginning an exercise program might benefit most from "informational and motivational experiences designed to increase the appeal of physical activity and to enhance efficacy expectations" (Marcus, et al., 1992, p. 64). Marcus and Owen (1992) studied motivational readiness, self-efficacy, and decision-making for exercise. They found that subjects in the precontemplation and contemplation stage of change had low self-efficacy scores, while those in the maintenance group

had much higher self-efficacy scores. They believe that it is important to design different types of intervention and exercise regimens to increase exercise adherence based on an individual's readiness for change.

Barke and Nicholas (1990) also investigated readiness for change in exercise behavior. They focused their investigation on older adults and found that, contrary to what many people believe, older adults are not set in their ways and are in many instances engaging in physical activity. There is a need to break the stereotype of the sedentary senior and help those who are not physically active change their self-perceptions. In order to do this, they recommend meeting individuals at their current stage of change. It is important that it is not assumed that all subjects are equally prepared to adopt new behaviors. Those people who are in the precontemplation stage need education and attitude intervention, while those in the contemplation stage could benefit most from skill instruction and supported practice. People who are in the maintenance stage may only require continued access to activities to facilitate their exercise adherence (Barke & Nicholas, 1990). Gill and Overdorf (1993) also focused on the exercise behaviors of older adults. They reported that a decrease in physical activity in later life is at least partially due to a lack of adult exercise models, a tendency to underestimate one's physical abilities, and stereotypes

concerning the appropriateness of physical activity. According to Gill and Overdorf's research, exercise incentives vary by age; thus they recommend using motivational techniques which are specific to younger and older individuals. Based on the results of their research, exercise programs for older women should emphasize the physical and mental health benefits of exercise, stress reduction, and social interactions, and promote mastery experiences.

Waller and Bates (1992) reported that self-efficacy is an important construct in maintaining healthy behaviors and lifestyle. If people practice healthy behaviors, their perceptions of self-efficacy will increase. Waller and Bates investigated the health behaviors of the elderly. They found that "healthy seniors were characterized by high generalized self-efficacy and good health practices. These individuals accepted the responsibility of maintaining their good health status, perceived that they had the ability to do so, and practiced healthy behaviors that led to the expected outcome of good health in the later years" (Waller & Bates, 1992, p. 307). These investigators believe that individuals with high self-efficacy will benefit from health promotion programs, but individuals with low self-efficacy need innovative interventions in health promotion to succeed.

Another strategy to increase adherence, especially for

less fit women who are in the initial state of involvement, is to focus on enhancement of self-efficacy (Hilgenkamp, 1993). Hilgenkamp reported on self-efficacy scores during adoption, compliance, and adherence phases of exercise participation. Self-efficacy scores for males and females increased from the adoption to compliance phase. Significant predictors of adherence to the structured running program used in this study were gender, fitness level, and self-efficacy.

Sallis, et al. (1988) believe that self-efficacy is a promising predictor of behavior change. They reported that changes in exercise habits are difficult to initiate and maintain, and the results of most programs are disappointing. Thus, Sallis, et al. (1988) developed a self-efficacy scale for health-related diet and exercise behaviors. The results from using their scale showed that resisting relapse and making time for exercise may be the most important factors to consider for exercise adherence.

Bernier and Avard's (1986) results from a study on weight reduction attest to the validity and utility of Bandura's self-efficacy construct in predicting behavioral persistence and level of behavior change. Self-efficacy was the only significant variable to predict weight reduction during and after the end of a behavioral management treatment. Self-efficacy was enhanced throughout the process of behavior change and decreased after the end of

the program. Self-efficacy was a significant predictor of adherence to the weight loss program and was also significant in predicting length of abstinence and relapse. Bernier and Avard also found a significant relationship between goal-setting and self-efficacy.

"Training that enables subjects to accomplish a new behavior leads to the expectation that the action can be replicated in the future. These changed expectations then become the mediators of behavior change" (Kaplan, Atkins, & Reinsch, 1984, p. 240). The self-efficacy gained through the accomplishment of one new behavior does not however generalize to dissimilar behaviors without additional training. When working with patients with chronic obstructive pulmonary disease, Kaplan, et al. (1984) found that after three months, the groups who were given specific training for compliance with a walking program significantly increased their activity in comparison to the control group who received only attention. They also investigated changes in self-efficacy and found that the changes were specific to physical activity, which was the target of their intervention. Thus, efficacy and performance attainments may affect each other in a reciprocal fashion. The intervention that Kaplan, et al. (1984) employed involved goal-setting, reinforcement, behavioral contracting, contingency management and relaxation training. Since self-efficacy beliefs can increase with training, they are a

useful intervention technique (King, et al., 1992).

Sallis, Haskell, Fortmann, Vranizan, Taylor, and Solomon (1986) support the importance of self-efficacy as a mediator of behavior change. They reported that perceived self-efficacy predicted change in both vigorous and moderate intensity activity. Similar results were reported by Sallis, Hovell, Hofstetter, Faucher, Elder, Blanchard, Caspersen, Powell, and Christenson (1989). In their study involving more than 2,000 subjects, they concluded that self-efficacy was a major variable in accounting for participation in vigorous exercise and that intervention studies should employ social learning theory to examine exercise behavior.

METHODOLOGY

Selection of Subjects

The participants in this study included 52 male and 44 female members of the Circuit Center at Dundalk Community College. Circuit training involves alternately exercising using a weight machine for 30 seconds with doing an aerobic exercise for 30 seconds. All subjects completed the same written and physical evaluations and participated in the same fitness activity. Subjects were randomly divided into three groups (experimental: n=34, comparison: n=33, and control: n=29). Married couples were assigned to the same group, and were also randomly divided into the three groups. The experimental group received behavioral intervention aimed at increasing exercise adherence. The comparison group received an intervention which was not aimed at influencing exercise adherence. The control group did not receive any additional intervention.

Subjects ranged in age from 19 to 72 years; the mean age was 42 years. The experimental group subjects ranged in age from 19 to 64 years, with a mean of 41.2 years. The comparison group age range was 22 to 72 years, with a mean of 45.2 years. The control group range was 19 to 71 years; the mean age was 39.1 years.

All current members of Dundalk Community College's Circuit Center were sent a letter (Appendix A) four weeks prior to the beginning of the investigation requesting their

participation in a 24 week study that required them to have a submaximal graded exercise tolerance test and body composition analysis at the beginning and end of the 24 weeks. All subjects also received a follow-up telephone call encouraging them to participate. All subjects were asked to keep 12 bi-weekly logs of their aerobic exercise during the study. A sample of the exercise log was mailed out with the request letter.

The goal of Circuit Training is for participants to exercise within their target heart rate (THR) zone for at least 20 minutes. Subjects were reminded that their THR zone is recorded on the Circuit Center workout card, which they were supposed to complete each time they exercised in the Center.

The subjects who were randomly assigned to the Experimental group were asked to attend four one-half hour intervention sessions (one each during weeks 9, 11, 13, and 15). Subjects who were randomly assigned to the Comparison group received telephone contact every two weeks (once each during weeks 9, 11, 13, and 15) to receive non-exercise related information from the investigator. Subjects in the Control group exercised in the Circuit Center, but had no other contact with the researcher.

Procedures

A. Exercise Adherence

Exercise adherence was determined from self-report

of exercise activity for 24 weeks. The 24 weeks were divided into 3 adherence periods: "before adherence" (weeks 1-8), "during adherence" (weeks 9-16), and "after adherence" (weeks 17-24). Subjects were asked to record this information using an exercise log form (Appendix B). Subjects were asked to estimate the mode, frequency, duration, and intensity of their exercise activity. Heart rate (intensity) is typically used to estimate physical activity and oxygen uptake based on the assumption of a linear relationship between heart rate and heat production (Haskell, et al., 1992). Subjects turned their logs in to the investigator via a box in the Circuit Center approximately every two weeks (weeks 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, and 24). Godin and Shephard (1990) and Sallis, et al. (1993) have reported that a number of investigators have found self-report of exercise behavior to be both reliable and valid. The total number of workouts that met the criteria of 20 or more minutes in target heart rate (THR) was used to determine exercise adherence. Subjects' Circuit Center workout cards (Appendix C) were also reviewed by the investigator to corroborate the information recorded on the exercise logs.

B. Exercise Self-Efficacy

Pre- and post-treatment exercise self-efficacy was

determined from subjects' completion of an Exercise Self-Efficacy Scale (Appendix D). This questionnaire was completed when subjects had finished their physical fitness pre-and post-tests.

C. Physical Fitness Assessment

Pre- and post-treatment physical fitness assessment included: height, weight, skinfold measurements, girth measurements, and a submaximal graded exercise tolerance test. As part of standard college procedures, all subjects must complete a series of physiological pre-tests before they are allowed to exercise in the Circuit Training Center. All tests were conducted by trained fitness professionals.

The workload achieved by each subject was correlated with their heart rate to extrapolate a specific maximum oxygen consumption (aerobic capacity). Before subjects were given a graded exercise treadmill test (GXT), they signed an informed consent form (Appendix E). Anyone who had high blood pressure, circulatory or metabolic disorders, or any questionable medical problem for which they were presently under a physician's care or taking prescription medications had to get a signed medical clearance from their physician prior to making an assessment appointment. Participants who were age 35 or older and had a high blood cholesterol level (over 200 mg), smoked, or had

a family history of heart disease prior to age 50 were also required to have a physician's referral before they could be tested (Appendix F). Anyone with known cardiovascular disease was not included in this investigation. Certified American College of Sports Medicine (ACSM) Exercise Test Technicians conducted all GXT testing. Upon completion of the pre-test fitness battery, subjects were provided with a printout of their results and a booklet of fitness norms for each test (Appendix G).

D. Fitness Testing Procedures

1. Height and Weight

The height of the subjects was measured in inches with the subjects standing erect. The weight of the subjects was measured in pounds to the nearest .25 pounds.

2. Skinfold Measurements

All skinfold measurements were taken on the right side of the body. Measurements were repeated until they were within one millimeter of each other. The three skinfold sites for males were: triceps, subscapularis, and pectoralis. The two skinfold sites for females were: triceps and suprailiac.

Skinfold Sites:

a) Pectoralis - diagonal fold located one-half of the distance between the anterior-axillary line and the nipple.

b) Tricep - vertical fold located posteriorly midway between the acromion and the olecranon with the elbow extended and relaxed.

c) Subscapula - diagonal fold about one centimeter inferior to the inferior angle of the scapula.

d) Suprailiac - diagonal fold located about 3 centimeters above the anterior superior iliac crest at the anterior axillary line.

3. Girth Measurements

All girth measurements were measured in the standing position. Girth measurements were taken at the chest, waist, right bicep, and right thigh using a tape measure. The tape measure was pulled snugly around the designated area. The measurements were rounded to the nearest .25 inches.

Girth Measures:

a) Chest - measure at nipple level at the end of a normal expiration.

b) Waist - measure at the level of the umbilicus.

c) Thigh - measure just inferior to the gluteal furrow at the maximal thigh circumference.

d) Arm - measure arm circumference at the mid-point of the biceps brachii with the individual in the anatomic reference position.

4. Exercise Tolerance Test

An exercise tolerance test is a modified form of a traditional medical diagnostic procedure known as a stress test. The tolerance test is used as an accurate and safe assessment of fitness. A standardized submaximal exercise tolerance test was given to each participant as a pre-program entrance fitness evaluation and a post-program evaluation as a comparative basis for:

a) determining existing workload capacity (fitness levels),

b) determining productive individual heart rates to regulate workload intensity during exercise sessions (target heart rates),

c) educating participants about their particular physiological responses during exercise (educational function), and

d) screening latent, undetected, asymptomatic abnormalities evident only under physical exertion (safety factor).

"The 'gold standard' or criterion measure of cardiovascular fitness is maximal oxygen uptake or power (VO_2 max)" (Haskell, et al., 1992, p. S212). Oxygen uptake can be accurately estimated from performance on a treadmill from the rate, speed, grade, and resistance of work completed. This type of procedure has been used extensively in exercise and fitness studies.

"Having a subject perform any maximal test to assess cardiovascular fitness carries a substantial subject and examiner burden; the burden for the subject includes time, effort, and risk. To reduce this burden, a wide variety of submaximal exercise testing protocols have been developed and used in numerous observational and intervention studies evaluating the relationship of physical activity, cardiovascular fitness, and cardiovascular health" (Haskell, et al., 1992, p. S212). An estimate of cardiovascular fitness is made from the submaximal heart rate response and is extrapolated to predict maximal oxygen uptake. The extrapolation is based on the assumption of a linear relationship between heart rate and oxygen uptake (Bar-Or 1983; Haskell, et al., 1992).

Specific guidelines were established to screen out symptomatic participants prior to testing. In the first

orientation session, each participant completed an extensive medical history (Appendix H) which was used as a tool to screen out those with known risk factors for cardiovascular disease or related diseases. To participate in the program, high risk subjects were required to have medical permission from their personal physicians. Without a physician's permission, symptomatic persons were not given an exercise tolerance test nor allowed to participate in the exercise program.

Throughout the exercise tolerance test, blood pressure and heart function (electrocardiogram) were monitored constantly to assess physiological responses to increasing workload. The testing was terminated on the basis of one of the following criteria:

a) achievement of predetermined test target (85% of predicted maximum or physician referral rate),

b) achievement of participant's tolerance limit (cannot go any further), or

c) manifestation of some abnormal physiological response (changes in EKG, elevations in blood pressure, or discomfort).

From the results of the workload tolerance, a specific target heart rate was assigned to each participant which identified a productive intensity to promote

physiological improvement. The target heart rate limits the intensity for older or symptomatic persons, and thereby contributes to safety during exercise sessions. Because this target is dependent upon individual adjustments to exercise, an exercise tolerance test is critical for determining safe and productive levels.

E. Behavioral Intervention

1. Circuit Center Program

The Circuit Center consists of 22 fitness stations designed to improve muscular strength and endurance as well as cardiovascular fitness. Aerobic exercises are alternated with weight stations to maintain target heart rate. Each workout is designed to last approximately 40 minutes from warm-up to cool-down. Membership was available to all Dundalk Community College students, faculty, staff, and community members.

2. Goal-Setting and Feedback

The investigator assisted the experimental group participants in identifying realistic short-term (proximal) and long-term (distal) goals throughout the study. These participants met biweekly during the intervention period with the investigator to discuss problems and adjust workouts and goals to adapt to

individual progress and personal needs. Feedback from the investigator regarding fitness progress, procedures, and personal accomplishments towards goals (Appendix I) was an integral part of this study. Participants were given written and/or verbal feedback at least every two weeks. The investigator monitored the workouts performed in the Circuit Center by reviewing weekly the training logs kept in the Circuit Center files. Written feedback was given to subjects via this form. In this way, expert knowledge and supervision was shared with the participants to help ensure safe progress and improved fitness. In addition, fitness monitors were present in the Circuit Center at all times to assist members as needed during their workouts.

3. Experimental Group Intervention I

During the eight week intervention period, the subjects in the experimental group were asked to meet with the investigator four times (Appendix J). Each meeting lasted approximately 30 minutes.

Physiological arousal was addressed in this study by having the investigator work with the experimental group participants until they could identify the level of intensity that is desirable for a safe and effective cardiovascular workout.

This range of intensity has been termed Target Heart Rate (THR). By working out in their THR subjects were able to monitor their workout to make sure that they were working hard enough to receive cardiovascular benefits without causing injury or undue discomfort. Saris (1986) and Freedson (1989) have recommended heart rate as an accurate index of physical activity.

An exercise prescription was generated from the results of the exercise tolerance test. Each person in the experimental group was asked to sign a contract that required them to exercise three to five days per week (frequency) in their THR (60-85% of maximum heart rate intensity) for 20 or more minutes (time). The Karvonen formula: target heart rate = % intensity (maximum heart rate - resting heart rate) + resting heart rate (Karvonen, Kentala, & Mustala, 1957) was used to calculate the THR range for each individual. The investigator met with participants in the experimental group to explain the results of the pre-testing and develop individualized programs of aerobic exercise activity and behavioral contracts based on their current level of fitness and their entry level performance on the machines in the Circuit Center.

Experimental Group Intervention II

During the second intervention meeting the investigator met the subjects in the experimental group in the Circuit Center. The primary purpose of this meeting was to review progress towards goals, compliance with the behavioral contract, and to help subjects overcome any difficulties they were having during their Circuit Center workouts.

Experimental Group Intervention III

This meeting also took place in the Circuit Center. The same process that occurred during Intervention II was repeated. In addition, any goals that needed modification were changed. Subjects were reminded to continue to complete their biweekly exercise logs and workout cards.

Experimental Group Intervention IV

This last individualized intervention was aimed at helping the subjects prepare for continued adherence without the investigator's assistance. Short and long-term goals and an updated Behavioral Contract were completed.

4. Comparison Group Intervention Procedures

In an attempt to control for the Hawthorne effect, a matched group of participants, the comparison group, also received contact

throughout the semester. The comparison group was called on the telephone every two weeks by the investigator. The purpose of the phone call was to inform subjects about different events that were taking place on campus or in the surrounding community. No specific mention of the Circuit Center or exercise was made.

5. Exercise Contract Adherence

Behavioral contracting, an explicitly defined commitment with specific outcomes for adherence or nonadherence, has been effective in increasing exercise frequency and adherence (Neale, et al., 1990). The subjects in the experimental group in this study were encouraged to sign and adhere to an exercise contract (Appendix K). The behavioral contract included the specific plan the person intended to follow, including the frequency, duration, intensity and mode of exercise. Participants were asked to have one of the Circuit Center monitors initial their training log to increase the reliability of reported workouts. All Circuit Center members signed in on a dated log sheet each time they used the facility. As stated earlier, workouts completed outside of the Circuit Center and after

the end of the intervention were recorded via self-report exercise logs. Participants were asked to have a witness initial the exercise log to help verify the activity performed.

Instrumentation

The Exercise Self-Efficacy Scale that was used in this study (Marcus, et al., 1992) is composed of items which reflect participants' confidence in their ability to adhere to an exercise program. Items represent the following areas: negative affect, resisting relapse, and making time for exercise. A 7-point scale was used to rate each of the five items with 1 (not at all confident) and 7 (very confident) as the anchor points. Subjects could also respond with a 0 (does not apply to me). The five items in the scale are: "I am confident I can participate in regular exercise when: 1) I am tired; 2) I am in a bad mood; 3) I feel I don't have the time; 4) I am on vacation, and 5) It is raining or snowing." Coefficient alpha was calculated by Marcus, et al. (1992) to determine internal consistency of this measure. Internal consistency was .82 (n = 917) in one study, and .76 (n = 388) in a second study. Test-retest (product moment) reliability for the self-efficacy scale over a two-week period was .90 (n = 20) (Marcus, et al., 1992). Additional items (items 6 through 14) were added to this scale by the investigator in an attempt to identify other possible reasons why subjects either did or did not

adhere to their aerobic exercise program (Appendix D).

Data Analysis

Multiple regression analyses were conducted to identify the variance in exercise adherence that could be accounted for by the variables investigated. This procedure was used to analyze the variance in exercise adherence patterns during and after the intervention period.

In addition to answering the three research questions, correlation coefficients were determined to analyze the relationships among the independent variables. Supplementary quantitative and qualitative analyses were used to examine subjects' responses to three open-ended questions that were included as part of the Exercise Self-Efficacy Questionnaire.

RESULTS

Introduction

This chapter first presents the exercise adherence and self-efficacy data collected in this study. Subsequently, the results of the research questions are reviewed, as well as the results of several supplementary analyses.

Descriptive Statistics

Complete data were collected from 96 subjects who reported their exercise adherence for 24 weeks. An exercise session met the criteria to be included in the data analysis if the subject reported that they exercised in their target heart rate zone for a minimum of 20 minutes. Thus, in a week, the maximum number of sessions of possible exercise adherence was seven. The American College of Sports Medicine (1990) recommends at least three days per week of exercise in target heart rate zone to increase cardiovascular endurance and bring about significant change in physical fitness and health.

Table 1 presents the sessions per week of exercise reported for the entire group and for the three subgroups. The range for all three groups was zero to seven sessions per week for each of the three adherence periods. Baseline adherence information was collected during weeks one through eight ("before adherence"). The mean adherence rate for those weeks was 1.96 sessions per week. Weeks 9 through 16 ("during adherence") served as the experimental phase of the

study for the subjects who were in that group. Mean adherence during weeks 9 through 16 was 1.82 sessions per week. The mean adherence rate for the last eight weeks, 17 through 24 ("after adherence"), was 1.86 sessions per week.

Statistics for the three subgroups were as follows: the experimental group's "before adherence" was 2.68 sessions per week; "during adherence" 2.52 sessions per week, and "after adherence" 2.56 sessions per week. For the comparison group, the results were: 1.86, 1.58, and 1.63 sessions per week, respectively. The control group reported adhering 1.25, 1.26, and 1.31 sessions per week for the three time periods.

One-way analyses of variance revealed that the three groups were significantly different with respect to "before", "during", and "after adherence" (see Appendices L & M). Scheffe's post hoc analysis (alpha = .05) (see Appendix N) revealed that the experimental group was significantly different than both the comparison and control groups for each of the three adherence time periods. The differences in the three groups was controlled for in the regression analyses by entering the grouping variable first in the regression equation.

Table 1. Reported Sessions Per Week of Exercise Adherence

	Before Adherence		During Adherence		After Adherence	
	M	SD	M	SD	M	SD
Total Group (n=96)	1.96	1.44	1.82	1.43	1.86	1.52
Experimental Group (n=34)	2.68	1.61	2.52	1.60	2.56	1.70
Comparison Group (n=33)	1.86	1.10	1.58	1.17	1.63	1.15
Control Group (n=29)	1.25	1.21	1.26	1.18	1.31	1.37

The Circuit Center was closed for one week, during the winter semester break, which fell during the experimental period. Based on the comments included on the exercise logs, this temporary "forced vacation" accounted for the slightly lower adherence rates reported for "during adherence." Several subjects remarked that the temporary closing of the facility, along with the hectic activity that accompanies the holiday season, kept them from adhering to their normal exercise routine. Self-efficacy question number four asked, "How confident are you that you could continue to engage in aerobic exercise when you are on vacation?" (1 = not at all confident to 7 = very confident). The mean response for this question was 4.70 on the pre-test and 4.64 on the post-test.

Subjects reported very high levels of exercise self-efficacy at both the pre- and post-test sessions. Mean pre-test exercise self-efficacy was 5.08 and on the post-test the mean score was 5.04 (see Appendix O). Mean pre-test exercise self-efficacy was 5.30 for the experimental group, 5.32 for the comparison group, and 4.59 for the control group. Mean post-test exercise self-efficacy scores were 5.47 (experimental), 5.20 (comparison), and 4.37 (control). Based on Scheffe's test, the three groups did not have significantly different self-efficacy means. Pearson-product moment correlations for pre- and post-test exercise self-efficacy were: .84 (total group), .89 (experimental),

.70 (comparison), and .85 (control). All of these correlations were significant at <.0001.

Pearson Correlation Analyses

Pearson product-moment correlations were conducted to determine the relationships between the independent variables (adipose body weight, aerobic capacity, behavioral treatment, self-efficacy and previous adherence) and the two dependent variables, "during" and "after adherence." These results are reported in Table 2. Highly significant relationships were reported when "before adherence", was correlated with both "during" and "after adherence." Strong relationships were also reported for aerobic capacity and "after adherence", and for self-efficacy and "during" and "after adherence." The only variable which was not significantly correlated with "during" or "after adherence" was adipose body weight.

Table 2. Pearson Correlation Coefficients for Adipose Body Weight, Aerobic Capacity, "Before Adherence", and Self-Efficacy with "During" and "After Adherence"

n=96

Independent Variables	"During Adherence"	"After Adherence"
Adipose Body Weight	-.06	-.06
Aerobic Capacity	.27*	.34**
"Before Adherence"	.88***	.87***
Self-Efficacy	.34**	.34**

* $p \leq .01$
** $p \leq .001$
*** $p \leq .0001$

A table of the intercorrelations between all of the independent variables is reported in Appendix P. There were moderate correlations between "before adherence" and the experimental variable (.37) and between "before adherence" and self-efficacy (.35). There was also a moderate correlation between self-efficacy and adipose body weight (.37) and between adipose body weight and aerobic capacity (.32).

Re-Statement of Research Questions

1) To what extent do the independent variables (adipose body weight, aerobic capacity, behavioral intervention treatment, exercise self-efficacy, and previous exercise adherence) predict exercise adherence during the intervention period (weeks 9-16)?
2) To what extent do the independent variables predict exercise adherence after the intervention period (weeks 17-24)?
3) To what extent do the interactions between the independent variables contribute to the variance in "during" and "after adherence?"

Regression Analyses for "During" and "After Adherence"

The first two research questions addressed the extent to which the independent variables were able to predict "during adherence" and "after adherence." Table 3 summarizes the multiple regression analyses for the effects of the four continuous variables on "during adherence" and

on "after adherence." Regressions were conducted to test predictions from adipose body weight, aerobic capacity, "before adherence", and exercise self-efficacy of "during adherence" and "after adherence."

The only significant variable was "before adherence", which accounted for 52% of the variance in "during adherence" and 51% of the variance in "after adherence." In each case, "before" adherence was significant at the $p<.0001$ level.

Table 3. Unique Contribution of Each Continuous Variable Partialling Out the Other Predictors

Dependent Variable = "During Adherence" (n=96)

Source	SS	F Value	P Value	R^2
Adipose Body Weight	.1382	.28	.5970	.0007
Aerobic Capacity	.0622	.13	.7228	.0003
"Before Adherence"	102.0872	207.96	.0001	.5236
Self-Efficacy	.5591	1.14	.2888	.0029

Dependent Variable = "After Adherence" n=96

Source	SS	F Value	P Value	R^2
Adipose Body Weight	.3455	.62	.4346	.0016
Aerobic Capacity	2.1645	3.86	.0526	.0099
"Before Adherence"	110.4128	196.89	.0001	.5060
Self-Efficacy	.5137	.92	.3411	.0024

Table 4 reveals the regression results for the full model, with the four continuous variables (adipose body weight, aerobic capacity, "before adherence", and self-efficacy), the experimental treatment variable, and the four interactions in the regression equation (product variables created by multiplying the experimental variable by the 4 continuous variables). The four continuous variables accounted for 77% of the variance in both "during" and "after adherence." The intervention did not add significantly to the regression, nor did the interactions of the intervention and the continuous variables.

Table 4. Unique Contribution of Each Set of Variables in the Full Interaction Model

Dependent Variable = "During Adherence"
n=94

Source	DF	SS	MS	F Value	R^2
4 Continuous Variables	4	150.6913	37.6728	76.0299	.7729***
2 Dummy Variables	2	1.0742	.5371	1.0840	.0055
4 Interactions	8	3.5606	.4451	.8982	.0183
Error	80	39.6377	.4954		

* $p \leq .01$
** $p \leq .001$
*** $p \leq .0001$

Dependent Variable = "After Adherence"
n=94

Source	DF	SS	MS	F Value	R^2
4 Continuous Variables	4	168.0170	42.0043	79.9624	.7700***
2 Dummy Variables	2	.8284	.4142	.7885	.0038
4 Interactions	8	7.3222	.9153	1.7424	.0336
Error	80	42.0275	.5253		

* $p \leq .01$
** $p \leq .001$
*** $p \leq .0001$

SUPPLEMENTARY ANALYSES

Quantitative Analyses

Pearson product-moment correlation coefficients were calculated to determine the strength of the relationships among pre- and post-test adipose body weight (.95), aerobic capacity (.89), exercise adherence (.92), and exercise self-efficacy (.84). These four correlations were significant at the $p<.0001$ level.

The Exercise Self-Efficacy Scale that was used in this investigation consisted of five items from an instrument created by Marcus, et al. (1990) (items 1 through 5) and six additional items (items 6 through 11) created by the investigator. The pre-test self-efficacy correlations with "during" and "after adherence" were both .34 ($p = .0006$). The correlations between post-test exercise self-efficacy and "during" and "after adherence" were .44 ($p < .0001$) and .62 ($p < .0001$), respectively.

Qualitative Analyses

The 96 subjects in this study had the option of answering three open-ended questions when they completed the Exercise Self-Efficacy Scale at their pre- and post-test sessions. The three questions were: (1) What would make you stop a regular aerobic exercise program?; (2) What would encourage you to continue a regular exercise program?, and (3) What would encourage you to start exercising again if you had to stop temporarily? Some subjects did not answer

the question(s) and some gave more than one response to one or more questions. Responses that were very similar were clustered and all responses were tallied. The responses that received a minimum of three tallies are listed in Table 5.

Table 5. Responses to Open-Ended Exercise Self-Efficacy Questions

Question 1: What would make you stop a regular aerobic exercise program?

	Pre	Post
Injury:	24	18
Illness:	16	7
Lack of Time:	12	8
Work/Family Obligations:	6	
Other:	28	6
Total Responses:	86	39

Question 2: What would encourage you to continue a regular exercise program?

	Pre	Post
Fitness Benefits:	37	15
Improved Health:	12	
Friends:	12	4
Other:	12	11
Total Responses:	73	30

Question 3: What would encourage you to start exercising again if you had to stop temporarily?

	Pre	Post
Wanting to Experience	16	
Fitness Benefits:	12	11
Weight Gain:	7	3
Fitness Loss:	5	5
Feeling Lazy:	10	15
Other:		
Total Responses:	50	34

Open-Ended Questionnaire Responses:

The primary reason listed on the pre- and post-test questionnaires for stopping a regular aerobic exercise program was injury or illness. The combined total of these two remarks accounted for a majority of the comments made by subjects. As noted previously in the review of literature, illness or injury has been well-documented as a barrier to exercise (Epstein, et al., 1980; Hofstetter, et al., 1991; Sallis & Hovell, 1990). Scheduling/time conflicts were also listed numerous times as deterrents to exercise. Six respondents listed increased workload and/or family obligations as a reason to stop exercising. These results are very consistent with other studies which have reported time constraints as a major reason why people do not adhere to exercise programs (Godin, et al., 1986; Iverson, et al., 1985).

Question number two asked, "What would encourage you to continue exercising regularly?." It elicited 73 responses on the pre-test and 30 responses on the post-test. The phrase listed most often was "seeing fitness benefits or results." Closely tied to this reason, "improved health or feeling better", was also identified by several respondents. These two response clusters accounted for the majority of the remarks.

From these responses it can be assumed that many of the subjects in this study were well aware of the benefits that

can result from a regular aerobic exercise program, and furthermore, that those benefits were important motivators for adherence. Exercising with friends also encouraged people to adhere to their program.

When subjects were asked, "What would encourage you to start exercising again if you had to stop temporarily?", most people responded, "knowing that I would experience benefits", or "actually experiencing benefits." Gaining weight was noted 12 times on the pre-test, and 11 times on the post-test. Almost all of the responses to this question involved the desire to improve physical and/or mental well-being. These responses attest to the importance of experiencing positive results as a motivator to continue regular aerobic exercise.

Summary

Enhancing physical fitness and feeling better was the most crucial motivator for exercise reported by the subjects who elected to answer the three open-ended questions at their pre- and post-test session. The primary reason to stop exercising was physical illness or injury, closely followed by a lack of time to devote to aerobic exercise.

A key motivator that encouraged these subjects to begin exercising again was a loss of physical and/or mental benefits. In particular, weight gain was a negative result that was associated with stopping exercise and a reason for wanting to resume a regular aerobic exercise program. A

small number of people also looked for support from friends to help them adhere to exercise.

Some of the reasons cited in the literature for improving adherence that did not appear to influence these subjects were: instructor influence, cost, convenience of programs or facilities, enjoyment, or burnout/boredom with the exercise program. A noteworthy comment about the subjects in this study that may account for the absence of these types of comments is that these participants had high exercise self-efficacy scores at their pre-test session. Only a very few subjects doubted their ability or commitment to exercising in their target heart rate at least three times a week. All of the subjects underwent a thorough battery of physical fitness tests and paid a fee to join the Circuit Center; thus, it can be assumed that they anticipated that they would have the ability to adhere to the program. Their actual adherence, however, was quite similar to the norm found in other adherence literature. Therefore, despite the fact that these subjects had very high expectations for exercise adherence, and believed that only a major barrier such as illness or injury would keep them from exercising, the actual results show that the majority of the subjects did not meet the demands outlined for adherence in this study (3 or more days per week of aerobic exercise lasting at least 20 minutes).

DISCUSSION

Introduction

The first section of this chapter includes a review of the descriptive statistics relating to the subjects in this study and their exercise adherence and exercise self-efficacy data. The second section includes a discussion of the issues raised by the data. This information is followed by an explanation of the qualitative analyses. The chapter concludes with a discussion of the limitations of the study and suggestions for future research.

Descriptive Statistics

Consistent with results reported in previous literature (Neale, et al., 1990; Noland, 1989; Robison, et al., 1992), on the average, the subjects in this study did not exercise with sufficient frequency or intensity to receive significant cardiovascular improvement. Yet, the reason most commonly reported for engaging in a regular aerobic exercise program was to improve physical fitness. The subjects in this study were very aware of the positive health and fitness benefits that can result from regular aerobic exercise and reported these benefits as major motivators for exercise adherence.

This study incorporated a stringent definition of exercise adherence. In order for an exercise session to be included in the data analysis, the participants had to maintain strenuous aerobic exercise for a minimum of 20

minutes. Much of the previous research on adherence has utilized attendance in class, with no evaluation of time spent in the target training zone, as a definition of adherence (Tetting, 1989). Quite often, attendance in an exercise class only one day per week has been considered to be exercise adherence (Marcus & Stanton, 1993). The criterion used in this study is suggested as a more accurate indication of commitment to exercise that will result in enhanced cardiovascular endurance (Albohm, 1993; Duncan & Stoolmiller, 1983; Dzewaltowski, 1989; Noland, 1989; Tetting, 1989).

According to Albohm (1993) a majority of participants drop out of an exercise program within the first twelve weeks. It is possible that the participants in the present study stopped exercising regularly before they had sufficient opportunity to realize physical fitness benefits.

Based on reported pre-test exercise self-efficacy scores, the subjects in this study had very high expectations for adherence to aerobic exercise at least three times each week. Post-test exercise self-efficacy scores were only slightly lower than the pre-test results. This suggests that most people expected to continue to participate in aerobic exercise. Exercise self-efficacy has been positively associated with exercise adherence in numerous research reports (Desharnais, et al., 1986; Garcia & King, 1991; Herbert & Teague, 1989; King, et al., 1992;

Marcus, et al., 1992; McAuley, et al., 1991; McAuley & Jacobsen, 1991; Sallis & Hovell, 1990). Once a participant has begun an exercise program, his/her self-efficacy for exercise tends to increase and the person continues to exercise (Marcus, et al., 1992; Sallis, et al., 1989).

Discussion of Research Questions

The first two research questions addressed the extent to which adipose body weight, aerobic capacity, behavioral intervention treatment, exercise self-efficacy, and previous exercise adherence predicted exercise adherence during and after the intervention period. The third question concerned the effect of the interactions between the independent variables in predicting "during" and "after adherence."

As stated previously, it was expected, and shown to be the case in this study, that adherence to aerobic exercise at one stage of the investigation would be predictive of adherence at other stages. Previous exercise adherence and current physical fitness have reportedly been strong predictors of continued adherence. Once an individual has established an exercise routine and has realized fitness benefits, he/she is much more likely to continue to exercise, regardless of barriers. This is particularly true when people believe they have control over their health (Dishman & Steinhardt, 1990). In the present study, there were very similar patterns of adherence for all three subgroups for "before", "during", and "after adherence."

Previous exercise adherence was a highly significant predictor of both "during" and "after adherence." Perhaps the fact that previous adherence was such a major predictor precluded the other predictors from adding significantly to the regression equations.

Past participation in an exercise program has been cited as the most reliable correlate of current participation (Dishman, et al., 1985). That was clearly the case in the present study. Discomfort during exercise was not listed as a reason to stop exercising by any of the subjects, which suggests that many of the participants knew how to monitor their exercise intensity to stay within safe parameters and they did not have unrealistically high expectations for fitness enhancement. The results could be expected to be quite different for subjects who were novice exercisers.

The subjects in this study reported engaging in more sessions of exercise per week than could be included in the adherence data because, based on their reported heart rate information, they were not in their target training zone for a minimum of 20 minutes. For example, an individual might have reported walking continuously for 30 minutes, but their heart rate did not reach their target level. Another example would be someone who reported playing tennis. At times they reached their target heart rate, but their activity was intermittent, so they did not maintain their

target level for the 20 minute criterion time. "Health benefits can occur at lower levels or intensities of exercise - amounts that may not necessarily improve cardiovascular fitness. Thus, even a modest amount of exercise, if performed regularly, may confer a substantial health benefit" (Franklin, 1994, p. 1). All participants may not have had the goal of improving their cardiovascular fitness.

Research has shown that there are very different reasons for beginning an exercise program compared to those for maintaining an exercise routine. For example, Godin, et al. (1987), Lindsay-Reid and Osborn (1980), and Oman and Zanna (1982) have all reported that knowledge of health risks enhances motivation to begin an exercise program, but does not affect long-term adherence.

The participants who are most likely to adhere to exercise are those who have successfully performed the same type of behavior in the past. The qualitative analyses showed that positive reinforcement, in the form of enhanced fitness, was a strong incentive to encourage the subjects in this study to maintain their exercise behavior. Previous experience in overcoming barriers, and finding time to exercise helped subjects continue to exercise (Atkins, et al., 1984; Godin, et al., 1994). "Exercise must be recognized as a lifetime pursuit and not a program of 10 to 12 weeks' duration with long-lasting residual effects. The

individual must develop an attitude toward exercise that reinforces adherence" (Franklin, 1994, p. 2).

One probable explanation as to why the behavioral intervention did not impact the experimental group participants in this study more than it did is that all of the subjects in this study were provided with extensive fitness pre-testing and received a printed copy of their results and an interpretation of those results. An individualized exercise plan was created for each participant. Although only the experimental group received intervention from the investigator, all of the subjects had access to other health and fitness experts, as well as Circuit Center monitors during every workout. Perhaps with the knowledge and support they received from becoming a Circuit Center member they were able to set their own goals for improvement and did not need the extra support that the experimental group members received. In addition, the experimental group began the study with high levels of exercise adherence, and thus, a ceiling effect may explain why greater improvement in adherence did not occur.

According to research conducted by King, et al. (1992) Noland (1989), and Sallis and Hovell (1990), behavioral intervention strategies can greatly increase exercise adherence. Most of the studies that have used behavioral interventions have been conducted with small, select groups (Sallis & Hovell, 1990). The participants in this study did

not report that behavioral contracts, feedback, or instructor support would encourage them to begin exercising or encourage them to start exercising again after stopping temporarily. One conjecture might be that intrinsic motivation was a more central contributor than extrinsic factors. According to Albohm (1993), self-motivation is the best predictor of long-term adherence. Goals were important to these participants, and their primary goal was improved fitness. According to Dzewaltowski, et al. (1990), people who are moderately dissatisfied with their fitness will be motivated to increase their level of physical activity. In this study, the participants in the experimental group were strongly encouraged to set their own goals for improvement -- a practice advocated by King (1991).

Another possible explanation for the present results is that approximately one-half of the subjects who volunteered to participate in this study had been exercising prior to the beginning of this study. Many of the subjects in this study began with fairly high levels of fitness. Physically fit subjects may not have needed external motivation or intervention to adhere since they had already been successful with their exercise program in the past. Even though a number of adherence and intervention studies have been conducted in recent years, according to Sallis (1994), "There is limited evidence that activity levels in the population are increasing. Thus, improving the

effectiveness of physical activity interventions is a high priority for public health" (p. S147). Sallis further remarks that the knowledge base related to methods of promoting physical activity is not well developed. He suggests that there should be greater emphasis on research to develop and evaluate effective physical activity interventions. Interventions should focus on enhancing exercise self-efficacy to improve exercise adherence.

The subjects in this study understood the positive and negative consequences of their exercise behavior. They knew that they would experience physical fitness improvement when they exercised regularly, and that they would lose those benefits when they stopped. This study is unlike some of the previous adherence studies (Martin & Dubbert, 1982; Martin, et al., 1984), that have incorporated a structured exercise program where people receive social rewards and reinforcement for attendance. These Circuit Center members had to be self-motivated to maintain their adherence. They did not receive social support or any type of extrinsic rewards for their continued exercise involvement. Perhaps that is one reason why some of the previous adherence intervention studies have reported higher levels of adherence than this study.

Another important distinction between this study and most others that have been conducted to date is the duration of the study. Most studies have been of short duration

(Marcus & Stanton, 1993). This study lasted 24 weeks, which allowed for a much more accurate assessment of true adherence and also allowed more time for participants to stop exercising. It is important that a study of adherence be of sufficient duration for subjects to appreciate the physical and psychological benefits of exercise, and to allow subjects who stop exercising temporarily to begin exercising again.

Discussion of Qualitative Analyses

The subjects in this study reportedly stopped exercising temporarily when they did not have enough time for exercise and when they experienced illness or minor injuries. According to Dishman (1991), even people who exercise regularly remark that time is a real barrier to exercise adherence. Lack of sufficient time to exercise has been repeatedly cited as a reason for dropping out of an exercise program (Godin, et al., 1986; Iverson, et al., 1985). Sallis, et al. (1988) reported that resisting relapse and making time for exercise may be the most important factors to consider for exercise adherence. When their schedule and physical health allowed them to, the majority of the people in this study resumed their regular exercise routine. Illness and/or injury has also been repeatedly noted in previous literature to explain non-adherence (Epstein, et al., 1980; Hofstetter, et al., 1991; King, 1991; Pollock, et al., 1991; Sallis & Hovell, 1990).

Quite a few subjects exercised consistently throughout the 24 weeks of the study, but according to their exercise logs, only one or two of their exercise sessions per week met the F.I.T. principle criteria to be included in the data analysis.

Recent research reveals that many benefits can be achieved by engaging in physical activities that are too low in intensity to maintain the 60 to 85 percent of maximum heart rate range required for cardiovascular improvement. Perhaps the subjects in this study were satisfied with the physical and mental benefits they were receiving and were not compelled to do more. Only three subjects reported having a self-history of cardiovascular disease; therefore, fear of heart disease was most likely not an important motivator for these participants to exercise sufficiently to gain cardiovascular improvement. Rather, losing or maintaining weight appeared to be the primary fitness goal for these participants.

Limitations and Suggestions for Future Research

It is important to recognize the limited generalizability of the results of this study to other populations. The conclusions that can be drawn from the data are only applicable to other research studies and populations which are similar to this study. The present findings, which support the hypothesized relationships, should be regarded as tentative due to the size of the

sample in this study (n=96). The inferences that were made from this study are dependent on the degree to which this sample is representative of the larger population.

It was assumed that subjects were able to accurately monitor their target heart rate and honestly report the frequency and intensity of their exercise sessions. All subjects received training regarding how to accurately monitor their heart rate, yet it is reasonable to assume some errors were made. It is also important to recognize that all of the subjects in the study volunteered to participate in an exercise-related research study and thus this was not a truly random sample of participants. Furthermore, many of the participants were experienced exercisers; therefore, the results of the present study may not be applicable to novice or beginning exercise participants. A further confounding factor is that some of the participants had been exercising regularly before the study began, while others were starting an aerobic exercise program for the first time. Intervention should have been designed to meet the specific needs of the beginning or continuing exercisers.

Oman and McAuley (1993) stress the importance of identifying the exercise stage(s) at which the sample population is currently operating. The factors which predict exercise adoption may be quite different than those which will predict maintenance of exercise adherence.

Intervention should be designed specifically to meet the needs of the individual.

Five recommendations are offered for researchers interested in future studies of exercise adherence. Exercise adherence investigations should utilize criteria for adherence similar to those used in this study. Large, random samples divided into treatment and control groups should be used to compare the effects of various behavioral interventions on exercise adherence and subsequent behavior. The interventions should include self-efficacy and time management training to help novice exercisers adjust to the change of incorporating exercise into their lifestyle. Since exercise behavior is a dynamic variable, a multivariate model guided by theory should be employed. A longitudinal design which allows for relapse and starting to exercise again will provide a more accurate view of true adherence as compared to short-term, one-time only analyses.

CONCLUSIONS

There is still a need to identify why some people begin and/or maintain aerobic exercise programs while the majority of the United States population remains sedentary. The results of this study support research studies which have found that previous exercise adherence is highly predictive of continued adherence. Adherence was very stable throughout this investigation. On the average, the subjects were unable or unwilling to perform aerobic exercise the three times per week necessary to substantially improve cardiovascular fitness. This finding is consistent with the majority of previous adherence studies.

The qualitative analyses revealed that improved physical fitness was the primary reason why subjects adhered to aerobic exercise and a loss of fitness was a strong motivator for participants to begin exercising again after a temporary lapse. The major barriers to exercise adherence were a lack of time for exercise and illness or injury. These barriers have been noted repeatedly in the literature. The high levels of exercise self-efficacy reported in this study may have helped the participants cope with short-term barriers to exercise and encourage them to start exercising again once the barrier was overcome.

APPENDIX A

LETTER TO PARTICIPANTS

July, 1992

Dear Circuit Center Member:

As a faculty member at Dundalk Community College, I greatly appreciate your dedication to our Circuit Training Program. The unique blend of community members, students, faculty, and staff working together to provide a high quality workout facility and program is a great addition to the services offered at Dundalk Community College. The reason why I have sent this letter to you is to ask for your assistance. I need Circuit Center members to volunteer to participate in a research study. The goal of this research is to learn more about how and why people exercise so that in the future we can offer even better services for our students and Circuit members.

In order to be a participant in the study, you have to be willing to do the following:

1. Complete a pre- and post-test including a submaximal (85%) treadmill and body composition test;

2. Complete biweekly exercise logs to record your exercise activity over a 3-month period (see attached), and

3. Complete two written questionnaires.

The testing procedures will be completed free of cost to you. (I know that many people do not enjoy having a treadmill test, but since everyone will only perform a submaximal test, the discomfort and effort should be minimal). Everyone who completes the study will receive one free month of membership at our Circuit Center!

I can't express to you how important it is to perform research that will help everyone who exercises learn more about how to get more out of their exercise program. I sincerely hope that you will consider participating. If you would like to participate, please complete the bottom portion and the Consent Form for Subjects and return them to the box marked "Circuit Center Research" located in the Circuit Center by July 31, 1992.

With appreciation,

Rose Mince, Associate Professor
Health/Life Fitness Division
285-9711

Name _____

Telephone Number _____

Social Security Number _____

I am willing to participate in the research study. I understand that I will be contacted to set up an appointment to be treadmill tested. I will be available to be tested during the following times (testing will be completed from 9:00 a.m. - 9:00 p.m. Monday - Friday).

Please Check One:

Time(s)

_____

____ Monday

____ Tuesday

____ Wednesday

____ Thursday

____ Friday

APPENDIX B

EXERCISE LOG

EXERCISE LOG

Name_____ Heart Rate Range: Resting_____Maximum_____

Target Heart Rate _____ to be maintained for a minimum of _____ minutes

Objectives for the months of _____

1. _____

2. _____

3. _____

Date	Activity Warm-Up (10 Min.)	Aerobics	Record Heart Rate Every 10 Minutes 10	20	30	40	50	60	Cool Down Activity	HR	Remarks May be Continued on the Back

APPENDIX C

CIRCUIT CENTER WORKOUT RECORD

DUNDALK COMMUNITY COLLEGE
CIRCUIT CENTER WORKOUT RECORD

NAME_____ **EXPIRATION DATE**_____

CLASS/PROGRAM_____ **TARGET HEART RATE ZONE**_____**10 SECONDS**

DATE/DAY	MIN HR	WT REP	WT REP	LEV REP	REP	WT REP	WT REP	WT REP	WT REP	WT REP	WT REP	WT REP
M T W T F S												
M T W T F S												
M T W T F S												
M T W T F S												
M T W T F S												

NOTE: All work-outs should begin with at least 5 minutes of walking and stretching and finish with 5 minutes of walking and stretching to lower heart rate below 15b/10 seconds.

DATE/DAY	WT REP	WT REP	WT REP	WT REP	SET REP	LEV REP	REP REP	WT REP	MIN LEV	MIN HR	MIN HRP	CD HR
M T W T F S												
M T W T F S												
M T W T F S												
M T W T F S												
M T W T F S												

AEROBIC WORKOUT: Record any extra work you may do on Liferower (R); Stairmaster (S); Lifecycle (C) or Jogging (J).

APPENDIX D

SELF-EFFICACY FOR EXERCISE SCALE

Name_____Date_____

EXERCISE SCALE

DIRECTIONS: Circle a number to indicate how confident you are that you could continue to engage in aerobic exercise in each of the following situations:

		Not at all Confident				Very Confident			Does Not Apply To Me
1.	When I am tired.	1	2	3	4	5	6	7	0
2.	When I am in a bad mood.	1	2	3	4	5	6	7	0
3.	When I feel I don't have the time.	1	2	3	4	5	6	7	0
4.	When I am on vacation.	1	2	3	4	5	6	7	0
5.	When it is raining or snowing.	1	2	3	4	5	6	7	0

DIRECTIONS: Circle a number to indicate how well each phrase describes you:

		Not at all Like Me				Very Much Like Me			Does Not Apply To Me
6.	I enjoy exercising.	1	2	3	4	5	6	7	0
7.	I am good at exercising.	1	2	3	4	5	6	7	0
8.	I have the skills needed to exercise.	1	2	3	4	5	6	7	0
9.	I can reduce my health risks if I exercise.	1	2	3	4	5	6	7	0
10.	I will achieve my desired fitness beliefs if I exercise.	1	2	3	4	5	6	7	0

11. I am confident that I can continue to exercise for at least the next two months. 1 2 3 4 5 6 7 0

12. What would make you stop a regular aerobic exercise program?

13. What would encourage you to continue a regular exercise program?

14. What would encourage you to start exercising again if you had to stop temporarily?

APPENDIX E

INFORMED CONSENT FOR GRADED EXERCISE TEST AND TEST DATA COLLECTION SHEET

HEALTH AND PHYSICAL FITNESS CENTER
INFORMED CONSENT FOR GRADED EXERCISE TEST

1. Explanation of the Graded Exercise Test

You will perform a graded exercise test on a motor-driven treadmill and/or a bicycle ergometer. The work levels will begin at a level you can easily accomplish and will be advanced in stages, depending on your work capacity. We may stop the test at any time because of signs of fatigue or discomfort. We do not wish you to exercise at a level which is abnormally uncomfortable for you.

2. Risks and Discomfort

There exists the possibility of certain changes occurring during the tests. They include abnormal blood pressure, fainting, disorders or heart beat, and very rare instances of heart attack. Every effort will be made to minimize them by the preliminary examination and by observations during testing. Emergency equipment and trained personnel are available to deal with unusual situations which may arise.

3. Purpose of the Evaluation

a. Objectively measure your fitness level.

b. Determine safe and productive intensity levels to improve fitness.

c. To give you information about your present state of fitness.

d. Screen out previously asymptomatic heart related problems.

4. Inquiries

Any questions about the procedures used in the graded exercise test or in the estimation of functional capacity are welcome. If you have any doubts or questions, please ask us for further explanations.

5. Freedom of Consent

Permission for you to perform this graded exercise test is voluntary. You are free to deny consent if you so desire.

I have read this form and I understand the test procedures that I will perform and I consent to participate in this test.

Signature _____ Date _____

Witness's Signature _____ Date _____

EXERCISE TOLERANCE TEST
INDIVIDUAL TOLERANCE TEST DATA

Name_____ Age_____

Date_____ Class_____ Section_____

Technician_____

Vital Capacity . . . _____

Flexibility. . . . . _____

Grip Strength. . . . Right_____ Left_____

Height (In inches) . _____

Weight . . . . . _____

Skin Folds . . . . . Sub-Scap____ Pec____ Iliac____ Tri____

Girth. . . . . Chest___ Waist___ Rt.Bicep___Rt.Thigh___

Sub Test 85%_____ Resting Heart Rate_____

Other_____ Resting Blood Pressure_____

Max Test_____

STAGE	SPEED (MPH)	GRADE (%)	BLOOD PRESSURE 1 2 3	HEART RATE 1 2 3	COMMENTS
1	1.7	10			
2	2.5	12			
3	3.4	14			
4	4.2	16			
5	5.0	18			
6	5.5	20			
7	6.0	22			

Total Time:_____

Post Exercise:

	R1.0	R2.0	R3.0	R4.0	R5.0	R6.0
Rate						
BP						

APPENDIX F

PHYSICIAN REFERRAL FORM

TO: _____
Primary Physician

FROM: Susan Fenton, Director of Wellness Center

Your patient, _____, contacted Dundalk Community College's Fitness Center regarding participation in one of the college's Cardiovascular Fitness programs. Our programs involve a pre- and post-exercise tolerance test evaluation, as well as individualized exercise recommendations tailored to each participant's needs.

Since our pre- and post-exercise tolerance test is utilized solely as a fitness evaluation, all participants over the age of 35 years and/or symptomatic individuals are tested to only 85% of their age predicted maximum heart rate. In addition, symptomatic individuals must have the attached medical referral signed by their physician prior to the Dundalk C.C. Fitness Evaluation.

The individualized exercise recommendations formulated for your patient will be based upon his/her age, present health status, and the exercise tolerance test results. Each participant will be instructed to exercise at his/her given target heart rate which is determined by the exercise tolerance test. This will insure safe but effective means of improving their cardiovascular fitness level. Each program reinforces the concept of training at the proper target heart rate, rather than straining at an inappropriate level. Dundalk C.C. Fitness Center has tested over 5,000 individuals and has found this procedure to be an effective means of achieving the desired cardiovascular results, as well as extremely safe in governing the exercise intensity.

Your cooperation and time are greatly appreciated. The results of the exercise tolerance test will be sent to you. Please feel free to contact us at 285-9937 should you have any questions regarding our programs and procedures.

Attachment (Medical Referral Form)

DUNDALK COMMUNITY COLLEGE
WELLNESS CENTER
PHYSICIAN REFERRAL FORM: GRADED EXERCISE TEST

Patient's Name_____ Date_____

Address_____ Age_____ Phone_____

I consider this individual to be:
(a) normal (B) cardiac patient (C)prone to heart disease

(D)other(explain)_____

Circle appropriate status:

Etiologic
1) No heart disease
2) Hypertension
3) CAD
4) Other_____

ECG
1) Normal
2) Abnormal
3) Infarction
4) Other_____

Present Physical Activity
1) Very active
2) Normal
3) Limited
4) Other_____

Rhythm
1) Sinus
2) Atrial fib.
3) Sinus/PVC's
4) NSST changes
5) Other_____

Specific cardiac diagnosis:_____

Additional abnormalities you are aware of:_____

_____

Date of last physical examination:_____

Present medications and dosage (please print):_____

_____

IT IS NOT NECESSARY TO FILL IN THE INFORMATION BELOW UNLESS IT IS AVAILABLE. HOWEVER, IF YOU THINK IT IS NECESSARY TO PERFORM ANY/ALL OF THE FOLLOWING TESTS WE WOULD APPRECIATE THE RESULTS.

1. Resting blood pressure_____
2. Cholesterol____mg/dl HDL____mg/dl Triglycerides____mg/dl
3. Graded exercise test and/or other cardiovascular test results (i.e., resting EKG, echo, etc.). Please enclose a copy of the results if available.

To the best of my knowledge and from the results of tests performed, the above listed person is capable of performing a submaximal graded exercise tolerance test under the guidance of a certified American College of Sports Medicine Exercise Test Technologist to a:

Check One:

_____ 85% of Predicted Maximum Test
_____ Other - please specify Test Target

NOTE: ALL SYMPTOMATIC OR PERSONS OVER THE AGE OF 35 YEARS WILL ONLY BE EVALUATED AT 85% OR LESS. NO EXCEPTIONS!

Depending upon the test results, the above listed person has clearance for participation in a physical fitness program monitored at approximately 70-80% of a predicted maximum heart rate.

Signed: _____,M.D.

Type or Print:
Name of Physician _____ Phone _____

Address _____

Upon the completion of the fitness evaluation, as a service of our Wellness Center, you will receive a copy of the completed evaluation packet. Thank you for your cooperation. For more information contact: Susan Fenton, Exercise Physiologist/Director of Wellness Center at 7200 Sollers Point Road, Baltimore, MD 21222 or call 285-9714.

DUNDALK COMMUNITY COLLEGE
WELLNESS CENTER

PARTICIPANT CLASSIFICATIONS AND PROGRAM RECOMMENDATIONS

APPARENTLY HEALTHY

Category I: Low Risk Individuals: Normal
Evaluation Restrictions: Persons over 35 years of age - submaximal evaluation only.
Medical Clearance: None required - suggested for all inactive persons.
Program Restrictions: None.

A, B, C

Category II: High Risk Individuals: Normal
Evaluation Restrictions: Submaximal Evaluations only.
Medical Clearance: Physician's Referral for High Risk Persons required (Physician's Medical Referral Form must be completed **before** evaluation).
Program Restrictions: None.

D

CARDIAC PATIENTS

Category III: Class I Cardiacs (without symptoms for a minimum of one year, active)
Evaluation Restrictions: Not evaluated at the Wellness Center.
Medical Clearance: Before fitness evaluation or Program Participation the following must be completed:

1. Medically Supervised Stress Test Required.
2. Minimum of an asymptomatic 7 MET work tolerance required (New York Heart Association Class I).
3. Report of Stress Tests forwarded to Wellness Center Director.
4. Upon review of the above listed information by the Medical Director of the DCC Cardiac Rehabilitation program, appropriate programming will be recommended. Unless waived by the medical staff, each person in this category must participate for at least one semester in the Medically Supervised College Based Cardiac Rehabilitation Program (CARE).

E

Category IV: Class II Cardiac (5 to 7 MET Tolerance)
Evaluation Restriction: Not evaluated at the Wellness Center.
Medical Clearance: Medical Stress test required.
Program Recommendations: CARE - Cardiac Rehabilitation Program (only), a Medically Supervised Phase III Cardiac Program which meets the American Heart Association standards for exercise treatment program.

F, G

Category V: Class III & IV Cardiacs (Less than 5 MET Tolerance)
Evaluation Restrictions: Not evaluated at the Wellness Center.
Medical Clearance: Medical Stress test only.
Program Recommendation: Phase I & II Cardiac Rehabilitation Program at Francis Scott Key Medical Center.

H, I

AMERICAN COLLEGE OF SPORTS MEDICINE

Classification by Age and Health Status of Participants for Exercise Testing

A. Asymptomatic, physically active persons of any age without CHD risk factors or disease.

B. Asymptomatic, physically inactive persons less than 35 years of age without CHD risk factors or disease.

C. Asymptomatic, physically inactive persons 35 years and older without CHD risk factors or disease.

D. Asymptomatic, physically inactive or active persons of any age with CHD risk factors but no known disease.

E. Asymptomatic person of any age with known CHD disease.

F. Symptomatic, physically active, stable 6 months or longer.

G. Symptomatic, physically inactive, stable 6 months or longer.

H. Symptomatic person with recent onset of CHD or a change in disease status.

I. Persons for whom exercise is contraindicated.

APPENDIX G

FITNESS ASSESSMENT NORMS & EXPLANATION

AND

SAMPLE PRINTOUT

DUNDALK COMMUNITY COLLEGE

FITNESS ASSESSMENT

NORMS AND EXPLANATION

EXPLANATION OF AN EXERCISE TOLERANCE TEST

Please relate this information to the "Personal Fitness Profile" which you have just completed.

NOTE: Explanation of all raw data scores with norms will be presented under the "Personal Assessment" discussion.

PERSONAL DATA

A. All of the explanation of your personal fitness profile is based upon normative information (norms) for a person your age, sex, height and weight.

B. Girth Measurements:

- Total body weight is not an accurate assessment of fitness or health. The distribution of lean mass (bone, muscle, and organ tissue) vs. adipose tissue (fat) will most accurately determine the effectiveness of your exercise/diet routine.

  As a cursory measure of your progress, use the Girth Measurements to monitor your weight, <u>not the scale</u>. If your clothing feels better and your girth goes down ... progress is being made even if the scale does not tell the same story.

C. Skinfolds:

Measurement is taken in millimeters on a pinch of skin which includes skin and (subcutaneous) fat.

- When placed in the appropriate formula, the site measurements will give an accurate determination of body density.
- The <u>more dense</u> you are, the more muscle you have. The <u>less dense</u>, the more fat you have.
- Skinfolds give a more accurate ideal weight than traditional height/weight charts because skinfolds consider total bone and muscle weight and not just skeletal size.

WORK TOLERANCE

Information presented in this section is your physiologic response (heart and blood pressure) to a very specific work load (the treadmill).

Explanation for Terms for this Section:

1. VO_2

   - Represents the ability of the heart and lungs to transport oxygen to the muscles (in milliliters of oxygen for every kilogram of body weight [2.2 lbs.] per minute).
   - The higher the number, the better the level of one's cardiovascular fitness (endurance).
   - As your weight goes up, without an increase in endurance, the VO_2 will be reduced, thus a lower Fitness Capacity (work tolerance). (See attached chart for VO_2 Maximum Ratings).

2. METS

   - Represents a measure of work.
   - One Met - the amount of energy expended (in calories) which is necessary for Basal Metabolic Rates to occur (i.e. survival).
   - In the protocols used, every minute of exercise requires approximately 1.2 times your resting caloric needs.
   - This met value enables us to determine a comparison of work capacities for people your own age and sex even though your weight may be different.

A. Resting

After placement of a 7 lead ECG (electrocardiogram) and performance of a hyperventilation maneuver (rapid breathing), your standing resting rate (in beats per minute) and blood pressure, were taken.

B. Exercise Protocol

1. One of four protocols have been utilized: two on a motorized/computerized treadmill, two on a stationary bicycle ergometer. The protocol and extent of the intensity selected was based upon:

   a. Physical limitation

   b. Age

2. The AMA (American Medical Association) and ACSM (American College of Sports Medicine) Guidelines state:

   a. Maximum Exertion

      For persons under the age of 35 years and asymptomatic (without any symptoms or extreme risk factors relating to cardiovascular disease), a maximum aerobic exercise protocol will be utilized.

   b. Submaximum Exertion

      For persons over the age of 35 years (regardless of asymptomatic status) or for persons under the age of 35 who have a:

      1. History of hypertension

      2. History of diabetes

      3. History of metabolic or cardiovascular disorder

      4. Circulatory or metabolic disorder or have recently been under the care of a physician for any disorder as dictated by a family physician with the following risk factors:

         a. Obesity
         b. Smoking
         c. Symptomatic pain
         d. Extremely sedentary lifestyle

3. Actual Submaximum

   a. In maximum exertion protocols:

      - Approximately the mid-point of the total evaluation

      - Listed are the actual elapsed time of the specific protocol with the corresponding heart rate, blood pressure, and protocol completed (speed/elevation for treadmill, or for bicycle ergometer)

   b. In submaximum protocols:

      Normally a workload that represents approximately:

      - 85% of the predicted maximal heart rate, or

      - a percentage determined by 1) medications, or 2) family physician

4. Actual Maximum Values

   a. In maximum exertion evaluations (only)

      - The actual aerobic end-point of the total evaluation

      - Listed are the actual total exercise time of the Specific Protocol with the corresponding Heart Rate and Blood Pressure

   b. In submaximum exertion evaluations (only)

      - The values presented here are a predicted response to the known protocol workload

      - The heart response to the protocols selected is linear (increases at a predictable rate)

      - One should note that the accuracy of the maximum tolerance may have some degree of error

c. In submaximum exertion evaluations while under the influence of medications

- The influence of certain medications may have a considerable effect on the validity of the maximum predictions
- Under severe conditions, the submaximal values should be utilized for pre-post comparisons

d. Recovery

- One indicator of "total fitness" or overall health of the cardiovascular system is the recovery rate from exercise
- Heart rate should approach 100 bpm or lower with blood pressure approaching resting levels three minutes after exercise or as quickly as possible

PERSONAL FITNESS ASSESSMENT

Information presented in this section utilizes the raw data scores which were obtained in this assessment. It presents the norms (ideals) for your age, sex, height, and weight and rates performance in relationship to those norms.

1. Resting Vital Statistics (taken while standing)

a. Blood pressure

- The top number is the systolic pressure. At resting levels, it should not exceed 140 mmHg nor be lower than 100 mmHg.
- The bottom number is the diastolic pressure. At resting levels, it should not exceed 90 mmHg nor be lower than 60 mmHg.

Systolic Blood Pressure (mmHg)	Category
<85	Normal Blood Pressure
85 to 89	High Normal Blood Pressure
90 to 104	Mild Hypertension
105 to 114	Moderate Hypertension
≥115	Severe Hypertension

Systolic Blood Pressure (mmHg) When DBP < mmHg	Category
<140	Normal Blood Pressure
140 to 159	Borderline Isolated Systolic Hypertension
≥160	Isolated Systolic Hypertension

b. Heart rate

- The resting heart rate (unless under the influence of certain drugs) should be between 60-80 bpm
- Levels in excess of this range at the time of the exercise tolerance test may be due to apprehension or fear

2. Body Composition

a. Weight = total weight in pounds

b. Density = the thickness or compactness of body material. The density of water is 1.0, fat is .7 and pure muscle is 1.9. The closer you are to 1.0, the more fat you have; the larger the number over 1, the more muscle you have.

c. Lean/Fat = the amount of lean body mass (bone, muscle, tissue) in pounds/the amount of fat (adipose) in pounds. Your lean mass + fat = total weight in pounds.

d. % Adipose = the percentage of fat in relationship to total body weight. The following table presents the norms for men and women:

BODY FAT NORMS

MEN	20-30	30-40	40-50	50+
*very low fat	-9	-11	-12	-13
low fat	9-12	11-13	12-15	13-16
average fat	13-16	14-17	16-20	17-21
very high fat	17-19	18-22	21-25	22-27
overfat	20+	23+	26+	28+

*Critical amount of fat that is necessary for normal physiologic function for males is 3%

WOMEN	20-30	30-40	40-50	50+
*very low fat	-17	-18	-20	-21
low fat	17-20	18-21	20-23	21-24
average fat	21-23	22-24	24-27	25-30
very high fat	24-27	25-29	28-31	31-35
overfat	28+	30+	32+	36+

*Critical amount of fat that is necessary for normal physiologic function for females is 12%

3. Strength

The hand grip dynamometer test is utilized as an indication of overall body strength.

a. The score is measured in kilograms (2.2 lbs.) based on the power of the dominant hand.

b. The basic inference is that of power.

c. It is not uncommon to have the non-dominant hand (right if left-handed) stronger (such as holding a jar stable while you twist off the top -- the stabilizing hand is usually stronger). It requires more power to stabilize an object than manipulate it.

STRENGTH

RATING	WOMEN	MEN
Super	45.0 42.5 40.0	73.0 69.5 65.5
Excellent	39.0 37.5 36.5	64.0 62.0 60.0
Good	35.0 34.0 32.5	58.5 56.5 55.0
Average	31.5 30.0 29.0	53.0 51.0 48.5
Fair	27.5 26.5 25.0	48.0 45.5 44.0
Poor	24.0 22.5 21.5	42.0 40.0 38.0
Very Poor	20.0 17.5 15.0	36.5 33.0 29.0

GRIP STRENGTH FOR DOMINANT HAND
MEASURED IN KILOGRAMS

4. Flexibility

Measurement is made in plus (+) or minus (-) from the toes on a sit-and-reach test.

a. Negative numbers indicate the inability to touch one's toes and an improper pelvic tilt. (Forward tilt which creates a curve in lower back which increases the possibility of lower back pains).

b. Associated with the forward pelvic tilt are weak abdominal muscles.

c. Normally, a positive number indicates a proper alignment and a minimum chance of back problems.

Caution: Sometimes a positive number associated with back pain indicates extremely weak abdominals. This may be a result of "loose" hamstrings.

FLEXIBILITY

RATING	WOMEN	MEN
Extremely Inflexible	less than -4	less than -6
Marginal Flexibility	-3.9 to 1.9	-5.9 to -.9
Desired Flexibility	2.0 to 6.0	0 to 5.0
Superior Flexibility	greater than 6.1	greater than 5.1

5. Work Capacity

a. The "bottom line" of aerobic fitness (endurance) is one's ability to transport oxygen (O_2) to the muscle cells. This is measured in milliliters of oxygen per every kilogram (2.2 lbs.) of body weight per minute (ml/kg/min.) or volume per weight per time. The higher this number, the better your fitness level.

b. This number often decreases with age and women will usually have a lower capacity due to size.

CARDIORESPIRATORY FITNESS CLASSIFICATION
OXYGEN CONSUMPTION (ml/kg/min)

100% Maximum Age in Years	MEN VERY POOR	POOR	BELOW AVERAGE	AVERAGE	HIGH AVERAGE
20-29	-25	25.1-34	34.1-37	37.1-40	40.1-44
30-39	-22	22.1-31	31.1-34	34.1-37	37.1-40
40-49	-19	19.1-28	28.1-31	31.1-34	34.1-37
50-59	-16	16.1-25	25.1-28	28.1-31	31.1-38
60 Above	-13	13.1-22	22.1-25	25.1-28	28.1-31

100% Maximum Age in Years	MEN LOW GOOD	GOOD	HIGH GOOD	HIGH	VERY HIGH	SUPERIOR
20-29	44.1-46	46.1-49	49.1-52	52.1-53	53.1-55	55.1
30-39	40.1-43	43.1-46	46.1-49	49.1-50	50.1-52	52.1
40-49	37.1-40	40.1-44	44.1-46	46.1-47	47.1-49	49.1
50-59	34.1-38	38.1-41	41.1-43	43.1-44	44.1-46	46.1
60 Above	31.1-34	34.1-37	37.1-40	40.1-41	41.1-43	43.1

CARDIORESPIRATORY FITNESS CLASSIFICATION
OXYGEN CONSUMPTION (ml/kg/min)

WOMEN

100% Maximum Age in Years	VERY POOR	POOR	BELOW AVERAGE	AVERAGE	HIGH AVERAGE
20-29	-21	21.1-30	30.1-33	33.1-36	36.1-39
30-39	-18	18.1-27	27.1-30	31.1-33	33.1-36
40-49	-15	15.1-24	24.1-27	27.1-30	30.1-33
50-59	-12	12.1-21	21.1-24	24.1-27	27.1-30
60 Above	-9	9.1-18	18.1-21	21.1-24	24.1-27

WOMEN

100% Maximum Age in Years	LOW GOOD	GOOD	HIGH GOOD	HIGH	VERY HIGH	SUPERIOR
20-29	39.1-42	42.1-45	45.1-48	48.1-49	49.1-51	51.1
30-39	36.1-39	39.1-42	42.1-45	45.1-46	46.1-48	48.1
40-49	33.1-36	36.1-39	39.1-42	42.1-43	43.1-45	45.1
50-59	30.1-33	33.1-36	36.1-39	39.1-40	40.1-42	42.1
60 Above	27.1-30	30.1-33	33.1-36	36.1-37	37.1-39	39.1

Aerobic Training Zone

The "training target heart rate" is the most effective and safe level to promote increase in work capacity and body composition changes.

1. Key Elements of Aerobic Training

   a. Frequency = a minimum of three days (alternate 1 day) per week is recommended for promoting cardiovascular (endurance) changes.

   b. Intensity = the greatest increase in endurance occurs at approximately 70-85% of maximum exertion levels. This range is presented on the "Personal Fitness Profile" as the "Aerobic Training Zone."

   c. Duration = a minimum of 20 minutes or more must be maintained at the target zone to promote an adjustment or increase in efficiency of the cardiovascular system.

Special Notes

1. During a work-out session, intensity (rate of activity, i.e., running at an 8 minute mile pace) must be reduced to maintain your target zone. If the intensity remains constant, your heart rate will exceed your training zone and aerobic training will be much less effective.

2. Aerobic training is four times more effective in burning fat and is much safer than all out power training. (See Target Heart Rate Sheet for example).

3. Taking Pulse (follows these tips)

   a. Use the carotid artery of your neck. Place two fingers on the "adams apple" and slide them into the "groove" of the neck. Be sure to place fingers flat instead of poking in.

b. Radial pulse = place your two fingers on the thumb-side of the wrist (palm side) closest to the hand/forearm joint line.

Caution: Pressure on the carotid artery may cause a slowing of the heart (especially in older participants). To make sure you have an accurate rate, first check the radial pulse, then check the carotid pulse to see if there is a difference. If not, use whatever is most convenient.

c. "Talk Test" = if you can comfortably converse with a partner (not too comfortably) while exercising, chances are you are at your training zone.

DUNDALK COMMUNITY COLLEGE
PERSONAL FITNESS PROFILE

NAME:_____ DATE:_____

GROUP:_____CODE 3:_____ TECHNICIAN:_____

****

PERSONAL DATA

All assessment data is based upon these personal data entries

AGE:_____ SEX:_____ WEIGHT:_____ HEIGHT:_____

GIRTH MEASUREMENTS: CHEST_____in. WAIST_____in.
RT. BICEP_____in. RT. THIGH_____in.

SKINFOLDS: ILIAC CREST_____mm TRICEP:_____mm

****

WORK TOLERANCE

RESTING: HEART RATE_____bpm BLOOD PRESSURE_____mmHg

Exercise Protocol

Elapsed Time	Heart Rate	Blood Pressure	VO_2 METS	Treadmill (Speed/ Elevation)
Actual Sub:				
Predicted Max Values:				
Recovery:				

****

PERSONAL FITNESS ASSESSMENT

	Personal Data Scores	Norms (Ideal)	Rating
Date:			
RESTING VITALS:			
Blood Pressure			
Heart Rate			
BODY COMPOSITION:			
Weight			
Density			
Lean/Adipose			
% Adipose			
STRENGTH:			
FLEXIBILITY:			
WORK CAPACITY:			
Treadmill Time:			
Aerobic Capacity:			

****

AEROBIC TRAINING ZONE

Based upon the results of the work tolerance test, this individual training target is most effective for increasing work capacity (fitness levels) with a significant margin of safety.

_____ beats/min.

or

_____ beats/10 sec.

****

APPENDIX H

MEDICAL HISTORY QUESTIONNAIRE

DUNDALK COMMUNITY COLLEGE
WELLNESS CENTER

INSTRUCTIONS FOR OBTAINING AN EXERCISE TOLERANCE TEST

I. MEDICAL CLEARANCE

The purpose of the Exercise Tolerance Test is to accurately assess your present levels of fitness. It is also designed to determine safe and effective exercise intensity levels to improve fitness. This test is **NOT** used as a tool to aid in the diagnosis of coronary heart disease. Therefore, it you have any **ONE** of the following conditions, medical clearance is required from your physician **PRIOR** to making an assessment appointment:

1. High Blood Pressure
2. Circulatory or Metabolic Disorders (i.e. diabetes, thyroid disorders, kidney, lung or liver disease)
3. Any questionable medical problem for which you are presently under a physician's care or taking prescription medications

Any of the following if you are **AGE 35 OR OLDER**:

4. High Blood Cholesterol Levels (over 200 mg.)
5. Cigarette Smoking
6. Family History of Heart Disease Prior to Age 50

A Physician Referral Form is enclosed. Please take this to your physician for completion.

IF YOU HAVE KNOWN CARDIOVASCULAR DISEASE, YOU WILL NOT BE EVALUATED IN OUR FACILITY.

II. MEDICAL HISTORY QUESTIONNAIRE

Prior to your fitness assessment, you must complete the attached Medical History Questionnaire. This is needed in an effort to ascertain a comprehensive picture of your health history.

III. INSTRUCTIONS FOR THE EXERCISE TOLERANCE TEST

1. Wear comfortable attire such as sneakers, slacks/shorts, and a comfortable shirt (no turtlenecks or leotards).

2. Do not smoke or drink caffeine for several hours prior to your scheduled fitness assessment.

3. No workouts or strenuous activity before your Exercise Tolerance Test.

IV. EXERCISE TOLERANCE TEST APPOINTMENTS

After you have completed all of the necessary forms (including Medical Clearance if warranted), please call the Dundalk Community College Wellness Center at 285-9937 for your individualized appointment.

DUNDALK COMMUNITY COLLEGE
WELLNESS CENTER

MEDICAL HISTORY QUESTIONNAIRE

All information you enter on your medical history form will be kept strictly confidential. As this data will be used in the evaluation of your health status, you will want to make it as accurate and complete as possible. Please fill out this form carefully and thoroughly.

NOTE: Please print all responses.

GENERAL INFORMATION:

Today's Date _____

___Mr. ___Ms. ___Mrs. ___Dr.

Name: _____
Last First Middle Initial

Address: _____
Number and Street

_____
City State Zip Code

Home Phone: _____ Work Phone: _____

Date of Birth: ____/____/____ Sex: Male____ Female____
Mo. Day Year

Occupation: _____

Social Security Number: _____

Family Doctor: _____
Last First

Doctor's Address: _____
Number and Street

_____
City State Zip Code

Doctor's Phone: _____

PRESENT HISTORY: Please place a check next to the items that apply to you. Leave the others blank.

_____ Has a doctor ever said that your blood pressure was too high or too low?

_____ Do you ever have pain in your heart or chest?

_____ Do you ever notice extra, skipped, or rapid heart beats/palpitations?

_____ Are your ankles often badly swollen?

_____ Do you often have difficulty breathing or unusual shortness of breath?

_____ Has a doctor ever told you your cholesterol or triglyceride level was high?

_____ Do cold hands or feet trouble you even in hot weather?

MEDICATIONS: List any medications you are now taking:

Prescribed by your doctor

Self-prescribed by you (include dietary supplements)

EXERCISE:

Have you been exercising regularly during the past 12 months?

_____ Yes _____ No

If yes: Type of Exercise Days Per Month Minutes Per Day

Date of last complete physical examination: _____
Month/Year

____Never ____Can't Remember ____Normal ____Abnormal

Date of last electrocardiogram _____
Month/Year

____Never ____Can't Remember ____Normal ____Abnormal

List any other medical or diagnostic tests you have had in the past:

List hospitalizations including dates and reasons for hospitalization:

List any drug allergies:

PAST HISTORY: Please place a check next to items that apply to you. Leave the others blank.

Have you ever had:

___Heart attack

___Cardiac surgery

___Rheumatic fever

___Heart murmur, clicks or unusual cardiac findings

___Peripheral vascular disease

___Arthritis of legs or arms, orthopedic problems

___Diabetes or abnormal blood sugar test

___Phlebitis, emboli

___Dizziness or fainting spells

___Stroke

___Pulmonary disease (i.e.asthma, emphysema, or bronchitis)

___Any nervous or emotional problems

FAMILY MEDICAL HISTORY:

Father:

____Alive

____Current Age

General Health Now:

____Excellent

____Good

____Fair

____Poor

____Don't Know

____Deceased

____Age at Death

_____
Cause of Death

Mother:

____Alive

____Current Age

General Health Now:

____Excellent

____Good

____Fair

____Poor

____Don't Know

____Deceased

____Age at Death

_____
Cause of Death

Have any of your grandparents, aunts, uncles, brothers, or sisters (blood relatives only) had any of the following?

	Yes/No	Age	Relative
Heart Attack	_____	_____	_____
Coronary Artery Disease	_____	_____	_____
Sudden Death	_____	_____	_____
Congenital Heart Disease	_____	_____	_____

Comments:

HEALTH HABITS:

Have you ever or do you presently smoke cigarettes, cigars, or a pipe? ____ Yes ____ No

How many a day?_____ How long?_____ Age quit?_____

Do you drink three or more alcoholic beverages a day?
____ Yes ____ No

Do you consider yourself to be more than 30 lbs. above your ideal weight? ____ Yes ____ No

In general, is your lifestyle: ____Not too stressful
____Moderately stressful ____Very stressful

Do you think you eat nutritionally balanced meals?
____Yes ____No

Please indicate the average number of servings of caffeine consumed daily.
_____ Coffee (8 oz.)
_____ Tea (8 oz.)
_____ Soft drinks (containing caffeine) (12 oz.)

APPENDIX I

PERSONAL GOAL SHEET

PERSONAL GOALS

Name_____ Class_____ Semester_____

RHR_____ THR_____

ASSESSMENTS	PRE	GOAL	POST	CHANGES
GIRTHS:				
Chest				
Waist				
Bicep				
Hip				
Thigh				
Calf				
SKINFOLDS:				
Subscapula				
Pectoralis				
Tricep				
Iliac				
Abdomen				
Thigh				
BODY COMPOSITION:				
Height				
Weight				
Lean				
Adipose				
% Adipose				
VITALS:				
Resting (PreEx) HR				
Resting (PreEx) BP				
Recovery HR				
Recovery BP				
STRENGTH:				
Grip R/L				
(1 RM) Bench Arm				
(1 RM) Press Leg				
FLEXIBILITY:				
Hip				
Shoulder (CM)				

MUSCLE ENDURANCE:

Pushups

Curls/Sit-Ups

Chinups

ASSESSMENTS	PRE	GOAL	POST	CHANGES
CARDIOVASCULAR ENDURANCE:				
Treadmill Test				
Aerobic Capacity				
10 Sec. Training Zone				
12 Min. Run				
Step Test				
Pulse Recovery				
1/2 Mile Walk Time				
1/2 Mile Run Time				

APPENDIX J

SAMPLE LETTER TO

EXPERIMENTAL GROUP PARTICIPANTS

October, 1992

Dear Circuit Center Research Participant:

In an effort to thank you for your participation in the Dundalk Community College Circuit Center Research Project, I would like to offer my services to you as a fitness/wellness counselor. I have outlined a program as follows:

1. October 26 - November 8

- Review fitness results from pre-test.
- Set appropriate goals for improvement.
- Explain safe and effective exercise heart rates (Target Heart Rate).
- Prepare a behavioral contract for fitness.

2. November 9 - November 22

- Provide support and assistance with Circuit Center (or any other type of) Aerobic Workouts.
- Review progress towards achieving goals.

3. November 23 - December 6

- Discuss how exercise can enhance your wellness.
- Find out what support can we offer you that will help you adhere to your exercise plan.

4. December 7 - December 21

- Prepare for continued adherence to aerobic exercise for future wellness.
- Set short and long-term future goals.
- Update behavioral contract.

I hope that you will be interested in meeting with me to find out more about these topics. We can meet in person at Dundalk Community College or we can talk on the phone. My best days for getting together are Tuesdays and Fridays from 9:00 a.m. to 3:00 p.m. and Monday evenings, but I will do my best to meet at your convenience. Please call me at 285-9711 and/or return the bottom portion of this letter to the box in the Circuit Center to set up an appointment. Many thanks for all of your help.

Sincerely,

Rose Mince

REMINDERS:

Log Due Dates:

5- 11/9
6- 11/23
7- 12/7
8- 12/21
9- 1/4
10- 1/18
11- 2/1
12- 2/15

Post-Testing should take place between February 1 & 15.

I am interested in finding out more about the topics listed above. From October 26-November 8 I would like to meet:

_____ Day _____ Date _____ Time

Please call me: _____ Day/Time

_____ Name _____ Day Phone

_____ Evening Phone

APPENDIX K

PERSONAL CONTRACT

PERSONAL CONTRACT

I, _____, understand the following:
print name

1. Cardiovascular Fitness involves lifestyle change in my exercise habits, eating behaviors, and other related health risks.

2. I am responsible for achieving my goals.

Furthermore, I, _____ accept the following responsibilities:
print name

1. To work out in the Circuit Center at least three times per week.

2. Plan to make up sessions I have to miss by participating in aerobic activities outside of the Circuit Center.

3. To maintain the exercise log and turn it in every two weeks.

4. To practice new ways to alter my lifestyle in order to achieve my goals.

My goals are to exercise according to the following guidelines:

Frequency: _____ days/week at

Intensity: _____ % of maximum heart rate for

Time: _____ minutes in target zone.

If I complete this contract I will reward myself by:

_____
Signature Date

_____
Witness's Signature Date

APPENDIX L

ONE-WAY ANALYSIS OF VARIANCE

PREDICTING THE EFFECTS OF GROUP ON

"DURING" AND "AFTER ADHERENCE"

One-Way Analysis of Variance Predicting the Effects of Group on "During" and "After Adherence"

Dependent Variable = "During Adherence"
n=95

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	27.6651	13.8325	7.69	.0008	.1419

Dependent Variable = "After Adherence"
n=95

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	27.1879	13.5940	6.62	.0021	.1246

APPENDIX M

ONE-WAY ANALYSIS OF VARIANCE PREDICTING THE EFFECTS OF GROUP ON THE CONTINUOUS VARIABLES

One-Way Analysis of Variance Predicting the Effects of Group on the Continuous Variables

Dependent Variable = Adipose Body Weight

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	1275.4874	637.7437	3.12	.0490	.0628

Dependent Variable = Aerobic Capacity

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	511.3536	255.6768	3.92	.0232	.0777

Dependent Variable = "Before Adherence"

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	32.5543	16.2772	9.13	.0002	.1642

Dependent Variable = "Self-Efficacy"

Source	DF	SS	MS	F Value	P Value	R^2
Group	2	10.5167	5.2584	3.85	.0247	.0773

APPENDIX N

SCHEFFE'S TEST

Scheffe's Test

Alpha=0.05, Confidence=0.95, DF=93, MSE=1.78225, Critical Value of F=3.09434
Comparisons Significant at the 0.05 Level are Indicated By ***

	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
Variable: "Before Adherence"				
experimental-comparison	0.0013	0.8128	1.6244	***
experimental-control	0.5913	1.4308	2.2703	***
comparison-control	-0.2274	0.6179	1.4633	
Variable: "During Adherence"				
experimental-comparison	0.1271	0.9425	1.7579	***
experimental-control	0.4156	1.2591	2.1026	***
comparison-control	-0.5327	0.3166	1.1660	
Variable: "After Adherence"				
experimental-comparison	0.0626	0.9338	1.8051	***
experimental-control	0.3472	1.2485	2.1497	***
comparison-control	-0.5928	0.3147	1.2222	

APPENDIX O

MEAN PRE- AND POST-EXERCISE SELF-EFFICACY SCORES

Mean Pre- and Post-Exercise Self-Efficacy Scores

Item		Pre-Test		Post-Test	
		M	SD	M	SD
1.	Tired	4.23	1.61	4.56	1.53
2.	Bad Mood	5.01	1.63	5.03	1.53
3.	Time	3.95	1.67	4.11	1.68
4.	Vacation	4.69	1.83	4.64	1.91
5.	Rain or Snow	4.84	1.73	4.66	1.87
6.	Enjoy	5.31	1.57	5.21	1.69
7.	Good	4.81	1.61	4.83	1.72
8.	Skills	5.34	1.53	5.28	1.49
9.	Health Risks	6.00	1.49	5.88	1.44
10.	Fitness Benefits	5.78	1.66	5.63	1.60
11.	Adherence	5.99	1.51	5.62	1.75

APPENDIX P

PEARSON CORRELATION COEFFICIENTS FOR THE INDEPENDENT VARIABLES

Pearson Correlation Coefficients for the Independent Variables

n = 96

	Experimental Group	Aerobic Capacity	Adipose Body Weight	Self-Efficacy
Aerobic Capacity	.28*			
Adipose Body Weight	-.06	-.32**		
Self-Efficacy	.13	.21	.37**	
"Before Adherence"	.37**	.28*	-.08	.35**

*** $p \leq .0001$
** $p \leq .001$
* $p \leq .01$

REFERENCES

Albohm, M.J. (1993). Prescription for exercise adherence: guts and smarts, American Council on Exercise Insider, 2, 1-2.

American College of Sports Medicine. (1990). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. Medicine and Science in Sports and Exercise, 22, 265-274.

American Heart Association. (1993). AHA declares regular exercise to be a major factor in cardiovascular health. Maryland Alliance of Health, Physical Education, Recreation, & Dance Journal, January, 31.

Andrew, G. & Parker, J. (1979). Factors related to dropout of post myocardial infarction patients from exercise programs. Medicine and Science in Sports and Exercise, 11, 376-378.

Andrew, G.M., Oldridge, N.B., Parker, J.O., Cunningham, D.A., Rechnitzer, P.A., Jones, N.L., Buck, C., Kavanaugh, T., Shephard, R.J. & Sutton, J.R. (1981). Reasons for dropout from exercise in post-coronary patients. Medicine and Science in Sports and Exercise, 13, 164-168.

Astrand, P.O., & Rodohl, K. (1977). Textbook of work physiology. New York: McGraw Hill.

Atkins, C.J., Kaplan, R.M., Timms, R.M., Reinsch, S., & Lofback, K. (1984). Behavioral exercise programs in the management of chronic obstructive pulmonary disease. Journal of Consulting and Clinical Psychology, 52, 591-603.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Bandura, A. (1977). Social Learning Theory. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A., & Cervone, D. (1983). Self-evaluative and self-efficacy mechanisms governing the motivational effects of goal systems. Journal of Personality and Social Psychology, 45, 1017-1028.

Bandura, A. & Schunk, D.H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. Journal of Personality and Social Psychology, 41, 586-598.

Barke, C.R., & Nicholas, D.R. (1990). Physical activity in older adults: the stages of change. Journal of Applied Gerontology, 9, 216-223.

Bar-Or, O. (1983). Pediatric Sports Medicine for the Practitioner. New York: Springer-Verlag.

Belisle, M., Roskies, E., & Levesque, J-M. (1987). Improving adherence to physical activity. Health Psychology, 6, 159-172.

Benyo, R. (1990). The Exercise Fix. Champaign, IL: Leisure Press.

Berlin, J.A., & Colditz, G.A. (1990). A meta-analysis of physical activity in the prevention of coronary heart disease. American Journal of Epidemiology, 132, 612-628.

Bernacki, E.J., & Baun, W.B. (1984). The relationship of job performance to exercise adherence in a corporate fitness program. Journal of Occupational Medicine, 26, 529-531.

Bernier, M., & Avard, J. (1986). Self-efficacy, outcome, and attrition in a weight-reduction program. Cognitive Therapy and Research, 10, 319-338.

Bertera, R.L. (1990). The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. American Journal of Public Health, 80, 1101-1105.

Blair, S.N., Jacobs, D.R., & Powell, K.E. (1985). Relationships between exercise or physical activity and other health behaviors. Public Health Reports, 100, 172-180.

Boyce, B. (1993). The effects of goal setting on spontaneous goal setting behavior and performance on experienced shooters. Research Quarterly for Exercise and Sport, March supplement, A-99.

Browder, S. (1991). Don't be an exercise dropout. Reader's Digest, Aug., 168-172.

Brozek, J., & Keys, A. (1951). The evaluation of leanness-fatness in man, norms and interrelations. British Journal of Nutrition, 5, 194.

Carlson, B.R., & Petti, K. (1989). Health locus of control and participation in physical activity. American Journal of Health Promotion, 3, 32-38.

Carmody, T.P., Senner, J.W., Malinow, M.R., & Matarazzo, J.D. (1980). Physical exercise rehabilitation: long-term dropout rate in cardiac patients. Journal of Behavioral Medicine, 3, 163-168.

Caspersen, C.J., Christenson, G.M., & Pollard, R.A. (1986). Status of the physical fitness and exercise objectives - evidence from NHIS 1985. Public Health Report, 101, 587-592.

Connell, C.M., Davies, R.M., Rosenberg, A.M., & Fisher, E.B. (1988). Retiree's perceived incentives and barriers to participation in health promotion activities. Health Education Research, 3, 325-330.

Desharnais, R., Bouillon, J., & Godin, G. (1986). Self-efficacy and outcome expectations as determinants of exercise adherence. Psychological Reports, 59, 1155-1159.

deVries, H.A., Dijkstra, M., & Kuhlman, P. (1988). Self-efficacy: the third factor besides attitude and subjective norm as a predictor of behavioral interventions. Health Education Research, 3, 273-282.

Dishman, R.K. (1981). Biologic influences on exercise adherence. Research Quarterly for Exercise and Sport, 52, 143-159.

Dishman, R.K. (1982). Compliance/adherence in health-related exercise. Health Psychology, 1, 237-267.

Dishman, R.K. (1987). Exercise adherence and habitual physical activity. In W.P. Morgan & S.N. Goldston (Eds.), Exercise and Mental Health (pp. 57-83). Washington, D.C.: Hemisphere.

Dishman, R.K. (1988). Overview. In R.K. Dishman (Ed.) Exercise Adherence: Its Impact on Public Health. (pp. 1-9). Champaign, IL: Human Kinetics.

Dishman, R.K. (1991). Increasing and maintaining physical activity and exercise. Behavior Therapy, 22, 345-378.

Dishman, R.K., & Gettman, L.R. (1980). Psychobiologic influences on exercise adherence. Journal of Sports Psychology, 2, 295-310.

Dishman, R.K., & Ickes, W. (1981). Self-motivation and adherence to therapeutic exercise. Journal of Behavioral Medicine, 4, 421-437.

Dishman, R.K., Sallis, J.F., & Orenstein, D. (1985). The determinants of physical activity and exercise. Public Health Reports, 100, 158-171.

Dishman, R.K., & Steinhardt, M. (1990). Health locus of control predicts free-living, but not supervised, physical activity: a test of exercise-specific control and outcome-expectancy hypotheses. Research Quarterly for Exercise and Sport, 61, 383-394.

Dubbert, P.M. & Wilson, G.T. (1984). Goal-setting and spouse involvement in the treatment of obesity. Behavior Research and Therapy, 22, 227-242.

Duda, J., Smart, A., & Tappe, M. (1988). Predictors of adherence in the rehabilitation of athletic injuries: an application of personal investment theory. Paper presented at the Annual Meetings of the Association for the Advancement of Applied Sport Psychology, Nashua, NH, October, 1988.

Duncan, T.E. & Stoolmiller, M. (1993). Modeling social and psychological determinants of exercise behaviors via structural equation systems. Research Quarterly for Exercise and Sport, 64, 1-16.

Dzewaltowski, D.A. (1989). Toward a model of exercise motivation. Journal of Sport and Exercise Psychology, 11, 251-269.

Dzewaltowski, D.A., Noble, J.M., & Shaw, J.M. (1990). Physical activity participation: social cognitive theory versus the theories of reasoned action and planned behavior. Journal of Sport and Exercise Psychology, 12, 388-405.

Eggers, J.L. (1988). Well-elderly women's entrance and adherence to structured physical fitness programs. Activities, Adaptations, and Aging, 11, 21-30.

Erfurt, J.C., Foote, A., & Heirich, M.A. (1991). Worksite wellness programs: incremental comparison of screening and referral alone, health education, follow-up counseling, and plant organization. American Journal of Health Promotion, 5, 438-448.

Epstein, L.H., Wing, R.R., Thompson, J.K., & Griffin, R. (1980). Attendance and fitness in aerobic exercise: the effects of contract and lottery procedures. Behavior Modification, 4, 465-479.

Field, L.K., & Steinhardt, M.A. (1992). The relationship of internally directed behavior to self-reinforcement, self-esteem, and expectancy values for exercise. American Journal of Health Promotion, 7, 21-27.

Fitch, V.L., & Slivinske, L.R. (1988). Maximizing effects of wellness programs for the elderly. Health and Social Work, Winter, 61-67.

Fitzsimmons, P.A., Landers, D.M., Thomas, J.R., & van der Mars, H. (1991). Does self-efficacy predict performance in experienced weightlifters? Research Quarterly for Exercise and Sport, 62, 424-431.

Franklin, B.A. (1994). Motivating patients to exercise: strategies to increase compliance. Sports Medicine Digest, 16, 2-4.

Freedson, P.S. (1989). Field monitoring of physical activity in children. Pediatric Exercise Science, 1, 8-18.

Gaa, J.P. (1973). Effects of individual goal-setting conferences on achievement, attitudes, and goal-setting behavior. The Journal of Experimental Education, 42, 22-28.

Gale, J.B., Eckhoff, W.T., Mogel, S.F., & Rodnick, J.E. (1984). Factors related to adherence to an exercise program for healthy adults. Medicine and Science in Sports and Exercise, 16, 511-519.

Garcia, A.W., & King, A.C. (1991). Predicting long-term adherence to aerobic exercise: a comparison of two models. Journal of Sport and Exercise Psychology, 13, 394-410.

Gill, K., & Overdorf, V. (1993). Reasons for exercise: differences between younger and older women. Research Quarterly for Exercise and Sport, March supplement, A-102-103.

Godin, G., Desharnais, R., Jobin, J. & Cook, J. (1987). The impact of physical fitness and health-age appraisal upon exercise intentions and behavior. Journal of Behavioral Medicine, 10, 241-250.

Godin, G., Desharnais, R., Valois, P., Lepage, L., Jobin, J., & Bradet, R. (1994). Differences in perceived barriers to exercise between high and low intenders: observations among different populations. American Journal of Health Promotion, 8, 279-285.

Godin, G., & Shephard, R.J. (1990). Use of attitude - behavior models in exercise promotion. Sports Medicine, 10, 103-121.

Godin, G., Shephard, R.J. & Colantonio, A. (1986). The cognitive profile of those who intend to exercise but do not. Public Health Reports, 10, 521-526.

Hamachek, D.E. (1986). Enhancing the self's psychology by improving fitness physiology. Journal of Human Behavior and Learning, 3, 2-12.

Hammond, E.C., & Garfinkel, L. (1969). Coronary heart disease, stroke, and aortic aneurysm: factors in the etiology. Archives of Environmental Health, 19, 167-182.

Harris, S.S., Caspersen, G.H., DeFries, G.H., & Estes, E.H. (1989). Physical activity counseling for healthy adults as a primary preventive intervention in the clinical setting. Report of the U.S. Preventive Service Task Force. Journal of the American Medical Association, 261, 3590-3598.

Haskell, W.L., Leon, A.S., Casperson, C.J., Froelicher, V.F., Hagberg, J.M., Harlan, W., Holloszy, J.O., Regensteiner, J.G., Thompson, P.D., Washburn, R.A., & Wilson, P.W.F. (1992). Cardiovascular benefits and assessment of physical activity and physical fitness in adults. Medicine and Science in Sports and Exercise, 24, S201-S220.

Healthy People 2000 Progress Report. (1992). Public Health Service, U.S. Department of Health and Human Services. Washington, D.C.: Office of Disease Prevention and Health Promotion.

Herbert, L., & Teague, M.L. (1989). Exercise adherence and older adults: a theoretical perspective. Activities, Adaptation, and Aging, 13, 91-105.

Hilgenkamp, K. (1993). Factors of self-efficacy, gender, and fitness level related to a structured running program. Research Quarterly for Exercise and Sport, March supplement, A-103.

Hofstetter, C.R., Hovell, M.F., Macera, C., Sallis, J.F., Spry, V. Barrington, E., Callender, L., Hackley, M., & Rauh, M. (1991). Illness, injury and correlates of aerobic exercise and walking: a community study. Research Quarterly for Exercise and Sport, 62, 1-9.

Howley, E.T., & Franks, B.D. (1986). Health/Fitness Instructor's Handbook. Champaign, IL: Human Kinetics.

Iverson, D.C., Fielding, J.E., Crow, R.S., & Christenson, G.M. (1985). The promotion of physical activity in the U.S. population: the status of programs in medical, worksite, community, and school setting. Public Health Reports, 100, 212-224.

Kaplan, R.M., Atkins, C.J., & Reinsch, S. (1984). Specific efficacy expectations mediate exercise compliance in patients with COPD. Health Psychology, 3, 223-242.

Karvonen, M., Kentala, K., & Mustala, O. (1957). The effects of training heart rate: a longitudinal study. Annals of Medical and Experimental Biology of Finland, 35, 305-315.

King, A.C. (1991). Principles of adherence and motivation. In American Council on Exercise Personal Trainer Manual. (pp. 359-372). San Diego, CA.

King, A.C., Blair, S.N., Bild, D.E., Dishman, R.K., Dubbert, P.M., Marcus, B.H., Oldridge, N.B., Paffenbarger, R.S., Powell, K.E., & Yeager, K.K. (1992). Determinants of physical activity and interventions in adults. Medicine and Science in Sports and Exercise, 24, S221-S236.

Kishchuk, N., Anbar, F., O'Loughlin, J., Masson, P., & Sacks - Silver, G. (1991). Efficiency of printed materials in worksite health promotion. American Journal of Health Promotion, 5, 355-359.

Lindsay-Reid, E., & Osborn, R.W. (1980). Readiness for exercise adoption. Social Science and Medicine, 14, 139-146.

Lobstein, D.D., Ismail, A.H., & Rasmussen, C.L. (1989). Beta-endorphin and components of emotionality discriminate between physically active and sedentary men. Biological Psychiatry, 26, 3-14.

Marcus, B.H., Banspach, S.W., Lefebvre, R.C., Rossi, J.S., Carleton, R.A., & Abrams, D.B. (1992). Using the stages of charge model to increase the adoption of physical activity among community participants. American Journal of Health Promotion, 6, 424-429.

Marcus, B.H., & Owen, N. (1992). Motivational readiness, self-efficacy and decision-making for exercise. Journal of Applied Social Psychology, 22, 3-16.

Marcus, B.H., Selby, V.C., Niaura, R.S., & Rossi, J.S. (1992). Self-efficacy and the stages of exercise behavior change. Research Quarterly for Exercise and Sport, 63, 60-66.

Martin, J.E., & Dubbert, P.M. (1982). Exercise applications and promotion in behavioral medicine: current status and future directions. Journal of Consulting and Clinical Psychology, 50, 1004-1007.

Martin, J.E., Dubbert, P.M., Katell, A.D., Thompson, J.K., Raczynski, J.R., Lake, M., Smith, P.O., Webster, J.S., Sikora, T., & Cohen, R.E. (1984). Behavioral control of exercise in sedentary adults: studies 1-6. Journal of Consulting and Clinical Psychology, 52, 795-811.

Mavis, B.E., Stachnik, T.J., Gibson, C.A., & Stoffelmayr, B.E. (1992). Issues related to participation in worksite health promotion: A preliminary study. American Journal of Health Promotion, 7, 53-60.

McCauley, E., Duncan, T.E., & Wraith, S. (1991). Self-efficacy, perceptions of success, and intrinsic motivation for exercise. Journal of Applied Social Psychology, 21, 139-155.

McAuley, E., & Jacobsen, L. (1991). Self-efficacy and exercise participation in sedentary adult females. American Journal of Health Promotion, 5, 185-191.

McGinnis, J.M. (1992). The public health burden of a sedentary lifestyle. Medicine and Science in Sports and Exercise, 24, S196-S200.

Mead, W.F. (1979). Maximal exercise testing -- Bruce Protocol. Journal of Family Practice, 9, 479-490.

Neale, A.V., Singleton, S.P., Dupuis, M.H., & Hess, J.W. (1990). The use of behavioral contracting to increase exercise activity. American Journal of Health Promotion, 4, 441-447.

Noland, M.P. (1989). The effects of self-monitoring and reinforcement on exercise adherence. Research Quarterly for Exercise and Sport, 60, 216-224.

O'Leary, A. (1985). Self-efficacy and health. Behavior Research Therapy, 23, 437-451.

Olson, J.M., & Zanna, M.P. (1982). Predicting adherence to a program of physical exercise: an empirical study. Toronto: Government of Ontario, Ministry of Tourism and Recreation.

Oman, R., & McAuley, E. (1993). Intrinsic motivation and exercise behavior. Journal of Health Education, 24, 232-238.

Paffenbarger, R.S., Blair, S.N., Lee, I.M., & Hyde, R.T. (1993). Measurement of physical activity to assess health effects in free-living populations. Medicine and Science in Sports and Exercise, 25, 60-70.

Pollock, M.J., Carroll, J.F., Graves, J.E., Leggett, S.H., Braith, R.W., Limacher, M. & Hagberg, J.M. (1991). Injuries and adherence to walk/jog and resistance training programs in the elderly. Medicine and Science in Sports and Exercise, 23, 1194-1200.

Powell, K.E., Spain, K.G., Christenson, G.M., & Mollenkamp, M.P. (1986). The status of the 1990 objective for physical fitness and exercise. Public Health Reports, 101, 15-21.

Robison, J.I., Rogers, M.A., Carlson, J.J., Mavis, B., E., Stachnik, T., Stoffelmayr, B., Sprague, H.A., McGrew, C.R., & VanHuss, W.D. (1992). Effects of a 6-month incentive-based exercise program on adherence and work capacity. Medicine and Science in Sports and Exercise, 24, 85-93.

Robinson, J. (1992). "Betting" on themselves helps exercisers stick to program. Sports Medicine Digest, 14, 4, 6.

Rodgers, W.M., & Brawley, L.R. (1991). The role of outcome expectancies in participation motivation. Journal of Sport and Exercise Psychology, 13, 411-427.

Sallis, J. (1994). Physical activity interventions: applications of behavior change principles across the lifespan. Medicine & Science in Sports & Exercise, 26, S147.

Sallis, J.F., Buono, M.J., Roby, J.J., Micale, F.G., & Nelson, J.A. (1993). Seven-day recall and other physical activity self-reports in children and adolescents. Medicine and Science in Sports and Exercise, 25, 99-108.

Sallis, J.F., Haskell, W.L., Fortmann, S.P., Vranizan, K.M., Taylor, C.B., & Solomon, D.S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. Preventive Medicine, 15, 331-341.

Sallis, J.F., & Hovell, M.F. (1990). Determinants of exercise behavior. In J.O. Holloszy and K.B. Pandolf (Eds)., Exercise and Sports Sciences Review, (18, pp. 307-330). Baltimore: Williams & Wilkins.

Sallis, J.F., Hovell, M.F., Hofstetter, C.R., Faucher, P., Elder, J.P., Blanchard, J., Casperson, C.J., Powell, K.E., & Christenson, G.M. (1989). A multivariate study of determinants of vigorous exercise in a community sample. Preventive Medicine, 18, 20-34.

Sallis, J.F., Pinski, R.B., Grossman, R.M., Patterson, T.L., & Nader, P.R. (1988). The development of self-efficacy scales for health-related diet and exercise behaviors. Health Education Research, 3, 283-292.

Saris, W.H.M. (1986). Habitual physical activity in children: methodology and findings in health and disease. Medicine and Science in Sports and Exercise, 18, 253-263.

Schneider, D., & Greenberg, M.R. (1992). Choice of exercise: a predictor of behavioral risks? Research Quarterly for Exercise and Sport, 63, 231-237.

Schunk, D.H. (1987). Self-efficacy and motivated learning. In N. Hastings & J. Schwieso (Eds.), New Directions in Educational Psychology: 2. Behavior and motivation in the classroom (pp. 233-251). London: The Falmer Press.

Schunk, D.H. (1989). Self-efficacy and cognitive achievement: implications for students with learning problems. Journal of Learning Disabilities, 22, 14-22.

Shephard, R.J. (1988). Exercise and lifestyle change. British Journal of Sports Medicine, 23, 11-22.

Shephard, R.J. (1992). A critical analysis of work-site fitness programs and their postulated economic benefits. Medicine and Science in Sports and Exercise, 24, 354-370.

Sloan, A.W., Burt, J.J., & Blyth, C.S. (1962). Estimation of body fat in young women. Journal of Applied Physiology, 17, 967.

Sonstroem, R.J. (1986). Enhancement of self-esteem through exercise applications. Paper presented at AAHPERD Eastern District Association Convention. Lancaster, PA. March 6, 1986.

Sonstroem, R.J. (1988). Psychological models. In R.K. Dishman (Ed.), Exercise Adherence: Its Impact on Public Health. (pp. 125-154). Champaign, IL: Human Kinetics.

Sopko, G., Obarzanek, E., & Stone, E. (1992). Overview of the National Heart, Lung, and Blood Institute Workshop on physical activity and cardiovascular health. Medicine and Science in Sports and Exercise, 24, S192-S195.

Stanton, A.L. (1987). Determinants of adherence to medical regimens by hypertensive patients. Journal of Behavioral Medicine, 10, 377-393.

Steinhardt, M.A., & Carrier, K.M. (1989). Early and continued participation in a work-site health and fitness program. Research Quarterly for Exercise and Sport, 60, 117-126.

Stotland, S., & Zuroff, D.C. (1991). Relations between multiple measures of dieting, self-efficacy, and weight change in a behavioral weight control program. Behavior Therapy, 22, 47-59.

Taylor, C.B., Sallis, J.F., & Needle, R. (1985). The relation of physical activity and exercise to mental health. Public Health Reports, 100, 195-202.

Tetting, D.W. (1989). Perceived benefits among regular exercisers at a health and fitness center. Fitness in Business, April, 183-188.

Tucker, L.A., Aldana, S.G., & Friedman, G.M. (1990). Cardiovascular fitness and absenteeism in 8,301 employed adults. American Journal of Health Promotion, 5, 140-145.

Waller, K.V., & Bates, R.C. (1992). Health locus of control and self-efficacy beliefs in a healthy elderly sample. American Journal of Health Promotion, 6, 302-309.

Weinberg, R. (1993). Good goals -- setting them, keeping them. Running and Fit News, 11, 3.

Wilmore, J.H. (1991). Exercise physiology. Sports Medicine Digest, 13, 7.

Wilson, B.R.A., Wagner, D.I., & Dwyer, E.S. (1991). Adherence factors in a worksite fitness program. American Journal of Health Promotion, 5, 172-175.

Wood, E.A., Olmstead, G.W., & Craig, J.L. (1989). An evaluation of lifestyle risk factors and absenteeism after two years in a worksite health promotion program. American Journal of Health Promotion, 4, 128-133.

Yang, M., Lairson, D.V., Frye, N., Herd, J.A., & Falck, V.T. (1988). The effects of wellness program attendance on physiologic measures, health practices, and diet habits. Health Education Research, 3, 293-303.

Yukelson, D. (1991). Psychological factors associated with exercise adherence. Sports Medicine Digest, 13, 7.