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Influential Factors Contributing to Exercise Compliance Following a Structured Lifestyle Change Program

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INFLUENTIAL FACTORS CONTRIBUTING TO EXERCISE COMPLIANCE FOLLOWING A STRUCTURED LIFESTYLE CHANGE PROGRAM

by

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ABSTRACT

Cardiovascular disease remains the number one cause of death in the United States, with five hundred thousand people diagnosed annually. Even though regular exercise has been shown to dramatically reduce the risk of cardiovascular disease, few hospitals offer programs that focus on the requisite lifestyle changes for participants to maintain long-term exercise programs. In an effort to determine what factors contribute to long-term exercise compliance, this study surveyed 279 participants of the Scripps Ornish/Healing Hearts program, a comprehensive lifestyle change program, to identify the factors that helped explain variation in exercise compliance among program completers.

Results of the hierarchical multiple regression analysis suggests that demographic factors, lifestyle habits, and safety issues were all important compliance factors for the 178 survey respondents. Specifically, participants who completed the program most recently, had a postgraduate education, a history of exercise, and exercised with a partner were more likely to comply following the completion of the formal program than those not exhibiting these characteristics. On the other hand, exercise compliance dropped following program completion for those who needed to exercise with a group.

Taken together, these findings clearly demonstrate the importance of a support system for successful exercise compliance, and Scripps is urged to expand their services to include some sort of post-program support system. In addition, recommendations for future research include expanding this design to include other populations and settings as well as investigating exercise compliance after the implementation of a post-program support structure. Hopefully the results of this study will lead to lower morbidity and

better quality of life for all individuals, since exercise compliance is not just an issue for

cardiac patients, but for all members of society.

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DEDICATION

This dissertation is dedicated to my father, Seymour J. Borin. His example as a hard working caring confident person provided me the role model to even consider such an endeavor as doctoral studies. He was a simple man who loved his family and wanted to provide the best he could for us. I hope I will be such a mench.

Early on I realized that the process of my doctoral studies was a team effort. I never could have completed such an undertaking with out the support of the many people in my life. The most important members of my team, Tracy and Taylor, gave me unconditional love, without which, this accomplishment would have been hollow.

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The mountains have been climbed, it is now time for the most important journey of my life with my T & t.

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CHAPTER ONE
Introduction to the Study

Introduction

This study was inspired by six years of experience leading and observing heart patients who participated in a lifestyle change program developed by Dr. Dean Ornish, a cardiologist in northern California (Ornish, 1990) and the subsequent Healing Hearts program, both offered at Scripps Center for Integrative Medicine. Although patients enrolled in the programs exercise regularly, it is unknown if they maintain this habit after completing the lifestyle change programs. The current study will attempt to identify the influential factors that contribute to aerobic exercise compliance after the completion of the lifestyle change programs. The lifestyle change programs address four areas of lifestyle behaviors or modalities: exercise, diet, stress management, and group support. Each of these behaviors is integral to maintaining a balanced, healthy lifestyle as well as to contributing to the processes of decreasing the blockages of coronary arteries and reversing heart disease (Ornish, 1998); however, the focus of this study will be on exercise. The subjects participating in this study are men and women who have completed the lifestyle change program and (a) had a cardiac intervention prior to beginning the program, or (b) enrolled in the program to avoid cardiac intervention.

Maintaining a healthy lifestyle is an ever-present challenge. It is difficult for many people to find the time to accomplish daily tasks, but it is often even more difficult to also fit in exercise. Somehow though, according to the Healthy People 2010 objectives and the Surgeon General's report, approximately one-third of Americans manage to make the

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time to exercise regularly (United States Department of Health and Human Services, 1996, 1998). The puzzling question remains: Why don't the other two-thirds of Americans exercise on any regular basis, even though they are aware of the many benefits? These benefits have long been established and include improvements in cardiovascular fitness, weight loss, reduction of cardiovascular disease risk factors, and increased energy levels (Pate, 1995; USDHHS, 1996).

Professionals in the wellness and healthcare communities are challenged with the task to motivate the sedentary. If these professionals are successful, many Americans will reap some of the previously mentioned benefits of exercise. The longer it takes to accomplish this task, however, the greater will be the incidences of illness, disease, and death that could have otherwise been prevented. Meanwhile, lifespans may be increasing (Kavenaugh, 1996; Nasser, 1996), but quality of life for many Americans is being compromised. This dichotomy is putting a greater demand on our healthcare system, which is not appropriately structured to care for this quickly growing population (USDHHS, 1998). Modern medicine is only just beginning to embrace the notion of prevention and the possibility of alternative forms of healing, yet it would seem that the medical setting has the best resources to provide the services and support needed for a sedentary population. Thus, dissemination of preventive health education information from medical institutions is slowly becoming part of public and patient education.

The setting for the current study, Scripps Center for Integrative Medicine, is a department of a large medical institution. The Center's mission is to bridge the gap between conventional medicine and alternative approaches to healthcare. This innovative approach to healing presents unique challenges. Both the conservative healthcare provider as well as the consumer must be convinced that there are other options to maintain well

being. Unfortunately many physicians are not open to alternative forms of treatment. Similarly, most Americans are resistant to practicing healthy behaviors (USDHHS, 1998). At the same time, the tremendous growth of the fitness industry over the past few decades seems to indicate that Americans are becoming more receptive to exercise (American Council on Exercise, 1997). But even with this wider acceptance, exercise is still not a regularly practiced behavior of the majority of Americans.

There are numerous reasons why people do not exercise. Some of the more commonly cited reasons are related to negative attitude, lack of motivation, lack of time, socioeconomic status, and previous experience with exercise (Dishman, 1994; Harris, 1978, 1978, 1983; Folsm, 1991; Heath, 1991; Dennison, 1988; Powell, 1987). These reasons, which will be addressed at length in the review of the literature, deserve acknowledgement because many non-exercisers perceive them to be barriers to exercise.

It is difficult to get non-exercisers to start exercising, but in many ways it is even more difficult to keep them exercising once they have started. Dishman (1981, 1985, 1991, 1994) and Oldridge (1979, 1982, 1983, 1984, 1988, 1990) have studied extensively the influential factors contributing to exercise adherence during participation in cardiac rehabilitation programs. These researchers have identified three general categories which impact exercise adherence: population characteristics, environment, and the actual exercise. The specifics of these three categories will be discussed in chapter two. While these factors are relevant to exercise adherence while participating in cardiac rehabilitation, it is unknown what effect they may have on exercise adherence following the completion of a structured lifestyle change program.

Statement of the problem

There are numerous studies which have investigated exercise compliance of patients while they are enrolled in a structured exercise program (Andrew, 1981; Dishman & Ickes, 1981; King, 1992; Oldridge & Streiner, 1990; Oldridge & Rogowski, 1990; Oldridge, 1979, 1982, 1988; Oldridge & Stoedefalke, 1984; Oldridge et al., 1983; Dishman, 1981, 1985, 1994) but there is very limited documentation regarding exercise compliance for patients upon completion of a structured exercise program.

What motivates participants to continue to exercise on their own after completing a lifestyle change program? In this study I will attempt to identify the factors that motivate and/or limit exercise habits following the Ornish/Healthy Hearts lifestyle change program. The implications and importance of compliance or non-compliance to exercise for heart patients are simple: Those who have higher compliance to exercise will live longer, experience a greater quality of life, and incur less medical expense (Dunn, 1999; Fletcher, 1996; American College of Sports Medicine, 1994, 1998; USDHHS, 1996, 1998).

There are many published studies that address the benefits of exercise as well as compliance of exercise during a structured program (Oldridge, 1990; Dishman, 1994; King, 1998). Benefits of exercise are often viewed in terms of providing improvement in functional capacity such as increased aerobic capacity, reduction in blood pressure and cholesterol, and weight loss, just to name a few. The significance of all these benefits is that people with improved functional capacities live longer, better quality lives. Compliance refers to the consistency of following a prescribed treatment. Andrew and colleagues (1981) found, in the Ontario Exercise Heart Collaborative Study, that different factors needed to be considered in order to enhance compliance in their exercise

rehabilitation program. These included such factors as time of day, location, staffing

needs, and participant interests or preferences. Oldridge et al. (1982, 1983, 1984, 1988,

1990) found similar factors that influence compliance, including psychosocial behavior,

knowledge, leader behavior, and variety. In an effort to improve compliance, the format

of cardiac rehabilitation exercise programs has been modified to take into account these

factors.

One study, however, by Bock and her associates (2001) studied the maintenance

of physical activity following an individualized, motivationally tailored intervention.

These researchers found a significantly high level of exercise participation following the

completion of a physical activity intervention. They attributed the success of the program

to individually tailored feedback reports and self-help manuals that were matched to the

participants' stage of motivational readiness for physical activity adoption. An important

point regarding Bock's study was that the participants were apparently healthy, whereas

heart patients are the subjects in most other studies. There is an apparent void of data

related to compliance to exercise by heart patients following a comprehensive lifestyle

change program; the majority of current research has focused primarily on traditional

cardiac rehabilitation programs that consist of exercise only.

Purpose of the study

The purpose of this study is to identify the influential factors that lead heart

patients to continue to comply with exercise habits following a structured lifestyle change

program. These influential factors could then be incorporated into the structure of a

lifestyle change program, cardiac rehabilitation program, or for that matter any exercise

regime to improve compliance. (One factor, demographics, would of course remain

unalterable. However, knowledge of the impact of certain demographics on exercise

compliance could lead to other considerations on how best to accommodate issues of gender, age, or, perhaps, ethnicity.) Such valuable information could lead to lower morbidity and a better quality of life for many future heart patients. The findings from this study may one day be used to bring about positive changes for other heart patients (or anyone else beginning an exercise program) by improving their success rate and compliance to exercise.

Research questions

The purpose of this study is to identify influential factors that may lead heart patients to continue or discontinue exercise following a structured lifestyle change program. The following research questions will be used:

1. To what extent do demographic factors, lifestyle habits, and safety issues contribute to aerobic exercise compliance for those who have completed the Ornish/Healing Hearts lifestyle change program in La Jolla, CA?
2. Do these demographic factors, lifestyle habits and safety issues vary when the length of program or severity of medical condition are factored in?

Specifically, the answer to the second question will state to what extent these factors contribute to exercise compliance in each of four groups: (a) participants who completed the one-year program and had a cardiac intervention prior to beginning the program, (b) participants who completed the six-month program and had a cardiac intervention prior to beginning the program, (c) participants who completed the one-year program to avoid cardiac intervention, and (d) participants who enrolled in the six-month program to avoid cardiac intervention.

Definition of terms

- Compliance--In the context of the medical community, compliance is defined as "the extent to which a patient's behavior, in terms of taking medications, following diets, or modifying other lifestyle habits, coincides with the clinical prescription." (Sackett, 1976)

- Myocardial Infarction--Death to heart tissue that results from insufficient blood supply to the myocardium. (Wilmore, 1999)

- Angioplasty--Medical procedure in which a catheter with a balloon on the end is inserted into the main arteries of the heart. The balloon is inflated at points of plaque narrowing in the artery to increase blood flow. (Ornish, 1990)

- Stent--Surgical metal lattice-like tube that is inserted in the coronary arteries to maintain optimal blood flow. (Online medical dictionary, OMD@www.graylab.ac.uk)

- Cohort--Clinical term for a group banded together for a common purpose. (Webster, 2000)

- Heart Disease Reversal--Regression of coronary atherosclerosis leading to increased myocardium blood flow. (Ornish, 1990)

- Aerobic exercise-- Continuous exercises at an intensity level to elevate the heart rate to a pre-determined training level. (Wilmore, 1999)

- Wellness--A characteristic lifestyle that employs and displays positive attitudes and actions toward daily living encompassing the total being of the person (Hoeger & Hoeger, 1997).

- Cardiovascular Fitness--The ability of the heart, blood vessels, blood, and respiratory system to supply fuel, oxygen, and nutrients to the muscles person. (Hoeger & Hoeger, 1997)

- Sedentary--A person who is relatively inactive and has a lifestyle characterized by a lot of sitting; or, having the characteristic of being inactive. (Kent, 1994)

CHAPTER TWO
Review of the Literature

Introduction

A comprehensive review of the literature is presented in this chapter that will support the basis of the study, that is, influential factors contributing to exercise compliance. This chapter is structured into two sections: section one addresses exercise compliance viewed from seven different perspectives, while the second section looks at compliance issues related to five various lifestyle behaviors.

Exercise compliance will be examined from seven perspectives in section one of this review of the literature. The first perspective reviews the structure of the Ornish / Healing Hearts program. The next perspective presents the rational for this study, emphasizing the potential significance of the findings. Third, the landmark Multi-Center Lifestyle Heart Trial study, the model this particular study is based on, will be described. Perspective four presents an overview of healthcare, while the fifth perspective addresses some of the more commonly cited reasons people are non-compliant while enrolled in an exercise program. Perspective six introduces the predictors of exercise maintenance following the completion of a physical activity intervention. An overview of the various stages of adult development and their relation to behavior change are presented as the final perspective.

The second section of this chapter consists of a comprehensive literature review of compliance to various lifestyle habits. This is presented for the purpose of comparison of the similar factors that contribute to exercise compliance. The areas of concentration in

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this review consist of compliance to (a) exercise for the apparently healthy, (b) diets, (c) smoking cessation, (d) physical therapy, and (e) substance abuse aftercare.

Section one: Seven perspectives on exercise compliance

Ornish / Healing Hearts. Many of society's illnesses are preventable (Ornish, 1994) or at the very least can be reduced in severity by the simple practice of healthy lifestyle behaviors. Unfortunately, the majority of people choose to live in very unhealthful ways. Dr. Dean Ornish (1991) proposes four primary behaviors that make up a balanced, healthy lifestyle: exercise, nutritious eating, stress management, and emotional well being.

The first behavior to consider is exercise. Most people get little or no exercise (USDHHS, 1996, 1998). This sedentary behavior is often explained by the rationale of not having enough time. Lack of exercise has also been attributed to the conscious or unconscious decision that it is not a priority (Dishman, 1994). Hubball (1995) suggests that a lack of information about the proper way to exercise is a primary reason for lack of participation. All to often exercise may be viewed in an antagonistic way due to previous negative experience as early as elementary or secondary school (Nigg, 2001). Youth today seem to prefer computer games to sporting activities and adults display similar equally sedentary behaviors such as using the escalator instead of the stairs (Malina, 1996). In today's technologically advanced society Americans have been able to create more free time only to waste it in sedentary ways (USDHHS, 1996, 1998).

The second behavior is poor dietary habits. Combined with sedentary ways, poor diet significantly affects an individual's quality of life. The fast paced lives people lead has significantly impacted the way they eat. Americans are always on the run, and the foods they eat reflect this. Fast foods are plentiful as well as unhealthy and non-nutritious

(Gotto & Ballantyne, 1994). In an effort to improve the dietary habits of the average American, the government standardized food labels to help inform the consumer of the nutritional content of packaged foods (Zimmerman, 1994). For the most part these labels have confused the average consumer as to what is a healthy choice. The nutritional facts are not easy to interpret (Reid, 1994). Additionally, prepackaged, processed foods have made meal preparation much easier but not necessarily nutritious. Finally, the abundance of marketing and advertising of colorful, flashy packaged foods and snacks by well-known media personalities provide stiff competition for dieticians, nutritionists, and health educators trying to promote a healthy diet. Advertising promotes more unhealthy choices than their nutritional alternatives, and this situation makes it very difficult for consumers to make healthy decisions.

The third behavior, stress, is with people every day of their lives. In addition to exercise and diet, stress is a prominent behavior not managed effectively by most people (Kabat-Zinn, 1990 & 1994). Stress comes in many different forms. Everyone has personal and professional obligations: family, finances, and countless deadlines are everyday occurrences. As a result of the lifestyles people choose to lead in this country, their health is often put at risk. One significant source of stress is the abundance of information available for consumption by the average person (Sobel, 1996). So much information is available through various forms of electronic technology, people struggle to sort and organize it in a manner that makes it readily retrievable. Sobel proposes that we are bombarded with so much information so quickly, the brain is unable to process and store all of the information in long term memory. This phenomenon is analogous to creating a document on the computer but not naming it, so when the document is needed it becomes difficult to find. People are pulled in many different directions, and they often

think about what needs to be done next before they complete the current task. This type of "sensory overload" impairs the individual's ability to quiet the mind, organize thoughts, and live in the present moment. What is more, the inability or unwillingness to slow down ultimately affects the way in which people react (or overreact) to other people (Kabat-Zinn, 1990). Even more important, however, at least as it relates to this study, is the fact that stress not only affects intellectual and sociological function, but it also results in such physiological changes as constriction of blood vessels and elevation of blood pressure and cholesterol (Ornish, 1983).

The fourth behavior of a balanced, healthy lifestyle is emotional well being. According to Ornish (1998), this behavior is typically considered the most foreign to Americans, as compared with the other three previously discussed behaviors. American culture does not support the concept of being open and sharing feelings. Currently, emotional wellness is the behavior Americans know the least about in regard to overall wellness in this society (Billings, 1996). People in general have become so detached from their feelings they have difficulty relating to others (Pennebaker, 1990; Seeman, 1987), and lack simple techniques for relating or listening to others, or having compassion and empathy. This lack of ability to relate to and connect with others limits the development of meaningful relationships, which can lead to isolation and depression (Amick, 1994; Greenwood, 1996; Seeman, 1987). Being connected to others leads individuals to having a greater appreciation of their own situations, yet empathy and compassion are often missing from relationships in which people think only about their own problems. Pennebaker (1990) accounts in part for this behavior by pointing out that people tend to live with the fear that they will be rejected if they express their feelings to others. In addition, American culture unfortunately fosters the idea that being an

emotional person is a sign of weakness. This stigma is difficult to overcome. Meanwhile, the most recent research suggests that opening one's heart figuratively can also lead to opening one's heart (arteries) literally (Greenwood, 1996).

The behaviors discussed above have been included in this section of the literature review for the purpose of providing the reader with an appreciation and understanding of the Ornish lifestyle change program. Research data are currently being analyzed on some five hundred participants of Dr. Dean Ornish's Multi-center Lifestyle Heart Trial to discover the value of the program for heart disease reversal. The initial findings of this research are very promising with significant results of heart disease reversal (Ornish, 1998). This is very encouraging, especially considering that other options prior to this study included invasive procedures or, even worse, no hope of improvement.

Theoretical framework for this study. It was stated in the introduction section of Chapter One that the four lifestyle modalities: exercise, diet, stress management, and group support form the basis for the Scripps Center for Integrative Medicine lifestyle change programs (i.e., the Ornish program and the Healing Hearts Program). Here, the recommendations and standards set by internationally recognized organizations for such programs will be examined in view of the significance of certain behaviors for success of the lifestyle change programs. While these recommendations are merely a guideline, they serve to keep in perspective how far away the average American is from meeting the American Surgeon General's Healthy People 2010 objectives (USDHHS, 1998), the American College of Sports Medicine guidelines (ACSM, 1998), and the American Heart Association recommendations (Fletcher et al., 1996).

The American College of Sports Medicine (ACSM) established specific exercise guidelines in 1978 (American College of Sports Medicine, 1978), which recommended

that apparently healthy people exercise a minimum of 20 to 60 minutes, 3 to 5 days per week. It was established that exercise should be aerobic (using large muscle groups) at a target heart rate intensity. The result of such exercise, according to ACSM, would be improvement in cardiorespiritory fitness.

The American Heart Association (AHA) developed two diet plans to reduce risk of heart disease (AHA, 2000). The step one diet is geared toward the individual who has diagnosed heart disease and must restrict his/her diet to no more than 20 percent fat. The second diet plan is for the apparently healthy person who is trying to prevent heart disease with no more than 30 percent of his/her diet coming from fat.

The guidelines put out by the ACSM regarding exercise were established as part of the United States Government's Healthy People 2000 objectives (United States Department of Health and Human Services, 1990). To the dismay of the organizations cited here and many others, Americans were still exercising very little by 1990. In fact, fewer than 30% of Americans were exercising regularly (USDHHS, 1990). In 1990, 12 years after its initial guidelines were released, ACSM published new guidelines recommending that Americans accumulate 30 minutes of physical activity most days of the week (ACSM, 1990). These new recommendations amounted to being a major departure from the original position statement, and may have been issued largely in response to the poor exercise habits of the typical American. Perhaps, this significant compromise was a plea for people to just get moving, to take stairs instead of the elevator, to park further away and walk, or to do more work around the house.

The guidelines for diet also have not been heeded (USDHHS, 1996, 1998). The dietary habits of the average American are excessively high in fat. Three prominent organizations: the American Heart Association, the American Diabetes Association, and

the American Cancer Society, have established reasonable guidelines of a diet not to exceed 30% fat. Even with the recommendations of these organizations and volumes of research confirming the high risk of heart disease and certain cancers, Americans continue to consume diets averaging 40% fat (Wilmore & Costill, 1999). On another front, the American Heart, Lung and Blood Institute has set safe levels of total serum cholesterol at 200 mg/dl or below. Too many Americans exceed this value and fall in the high-risk category of 240 mg/dl or higher. Because genetics already play a significant role in the cholesterol game (Novitt-Morena, 1998; Gotto, 1994), it is even more important to moderate dietary fat intake due to its ability to elevate serum cholesterol. Clearly, American dietary habits are not aligned with the guidelines that have long been well established (United States Department of Agriculture, 1998), and most people still make unhealthy choices.

As it was noted earlier, stress management is the third behavior that is relevant to the success of the lifestyle change programs. It is, perhaps, one of the more difficult behaviors to tame, however, because unlike diet awareness, stress awareness is essentially nonexistent in most Americans. Indeed, few Americans can even identify what the stressors are in their life (Kabat-Zinn, 1990), and as a result these individuals don't know how to manage them. In fact, most people don't even recognize the signs and symptoms of stress or for that matter what causes stress in the first place. In general, people don't realize that stress can display itself in minor forms such as irritability, impatience, or in more acute forms such as mild headaches; they also don't recognize chronic stress, which can manifest into such debilitating symptoms as insomnia, hypertension, and personality disorders (Donatelle, 2001). Because any of these conditions can be debilitating,

especially for heart patients, there is a monumental need to train people how to avoid, recognize, and reduce stressful situations.

The fourth component, group support, deals with a person's ability to connect with others. This lack of connectivness is actually the inability or unwillingness to be open with feelings (Kabat-Zinn, 1990, 1994). Most Americans lack sufficient emotional support systems and, as a result, keep feelings "bottled up" inside. The inability to communicate feelings and express oneself can lead to pent up tension and frustration, feelings of isolation, and in many cases a sense of low self esteem (Lasher, 1992; Pennebaker, 1990). In short, lack of emotional and psychological well-being can have as great an impact on our physical wellness as do the lack of exercise and an unhealthy diet, (Shumaker, 1994; Totman, 1997).

In conclusion, the framework for the current study is based on work previously done by Ornish for reversing heart disease that began at several different locations more than a decade ago. The research presented here will examine individuals who have been participants at the Scripps site over the past six years. The next section is a detailed account of the Ornish program history and structure.

Multi-Center Lifestyle Heart Trial. The lifestyle change program developed by Dr. Dean Ornish is comprehensive and includes four modalities that have already been discussed at some length: exercise, diet, stress management, and group support. Encouraging results have been reported from the initial Lifestyle Heart Trial regarding the implementation of the lifestyle change program (Ornish, 1998). The conclusion of the study was that the intensive lifestyle changes advocated by the program do, indeed, lead to heart disease reversal. Additional research analysis is being conducted on data that has been collected from some five hundred participants of Dr. Ornish's Multi-Center

Lifestyle Heart Trial study in eight different hospital sites across the country, including Omaha, Nebraska; Ft. Lauderdale, Florida; Columbia, South Carolina; New York, New York; La Jolla, California; Des Moines, Iowa; San Francisco, California and Pittsburgh, Pennsylvania. (These sites were purposely chosen for their geographic and demographic diversity, based on the expectation that similar results could be attained regardless of location or population.)

The four modalities that are the basis of the lifestyle change programs followed specific research protocol criteria. Participants fell into one of three categories. The first population was comprised of individuals who had had a myocardial infarction (heart attack) and had undergone a cardiac procedure (e.g., angioplasty, bypass surgery, stent) to correct their problem. Individuals included in the second group had received a diagnosis of cardiovascular disease and were candidates for a cardiac procedure, but had chosen the lifestyle change program instead. The third group of participants (often the spouse of a participating heart patient) had joined the program with the idea that it would be a preventive measure against heart disease. All participants made a 3-year commitment to the program: In the first 3 months of the first year, participants attended 3 days per week (4, 4, and 2 hours respectively) at the hospital site. For the remaining 9 months of the first year, they came 4 hours once per week. The final 2 years they practiced their lifestyle habits on their own and reported adherence results to the hospital site (Ornish, 1990).

The exercise modality consisted of aerobic exercise performed a minimum of 30 minutes 6 days per week. The exercise (e.g., walking or stationary cycling) was continuous at the appropriate intensity as prescribed by their target heart rate.

The required diet was largely plant-based and did not exceed 10% fat. Foods were prepared with no added oil. The only animal products included in the diet were non-fat dairy and egg whites. All breads and similar carbohydrates were made from whole grain, and consumption of refined flour or sugar was extremely limited.

Stress management took the form of yoga, meditation, visualization, and/or progressive relaxation. These techniques were to be practiced for one hour every day, preferably not combined with other activities.

Group support was structured in a manner that members of each cohort could share their feelings in a safe environment. The purpose of cohort gatherings was to emotionally connect participants with one another, and to help them learn to actively listen, cultivate empathy, and relate to one another's feelings.

Healthcare. One important characteristic of the eight sites in which the Multi-Center Lifestyle Heart Trial was conducted is that each site was a medical setting. Therefore, the discussion will now turn to the importance healthcare plays in the movement toward healthy lifestyle behaviors.

With the recent introduction of healthcare reform it is difficult to project what health care will look like in the new millennium. The old paradigm of the family doctor making a house call is a thing of the past, having been replaced with the new paradigm: "do more with less." Physicians today have very limited patient contact time, and many procedures, which previously required several days of recovery in the hospital, are now routinely done as outpatient procedures. Meanwhile, hospitals are functioning with a turnstile mentality, discharging everyone from new mothers to heart bypass patients after very short periods of recovery.

In reaction to the healthcare crisis, which is in large part due to the rising cost of medicine, the practice and business of medicine has attempted to employ new technological advances and more cost effective avenues to deliver health care (Topol, 1998). We can only speculate what the right solution may be to make healthcare affordable and accessible for everyone. One known fact is that the cost of health care continues to rise (Topol, 1998). In 1998, for example, cardiovascular diseases alone cost more than $275 billion (American Heart Association, 2000). Meanwhile, degenerative diseases such as heart disease, hypertension, obesity, diabetes, and cancer are on the rise, escalating, perhaps, due to unhealthy lifestyle behaviors (Ornish, 1983). Despite advances in medicine, cardiovascular disease continues to be the number one cause of death in the United States (USDHHS, 1996). In fact cardiovascular disease accounts for over 42 % of all deaths. That is three times the rate of cancer, the second greatest killer, and more than the number of deaths caused by all other diseases combined (American Heart Association, 2000; American Cancer Society, 1999). Cardiovascular related diseases kill more than one million annually. Almost everyone has been touched, directly or indirectly, by this deadly disease. In addition to resulting in the needless loss of life, this is a very costly disease process. In many cases employers and health care providers must absorb the financial burden placed on society (www.agents.com, 1999). It would seem as though all could benefit if there were a process by which cardiovascular disease risk factors could be arrested and people's quality of life improved.

Prevention of degenerative diseases via healthy lifestyle behaviors may be the fountain of youth researchers have been searching for (Scherwitz & Kesten, 1994). Following the basics of being physically active, eating nutritiously, managing stress, and sharing feelings is the proactive way to a long, healthy, quality life (Ornish, 1998). There

is a lot of truth in the old saying, " an ounce of prevention is worth a pound of cure." Yet,

interventional or reactional medicine traditionally has been the standard of health care in

this country (Ornish, 1990). Directives to take a pill or conduct an invasive procedure

after the disease has become life-threatening tend to be standard operating procedures.

However, the practice of using technology to rebuild much of what is broken is a reactive

rather than a proactive approach. The mindset of many people is to live hard, undergo

dangerous surgery such as coronary bypass and go right back to their old habits with the

knowledge that they will have another procedure ten years later (Sackett, 1979; Marston,

1970). The most unsettling thing about this mindset is that so many people are so

unwilling to consider some behavior modification (Schoenborn, 1986). It seems as

though they think it is easier to take medications and have multiple surgeries than it is to

stop smoking, exercise a little, or make healthier dietary choices (Haynes, 1976; Harris,

1983). It would seem the more sensible thing to do would be to start thinking of

healthcare before problems arise rather than after a diagnosis is made.

It was initially thought that life expectancy would increase as technology

advanced (www.welcoa.com, 2001; www.aolnews.com, 2000; USDHHS, 1998). To the

contrary, an enormous price has been paid as a result of the development of so many

technological luxuries: more people now live the kind of sedentary lifestyle that increases

risk of cardiovascular disease (www.dentnews., 2000). Being able to complete work

smarter and faster has only led to having more free time to surf the net or television

channels. What is more, today's adults have set an example for the next generation, and

the incidence of childhood obesity is increasing at an alarming rate (Novitt-Morena,

1998). Clearly, modification of lifestyle habits is the required solution to these problems.

Many healthcare organizations now provide on-site wellness and/or fitness centers. Additionally, many insurance companies offer various financial incentives for individuals to obtain health club memberships. Even with all of these opportunities, however, most Americans choose a sedentary lifestyle. The next section addresses this issue of inactivity as it relates to the perspective of a lack of long-term commitment or non-compliance.

Non-compliance. The benefits of exercise are indisputable according to the United States Surgeon General (USDHHS, 1996), yet the fact is that most Americans are non-compliant when put on exercise regimens. The importance of exercise in relation to the reduction of cardiovascular disease risk factors has been well documented (USDHHS, 1998; Pate, 1995; ACSM, 1998). Regular aerobic exercise reduces blood pressure, serum cholesterol, and body fat as well as improves coronary and peripheral blood flow, cardiac output, and maximal oxygen uptake. Other well-known benefits of exercise include elevated metabolism to aid in weight loss, more energy for greater productivity, and higher self-esteem from the physiological and psychological improvements. Even with this long list of benefits, the majority of Americans are not compliant with their exercise for various reasons.

Perseverance is a serious problem in preventive and rehabilitative exercise programs that require high adherence to a habitual behavior pattern to elicit any significant health benefits (Baekeland & Lundwall, 1975; Haynes, 1979). People choose not to exercise for a variety of different reasons. Several studies have identified the following factors that influence exercise compliance: (a) attitude or motivation, (b) socioeconomic status, and (c) previous experience with exercise (Dishman, 1994; Harris, 1978a, 1978b, 1983; Folsm, 1991; Heath, 1991; Dennison, 1988; Powell, 1987).

Most research on the influence of attitude and motivation on exercise compliance deal with older populations. There appear to be varying opinions regarding attitudes and beliefs about exercise among persons over 65. For example, Stephens (1990) found that attitudes are strikingly similar in both young and older people in that both groups view exercise positively and make it a major goal of their leisure time. In contrast, another study reported that older persons often consider exercise to be a low priority; they do not perceive themselves as having much control over being active, and they fear injury (Dishman, 1994). A paradox exists in that increasing age is often associated with exercise limitations due to deteriorating health, while the need for exercise simultaneously increases. Older women, on the other hand, feel more comfortable beginning an exercise program than older men do (Dishman, 1994). Another attitudinal factor deals with the false perception of on the job physical activity. For example, blue-collar workers generally believe they get adequate exercise during their workday (King, 1988), even though this is often not the case.

Socioeconomic status has long been viewed as a benchmark for identifying the majority of those who exercise regularly. Harris, Louis & Associates (1978,1979,1983), for example, reported that high income white, college-educated, young middle-aged adults make up the majority of regular exercisers. Folsom et al. (1991) and Heath (1991) also noted similar differences in activity levels between Blacks and Whites. Additionally, the National Centers for Health Statistics and the National Endowment for the Arts (1990, 1992) have confirmed that higher education level directly correlates with regularity of exercise.

Dennison (1988) and Powell (1987) have conducted significant research on previous experience with exercise and its connection to later exercise compliance. They

found that exercise habits established early in life are a good indicator for consistency of exercise throughout life. Young exercisers tend to maintain this healthy lifestyle habit. Regardless of whether they began to exercise at an early age or became motivated later in life, however, people who continue to exercise regularly throughout their lives still make up the minority of the general population. In fact, according to national statistics, fewer than 30 % of Americans exercise regularly (USDHHS, 1998). Considering the abundance of fitness centers, gyms, community programs, and home exercise equipment that is available, there appears to be significant interest by Americans to be active. Yet, the interest apparently does not last long, given the evidence of high dropout rates that are common in health clubs and the amount of exercise equipment that is resold or never used (USDHHS, 1996; Dishman, 1981,1991; Caspersen, 1995; McAuley, 1994).

In addition to the studies discussed above on attitude or motivation, socioeconomic status, and previous experience with exercise, there is an abundance of research that analyzes the connection between exercise adherence and factors of population characteristics, environment, and the actual exercise required by a structured regime (Dishman & Ickes, 1981; King, et. al., 1992; Oldridge & Rogowski, 1990).

Some of the population characteristics that have been studied include: age, race, ethnicity, gender, occupation, education, income, health status, knowledge, attitude, and beliefs. With regards to age, Schoenborn (1986) has shown that adherence to exercise has consistently been found to decrease with age, particularly after late adolescence and early adulthood. Oldridge (1988) studied differences in gender and discovered that women in general, and specifically older women, tend to exercise less than men do. However, Dishman (1994) discovered that older women feel more comfortable beginning an exercise program than do older men.

There are limited studies on the relationship between exercise and factors of race and ethnicity, and typically this research also considers socioeconomic status and education levels of subjects (Folsom, 1991; Heath, 1991). Some of the available data, for example, proposes that young white males make up the majority of regular exercisers and report the best compliance (Stephens, 1994). However, higher income and education levels are the two most consistently identified predisposing factors studied in connection with exercise adherence (Harris, 1978,1979, 1983; NCHS, 1990; NEA, 1992). King, et al. (1988) found a positive connection between level of education and compliance to exercise, while income only had a modest relationship. Some studies have reported little or no relationship between education level and exercise adherence (Folsom, 1991), while others have documented that blue-collar workers are less likely to adhere to regular exercise compared to white-collar workers (King, 1988). Dishman (1994) observed that blue collar workers, who are physical labor oriented, most often perceived that their job provided the appropriate quality and quantity of exercise for maintaining health levels even though this was often not the case. Additionally, in clinical settings, blue-collar occupation and socioeconomic status have been associated with poor adherence during and following completion of an exercise program (Oldridge, 1988). The relationship between occupation and exercise compliance remains unclear.

When taking into consideration health status, another one of the population characteristics, it is not surprising that healthy people exercise more consistently than people who are less healthy (Dishman, 1985). What Oldridge (1982) discovered that was not expected, however, is that cardiac patients are less likely to adhere to fitness or wellness programs than non-cardiac patients. While knowledge, attitude, and beliefs in the health benefits of exercise have been associated with initial adoption of an exercise

program, the relationship of these factors to continued compliance has been inconsistent in cardiac rehabilitation intervention programs. Dishman found that perceptions of being in poor health are often associated with reduced exercise participation. Similarly, Oldridge concluded that people with the belief that exercise has little value for health and fitness or that health benefits from exercise are beyond one's personal control have been found to exercise less frequently and drop out sooner than peers having opposite views.

While research regarding population characteristics and exercise adherence provides conflicting evidence on how exactly demographic factors influence exercise compliance, studies on environmental factors appear to show a clearer relationship between environment and exercise adherence. Environmental factors consist of support systems and physical environment (King, et al., 1992). King (1998) conducted a critical review of physical activity interventions and concluded that environmental factors were among the leading influences on exercise adherence. The evidence highlights the importance of social support in the adoption and maintenance of exercise. King further suggests that this support can come from a variety of different sources. Family participation and support have been documented to be strong predictors of exercise compliance. Additionally, King found that social support from friends did not increase exercise compliance, although staff support and instruction did.

Oldridge (1984) and Dishman (1994) reported findings similar to King's for interventions of motivation to improve compliance. In each case the interventions resulted in a 40 % - 60 % dropout rate within 3 to 12 months. The introduction of family support or peer support increased participation by only 10 %. What is important to recognize is that participation did increase. Both investigators concluded that better success rates could be attained.

Another consistent predictor of exercise compliance among physical environmental factors, according to King, is the distance the individual has to travel to reach the exercise facilities. Other factors such as setting (e.g., city versus rural; beach versus mountains; neighborhood safety) were not found to significantly influence exercise compliance (King, 1998).

The last influential factor for exercise compliance, that is the actual exercise regime, incorporates the type, intensity, and frequency of the actual activity, as well as the mode of supervision (ACSM, 1998). The type or style of exercise is critical for compliance, particularly from an enjoyment standpoint. If the exercise is too complicated or requires special skills, then it can more easily be construed as distasteful. Similarly, the participant can be turned off by an activity if the difficulty or intensity level is too great. Reluctant participants should begin with activities that are simple and progressively increase the complexity, if this is warranted. Additionally, too great a time commitment can lead to early poor compliance (Dishman & Ickes, 1981). Exercise is a new behavior for most people, especially cardiac patients, so it is important to increase the frequency gradually to help ensure compliance (ACSM, 1998; Godin, 1990; Marcus et al. 1992).

Finally, good instruction and supervision has been found to elevate the motivation and sense of security of the participant. This allows the participant to proceed with a feeling of confidence and safety that leads to a high level of compliance (Oldridge & Stoedefalke, 1984).

Post program exercise maintenance. The most recent research by Bock et al. (2001) on post program exercise maintenance looked beyond the time participants are enrolled in an exercise program and has studied the maintenance of physical activity

following an organized exercise program. This study examined predictors of exercise maintenance following completion of a physical activity intervention. The subjects were randomly assigned to receive either a motivationally matched intervention with feedback reports that were individually tailored (IT) to psychological variables or a standard intervention (ST). Significantly more participants in the IT condition met or exceeded participation goals at the end of the intervention period and maintained this level of physical activity through the month 12 follow-up than did the ST participants. The results of Bock's study suggest that the maintenance of physical activity following the end of an active intervention program may be influenced by attitudes and behaviors acquired along with increased participation in physical activity, as well as by preexisting characteristics that individuals bring into treatment.

The results of the Bock study were valuable in identifying motivational readiness for physical activity of sedentary female adults. However, these were also limited for general purposes due to the specific nature of the subject population that was made up only of women with no apparent cardiovascular disease risk factors. (This population differs from the one represented in the current study, which will consist of both men and women with heart disease. In addition, at the present time the current study stands alone in investigating the influential factors contributing to exercise compliance of heart patients following a structured lifestyle change program.)

The influential factors discussed in this section most often have psychological origins. A discussion of the psychology of behavior change and the process adults go through to prepare for change will be addressed in the following section.

Stages of adult development. The psychology of behavior change and the process human beings experience in preparing for change must be understood in order to

provide a context for identifying the factors that influence exercise compliance. Fuller comprehension of this process gives a greater appreciation of what steps the participants in lifestyle change programs must take to achieve behavior change. Most of the participants of the Ornish/Healing Hearts lifestyle change programs had unhealthful habits prior to enrollment. Their physical activity was very limited; they consumed high caloric, high fat diets; they did not manage their stress; and many of them did not share their feelings with others. Exercise, diet, stress management, and group support are the components that make up the lifestyle change program. The program participants were asked to change behaviors that, in many cases, had been practiced for a half-century or longer. Even though these people were heart patients who knew how beneficial these healthy behaviors would be (USDHHS, 1996), there was still considerable resistance to change.

Change does not come easily for most adults. Donatelle (2001) described in detail the Stages of Change or Transtheoretical model developed by Prochaska and DiClemente as a way of explaining the difficulty people face when trying to change their behavior. The five stages include: preconception, contemplation, preparation, action, and maintenance. The underlying premise of this model is that people's beliefs and attitudes reflect their behavior, and behaviors result from intentions to perform certain actions. This model has been applied to a number of behavior-changing challenges, including smoking cessation (Prochaska, 1988; DiClemente, 1991) and increasing the adoption of physical activity (Marcus & Banspach 1992). In each of these cases it was found that if the appropriate beliefs and attitudes were not learned in early developmental stages, the desired action was unlikely to occur. Marcus and Banspach found that beginning an exercise regime later in life is more difficult if the appropriate beliefs and attitudes

weren't adopted at a younger age. He further discovered that behavior change is even more difficult when the action, in this case exercise, is not practiced.

The process by which we prepare for the behavior change of exercise can also be compared to the higher stages of human development as described by Alexander and Langer (1990). These stages of change include: habit building, associative and content learning, and logical structural learning of patterns and sets that develops slowly but progressively with repetition. Learning from tradition through affectively driven imitation of others adds to the determination of performance.

Erik Erikson (1982) proposed a similar model in the form of the major stages in psychosocial development. According to Erikson, adults progress through these stages, eventually reaching old age and ultimately attaining wisdom. The early psychosocial stages that Erikson (1982) depicts are: will, purpose, competence, and fidelity, which set the foundation for the later developmental stages of love, care, and wisdom. Wisdom is thought to be formulated in the middle years in order to prepare human beings for old age. If any of the early stages were not appropriately developed it would be reasonable to hypothesize that the development of the latter stages may be impeded, and, indeed, it is unfortunately true that very few people consider what the future holds when forming behaviors in their middle years. Due to this lack of forethought too many people reach old age unprepared for their physical and emotional well-being.

A review of the different theories that describe the various stages of change and adult development seems to point to a common denominator: These models are based on a sequence of development. Rakowski (1996) has described this sequence or the stages of adoption as a continuum of change. A transition or overlap occurs in moving from one stage to the next. In some cases one stage must be attained before moving on to the next.

This phenomenon is characterized by a person's interest in changing his or her lifestyle behaviors. If the appropriate stages are not learned, practiced and adopted there can exist the inability to progress to the next stage and/or succeed at the subsequent stages. This same premise could be applied to the behavior change of exercise adoption. If basic healthy lifestyle habits, such as exercise, are taught and reinforced early in life there may be a greater purpose and value associated with them (Marcus & Selby, 1992; Marcus & Rakowski, 1992). Furthermore, if this process took place early on in a person's life— even if habits did not continue--, it could be easier to reintegrate these habits later in life.

It is probable that the stages of change also apply to a variety of other behaviors. The following discussion focuses on compliance to five other lifestyle habits for the purpose of drawing analogies to the influential factors contributing to exercise compliance following a structured lifestyle change program.

Section two: Compliance to various lifestyle behaviors

Introduction. Compliance to various lifestyle behaviors such as exercise for the apparently healthy, diets, smoking cessation, physical therapy, and substance abuse has been well documented (Marcus, 2000; Martin, 1985; Dishman, 1991; King, 1997; Thomas, 2001; Millem, 2001; Evangelista, 2001; Naslund, 1996; Razavi, 1999; Borelli, 2001; Guise, 2000; Campbell, 2001; Trafimow, 1998; Annesi, 2001; Daley, 1998; Lash, 1999, 2001). What follows is a review of what is known about the factors influencing compliance related to these behaviors. Additionally, comparisons are reported between influential factors contributing to these various lifestyle behaviors and the factors influencing exercise compliance of heart patients following a structured lifestyle change program. The comparisons exhibit striking similarities.

Exercise for the apparently healthy. The comparison between exercise compliance factors for heart patients and those for apparently healthy people resulted in contrasts as well as similarities. Higher level of education was previously sited as a contributing factor for exercise compliance for heart patients. King (1997) found an inverse effect for a healthy population. She reported that individuals who were less stressed, had higher fitness levels, and fewer years of formal education had the greatest probability of successful exercise adherence. The same study found that overweight individuals were least likely to be successful with exercise adherence. In a study by Dunn (1999) comparing lifestyle and structured interventions to increase physical activity, exercise barriers included lack of time, lack of social support, inclement weather, disruptions in routine, lack of access to facilities, and dislike of vigorous exercise. Many of the same barriers have been reported for cardiac populations (Dishman, 1994; Harris, 1978a, 1978b, 1983; Folsm, 1991; Heath, 1991; Dennison, 1988; Powell, 1987). The principle finding from Dunn's study, which used the Stages of Change Model, was that factors of both lifestyle and structured interventions produced significant and comparable beneficial changes in physical activity. Dunn reported that a behavioral-based lifestyle physical activity intervention increases the use of strategies of change, and this increase is associated with maintaining physical activity. The Stages of Change Model, which proposes that individuals differ in their motivational readiness for change, has been applied to a number of health behaviors including exercise, diet, and smoking cessation. Marcus (1992a, 1992b, 1992c, 1992d, 2000), who has applied the Stages of Change Model to many different populations, has concluded that, for most people, indicators of progression toward physical activity adoption have included advanced stages of motivational readiness for physical activity. Another conclusion made by Marcus is that

adherence decays over time. This finding is of particular interest since it is a hypothesis of the current study. An independent variable of time-elapsed-since-program-completion was used as a predictor for the average weekly minutes of exercise.

Exercise intensity has been another common theme as an influential factor for exercise compliance. King (1995) compared traditional group-based and home-based exercise programs and found that in both cases moderate or vigorous intensity exercise had significantly greater adherence at the 1-year assessment. Oldridge (1983, 1988, 1990), on the other hand, reported an inverse effect of increased intensity upon exercise compliance in cardiac patients. Basically, he found lower compliance if the exercise intensity level was too great. Upon reviewing both scenarios it is apparent that exercise intensity, high or low, plays a significant role on exercise compliance. Finally, Marcus (2000) found superior adherence when supervision of exercise and more frequent contact with program staff was reported. This factor could be categorized as exercise leadership, which is another important variable being investigated in the present study.

Diet. Compliance to a prescribed diet shares a common denominator with exercise compliance: readiness to comply. According to Thomas (2001), the Stages of Change model could be used to explain why subjects were more likely to be compliant with their therapeutic diets if they indicated favorable attitudes toward their diet plan. Additionally, compliance was greater if they were knowledgeable about their diet and if patients were in a supportive environment. A sense of support and security has also been cited as being influential to exercise compliance (Oldridge, 1984) and has great relevance to the current study as one of the independent variable categories. In another study, poor compliance with a low fat diet was linked with smoking, younger age and not having relatives or friends afflicted with coronary artery disease (Naslund, 1996). Furthermore,

high levels of hostility, perception of barriers to diet change and little knowledge of cardiovascular disease risk factors were linked to poor compliance with increased intake of dietary fiber.

Evangelista (2001) looked at the relationship between psychosocial variables and dietary compliance. The poor compliance observed in this study was attributed to higher education level, higher mental and physical health status and neuroticism. The same study found these factors also contributed to poor exercise compliance. There appears to be some inconsistency in the literature regarding education level. As previously noted, higher education level has been generally associated with greater exercise compliance (Harris, 1978, 1979, 1983; NCHS, 1990; NEA, 1992; King, 1988).

The landmark Framingham Heart Study (Millen, 2001) explores the relationship between diet and the development of chronic diseases. This study used a variety of dietary recall questionnaires to measure compliance and to improve the understanding of the complexities of dietary behavior. Distinct dietary patterns for men and women were characterized from the questionnaires. The content of the diets differed markedly as did the baseline cardiovascular disease risk factors. As a result of these findings it was recommended that more insightful dietary counseling take place. In addition, it was recognized that the baseline differences would dictate appropriate behavior modification strategies.

Smoking cessation. Factors related to maintaining smoking cessation are similar in some ways to exercise and diet, but also uniquely different in other ways. One similarity is found in Guise's (2000) use of the behavior change model in a study of smoking abstinence. The use of the model was found to be as significant for looking at smoking abstinence as it was in studying the other various lifestyle behaviors and

compliance. In this case, the training in and use of behavior change techniques for physicians were strongly recommended for patient smoking cessation compliance. Another predisposing factor for compliance to smoking cessation was group support (Razavi, 1999). Unlike the success of exercise and diet compliance with support, smoking abstinence was not significant with group support. Another unique finding by Borelli (2001) noted that weight gain predicted smoking relapse for men. Furthermore, female gender also predicted relapse.

Physical therapy. Physical therapy compliance is just as big a problem as compliance to the previously listed behaviors. Campbell (2001) found that initial compliance to physical therapy for knee patients was high because of loyalty to the physiotherapist. Reasons underpinning continued compliance, however, were more complex, involving willingness and ability to accommodate exercises within everyday life, the perceived severity of symptoms, attitudes towards arthritis and comorbidity and previous experiences of osteoarthritis. In another study Trafimow (1998) found that perceived behavioral control measures were a moderately successful independent predictor of back pain suffers' intentions to exercise. In another approach, measures were taken to improve compliance to shoulder physical therapy exercise using technology. A computer feedback system was tested for its influence on post-physical therapy exercise compliance (Annesi, 2001). The patients using this computer system were more likely to continue to exercise after treatment termination and required less therapist time.

Substance abuse aftercare. Compliance to aftercare therapy for substance abuse treatment, the final category of lifestyle behaviors to be reviewed here, has been associated with improved outcomes. Group therapy has also been found to play a significant role in obtaining compliance. Daley et al. (1998) concluded that group

motivational therapy sessions appear to be promising for improving treatment adherence and program completion. In a similar study, Lash (2001) reported that clients who received social reinforcement attended more aftercare group sessions than did clients receiving less reinforcement. An earlier study by Lash (1999) found success with the use of prompts and feedback. The participants who received the feedback and prompts were more likely to begin aftercare and attend more aftercare weekly groups, and they were less likely to be readmitted to the hospital.

Summary

The review of the literature in this chapter was divided into two sections. The first section provided an overview of existing research on exercise compliance from seven different perspectives. These past insights have brought into focus the significance of this study and the importance of identifying the influential factors contributing to exercise compliance. From the first perspective, the Ornish / Healing Hearts program, a clarification of exactly what are healthy lifestyle habits was made. This information is necessary for providing an appreciation of the lifestyle change components of the program as well as the behaviors the participants adopted. The second part of this first section of the review of the literature was intended to support the theoretical framework of this study by presenting the standards that have been set for healthy lifestyle behaviors. Part three gave a detailed description of the multi-center lifestyle heart trial. This ground-breaking study was the inspiration for the current study. The overview of healthcare management (in the fourth part of this section) discussed the current movement towards a prevention orientation and asserted the need for an emphasis on meeting the needs of a predominately sedentary population. The next perspective, non-compliance to exercise, indicated that non-compliance is not unique to one segment of the population: There are

numerous reasons people do not stick with their exercise programs. (An expectation of this study is to learn from previous studies and relate their findings to the special population of the current study.) The sixth area of discussion focused on research limited to apparently healthy women and post program exercise maintenance. The current study will extend the depth and breath of this particular work to include a heart disease population of men as well as women. The first section of the literature review concluded with a review of the stages of adult development. This provided the framework for understanding the process of adopting new behaviors.

The second section of the review of the literature attempted to discover what factors influence various other lifestyle behaviors. In identifying these factors, contrasts and comparisons were drawn for the purpose of acknowledging that behavior change is influenced in many different ways. It was noted that exercise compliance for apparently healthy individuals is greatly influenced by education level, lack of time, lack of social support, inclement weather, disruptions in routine, lack of access to facilities, exercise intensity and leadership. Studies on diet compliance suggested a wide range of significant factors including a supportive environment, a good grasp of knowledge regarding the diet and cardiovascular risk factors, smoking abstinence, younger age, education level, and mental health status. Smoking cessation was uniquely different from the other lifestyle behaviors due to the lack of significance of group support as a predictor for abstinence. Predictors of smoking relapse were weight gain for men and female gender in general. Physical therapy compliance was greatly influenced by loyalty to the physical therapist, as well as willingness and ability to accommodate exercises within everyday life, the perceived severity of symptoms, attitudes towards arthritis and comorbidity, and previous experiences of osteoarthritis. Additionally, a computerized feedback system was found to

improve after treatment exercise. Substance abuse aftercare was most successful with group therapy, social reinforcement and the use of prompts and feedback.

The factor that was common to all of the behaviors, including exercise for heart patients, was patients' motivational readiness for change. The use of the Stages of Change model appears to provide the link between the various lifestyle behaviors, exercise for heart patients, and compliance.

The purpose of the current study on what influential factors contribute to exercise compliance following the structured lifestyle change program is to gain insights that can be helpful in designing programs to improve exercise compliance. To do this, it is necessary to first identify what the factors are that influence compliance to exercise and then to quantify the significance each factor has on compliance. The process used to accomplish this task will be the implementation of a survey instrument analyzed by quantitative methodology.

CHAPTER THREE
Research Design and Methodology

Introduction

      This chapter discusses the research design and methodology used in this study.

The first section explains how this methodology uncovers the most meaningful results

regarding the relationship between variables. This section also establishes the purpose of

the study by presenting the research questions that identify the dependent and

independent variables. The subjects and how they were recruited are also discussed. In the

following section the survey instrument is described in detail in order to clarify how the

requisite information was collected. An explanation of how the data was analyzed is then

presented. Finally, the possible limitations of this study are enumerated.

Research Questions

      The primary purpose of this study is to identify the influential factors that lead

heart patients to continue to comply with exercise habits following a structured lifestyle

change program. Compliance was defined in terms of minutes of exercise. The

compliance criteria of one hundred and eighty minutes of aerobic exercise per week was

established by Dr. Dean Ornish for the Multi-center Lifestyle Heart Trial study, upon

which the lifestyle change program is based (Ornish, 1990).

      Participants were asked to report the number of minutes per day they exercised

aerobically during an average week following completion of the lifestyle change program.

This dependent variable was then analyzed for significance relative to the independent

variables of demographic factors, lifestyle habits, and safety issues. This information was

attained through the use of a survey instrument.

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The methodology used to analyze the data attained from the survey instrument was multiple regression analysis. The general purpose of the analysis was to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. The focus of this study is to discover how three sets of independent variables predict or explain variation in the dependent variable, exercise compliance. For example, the study measured how length of time since completing the program, number of years of regular exercise, and exercise setting influence the average total number of exercise minutes per week.

A survey instrument designed to determine compliance was used to answer the following research questions: (1.) To what extent do demographic factors, lifestyle habits, and safety issues contribute to aerobic exercise compliance for those who have completed the Ornish/Healing Hearts lifestyle change program in La Jolla, CA? and (2.) Do these demographic factors, lifestyle habits and safety issues vary when the length of program or severity of medical condition are factored in? More specifically, these research questions asked for the details pertaining to the following variables:

(a) To what degree do demographic factors such as age, gender, socio-economic status, partner support, length of time since program completion, distance traveled to exercise, cost incurred to exercise, and history of cardiac intervention contribute to exercise compliance?

(b) How influential are lifestyle habits such as past history of consistent exercise, as well as the need to see relatively immediate health improvements impact exercise compliance?

(c) To what extent does safety, as this is affected by group format, medical setting, and supervision expertise, influence exercise compliance?

(d) "What other perceived factors influence exercise compliance", (This open-ended questioned was designed to be used as an exploratory question in post-hoc analysis.)

Selection of Subjects

Approximately 273 men and women who fit the study entry criteria were invited to participate in this study. (The entry criteria required participants to be heart patients who had completed the lifestyle change program no less than three months prior). The 273 subjects who were asked to complete the survey completed the Ornish / Healing Hearts lifestyle change program for reversing heart disease at Scripps Center for Integrative Medicine. The participants were predominately white men and women who ranged in age from 32 to 92 years. They fell into one of two categories: (a) patients who had diagnosed heart disease and had had a cardiac procedure (e.g., angioplasty, stent, or by-pass surgery), or (b) patients who had diagnosed heart disease and were in need of a cardiac procedure but preferred trying to change their lifestyle habits to improve their health.

All potential subjects were members of cohorts 1 through 26, those who had completed the program together no sooner than three months prior (January 2002) and dating back as long as fifty-six months (May 1997). (This researcher anticipated getting at least a fifty- percent response rate, having worked closely with the members of all 26 cohorts.) An important distinction, which will be addressed in the data analysis section, between the cohorts is that Cohorts 1 – 10 program length was one year while Cohorts 11

– 26 program length was six months. However, program content for all cohorts was consistent and exercise leadership was the same, facilitated by this researcher.

The potential subjects were sent a letter explaining the purpose of the study and the valuable role they could play with the information they provided. Subjects were encouraged to answer questions truthfully, in the hopes their responses would help heart patients in the future, rather than try to provide answers they thought the researcher might want. I anticipated this approach would minimize any sort of bias in their responses. Along with the cover letter, the survey questionnaire containing sixteen questions and the informed consent were sent to all invited study participants (see Appendix A & B). Follow-up calls were made within one week after the mailing to confirm that the material was received. Subsequent calls were made when questionnaires were not returned within one week after the deadline stated in the informed consent. At the end of this process, 178 participants were enlisted for the study.

Survey Instrument

A survey was created that assessed the influential factors of why past participants had chosen to continue to exercise following the Ornish/Healing Hearts program. The survey was developed to attain high face validity by posing straightforward questions that specifically pertained to this study's population. The survey was then reviewed by a panel of experts.

Bock (2001) and Oldridge (1984) took a similar approach for the development of the surveys used in their studies. Their research examined the maintenance of physical activity following an individualized motivationally tailored intervention as well as compliance and motivation in cardiac exercise programs. In the present study, questions

were posed to assess the influential factors of why past participants of the lifestyle change program had chosen to continue or not to continue to exercise on their own. This quantitative format also provided responses of the participants' compliance.

The survey, the Exercise Compliance Questionnaire (ECQ), was formatted into two main sections. Section one asks the question: "How many minutes per week do you exercise aerobically?" This information pertains to the dependent variable. The dependent variable is defined as the total number of minutes of aerobic exercise for an average week compared to the criteria of one hundred and eighty minutes of aerobic exercise per week set by Dr. Ornish. The independent variables of this study, demographics, lifestyle habits, and safety, were judged for their influence on the total number of minutes of aerobic exercise for an average week relative to the minimum suggested, one hundred and eighty minutes of exercise per week. The participants of the study were asked to report the number of minutes per day they exercised aerobically during an average week. Data from this dependent variable was used to calculate the total number of minutes each subject exercised aerobically during any typical week following completion of the lifestyle change program. [1]

Section two of the survey addresses the potential independent variables that include demographics, lifestyle habits, safety, and other:

1. Demographics – The respondents were asked to answer eight demographic questions regarding age, gender, annual income, and education level. Respondents were also asked about whether they exercised with anyone

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[1] The question regarding exercising with a partner which was originally in the demographic section of the survey was moved to the lifestyle section after the data was collected. It was determined that the independent variable of exercising with a partner was more of a choice and more appropriately fit a lifestyle habit rather than a fixed demographic factor.

else, the length of time since completed lifestyle change program, the distance traveled to exercise, and the cost involved to exercise.

2.   Lifestyle habits - The respondents were asked to answer two lifestyle related questions associated with number of years they had regularly exercised, and the importance they placed on immediate improvements in health.

3.   Safety – Three questions were asked about safety factors. These were related to (a) sense of security exercising in a group, (b) greater piece of mind exercising in a medical setting, and (c) the importance of exercise instructor expertise.

4.   Other – This question was left open ended to allow the respondents to fill in any other factor(s) that may be influential to their exercise compliance. This exploratory information was designed to be used in post-hoc analysis.

Data Analysis

Regression analysis was used to test the significance of demographic, lifestyle, and safety factors in explaining variation in the amount of exercise. One hundred and eighty minutes of aerobic exercise per week was used as the compliance criteria. The survey questions were converted into one of two types of variables, continuous or dummy. The dependent variable of minutes of aerobic exercise, as well as the independent variables of age, time since completed program, income, education level, and years of exercise as a lifestyle habit, are continuous in nature. The dummy variables include gender, travel distance, cost, improvements in health, sense of security in a group,

piece of mind in a medical setting, and expertise of instructor. These variables are typically measured as binary variables, since their values are either zero or one. Two additional dummy variables were used to differentiate between the two distinctive groups of subjects. These characteristics identify those who completed the one-year program rather than the six-month program, as well as those who had a cardiac intervention prior to beginning the lifestyle change program.

The analysis began with a process of regressing minutes of exercise onto the demographic variables. This regression model was repeated by substituting the other independent variables of lifestyle-habits and safety-issues. For each analysis, the data was fitted and the following criteria was used:

1. Goodness-of-fit statistics such as R^2 and R^2 adj was used to investigate the overall fit of the models.

2. The relevance of each variable to the model was investigated by the significance of their t statistics.

3. The overall significance of the successive models was investigated through the use of F statistics.

Summary

This chapter has presented the research design and methodology for this study. A survey was administered to 178 eligible subjects who had completed the lifestyle change program. These surveys were then analyzed using multiple regression to test for the significance of demographic, lifestyle, and safety factors in explaining variation in exercise compliance.

Limitations

Several potential limitations to this study will be addressed here. Each of the limitations pertains to some aspect of the data collection. The first limitation comes from the possible unwillingness of past participants to complete the survey. Theoretically, if compliance was poor the past participant may have elected not to return the survey. If this had occurred, a bias would have resulted, depending on the total number who responded. Another limitation is the accuracy of the past participants' recollection of exercise habits or feelings about safety issues. Some participants had been out of the program for almost five years, and they might not have been documenting their exercise habits as they did during the program. Additionally, they may not have been able to relate their current sense of safety to how safe they felt while attending the program. The third limitation to this study is related to the truthfulness of participants' responses to the survey questions. For a number of reasons, the participants may have reported more positive experiences than they had truly achieved. A fourth limitation is the possibility that some questions were left unanswered. This could have occurred because participants did not want to divulge certain information, such as annual income. Another limitation is connected to the researcher's inability to reach past participants. The cohort database is not consistently updated and there may exist old addresses for some past participants. The final limitation is the potential for bias. There exists the possibility the participants many have given false reports. This may have occurred because the researcher has worked closely with the participants in the lifestyle change program and they could have reported information they thought would help the researcher. Furthermore, they may have elected to not complete the survey for fear of disappointing the researcher or negatively affecting the study.

Generalizability of the results from this study is yet another possible limitation. Since the structure of Ornish / Healing Hearts program is so unique, the findings of this study may not apply specifically to other programs and/or populations. There are still a significant number of similarities that will apply.

CHAPTER FOUR
Data Analysis

Introduction

This study was conducted for the purpose of filling a void in the literature regarding exercise compliance following participation in a structured program. Specifically, the objective of this study is to uncover the influential factors contributing to exercise compliance following a structured lifestyle change program. This objective was accomplished through the implementation of a survey that was analyzed using a multiple regression method to assess the relationship between demographic, lifestyle, and safety variables and variations in exercise compliance.

The objectives of this chapter are to discuss the research methodology of this study, present the data analyses, and answer the study's two research questions. The first section describes the study population and includes descriptive tables. The next section discusses the data collection process, reviews the study criteria and presents the response rate data. The third section addresses the various challenges incurred during the data collection process. The fourth section describes the sample and also includes descriptive tables. The descriptive statistics of the sample follows in section five, while in section six the intercorrelations among the variables used in the study are discussed. A discussion regarding the regression analysis as it applies to the two research questions follows in the next two sections. The open-ended responses to the surveys are then discussed in the next section, followed by a summary of the data analyses.

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Study Population

The study population consists of 273 heart patients who had completed the lifestyle change program at Scripps Center for Integrative Medicine between May 1997 and January 2002. These men and women were members of cohorts 1 through 26 and fell into one of two categories: (a) patients who have been diagnosed with heart disease and have had a cardiac intervention (e.g., angioplasty, stent, or by-pass surgery), or (b) patients who have been diagnosed with heart disease and are in need of a cardiac intervention, but would rather try changing their lifestyle habits to improve their health. Each cohort consisted of approximately fifteen participants. Typically two-thirds of the cohort participants were actual heart patients, while the remaining third was spouses and people enrolled for prevention of heart disease.

Table 1 presents the descriptive statistics for the 195 men (71%) and 78 women (29 %) enrolled in cohorts 1 through 26. The mean age for the entire population was 64 years, with men averaging 64 years of age and women 65. Furthermore, a total of 187 participants (68 percent of the study population) had undergone a cardiac procedure prior to beginning the program, 78 percent of which were men and 22 percent were women.

Table 1. Study Population Comparative; Totals and Mean Demographics.

	N	%	Mean Ages	Procedure N	%
Total	273	100	64	187	68
Male	195	71	64	145	78
Female	78	29	65	42	22

Table 2 presents the descriptive statistics for the 109 people (40%) in the study

population who had completed the one-year program (Cohorts 1 – 10). Seventy-six of the

109 were men, and 33 were women, 70 and 30 percent respectively. This proportion is

very similar to that of the whole study population of 71 percent men and 29 percent

women. The mean age for the one-year program was 65 years old. The mean age for men

was also 65 years, while the women's mean age was 66 years. In the one-year program

71 of the 109 (38 percent) had had a cardiac procedure prior to beginning the program.

This equates to 51 men and 20 women, or 72 and 28 percent respectively for those who

completed the one-year program.

Table 2. One-Year Study Population; Comparative Totals and Mean Demographics.

	N	%	Mean Ages	Procedure N	%
Total	109	40 (of study pop.)	65	71	38
Male	76	70	65	51	72
Female	33	30	66	20	28

Table 3 summarizes the descriptive statistics for the study population in the six-

month program. By comparison to the one-year program, the six-month program had 164

participants, constituting 60 percent of the study population. One hundred and nineteen

were men (73%), and 45 were women (27%). The mean age for the six-month program

was 64 years, with men averaging 63 years of age and women 65. One hundred and

sixteen participants (62 percent) in this group had had a cardiac procedure before starting

the program, and 94 (81 %) were men and 22 (19 %) were women.

Table 3. Six-Month Study Population; Comparative Totals and Mean Demographics.

	N	%	Mean Ages	Procedure N	%
Total	164	60 (of study pop.)	64	116	62
Male	119	73	63	94	81
Female	45	27	65	22	19

Data Collection and Response Rate

Data collection was conducted by the use of a three-part survey. Subjects were mailed a packet on April 10, 2002 consisting of a cover letter, an informed consent statement, a survey (Appendixes A, B, & C) and a self-addressed stamped envelope. The cover letter explained the purpose of the study and stated the valuable role participants could play with the information they provide. The informed consent statement specified the confidentiality each respondent would be guaranteed and the freedom each participant would have to not answer questions to which they might object, and reminded candidates that their participation would be considered voluntary. Also included with the materials each candidate received were the researcher's and program administrator's phone numbers and e-mail addresses. The survey contained sixteen questions related to the following categories: average weekly minutes of exercise, demographics factors, lifestyle habits, safety issues and other individual factors.

The response rate was remarkably favorable and in the first week 100 surveys were returned. By the April due date a total of 161 surveys had been returned. All incomplete surveys (largely the result of missed questions) were followed-up with calls intended to retrieve the missing data. Additionally, follow-up calls were made to the non-responders two weeks after the mailing to confirm that the material inviting their

participation in the study had been received. Although in most cases voice-mail or answering–machine messages were left, when participants were actually reached, they were typically apologetic concerning their lack of response and indicated that they had misplaced the survey and were more than happy to participate. In an attempt to capture any additional data, the remaining non-respondents were called one month after the mailing. This extra effort resulted in seventeen more completed surveys, for a total of 178 out of a potential 273 respondents, for a 65 percent response.

Data Collection Challenges

The primary challenge encountered in the data collection process was getting responses to the survey question regarding income. Of the 161 surveys initially returned, 51 respondents left the income question blank. In order to capture this potentially important information, these respondents were phoned and asked if they would feel more comfortable choosing a range for their income rather than providing an exact amount. Based on the income categories used in the Beginning Services Survey (Psychiatric Professional Services, Inc., 1994), which had recently been adopted for the Scripps Healing Hearts program, this alternative questioning method resulted in all but ten people from the sample providing their income category.[2] These ten individuals were not used in the income part of the analysis.

In addition to the missing data, income posed another challenge in the analysis. Due to the extremely wide range of respondent incomes ($0 - $400 million), the distribution of income was highly skewed to the right, providing an artificially high mean

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[2] The following annual income categories were used: less than $30,000, $30,000 – $49,000, $50,000 – $79,000, $80,000 – $100,000, $100,000 – 199,000, or more than $200,000.

of five million dollars per year[3]. However, because the distribution of income was so skewed, the standard correction procedure for replacing the missing income with the sample mean could not be used and as such, any respondent with missing income data was eliminated from that part of the analysis.

In the process of retrieving some of the missing income data, it was determined that information regarding the highest level of education attained by the participants would enrich the results of this study. To accomplish this task, all 178 respondents were phoned and asked to choose one of the following education categories: (a) 8th grade or less, (b) some high school, (c) high school graduate, (d) some college, (e) college graduate, and (f) any postgraduate work. These categories also came from the previously cited Beginning Services Survey. There were no responses to the 8th grade-or-less categories, but there was an overwhelming 68 percent of the participants who were college graduates and/or who had completed postgraduate work. (The two added questions regarding income and education can be found in appendix D).

Both income and education are important demographic factors when looking at the sample characteristics since they have been closely associated with exercise compliance in several previous studies (Folsm, 1991, Heath, 1991 and Dishman, 1981). Yet, as was the case in this study, data collection via survey can be challenging, particularly when probing personal questions are asked. Inquiring about a person's annual income tends to be a very sensitive subject. I believe that is why ten participants would not provide this information. The rest of the sample seemed to be comfortable releasing

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[3] This artificially high mean was due to several unique demographic factors. For example, the top five percent of the sample made forty million to four hundred million dollars per year and when the top 15% of the sample was included, the mean income increased from $200,000 to $5,000,000 per year.

this information with the reassurance of confidentiality. (This comfort level may have been due to the long relationship of instructor and participant.) Education level didn't appear to be as sensitive a question as income, but three of the respondents refused to provide this information. Those who did not provide education level were excluded from the analysis.

In order to better familiarize the reader with the participants of this study the following section will address the descriptive statistics of the sample in detail.

The Sample

Table 4 presents the descriptive statistics for the total sample. The 178 people who comprised the sample consisted of 128 men and 50 women, 72 and 28 percent respectively. These percentages are very representative of the study population, since 71 percent of the population was men and 29 percent were women, a difference of only one percent. The same representativeness holds for age as well, since the mean age for the sample as well as by gender was 66 years old. This compares favorably to the study population where the average was 64 for men and 65 for the women. Furthermore, the number of participants in the sample who had undergone cardiac procedures was 125 or 70 percent of this population, which compares quite favorably to the 68 percent for the study population.

Table 4. Sample; Comparative Totals and Mean Demographics.

	N	%	Mean Ages	Procedure N	%
Total	178	65	66	125	70
Male	128	72	66	96	77
Female	50	28	66	29	23

In addition, the sample retains its representativeness even when viewed by program length (Table 2 & 3). Table 5 lists the comparative totals and mean demographics for those who participated in the one- year program. There were 78 participants in the sample for this program, which was 44 percent of the total group. Fifty-three were men and 25 were women, representing 68 and 32 percent respectively. The mean age for the one-year program participants was within 2 years of each group. Furthermore, over 50 percent of these participants had undergone a cardiac procedure before starting.

Table 5. One-Year Sample; Comparative Totals and Mean Demographics.

	N	% of sample	Mean Ages	Procedure N	%
Total	78	44	67	54	43
Male	53	68	67	38	70
Female	25	32	65	16	30

As shown in Table 6, the six-month program participants were similar to the one-year program participants. In this case there were 100 participants, 75 men and 25 women. The six-month group made up 56 percent of the sample. Similar to the one-year

program, the six-month program mean age was 65. Fifty-seven percent of the six-month

program participants had had a cardiac procedure. This was 14 percent greater than the

one-year program results.

Table 6. Six-Month Sample; Comparative Totals and Mean Demographics.

	N	% of sample	Mean Ages	Procedure N	%
Total	100	56	65	71	57
Male	75	75	65	58	82
Female	25	25	65	13	18

Upon review, Tables 1 through 6 reveal that the sample is truly representative of

the study population on the most important demographic measures; gender, age, length of

program, and incidence of having a cardiac procedure. As such, the researcher concludes

that no non-response bias exists.

Descriptive Statistics of the Sample

The descriptive statistics for the sample are presented in Table 7. For each of the

variables used in the analysis means and standard deviations as well as the number of

respondents are presented in this table. A close examination of these descriptive statistics

reveals a general picture of the typical participant in this study.

The demographics of the sample show that participants were predominantly men

(72 percent of the population, to be exact), with an average age of 66. In addition, 70

percent of respondents had a cardiac procedure such as bypass surgery or angioplasty

prior to beginning the lifestyle change program. This was a very well educated

population, with 42 percent of the participants having completed post-graduate studies, and another 26 percent who were college graduates. Less then one percent of the population had only some high school education. A close look at the distribution of income revealed that 40 percent of the sample population made more than $200,000 per year, 5 percent made $100,000 - $199,000/year, 7 percent made $80,000 - $100,000/year, 20 percent made $50,00 - $79,000/year, 10 percent made $30,000 - $49,000/year, and 14 percent made less than $30,000 per year. Furthermore, 20 percent reported that they exercise with a partner. Cost was a deterrent with regards to exercise for 13 percent of the participants, while 24 percent considered distance to travel for exercise to be an inhibiting factor.

The lifestyle habits category of the survey (Table 7) reveals that the mean number of years of regular exercise was 9. Additionally, 58 percent of the population believed that experiencing immediate improvements in their health was an influential factor to exercise. With regards to the safety related issues, a sense of safety appeared to be an important factor for most of the participants. Forty percent of the population reported that they felt safer exercising in a group, 37 percent of the respondents had a greater peace of mind exercising in a medical setting, and 68 percent felt safer due to the expertise of the instructor.

Table 7. Descriptive Statistics of Sample

Variable	Variable Definition	N	Mean	Std. Deviation
Age	Age	178	65.65	10.04
Cohort	Cohort number	178	12.44	7.61
ColGrd	College graduate	175	.26	.44
Cost	Cost	178	.13	.34
Dist	Distance	178	.24	.43
ExHist	Exercise history	172	9.15	10.08
Gen	Gender	178	.72	.45
HsGrd	High school graduate	175	4.57	.21
Improve	Improvement	176	.59	.49
Inc	Income	168	5,140,219.64	33,453,133.44
Intrev	Intervention	178	.70	.46
Less100	$100,000 or less	168	7.74	.27
Less200	$200,000 or less	168	.05	.21
Less30	$30,000 or less	168	.15	.36
Less50	$50,000 or less	168	.11	.31
Less80	$80,000 or less	168	.28	.93
MinEx	Minutes of exercise	178	188.01	139.50
Mor200	$200,000 or more	168	.40	.49
Part	Partner	178	.20	.40
PstGrd	Post graduate	175	.42	.49
SafGrp	Safe group	177	.40	.49
SafIns	Safe instructor	177	.68	.49
SafMed	Safe medical	176	.37	.48
SomCol	Some college	175	.26	.44
SomHs	Some high school	175	.01	.11
Time	Time	178	27.04	15.78
Valid N		155		

Correlation Matrix

A number of very interesting observations can be made when reviewing the correlation matrix. Presented in Table 8, this matrix describes the linear relationship between the independent variables used in the analysis and the dependent variable, minutes of aerobic exercise. What follows is a description of the most significant

relationships amongst all the variables, beginning with a discussion of some of the interrelationships among the independent variables as well.[4]

Education played an important role in this study. All participants were at least high school graduates. In fact, being a high school graduate was associated with the feeling of safety exercising in a group. Older participants were more likely to have a college degree, while younger participants were more likely to have a postgraduate education. Additionally, most college graduates did not feel that the distance to travel to exercise was a limiting factor. Furthermore, the variable of distance was positively correlated with a sense of safety, indicating those who traveled farther reported a greater need for safety. Distance also correlated negatively with the amount of time that had passed since the completion of the program. In other words, distance traveled to exercise was less of a factor for those who most recently finished the program.

Cost associated with maintaining exercise compliance also produced noteworthy correlations. Those who reported that cost was an influential factor typically reported that distance was also a factor. Cost had more of an influence for women than men. Furthermore, cost was inversely correlated to exercise history. Cost was not a deterrent for those who had a past history of exercise.

The variable of exercise history was negatively related to the importance of immediate improvements in health. Those who had a history of past exercise generally did not feel it was important to see immediate health improvements. One of the most significant correlations was the relationship between exercise history and the dependent variable of minutes of exercise. The participants who exercised in the past were most

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[4] These additional correlations can be found in a supplemental correlation matrix presented in Appendix E.

likely to be exercising presently. Simply put, the best predictor of future behavior turned out to be past behavior. Furthermore, the participants who had completed the program most recently reported more minutes of exercise. The more recent participants also reported more often the importance of a medical setting giving them a sense of safety.

The Pearson correlation suggests an indirect effect of the importance of instructor-expertise that was mediated through the sense of safety exercising in a group. Generally speaking, people have a need to feel safe, and the expertise of the instructor gives a group a sense of safety. The feeling of safety in a group and safety in a medical setting correlated highly with the safety associated with instructor expertise. Additionally, those who felt safer because of the instructor typically reported immediate improvements in health as being important to their willingness to continue exercising. Furthermore, the importance of having a sense of safety due to instructor expertise was reported by more women than men.

Finally, a review of the dependent variable, minutes of aerobic exercise, reveals a number of relationships that provide some insight regarding the correlation between this variable and the independent variables. There were five variables that correlated highly with minutes of exercise. Those who met or exceeded the exercise compliance criteria had: (a) most recently completed the program, $r = .16$, $p = .04$,[5] (b) a postgraduate education, $r = .23$, $p = .00$, (c) previous history of regular exercise, $r = .19$, $p = .01$, (d) an exercise partner, $r = .17$, $p = .02$, and (e) reported feeling safer exercising in a group, $r = -.27$, $p = .00$. Three other variables also had a strong relationship to minutes of exercise: income of less than $30,000, $r = -.16$, $p = .04$, feeling safe in a medical setting,

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[5] r = Pearson correlation, p = significance level, * = .05, ** = .01.

$\underline{r} = -.21$, $\underline{p} = .01$, and education level of "some college", $\underline{r} = -.02$, $\underline{p} = .02$. However these

last three variables turned out to be poor predictors in terms of explaining the variation in

minutes of aerobic exercise when included in the regression analysis.

Table 8. Pearson Correlation Matrix of the Dependant Variable

Independent Variables	Dependant Variable; MINEX	
	r	p
Age	-.05	.49
Cohort	.16*	.03
ColGrd	-.02	.81
Cost	-.07	.37
Dist	-.04	.59
ExHist	.19*	.03
Gen	.10	.20
HsGrd	-.09	.24
Improve	-.08	.28
Inc	.19*	.09
Interv	.05	.54
Less100	.07	.34
Less200	.03	.72
Less30	-.16*	.04
Less50	-.10	.21
Less80	.12	.13
MinEx	1.00	
Mor200	.06	.44
Part	.17*	.02
PstGrd	.23**	.00
SafGrp	-.27**	.00
SafIns	-.12	.10
SafMed	-.21**	.01
SomCol	-.17*	.02
SomHs	-.09	.25
Time	-.16*	.04

*$\underline{p}<.05$; **$\underline{p}<.01$

Regression Analysis

Research Question 1 - demographic factors, lifestyle habits, and safety issues

Demographic Factors

Regression analyses were conducted sequentially on the three categories of factors

hypothesized to explain variation in exercise compliance: demographic factors, lifestyle

habits, and safety issues. However, prior to specifying the demographic model it was

determined that the survey question regarding exercising with a partner (Part) was better

placed in the lifestyle category rather than the original demographic section. This decision

was based on the choice aspect of exercising with a partner as compared to the fixed

nature of the other demographic factors. Although many different demographic models

were eventually run, the first model consisted of all the demographic variables; gender,

age, income, education, time since program completion, distance, and cost. Table 9

presents the results of Model 1, the initial demographic model, and shows that the R^2 was

.16, indicating that 16 % of the total variation in the dependant variable, minutes of

aerobic exercise, was explained by the demographic factors. F-tests were conducted to

determine if, taken together, the independent variables had any explanatory power. As

shown in Table 9, the change in this model's R^2 was significant at the 10 % level,

indicating with 90 % confidence that this group of demographic variables explains

variation in the minutes of aerobic exercise. This suggests that demographic factors

appear to be related to continued regular aerobic exercise habits.

Table 9. Initial Demographics Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.16	.16	1.53	.08

Further investigation of this model reveals many non-significant values for the t-statistics for the variables listed in Table 10. These results indicate that no significant relationship was found for minutes of regular aerobic exercise with regard to: age (t = .28), cohort (t = .88), college graduate (t = 1.53), cost (t = -1.20), distance (t = -.23), gender (t = .25), high school graduate (t = .22), income (t = 1.88), intervention (t = .88), income; $100,000 or less ($t$ = .34), $200,000 or less ($t$ = -.20), $30,000 or less ($t$ = -1.10), $50,000 or less ($t$ = -1.23), $80,000 or less ($t$ = 1.02), more than $200,000 ($t$ = -.39), some high school (t = -.02), and time (t = .62). However, a closer look at the initial demographics model regression in Table 10 does indicate a significant t-test score for post-graduate education (PstGrd, t = 2.41). The implication of this finding is that exercise compliance is significantly influenced by level of education, specifically the highest level. Those participants with post-graduate education were the most likely to continue to exercise after they had completed the lifestyle change program and exercised an average of one hundred and thirty-seven minutes per week more than those without a postgraduate education.

Table 10. Initial Demographics Model Regression

Model	Variables	Coefficients B	Std. Error	t
1	Age	.30	1.09	.28
	Cohort	8.67	9.87	.88
	ColGrad	89.06	58.04	1.53
	ColMor	-48.63	49.54	-.98
	Cost	-42.00	34.93	-1.20
	Dist	-6.17	27.43	-.23
	Gen	6.27	25.25	.25
	HsGrad	33.62	150.16	.22
	Inc	.00	.00	1.88
	Interv	20.90	23.82	.88
	Less100	15.96	47.01	.34
	Less200	-11.66	59.76	-.20
	Less30	-49.85	45.38	-1.10
	Less50	54.67	44.38	-1.23
	Less80	14.55	14.32	1.02
	Mor200	-13.21	33.84	-.39
	PstGrd	136.88	56.79	2.41
	SomHs	-2.66	173.42	-.02
	Time	2.98	4.84	.62

To help further refine the initial demographic model, the Pearson correlation

matrix (Table 8) was also used to help identify other potential modeling specifications.

After running numerous models, the final demographic model was found to contain post-

graduate (PstGrd) and the amount of time elapsed since completion of the lifestyle change

program (Time). The results of this model are presented in Table 11 and 12 and reveal

that 7 percent of the total variation in the dependant variable was explained by the

demographic factors. As shown in Table 11 and indicated by the F change statistic, the R^2

change in this model was significant. This suggests that these two demographic factors,

PstGrad and Time, may be related to continued regular aerobic exercise habits.

Table 11. Final Demographics Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.07	.07	6.86	.00

The results for the final demographic model are presented in Table 12 and show that the amount of time since completing the program has a significant relationship to minutes of regular aerobic exercise (t = -1.88). The longer the participant had been out of the program the less they exercised. Specifically, for each month since program completion they exercised an average of 1.2 minutes less. For example, a participant who completed the program two years ago would be exercising approximately 29 minutes less per week. Furthermore, postgraduate education had an even stronger relationship on minutes of exercise (t = 3.01) than in the original demographic model.. This means that those with postgraduate education exercised an average of sixty-three minutes more than those without a postgraduate education.

Table 12. Final Demographics Model Regression

Model	Variables	Coefficients B	Std. Error	t
1	Time	-1.21	.65	-1.88
	PstGrd	62.61	20.79	3.01

Lifestyle Habits

The next part of the sequential analysis combines the demographic and lifestyle variables to create Model 2, as shown in Table 13. The variables used in this regression analysis were the significant demographic variables of the previous analysis and the

original lifestyle variables from the survey instrument. More specifically, the variables

included in this initial analysis for Model 2 were Time, PstGrd, Part, ExHist and

ExHistSq. Table 13 presents the initial demographics and lifestyle summary results.

When the multiple regression technique was applied to the demographic and lifestyle

variables the R^2 for Model 2 was .18, an increase from .07 in Model 1, resulting in an R^2

change of .10. The R^2 indicates that 18 % of the total variation in the dependant variable,

minutes of exercise, was explained by the combination of demographic factors and

lifestyle habits as shown in Table 13 and, as indicated by the F change statistic, the R^2

change in this model was highly significant. This suggests that demographic and lifestyle

are important determinants to continued regular aerobic exercise habits.

Table 13. Initial Demographics / Lifestyle Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.07	.07	6.86	.00
2	.18	.10	7.08	.00

Note: The R square change value may not equal the difference in Model 1 and 2 R square due to rounding off.

Table 14 presents the initial demographic and lifestyle regression results. The t-

statistics for the demographic variables, Time and PstGrd, increased from Model 1 when

the lifestyle variables were introduced. Time went from t = –1.88 to t = –2.95 while

PstGrd increased from t = 3.01 to t = 3.19, suggesting that the presence of lifestyle factors

does not diminish the importance of select demographic measures in helping to maintain

exercise compliance. The magnitude of the estimated coefficients suggest that there is a

decrease in exercise time of 1.87 minutes per week for each month out of the program

and an average of sixty-four minutes more of exercise per week for those with post-graduate education. A point of great interest is that all of the lifestyle variables turned out to be significant. Exercising with a partner (Part, t = 1.84) was associated with almost forty-six minutes of exercise more per week. Interestingly, the relationship between exercise history and minutes of exercise turned out to be non-linear, as evidenced by the significance of ExHist (t = 3.59) and ExHistSq (t = -2.80). This indicates that as individuals age and have more years of exercise history behind them, their current minutes of exercise increase up until a threshold level of exercise history is reached and from that point on their current minutes of exercise begin to decrease. Using optimization theory, this threshold point was calculated as 26 years, the point at which the relationship between exercise history and minutes of exercise turns from positive to negative. [6]

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[6] Since the mean level of exercise history in the sample was 9 years, for the average person in the sample, each year of exercise history was associated with about 6 extra minutes of exercise per week. This was calculated by taking the partial derivitive of MinEx with respect to ExHist and using the mean value of ExHist.

$$\frac{\partial MinEx}{\partial ExHist} = 9.30 + (2)(.18)(ExHist)$$
$$= 9.30 + (2)(-.18)(9)$$
$$= 9.30 - 3.24$$
$$= 6.06$$

Table 14. Initial Demographics / Lifestyle Model Regression

		Coefficients		
Model	Variables	B	Std. Error	t
1	Time	-1.21	.65	-1.88
	PstGrd	62.61	20.79	3.01
2	Time	-1.87	.63	-2.95
	PstGrad	64.14	20.10	3.19
	Part	45.77	24.91	1.84
	ExHist	9.30	2.59	3.59
	ExHistSq	-.18	.06	-2.80

Table 15 presents the R^2 and F-statistic for the final demographics and lifestyle variables model and Table 16 presents the final demographics and lifestyle variables regression results. [6] Since all of the variables used in the initial models (Tables 13 & 14) were significant the tables for the final models are the same as the initial.

Table 15. Final Demographics / Lifestyle Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.07	.07	6.86	.00
2	.18	.10	7.08	.00

Table 16. Final Demographics / Lifestyle Model Regression

		Coefficients		
Model	Variables	B	Std. Error	t
1	Time	-1.21	.65	-1.88
	PstGrad	62.61	20.79	3.01
2	Time	-1.87	.63	-2.95
	PstGrad	64.14	20.10	3.19
	Part	45.77	24.91	1.84
	ExHist	9.30	2.59	3.59
	ExHistSq	-.18	.06	-2.80

Safety Variables

Table 17 summarizes the goodness of fit for the models that include the significant demographic, lifestyle and safety variables. When the multiple regression technique was applied to the demographic, lifestyle and safety variables, the R^2 for Model 3 was .22, an increase from .18 in Model 2. This indicates that 22 % of the total variation in the dependant variable, minutes of exercise, was explained by the combination of demographic factors, lifestyle habits and safety issues. The R^2 change decreased from .10 to .05 with the addition of all the safety variables to the significant demographic and lifestyle variables. As shown in Table 17 and indicated by the F change statistic the change in this model's R^2 was significant. This suggests that demographic, lifestyle and safety variables are related to continued regular aerobic exercise habits.

Table 17. Initial Demographics / Lifestyle / Safety Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.07	.07	6.86	.00
2	.18	.10	7.08	.00
3	.22	.05	3.30	.02

Table 18 presents the demographics, lifestyle and initial safety regression results. When the safety variables were introduced in Model 3 the t-statistics for Time increased while PstGrd decreased. Time went from t = -2.95 to t = -3.27 and PstGrd decreased from t = 3.19 to t = 2.44. However, these changes indicate that these variables are still quite significant. The changes in the coefficients explain that there is a decrease in exercise time of 2.05 minutes per week for each month out of the program. The PstGrd

variable dropped to an average of approximately fifty minutes more of exercise per week for those with post graduate education. Exercising with a partner (t = 2.28) was associated with fifty-seven minutes more of exercise per week. Exercise history (t = 2.60) equates to almost seven minutes more of exercise per week for each year of past exercise history. The last lifestyle variable, ExHistSq (t = -1.93) with a coefficient of -.13 indicates a decrease of less than a quarter minute of exercise for each year of exercise over twenty-six. [7]

Of the three safety variables, the sense of feeling safe while exercising in a group was the only one of significance, (SafGrp, t = -2.26). These people who felt the need to exercise in a group, exercised an average of fifty-four minutes less per week after completing the lifestyle change program. Non-significant values of the t-statistics resulted from the variables associated with the need for the sense of safety from the instructor (SafIns, t = -.25) and exercising in a medical setting (SafMed, t = -.56), suggesting that these variables were not helpful in explaining variation in exercise compliance.

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[7] Based on the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist, for the average person in the sample, each year of exercise history was associated with approximately 4.55 extra minutes of exercise per week.
This was calculated by taking the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist.

$$\frac{\partial MinEx}{\partial ExHist} = 6.89+(2)(-.13)(ExHist)$$
$$= 6.89 + (2)(-.13)(9)$$
$$= 6.89 - 2.34$$
$$= 4.55$$

Table 18. Initial Demographics / Lifestyle / Safety Model Regression

Model	Variables	Coefficients		
		B	Std. Error	t
1	Time	-1.21	.65	-1.88
	PstGrd	62.61	20.79	3.01
2	Time	-1.87	.63	-2.95
	PstGrd	64.14	20.10	3.19
	Part	45.77	24.91	1.84
	ExHist	9.30	2.59	3.59
	ExHistSq	-.18	.06	-2.80
3	Time	-2.05	.63	-3.27
	PstGrd	49.46	20.26	2.44
	Part	57.13	25.08	2.28
	ExHist	6.89	2.65	2.60
	ExHistSq	-.13	.07	-1.93
	SafGrp	-54.27	24.00	-2.26
	SafIns	-6.08	23.97	-.25
	SafMed	-14.16	25.19	-.56

Table 19 presents the final demographics, lifestyle and safety summary results. The R^2 of this final model indicates that twenty-two percent of the variation in the minutes of exercise is explained by the combination of demographic factors, lifestyle habits and safety issues. When the two non-significant safety variables were removed from the regression, the R^2 change decreased to .04 in the Final Model 3 from .05 in the Initial Model 3. The R^2 change and significant F change statistic in this model point to the significant role the combination of demographic, lifestyle and safety play in the minutes of exercise. This suggests that demographic, lifestyle and safety variables do influence continued regular aerobic exercise habits.

Table 19. Final Demographics / Lifestyle / Safety Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.07	.07	6.86	.00
2	.18	.10	7.08	.00
3	.22	.04	9.42	.00

Table 20 presents the final demographics, lifestyle and safety regression results. After removing SafIns and SafMed from the regression model, the t-statistics for Time decreased from the Initial Model 3 to the Final Model (t = –3.27 to t = -3.22). On the other hand, PstGrd increased (t = 2.44 to t = 2.51) when the two safety variables were dropped. Even with these minor changes both Time and PstGrd are still highly significant. The coefficients for these two variables remained about the same explaining that there is a decrease in exercise time of 2.00 minutes per week for each month out of the program and an average of approximately fifty minutes more of exercise per week for those with post graduate education. The remaining lifestyle and safety t-statistics all increased. Exercising with a partner increased in the Final Model to 2.39, which resulted in fifty-nine minutes more of exercise per week. ExHist (t = 2.70) equates to seven minutes more of exercise per week for each year of past exercise history. ExHistSq (t = - 2.04) had a coefficient of -.13 which indicates a decrease of less than a quarter minute of

exercise for each year of exercise over twenty-six. [8]

The final variable to have a significant influence was SafGrp (t = -3.07). Those

who reported the preference to exercise in a group exercised an average of sixty-three

minutes less per week after completing the lifestyle change program.

Table 20. Final Demographics / Lifestyle / Safety Model Regression

Model	Variables	Coefficients B	Std. Error	t
1	Time	-1.21	.65	-1.88
	PstGrd	62.61	20.79	3.01
2	Time	-1.87	.63	-2.95
	PstGrd	64.14	20.10	3.19
	Part	45.77	24.91	1.84
	ExHist	9.30	2.59	3.59
	ExHistSq	-.18	.06	-2.80
3	Time	-1.99	.62	-3.22
	PstGrd	50.46	20.12	2.51
	Part	59.07	24.70	2.39
	ExHist	7.10	2.63	2.70
	ExHistSq	-.13	.06	-2.04
	SafGrp	-63.23	20.60	-3.07

Research Question 2 - length of program or severity of medical condition

The second research question considered two other factors that were thought to

influence average weekly minutes of exercise; (1) the program length and (2) if the

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[8] Based on the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist, for the average person in the sample, each year of exercise history was associated with approximately 4.76 extra minutes of exercise per week.
This was calculated by taking the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist.

$$\frac{\partial MinEx}{\partial ExHist} = 7.1 + (2)(-.13)(ExHist)$$
$$= 7.1 + (2)(-.13)(9)$$
$$= 7.1 - 2.34$$
$$= 4.76$$

participant had a cardiac procedure. This section will address program length while the next section will cover severity of medical condition.

Since the participants in the one-year program (cohorts 1- 10) and the six-month program (cohorts 11 –26), as defined by the variable program length, was highly confounded with time they could not be used as independent variables[9]. The solution to this problem was to run separate regressions for those individuals that participated in the six-month program and those individuals in the year-long program. These separate regressions will now be discussed.

One-Year Program

Table 21 presents the results of the one year program final demographics / lifestyle / safety model summary. The R^2 of this final model indicates that twenty-five percent of the variation in the minutes of exercise for those that participated in the year long program is explained by the combination of demographic factors, lifestyle habits and safety issues. The R^2 change and significant F change statistic in this model point out the significant role the combination of demographic, lifestyle and safety play in the minutes of exercise suggesting that demographic, lifestyle and safety variables influence continued regular aerobic exercise habits for participants in the one year program.

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[9] $\underline{r} = .858$, $\underline{p} =$ less than .001

Table 21. One Year Program Final Demographics / Lifestyle / Safety Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.01	.01	.39	.68
2	.21	.20	6.15	.00
3	.25	.03	3.25	.08

Table 22 presents the one-year final demographics, lifestyle and safety regression

results. The coefficients for time increased from 1.10 minutes to 1.57 minutes explaining

a significant increase in the number of minutes of exercise per week for each month out

of the program. Interestingly, in the final one-year model, neither Time (t = 1.09) nor

PstGrd (t = .22) were significant determinants of exercise compliance. Further

comparison among models finds that all the lifestyle factors remain significant. The

independent variable "Part" increased in significance in Model 3 (t = 2.24). The

coefficient for exercising with a partner increased from fifty minutes to sixty-five minutes

of exercise per week. The next lifestyle variable, ExHist, was also highly significant (t =

2.87). For this variable there was a slight decrease in minutes of exercise, from

approximately eleven minutes to ten minutes. The last lifestyle variable, ExHistSq, the t

statistic was significant as well, t = -2.19. Minutes of exercise decreased minimally, 22

seconds versus 19 seconds for each year over twenty-six. [10] Finally, the significant safety

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[10] Based on the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist, for the average person in the sample, each year of exercise history was associated with approximately 6.42 extra minutes of exercise per week.
This was calculated by taking the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist.

$$\frac{\partial MinEx}{\partial ExHist} = 9.84 + (2)(-.19)(ExHist)$$
$$= 9.84 + (2)(-.19)(9)$$
$$= 9.84 - 3.42$$
$$= 6.42$$

variable, SafGrp (t = -1.80), had a coefficient of -47.71 which indicates almost forty-eight minutes less of exercise due to no longer exercising in a group.

The most obvious difference for the one-year program is that the demographic variables are no longer significant influential factors contributing to exercise compliance.

Table 22. One Year Program Final Demographics / Lifestyle / Safety Model Regression

| Model | Variables | Coefficients | | |
		B	Std. Error	t
1	Time	1.10	1.57	.70
	PstGrd	14.56	26.74	.55
2	Time	1.19	1.45	.82
	PstGrd	14.65	24.51	.60
	Part	50.08	28.30	1.77
	ExHist	11.42	3.37	3.39
	ExHistSq	-.22	.08	-2.66
3	Time	1.57	1.44	1.09
	PstGrd	5.38	24.68	.22
	Part	65.23	29.10	2.24
	ExHist	9.84	3.44	2.87
	ExHistSq	-.19	.09	-2.19
	SafGrp	-63.23	26.48	-3.07

Six-Month Program

Table 23 presents the results of the six-month program final demographics / lifestyle / safety model summary. The R^2 of this final model indicates that twenty-four percent of the variation in the minutes of exercise is explained by the combination of demographic factors, lifestyle habits and safety issues. The R^2 change and significant F change statistic in this model point out the significant role the combination of demographic, lifestyle and safety play in the minutes of exercise, suggesting that

demographic, lifestyle and safety variables influence continued regular aerobic exercise habits for participants in the six-month program.

Table 23. Six Month Program Final Demographics / Lifestyle / Safety Model Summary

Model	R Square	R Square Change	F Change	Sig. F Change
1	.10	.10	5.52	.01
2	.18	.08	3.02	.03
3	.24	.06	7.67	.01

Table 24 presents the six-month final demographics, lifestyle and safety regression results. The coefficients for time increased from -.44 in Model 1 to –2.14 in Model 3. This explains a decrease in minutes of exercise from three quarters of a minute to two and one quarter minutes per week for each month out of the program. The t-statistics for Time, $(t = -1.18)$ was not considered significant, whereas PstGrd maintained its level of significance, $(t = 2.72)$. Furthermore, the lifestyle variable of Part was not significant $(t = 1.61)$ in Model 3. The coefficient for exercising with a partner increased significantly from fifty-two to sixty-three minutes of exercise per week. The second lifestyle variable, ExHist was found to be significant, $t = 1.59$. For this variable there was a drop in minutes of exercise, from approximately nine minutes to six minutes. A similar shift in significance occurs with ExHistSq. The t statistic of -1.97 was significant in Model 2 but not significant in Model 3 when $t = -1.34$. Minutes of exercise decreased

minimally from 18 seconds to 12 seconds for each year over twenty-six. [11] The last

variable to consider was SafGrp, (t = -2.77), that had a coefficient of -82.70 which

indicates almost eighty-three minutes less of exercise due to no longer exercising in a

group.

When the six-month program was analyzed independent of the one-year program

the variables that were significant varied. With the six-month program length the

demographic variable of Time dropped out as well as all of the lifestyle variables. Only 2

variables, PstGrd and SafGrp remained significant.

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[11] Based on the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist, for the average person in the sample, each year of exercise history was associated with approximately 3.71 extra minutes of exercise per week.
This was calculated by taking the partial derivative of MinEx with respect to ExHist and using the mean value of ExHist.

$$\frac{\partial MinEx}{\partial ExHist} = 5.87 + (2)(-.12)(ExHist)$$
$$= 5.87 + (2)(-.12)(9)$$
$$= 5.87 - 2.16$$
$$= 3.71$$

Table 24. Six Month Program Final Demographics / Lifestyle / Safety Model Regression

| Model | Variables | Coefficients | | |
		B	Std. Error	t
1	Time	-.44	1.86	-.24
	PstGrd	98.04	30.18	3.25
2	Time	-1.87	1.87	-1.00
	PstGrd	100.66	30.14	3.34
	Part	52.16	40.11	1.30
	ExHist	8.70	3.68	2.36
	ExHistSq	-.18	.09	-1.97
3	Time	-2.14	1.81	-1.18
	PstGrd	81.40	29.94	2.72
	Part	62.88	38.95	1.61
	ExHist	5.87	3.70	1.59
	ExHistSq	-.12	.09	-1.34
	SafGrp	-82.69	29.86	-2.77

Severity of Medical Condition

The second parameter of research question 2 was severity of medical condition. This independent variable representing whether an individual had a cardiac procedure was found to be poorly correlated, ($t = .88$), with MinEx in the preliminary regression analysis. This is made clear in Table 10 for the initial demographic regressions where the history of a cardiac intervention variable was insignificant ($t = .88$). Apparently this populations' exercise habits was not significantly influenced by the severity of their medical condition.

Open ended responses

When prompted with an open-ended question asking for other factors that contribute to exercise compliance, seventy percent of the respondents, one hundred and twenty-five people, provided responses. Even though there were a wide variety of terms used, the reasons were grouped into ten categories. Table 25 lists the various categories

and the frequency of the responses. Six out of the ten categories were considered negative influences: Weather, Psychological, Priority, Health, Travel and Work. Two categories reflected positive influences; Doctor and Benefits. The remaining two categories, Program Structure and Support, had both positive and negative attributes. The most surprising factor given was Weather. It was surprising for two reasons; the frequency it was given, twelve percent of the survey respondents that answered the open ended question, and due to the fact that the climate in southern California is conducive to year round exercise. The factor that was most expected was Priority. The various terms that fit into the Priority category were; time, appointments, commitments, schedule, and opportunity. These are common reasons that are given when people say they do not have the time, or can not find the time to exercise. Another category, Health, was also somewhat expected due to the heart disease medical history of the sample. The two most common factors, Priority and Health were each reported by twenty-two percent of the respondents as negative influences on their exercise habits. The one factor that had the most positive influence was the category of Benefits. More than seventeen percent of the sample reported that they were motivated to exercise because; "it feels good, they feel better after exercising, for well being, they sleep better, to control weight, increased stamina, keep down cholesterol, better problem solving and thinking, seeing the benefits, and it's fun and they enjoy it". While the category of Benefits was encouraging, it was very clear that there were far more negative factors than positive that influenced exercise compliance.

Approximately forty-two percent or fifty-three of the one hundred and twenty-five respondents reported one "other" factor outside of the survey categories that influenced their exercise compliance. The majority of the sample reported two to three "other"

factors their exercise was influenced. Only one person listed four factors that influenced exercise compliance. This person reported four negative reasons and still managed to exercise an average of one hundred and ninety-five minutes per week, exceeding the one hundred and eighty minute criteria.

For the most part the respondents entered one word answers as "other" factors, but some of them went to the trouble of writing a sentence or two. I have included some of the most unique responses because I think they are representative of the mind-set of many more participants who did not write out comments. Their thoughts are so valuable because it is their perceived reality, not excuses. Additionally, these "other" factors are potential influences of exercise compliance that were not considered in this study's survey. Specific questions relating to the following "other" factors could be useful in future research design. The following reasons motivate or inhibit many peoples' exercise compliance. Their responses included; "It's too cold for outdoor swimming", or, "It's been a short time since I had my bypass surgery and I have not exercised since then", or, "There are days I do not want to exercise, but I just tell myself "Just do it"", or, " I am more alert – my thinking and problem solving is enhanced", or, "I have a fear of loss of mobility, so I want to keep weight and stress off my ankles", or, "Whatever my wife wants me to do takes first priority", or, "My wife keeps me honest", or, "The only factor is that I wish to live a long and healthy life", or, "Because of the heart problems I am more dedicated to compliance than I would be otherwise", or, "Dr. G says do it", or, "When I get angina I tend to get nervous about walking alone", or, " Sometimes when I play golf I am too tired to exercise after", or, "I don't exercise because of the long distance between where I am and the distance to the exercise bike", or, "I do not want to have heart problems", or, "I have other commitments that interfere with my exercise

schedule", or, "The results are apparent and I feel better if I exercise every day", or,

"Knowledge gained in the program and seeing the benefits in my own body promoted a

continuous exercise regime", or, "Time and energy from home chores and work limit my

exercise", or, "My full time job interferes with exercise, - During the program I did not

work and I exercised daily 90 minutes 7 days a week", or, "Although I'd feel safer in a

group setting, I have no problem exercising alone", or, "Exercise classes keep me

motivated", and "I'm more apt to exercise with others than on my own". The participants

responses were sorted into one of ten categories; weather, psychological, priority, health,

travel, program structure, doctor, benefits, support, and work.

Table 25. Open ended question responses – "Other Factors"

Type	Category	Number of responses #
(Negative)	Weather	15
	Psychological	20
	Priority	28
	Health	28
	Travel	5
	Work	10
(Positive)	Doctor	2
	Benefits	22
(Positive & Negative)	Program Structure	6
	Support	9
	*Total	145

*The total number of responses exceeds the number of respondents because in most cases
the participant reported multiple "other factors".

Chapter Conclusions

The purpose of this chapter was to analyze and present the data collected from the administration of the survey instrument. The data was assessed by using a multiple regression analysis to uncover the relationship between demographic, lifestyle, and safety variables and the variation in exercise compliance.

The data collection process presented a challenge regarding the willingness of the respondents to share annual income information. This dilemma was successfully resolved by changing the structure of the question. In conjunction to changing the income question, a question regarding level of education was also added (Appendix D). This addition was very meaningful to the outcome of the data analysis since level of education was a significant determinant of exercise among the sample. What was most encouraging regarding the data collection process was the timeliness of the surveys returned as well as the total number of respondents. The response rate was a favorable sixty-five percent of the study population.

The descriptive statistics provided a detailed profile of the sample. The data confirmed that the sample was representative of the study population. The typical participant was a 66-year-old male who had a cardiac procedure prior to starting the lifestyle change program. His income was more than $200,000 per year and he had at least a college education. In addition to the similarities between the study population and the sample there were also similarities between the participants from the one-year and the six-month programs. The mean ages for all conditions ranged from 63 to 67 years. Men made up approximately 70 percent of each cohort and had a cardiac procedure 70 percent of the time in the one-year program and 82 percent of the time in the six-month program.

Women, the other 30 percent, had a cardiac 18 percent of the time in the one-year program and 30 percent of the time in the six-month program.

Upon further review of the descriptive statistics, the variables that were most meaningful were exercise history and minutes of exercise. The first variable, the mean number of years of exercise history, was slightly over nine. This value was critical for the process of determining the point at which minutes of aerobic exercise begins to diminish relative to the total number of years of exercise history. The other descriptive statistic, mean minutes of exercise, was extremely meaningful because it surpassed the dependent variable criteria of one hundred and eighty minutes. The sample MinEx mean was one hundred and eighty-eight minutes. This is most encouraging because it supports the hypothesis that post-lifestyle change program participants continue to exercise and actually exceed the set criteria.

The regression methodology for research question #1 involved a process of creating a series of sequential models and analyzing a variety of combinations of independent variables to identify significant factors. Following numerous trials, a final model was identified that included the significant variables from the demographic, lifestyle, and safety categories. The variables that turned out to be significant were: time since program completion (t = -3.22), post graduate education (t = 2.51), exercising with a partner (t = 2.39), years of exercise history (t = 2.70), years of exercise history squared (t = -2.04), and exercising in a group (t = -3.07). The coefficients for Time and PstGrd indicated a decrease in aerobic exercise time of 2.00 minutes per week for each month out of the program, while aerobic exercise increased an average of approximately fifty minutes per week for those with postgraduate education. Exercising with a partner also increased exercise time by fifty-nine minutes per week. ExHist equates to seven minutes

more of exercise per week for each year of past exercise history. ExHistSq had a coefficient of -.13 which indicates a decrease of less than a quarter minute of exercise for each year of exercise over twenty-six. Finally, those who reported the preference to exercise in a group (SafGrp) exercised an average of sixty-three minutes less per week after completing the lifestyle change program.

There were two other variables that were considered for research question # 2. The hypothesis of this question was that the program length and incidence of cardiac procedure influence exercise compliance. It was determined at an early point that having had a cardiac procedure does not significantly influence exercise compliance. Program length presents more complexities as previously discussed. In an attempt to disentangle the effect of the program length and time, a separate set of regressions were run to determine what variables were significant under this condition. When the one-year program was isolated, the previously significant demographic factors dropped out. Exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group retained their significance. By comparison, the only significant variables for the six-month program were post-graduate education and exercising in a group.

Finally, the length of the program was important relative to the amount of time that had passed since the program ended. The one-year participants had completed the program between 28 and 56 months ago as compared to the six-month participants who finished between 3 and 30 months ago. Those who had been out of the program for a longer period of time reported poorer exercise compliance, as compared to those who had completed the program more recently reported better exercise compliance. This appears to be due to the greater elapsed time since program completion.

CHAPTER FIVE
Summary, Conclusions, and Recommendations

Introduction

This final chapter begins with an overview of the research questions and data

collection process used, followed by a detailed description of the study population and the

sample. The data collection process is then presented in the third section. The

methodology and data analysis of the study then follows. Section four contains the

discussion of the findings which includes a profile of the sample, descriptive statistics, as

well as the conclusions for the study's research questions. The next section then

contextualizes these results by grounding them in the relevant literature. Policy

implications and recommendations follow and focus on areas deemed important in light

of the findings of this research study. Finally, conclusions are presented with

recommendations for future investigative studies of a similar nature.

Research Questions and Data Collection

This quantitative study examined the influential factors contributing to exercise

compliance following a lifestyle change program. The goal of this study was to answer

the following two research questions: (1) To what extent do demographic factors, lifestyle

habits, and safety issues contribute to exercise compliance for those who have completed

the Ornish/Healing Hearts lifestyle change program in La Jolla, CA and (2) Do these

demographic factors, lifestyle habits and safety issues vary when the length of program or

severity of medical condition are factored in?

Study Population and Sample

The sample consisted of 178 people, 128 men and 50 women (72 and 28 percent respectively). These percentages were highly representative of the study population, since 71 percent of the study population were men and 29 percent were women. The same representativeness holds for age as well, since the mean age for the sample was 66 years old. This compares favorably to the study population where the average age was 64 for men and 65 for the women. Furthermore, the number of participants in the sample who had undergone cardiac procedures was 125, or 70 percent of this population, which compares quite favorably to the 68 percent for the study population. Due to all these similarities it can be concluded that the sample was truly representative of the population.

Data Collection

To address the research questions, a quantitative research design was used that involved the collection of survey data from past participants of the Ornish/Healing Hearts lifestyle change program. The goal of the survey was to capture demographic, lifestyle, and safety related data regarding the individuals level of exercise compliance. Two hundred and seventy-three surveys were mailed on April 10, 2002 to past Ornish/Healing Hearts program participants. The response rate was quite favorable with 100 surveys being returned within the first week. Follow-up calls were made to the non-responders one week after the mailing to confirm that the material was received. Additional calls were made when questionnaires were not returned within one week after the deadline stated in the informed consent. By the due date, two weeks later, a total of 161 surveys had been returned. In an attempt to capture any additional data, the remaining non-respondents were called one month after the mailing. The personal phone contact proved to be beneficial and increased the response total to 178 completed surveys.

In the event that surveys were returned incomplete, follow-up calls were made to retrieve the missing data. Due to the sensitive nature of the question regarding income, more than one third of the respondents left this question blank. To improve the response rate these individuals were contacted by phone and asked to choose an income category rather than their approximate annual income. As a result of the calls all but thirteen respondents provided their income range. Furthermore, all one hundred and seventy-eight respondents were called and asked to select a category for highest level of education attained. In this case all but ten people were willing to answer, and as a result, they were not included in this part of the analysis.

Methodology and Data Analysis

Regression analysis was then used to test the significance of demographic, lifestyle, and safety variables in explaining variation in individuals' minutes of aerobic exercise. The first step in the analysis was to regress minutes of exercise onto the demographic variables: age, gender, income, education, partner support, length of time since program completion, distance traveled to exercise, cost incurred to exercise, and history of cardiac intervention. This regression model was then repeated with lifestyle-habits: past history of consistent exercise, and the need to see relatively immediate health improvements. The final analysis included safety factors of: group format, medical setting, and supervision expertise.

For each analysis the data was fitted and the following criteria was used: (a) Goodness-of-fit statistics such as R^2 and R^2 adj was used to investigate the overall fit of the models, (b) The relevance of each variable to the model was investigated by the significance of their t statistics, and (c) The overall significance of the successive models was investigated through the use of F statistics.

Numerous combinations of exploratory regressions were completed, as described in Chapter 4, yielding the significant variables and producing the final regression models. What follows in the next section is a detailed account of these variables and their relationship to the dependant variable of minutes of aerobic exercise.

Discussion of Findings

Sample Demographics

As previously discussed, a comparison of select demographic measures suggested that the 178 participants in this study were representative of the 273 individuals that comprise the study population. The typical participant was a 66-year-old male who had a cardiac procedure prior to starting the lifestyle change program. His income was more than $200,000 per year and he had at least a college degree. In addition to the similarities between the study population and the sample there were striking homogenous characteristics between the participants from the one-year versus the six-month programs. The mean ages ranged from 63 to 67 years within the sample, the one-year and six-month groups. Furthermore, men made up approximately 70 percent of each cohort and had a cardiac procedure 70 percent of the time in the one-year program and 82 percent of the time in the six-month program. Women, the other 30 percent, had a cardiac procedure 18 percent of the time in the one-year program and 30 percent of the time in the six-month program.

The descriptive statistics also revealed that the mean minutes of exercise in the sample was 188 minutes, exceeding the suggested criteria of 180 minutes. This statistic is the most encouraging because it supports the hypothesis that post-lifestyle change program participants continue to exercise and actually exceed the set criteria of one hundred and eighty minutes per week. Additionally, the mean number of years of exercise

history was important. This variable was slightly over nine years, a value that was critical for the process of determining the point at which minutes of aerobic exercise begins to diminish relative to the total number of years of exercise history.

Research Question #1 - To what extent do demographic factors, lifestyle habits, and safety issues contribute to aerobic exercise compliance for those who have completed the lifestyle change?

The results of this study's data analysis help to answer research question # 1. Of the sixteen independent variables listed in the survey, six were determined to be significant. These variables were; time since program completion, post graduate education, exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group.

Analyses of a variety of combinations of all independent variables produced the final model with an R^2 that indicates twenty-two percent of the variation in the minutes of aerobic exercise was explained by the combination of demographic factors, lifestyle habits and safety issues. The R^2 change of .04 and the significant F change statistic in the final model pointed to the significant role the combination of demographic, lifestyle and safety play in the minutes of exercise. This suggested that demographic, lifestyle and safety variables do influence continued regular aerobic exercise habits.

The importance of time since program completion, post graduate education, years of exercise history, years of exercise history squared, exercising with a partner, and exercising in a group were all confirmed by their estimated coefficients and t-statistics. The coefficients explained that there is a decrease in exercise time of two minutes for each year out of the program and an average of approximately fifty minutes more of exercise per week for those with a post graduate education. Previous exercise history

equated to seven minutes more of exercise per week for each year of past exercise. This supports the premise that previous history of regular exercise influences current exercise habits. However, exercise history squared indicated a decrease of less than a quarter minute of exercise for each year of exercise over twenty-six, suggesting that older individuals tend to exercise less with each additional year. This is in part due to an aging population who begin to experience significant health issues and diminished physical capacities. Finally, the issue of the importance of a support system was clarified by the significant correlations of both exercising with a partner and exercising in a group. Exercising with a partner resulted in fifty-nine minutes more of exercise per week. Those who reported the preference to exercise in a group, exercised an average of sixty-three minutes less per week after completing the lifestyle change program. This result was apparently due to the lack of a support system after program completion.

Research Question # 2 - Do the demographic factors, lifestyle habits and safety issues vary when the length of program or severity of medical condition are factored in.

The hypothesis of research question # 2 was that program length and severity of cardiac condition might influence exercise compliance. It was determined at an early point in this study that having had a cardiac procedure did not significantly influence exercise compliance. On the other hand, program length has a much different effect. A conclusion of this study is that program length was highly correlated to exercise compliance.

When the one-year program was isolated, the previous significant demographic factors of time and post-graduate education fell out. Exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group retained their significance. By comparison, the only significant variables for the six- month program

were post-graduate education and exercising in a group. Once again, those who had been out of the program for a longer period of time reported poorer exercise compliance, as compared to better exercise compliance for those who had completed the program more recently. This appears to be due to the greater elapsed time since program completion.

Further analysis revealed the R^2 of the one-year program indicates that twenty-five percent of the variation in the minutes of aerobic exercise was explained by the combination of demographic factors, lifestyle habits and safety issues. Additionally, the R^2 change and significant F change statistic in this model suggests that these variables influence continued regular aerobic exercise habits for participants in the one-year program.

The coefficients and t-statistics revealed that both time and post-graduate education were not considered significant variables for the one-year program length as compared to the full sample where they were significant. The lifestyle factors from the full sample remain significant for the one-year program. Exercising with a partner indicated an increase of exercise to sixty-five minutes more per week. Exercise history revealed approximately ten minutes more of aerobic exercise for each year of previous exercise, while exercise history squared represented 19 seconds less of exercise for each year over twenty-six. Finally, the significant safety variable, safety exercising in a group indicated almost forty-eight minutes less of aerobic exercise due to no longer exercising in a group.

The most obvious difference for the one-year program as compared with the full sample is that the demographic variables were no longer significant influential factors contributing to exercise compliance.

The R^2 for the six-month program indicates that twenty-four percent of the variation in the minutes of aerobic exercise is explained by the combination of demographic factors, lifestyle habits and safety issues. The R^2 change and significant F change statistic bring to light the significant role the combination of demographic, lifestyle and safety play in continued regular aerobic exercise habits for the six-month program. Specifically, time since program completion explains a decrease in minutes of aerobic exercise of two and one quarter minutes for each year out of the program. Post Graduate education corresponded with approximately eighty-one more minutes of aerobic exercise, while exercising with a partner represented sixty-three minutes more of aerobic exercise per week. Exercise history squared showed a 12 second decrease in exercise for each year of previous exercise history over twenty-six. And finally, safety of exercising in a group indicated almost eighty-three minutes less of aerobic exercise due to no longer exercising in a group.

The six-month program analyzed alone had more variations in the significant variables than the one-year program had. With the six-month program length the demographic variable of time dropped out as well as all of the lifestyle variables. Only 2 variables, post-graduate education and Safety exercising in a Group remained significant.

A comparison of the one-year and six-month program lengths revealed virtually the same amount of explained variance in the minutes of exercise, twenty-five percent and twenty-four percent respectively. From this perspective, program length didn't seem to be significant. The more detailed view of program length from the regression analysis shows that the independent variables had different influences on exercise compliance. For example, the coefficient for time in the one-year program suggested an increase of approximately one and one half minutes per week for each month out of the program.

This differs from the six-month program that showed a decrease of approximately two and one quarter minutes per week for each month out of the program. Postgraduate education also had a much different influence for exercise compliance. In the one-year program post graduate education equated to approximately five and one half minutes more exercise, whereas in the six-month program it positively influenced exercise compliance by over eight-one minutes per week. The next variable, exercising with a partner, had similar coefficients for one-year and six-month programs, sixty-five and sixty-three minutes respectively. Exercise history, on the other hand, had a greater impact in the one-year program models where the estimated coefficient was almost ten minutes more of exercise versus the six-month coefficient of approximately six minutes more for each year of previous exercise history. The coefficient for the variable of exercise history squared was similar at approximately a quarter minute less of exercise for either program length. The last variable coefficient for safety with exercising in a group was greater in the six-month program at eighty-three minutes compared to sixty-three minutes for the one-year program. Even though the program lengths were found to not significantly influence exercise compliance the regression analysis clarified that the variables had different influences on exercise compliance for the one-year and the six-month programs.

Relation of Findings to the Literature

Similarities were found between the results of this particular study and several studies reviewed in the literature. This study identified six significant variables that influence exercise compliance. These variables were: time since program completion, post graduate education, exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group. Most of these variables have been identified in previous studies but under different conditions. Typically exercise

compliance was measured during or following a traditional cardiac rehabilitation program

unlike the current study's lifestyle change program. The review of the literature could

only locate exercise compliance in relation to cardiac rehabilitation programs. This study

is unique due to the lack of any other research existing that has examined the same type

of program.

Even though program structure differed, one common denominator this study

shared with many of the previous studies is the population, heart patients. A closer

examination of the literature reveals similar independent variables with the current

findings such as; income, previous experience with exercise, education, and support. This

study found these factors to significantly influence exercise compliance in the lifestyle

change program.

Even though income was not considered a significant variable in this study there

was a very high percentage (forty- percent) of the cohort participants that were in the

$200,000 or more annual income category. Additionally, over twenty-percent of the

participants reported income ranges of $1,000,000 or greater. Higher income has been

associated with greater exercise compliance in a number of other studies (Dishman, 1994;

Harris, 1978a, 1978b, 1983; Folsm, 1991; Heath, 1991; Dennison, 1988; Powell, 1987).

Furthermore, socioeconomic status and previous exercise history have been correlated in

the same studies as significant factors to exercise compliance. Exercise history in the

current study was also identified as significant in explaining variation in minutes of

exercise; specifically for each year of exercise history, respondents exercised an

additional seven minutes per week. Dennison (1988) and Powell (1987) have conducted

significant research on previous experience with exercise and its connection to later

exercise compliance. They found that exercise habits established early in life are a good

indicator for consistency of exercise throughout life. This appears to also hold true in the current study.

Education also significantly influenced exercise compliance in the current study. A total of sixty-eight percent of the participants had a college degree with twenty-six percent of them possessing at least some post-graduate education. The National Centers for Health Statistics and the National Endowment for the Arts (1990, 1992) have confirmed that a higher education level directly correlates with regularity of exercise. Higher income and education levels are the two most consistently identified predisposing factors studied in connection with exercise adherence (Harris, 1978,1979, 1983; NCHS, 1990; NEA, 1992). King, et al. (1988) found a positive connection between level of education and compliance to exercise, while income only had a modest relationship. Some studies have reported little or no relationship between education level and exercise adherence (Folsom, 1991), while others have documented that blue-collar workers are less likely to adhere to regular exercise compared to white-collar workers (King, 1988). Dishman (1994) observed that many blue-collar laborers, whose work is physically oriented, perceived that their job provided the appropriate quality and quantity of exercise for maintaining health levels even though this was often not the case. Additionally, in clinical settings, blue-collar occupation and socioeconomic status have been associated with poor adherence during and following completion of an exercise program (Oldridge, 1988). While the relationship between occupation and exercise compliance appears to be unclear, there does seem to be a tendency that most blue collar jobs are associated with lower levels of education which in turn, traditionally, reflect poorer exercise compliance.

The final similarity in this study compared to the literature dealt with support. Exercising with a partner and exercising in a group were both significant influences for

exercise compliance in the current study. An additional fifty-nine minutes more of exercise per week was attributed to those exercising with a partner. Exercise compliance diminished following the lifestyle change program due to the loss of group support. The importance of exercising in a group became clear with a reported sixty-three minutes less exercise per week for those who felt exercising in a group to be a priority. King (1992, 1998) discovered a similar preference to exercising in a group and that the group structure was among the leading influences on exercise adherence. This evidence highlights the importance of social support in the adoption and maintenance of exercise. King further suggests that this support can come from a variety of different sources. Family participation and support have been documented to be strong predictors of exercise compliance (King, 1998). Furthermore, King found that social support from friends did not increase exercise compliance, although staff support and instruction did. Additional confirmation of the value of support was reported by Oldridge (1984) and Dishman (1994) with increased participation of 10 % when family or peer support was introduced.

The findings of the current study revealed the variables' relevance as they relate to a new intervention, the lifestyle change program. The variables of time since program completion, post-graduate education, exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group were all found to have a significant influence on aerobic exercise compliance. While all of these variables have been previously reported they have not been studied relative to a lifestyle change program.

One new finding with this program type that varied from previous cited research had to do with income and education. Socioeconomic status has long been viewed as a benchmark for identifying the majority of those who exercise regularly. Harris, Louis &

Associates (1978,1979,1983), for example, reported that high income white, college-educated, young middle-aged adults make up the majority of regular exercisers. The subtle but highly significant difference in the current study is age. The participants of this study were an average of 66 years old, in addition to being well educated and in a high income category.

Finally, the significance of previous experience and exercise history has been reported in the literature as well as in this study. Unique to this study is the non-linear relationship between current levels of exercise and years of previous exercise as evidenced by the significance of the variables exercise history and exercise history squared. This indicates that as individuals age and have more years of exercise history behind them, their current minutes of exercise increase until a threshold level of exercise history is reached, and from that point on their current minutes of exercise begin to decrease. Using optimization theory, this threshold point was calculated as 26 years, the point at which the relationship between exercise history and minutes of exercise turns from positive to negative.

Policy Implications and Recommendations

The potential policy implications point to the implementation of an expanded Healing Hearts continuation program. There currently exists a continuation, "Alumni", program that is poorly attended by approximately 10 percent of past participants. The schedule and services are limited. Most importantly, exercise is not included in this program. The addition of group-oriented exercise would provide continued opportunities to maintain exercise compliance. This proposal is supported by the fact that exercising with a partner or in a group were identified as influential factors for continued exercise compliance. Additionally, the ability to immediately transition into the Alumni program

would reduce the risk of a decline in exercise compliance that is positively related to the elapsed time since program completion. Furthermore, the current Alumni program is limited to only two weekly meetings. Additional days and/or times of day could provide more opportunities for recent graduate and past participants to continue to exercise.

Furthermore, this study showed that the longer the participants were out of the program the less compliant they were. More immediate transition into the Alumni program could be facilitated if there were a dedicated employee for this function. A recommendation from the current study is to hire a qualified person to perform this and other related responsibilities. Additionally, with leadership the program could better utilize the very valuable resource of volunteers. The few current volunteers, past participants, lack direction and organizational support that a staff member in the leadership role would provide. A person in this leadership role could coordinate the expansion of volunteerism and thereby create more opportunities for exercise. These opportunities could include organized walks throughout the community, a resource guide of community events such as the American Heart Association Heart Walk, special events such as guest speakers, as well as social gatherings that would provide the much needed support previously cited. Someone in a leadership position could coordinate with other outside organizations such as hospital-based cardiac rehabilitation, adult fitness programs or community centers to organize activities. Furthermore, a dedicated staff person would have access to data base information to create a zip code support list for Alumni to identify potential exercise partners who live in their area. Additionally, phone call follow-up could be implemented to help maintain motivation through support. The addition of this proposed leadership component would not only provide greater opportunities for exercise, but also for all program components; stress management,

group support, cooking classes, etc. Greater participation in an expanded Alumni program would capture additional revenue.

A Final recommendation is to share the results of this study with current participants in the Scripps Ornish/Healing Hearts lifestyle change program, or for that matter, any other structured exercise program. By stressing the significance of some of the findings in this study, like the significance of exercising with a partner or in a group, current participants may find it easier to establish a support system for exercise compliance before completing their current program. Additionally, by sharing this information early enough on in the program, participants be able to establish an exercise regime that they can follow on their own, rather than feel the need for support from others.

Conclusions

Some of the influential factors contributing to aerobic exercise compliance following the Ornish/Healing Hearts lifestyle change program are clear. The significant factors identified in this study were; time since program completion, post-graduate education, exercising with a partner, years of exercise history, years of exercise history squared, and exercising in a group. These factors could be viewed as past and present influences. What is most striking about the results of this study is the significant influence exercise history plays on future exercise compliance. Those who had regular exercise habits in the past continue to have regular exercise habits. Additionally, exercising with a partner and/or in a group has strong ties to exercise compliance. Without this support exercise compliance declined. Marcus & Banspach (1992) found that attitudes, beliefs and past exercise history are essential to exercise compliance. This researcher concurs. If

these influential factors to exercise were not adopted at a younger age, it is unlikely they would be adopted later in life.

Since we cannot change the influence of past factors, it is this researchers' recommendation that efforts should concentrate on the factors that can influence present exercise habits. The Healing Heats program should focus energy on greater and more timely support to enhance aerobic exercise compliance. What can be changed is the amount and type of support the post-lifestyle change program participants receive. It appears as though exercise compliance could be positively influenced with a greater leadership component provided by additional staff, continuation programming that would emphasize group oriented classes, more outside resources, and extensive follow-up that would provide the necessary support component. In order to successfully influence current behaviors, there clearly appears to be a need for a more comprehensive Alumni continuation program for the Healing Hearts participants.

The proposed expanded Alumni program services are also applicable to other program structures. Cardiac rehabilitation programs suffer from the same type of compliance issues. Additionally, apparently healthy people show the same patterns of exercise compliance decline. Post-program, comprehensive, support oriented exercise could be a key to success for all populations.

Based on the findings of the current study it is recommended that future research investigate exercise compliance with the implementation of a more comprehensive post-program support structure. Furthermore, future research should include survey questions addressing the most common responses from this studies open ended survey question such as: the weather, psychological issues, priority, doctors recommendation, health concerns, travel, work conflicts, program structure, possible benefits, and support

systems. These factors could be influential to exercise compliance amongst other populations as well. This proposed research should be conducted on various types of exercise programs and populations. Exercise compliance is an issue whether it is in a private health club, personal training, or hospital cardiac rehab program. Additionally, both healthy and diseased populations struggle with many of the same barriers to exercise. The scope of future research should also include younger adults. Insight regarding influential factors at early stages in life could potentially improve future exercise compliance.

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APPENDIX A

COVER LETTER

April 10, 2002

Dear

It's been a while since I've seen you and _____ months since you completed the Ornish / Healing Hearts program. I think you may already know I have been pursuing my doctoral degree. I am in the dissertation phase of my program and need your help. I have enclosed a short survey regarding your exercise habits since you completed the program here.

Please take a moment now to fill in the few blanks "honestly" and put the survey in the stamped envelope and drop it in the mail by tomorrow.

Your assistance of completing this survey will allow me to realize a life long dream of attaining my doctoral degree. Your responses will also help the many exercisers who will follow by providing valuable information that will help them to overcome barriers or stay motivated and maintain their exercise habits.

The results of my study will be available in the summer and will be published in the Integrative Medicine newsletter, Visions.

Please accept my heart felt thank you in advance for your support with this enormous endeavor.

Be well,

Wayne

APPENDIX B
INFORMED CONSENT

DOCTORAL DISSERTATION:
Influential Factors Contributing To Exercise Compliance Following a
Structured Lifestyle Change Program

I understand the purpose of the study is to identify the key factors for compliance to exercise following a structured lifestyle change program.

I understand the information I provide by completing the survey can provide others with valuable information to assist them with their exercise compliance, thereby improving their quality of life.

I understand that the procedures of this study will be as follows:

- I will receive a survey in the mail which should be completed and returned within 2 weeks of receipt.

- I will receive two copies of this Consent Form. I will sign one and return it with my completed survey and retain the other copy for my records.

- The questions contained in the survey will pertain to my exercise habits.

- I am free not to answer any survey question.

- I can contact the researcher, Wayne Borin, during normal working hours to have any questions relating to this study answered. (858-554-3302) or borin.wayne@scrippshealth.org

- I can also contact the Administrative Director of Scripps Center for Integrative Medicine, Phyllis Mabbett, during normal working hours to have any questions relating to this study answered. (858-554-3300) or mabbett.Phyllis@scrippshealth.org

- There will be no expense or remuneration for my participation in this study.

- I understand that this is voluntary and I am free to stop my participation in this study at any time.

- I understand that my identity will be kept confidential.

I understand surveys must be returned and postmarked no later than April 24, 2002.
I understand the above explanations and give consent to my voluntary participation in this research.

_____   _____   _____
Name   Signature   Date

APPENDIX C

SURVEY

Exercise Compliance Questionnaire

Influential Factors Contributing To Exercise Compliance Following a
Structured Lifestyle Change Program

SECTION I – Average weekly compliance

Enter the number of minutes you exercise aerobically in a typical week.
(Examples of aerobic exercise include; walking, cycling, or swimming continuously at your
target heart rate.)

M	Tu	W	Th	F	Sa	Su	total

SECTION II

Please respond to the following questions by filling in the space before the answer which best
represents your status.

DEMOGRAPHICS

1.) Cohort #:   ____

2.) Gender: ____ F   ____ M

3.) Age: ____ yrs

4.) Approximate annual income: _____

5.) Do you exercise with a partner?   ____ yes   ____ no

6.) How long has it been since you completed
the Ornish/Healing Hearts program?   ____ yrs   ____ mos

7.) Is the distance you have to travel a determining
factor to whether or not you exercise?   ____ yes   ____ no

8.) Is cost a determining factor to whether or not
you exercise?   ____ yes   ____ no

9.) Did you have a procedure prior to beginning the Ornish/
Healing Hearts program? (Bypass, angioplasty, stent)

     ____ yes   ____ no

LIFESTYLE

10.) How many years has regular aerobic exercise
(20 –60 minutes, 3 – 5 days/week, continuos,
i.e., walking, swimming, cycling, etc.)
been part of your lifestyle? _____ years

11.)Are relatively immediate improvements in your health
a determining factor to exercise? _____ yes _____ no

SAFTEY

12.)Do you have greater piece of mind exercising
in a medical setting rather than out in the community? _____ yes _____ no

13.)Does the expertise of the exercise instructor
make you feel safer? _____ yes _____ no

14.)Do you have a greater sense of security exercising
in a group rather than alone? _____ yes _____ no

OTHER
15.)Other factors which influence my exercise compliance include _____

_____

_____

_____

APPENDIX D

SUPPLEMENTAL SURVEY QUESTIONS

1.) Select the income category that is most representative.
    a. less than $30,000   _____
    b. $30,000 – $49,000   _____
    c. $50,000 – $79,000   _____
    d. $80,000 – $100,000   _____
    e. $100,000 – 199,000   _____
    f. more than $200,000   _____

2.)   Select the highest level of education attained.
    a. 8th grade or less   _____
    b. some high school   _____
    c. high school graduate   _____
    d. some college   _____
    e. college graduate   _____
    f. any postgraduate work   _____

APPENDIX E

SUPPLEMENTAL CORRELATION MATRIX

Independent Variables	Dependant Variables		
	HsGrd	Age	Dist
r/p			
ColGrd		.01	
PstGrd		-.22**	
SafGrp	-.21**		
SafIns			.16*
Time			-.15*

*p<.05; **p<.01