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1970

Hall, Cortni K., An Analysis of Patient Health Outcomes in a Cardiac Rehabilitation Program. Master of Public Health, Epidemiology Track, December 2000, 48 pp., 11 tables, references, 30 titles.

This study analyzed the coronary risk factor and quality of life outcome results of 55 patients who participated in a 12 week, phase II cardiac rehabilitation program. Baseline and post cardiac rehabilitation data were analyzed.

There was an overall improvement of the coronary risk factor variables with significant improvements in functional capacity ($p=0.001$), diastolic blood pressure ($p=0.01$), total cholesterol ($p=0.017$), and LDL ($p=0.01$). Significant improvements in the quality of life variables included physical function ($p<0.01$), role-physical ($p<0.01$), body pain ($p<0.05$), vitality ($p<0.05$), and social ($p<0.05$).

There was also a significant finding of improved knowledge ($p<0.01$) after completion of phase II cardiac rehabilitation program.

AN ANALYSIS OF PATIENT HEALTH OUTCOMES

IN A CARDIAC REHABILITATION PROGRAM

Cortni K. Hall, B.S.

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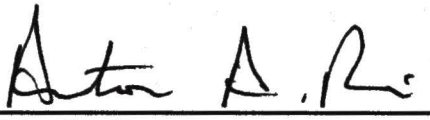

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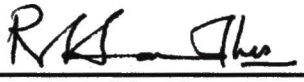

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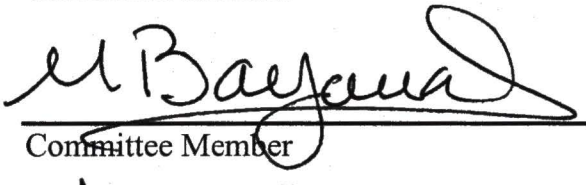

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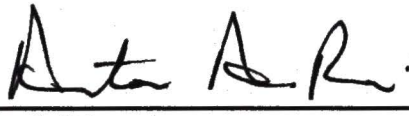

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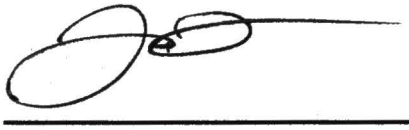

Dean, School of Public Health

AN ANALYSIS OF PATIENT HEALTH OUTCOMES IN A CARDIAC REHABILITATION PROGRAM

THESIS

Presented to the School of Public Health

University of North Texas Health Science Center at Fort Worth

in Partial Fulfillment of the Requirements

for the Degree of

Master of Public Health

By

Cortni K. Hall, B.S.

Fort Worth, Texas

December 2000

ACKNOWLEDGEMENTS

I would like to thank the following individual individuals and organizations for their support while conducting this study and upon completion of this thesis.

Dr. Antonio Rene, you provided me with constant guidance and support throughout this thesis process and my graduate studies as well as making available the opportunity to conduct this research. Dr. Raghbir Sandhu, you provided insight and direction in this research. Dr. Manuel Bayona, thank you for your willingness to participate on my committee. Dr. Alberto Coustasse, thank you for providing me with guidance and much needed advice on this research. I would like to thank Denise Colbert, David Wright, and the entire staff of the Life Beat Cardiac Rehabilitation Program for opening your facility to me and for your cooperation and assistance in this research.

I would also like to thank Raasaan Haralson for your support during my graduate studies. Most importantly, I would like to thank Mr. And Mrs. Howard Hall, Lakeisha Hall, Howard Hall Jr., Latonya Brown and Joshua Brown for your love, support, and guidance throughout this process. You have been and continue to be my inspiration to achieve all that I can in life.

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CHAPTER I

INTRODUCTION

Cardiovascular disease is currently the leading cause of death and disease in the United States. In 1997, cardiovascular disease accounted for 41.2% of all deaths (American Heart Association, 1999). It has also been estimated that approximately 59,700,000 Americans have some form of cardiovascular disease. Among cardiovascular diseases, coronary heart disease is the leading cause of death. In 1997, coronary heart disease caused 466,101 deaths, which represent over 51% of all cardiovascular disease deaths (Brownson, Remington, and Davis, 1998). The American Heart Association (1999) estimated that in 1997, over 2 million hospital admissions each year involve diagnoses of coronary heart disease and the costs associated with medical care, lost earnings, and lost productivity due to coronary heart disease was $90.9 billion. With such a large prevalence of cardiovascular disease in this country, cardiac rehabilitation continues to be a very useful and needed tool in the management of cardiovascular diseases, more specifically coronary heart disease.

Cardiac rehabilitation has been shown to improve both the clinical and the quality of life status in the patients who participate in this form of treatment. The objectives of cardiac rehabilitation include "secondary prevention of coronary diseases and improved physical, functional, and psychosocial status" (Morrin, Black, Reid, 2000). The proven

benefits include improvements in quality of life, exercise capacity, weight, glucose tolerance, lipid values, and psychosocial factors as well as reducing cardiac symptoms, mortality, cigarette smoking, and stress. However, in this era of cost containment, it is priority among advocates of rehabilitation to demonstrate which rehabilitative services are effective. Also, as the United States population ages, the prevalence of coronary heart disease will more than likely increase and with shorter hospital stays, the need for post hospitalization cardiac rehabilitation services will also increase (Bittner and Oberman, 1993). The analysis of patient health outcomes is an essential part of evaluating the benefit of cardiac rehabilitation on patients.

Healthcare decisions are made by estimates of the effect of interventions on health outcomes that are significant to that organization (Oldridge, 1997). Outcomes are now considered to be "major indicators of the quality of medical care and are particularly of interest in the evaluation of the medical effectiveness of cardiac rehabilitation, in which the treatment goal is improved function by limiting the severity and progression of disease are applied both to clinical decision making as well as policy decision making" (Oldridge, 1997). In the current health care environment and in the near future, services, such as cardiac rehabilitation, will require documentation and accountability for quality and cost of the program (American Association of Cardiovascular and Pulmonary Rehabilitation Outcomes Committee, 1995). This information will also play an important role in the future of cardiac rehabilitation because it is estimated by the year 2005, fifty-five percent of all cardiovascular procedures will be performed on an outpatient basis which means that cardiac rehabilitation programs will probably increase in number and

availability (American Association of Cardiovascular and Pulmonary Outcomes Committee, 1995). The best method of evaluating cardiac rehabilitation program is through analysis of patient health outcome results that may show patient improvement in the areas of behavior, clinical status, and overall health status.

This study will analyze the patient health and quality of life outcome results of the Life Beat Cardiac Rehabilitation Program located at the Osteopathic Medical Center of Texas in Fort Worth, Texas. The purpose of this study is to determine the effects of cardiac rehabilitation on patients by assessing the changes in coronary risk factors and health related quality of life before and after completion of the phase II component of cardiac rehabilitation. It is hypothesized that patients who were enrolled in this phase of cardiac rehabilitation will have significant improvements in their coronary risk factor variables. It is also hypothesized that the changes or improvements will differ across gender, race, age, and diagnosis. The specific aims of the study include 1) performing a demographic profile of the patients who participated in the program, 2) investigating the effects of cardiac rehabilitation on the coronary risk factor and quality of life variables by comparing baseline results with post phase II rehabilitation results, and 3) investigating the potential difference in change from base line to post phase II results for selected grouping variables after completing the cardiac rehabilitation program.

CHAPTER II

REVIEW OF LITERATURE

Overview of Cardiovascular Disease

Since the early decades of the twentieth century when the epidemic of coronary atherosclerosis first began to appear in the United States, cardiovascular disease has been the leading cause of death in this country, as well as contributing significantly to the disability of persons afflicted with its various clinical syndromes and accompanying symptomology (Ockene and Ockene, 1992). Despite the decrease in mortality from cardiovascular disease, it remains a major health concern. In 1997, the American Heart Association estimated that approximately 59,700,000 Americans have one or more types of cardiovascular disease. With this data, it is also estimated that 1 in 5 males and females have some form of cardiovascular disease and 1 in 3 men and 1 in 10 women can expect to develop some major cardiovascular disease before the age of 60 (American Heart Association, 1999). Cardiovascular disease claimed 953,110 lives in the United States in 1997 and was about 60% of total mention mortality, which means that of the more than 2,000,000 deaths from all causes, cardiovascular disease was listed as a primary or contributing cause on over 1,406,000 death certificates (American Heart Association, 1999). As far as the hospital impact of cardiovascular disease, it was estimated that in 1996, $26.1 billion in payments were made to Medicare beneficiaries

for hospital expenses due to cardiovascular problems and in 1997, there were 60,199,000 physician office visits and 4,481,000 hospital emergency room visits with a principal diagnosis of cardiovascular disease (American Heart Association, 1999). It clinically originates in atherosclerosis, which is a slowly progressive condition where the inner layers of the artery walls become thick, irregular, and harsh (Brownson, Remington, Davis, 1998). Of the various types of cardiovascular disease, heart disease and stroke are the most prevalent, significantly affecting individual and community mortality rates and the use of health care resources (Ockene and Ockene, 1992). The various manifestations of heart disease are rheumatic and hypertensive heart disease, diseases of the pulmonary circulation, heart failure, cardiomyopathies, and coronary heart disease or atherosclerotic heart disease.

Coronary heart disease is considered the major category of cardiovascular disease and is clinically manifest as stable angina pectoris, unstable angina pectoris, myocardial infarction, silent myocardial ischemia, and sudden death (Wenger et al., 1995). It is currently considered the single largest killer of American males and females. According to the American Heart Association (1999), it is estimated that this year 1,100,000 Americans will have a new or recurrent coronary attack (myocardial infarction or fatal coronary heart disease) and approximately 650,000 of these will be first attacks with 450,000 being recurrent attacks. Coronary heart disease encompasses several disorders that basically reduce the blood supply to the heart muscle and is the result of narrowing of the coronary arteries by atherosclerosis (Brownson, Remington, Davis, 1998). "Most major prospective epidemiologic investigations carried out in the United States over the

past several decades has shown a marked increase in the risk of coronary heart disease with increasing age" (Ockene and Ockene, 1992). It is estimated that 84.9% of people who die of coronary heart disease are age 65 and older. Even though nearly 55% of all acute myocardial infarctions occur in the Medicare age group, the Clinical Practice Guidelines for Cardiac Rehabilitation (1995) reports that about 5% of myocardial infarctions occur in people younger than age 40 and about 45% occur in people under the age of 65. In relationship to gender, coronary heart disease is still a major health concern for both men and women. Ockene and Ockene (1992) reported that in the United States, males typically exhibit higher age-specific incidence rates of coronary heart disease than women, however, after menopause, it becomes a major cause of morbidity and mortality among women beyond their fifties. In 1997, 50.9% (237,332) of all coronary heart disease deaths were male and 49.1% (228,769) were female. With regard to race, in 1987 black males had higher mortality than white males until the age of 60, after which whites had higher death rates (Ockene and Ockene, 1992). In 1997, with rates age-adjusted to the year 2000 standard, black males had a higher death rate (542.0) than white males (438.2) and black females had a higher rate (402.8) than white females (301.9) (American Heart Association, 1999). Stroke is a disease associated mostly with high blood pressure.

Overview of Cardiac Rehabilitation

Cardiac rehabilitation is used in the management of patients suffering from some form of cardiovascular disease (Morrin, Black, and Reid, 2000). Wenger et al. (1995)

used the U.S. Public Health Service's definition of cardiac rehabilitation which describes cardiac rehabilitation as services that are comprehensive, long term programs, involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling. These types of programs are designed to limit the physiologic and psychological effects of cardiac illness, reduce the risk for sudden death or reinfarction, control cardiac symptoms, stabilize or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients who 1) have had a myocardial infarction, 2) coronary bypass surgery, or 3) have chronic stable angina pectoris. The U.S. Department of Health and Human Services, Agency for Health Care Policy and Research characterizes cardiac rehabilitation as a comprehensive long-term service involving medical evaluation, prescribed exercise, cardiac risk factor modification, and education, counseling, and behavioral interventions (American Association of Cardiovascular and Pulmonary Rehabilitation, 1999). These two definitions cover the wide range of services and care provided by cardiac rehabilitation programs.

During the pass three decades, changes in the delivery of rehabilitative care for patients with coronary heart disease have reflected changes in the demography and characteristics of the coronary population, as well as changes in treatment strategies for coronary patients (Wenger et al., 1995). Over 40 years ago, cardiac rehabilitation began as a program based on a restorative care model (Mckool and Nelson, 1985). "Treatment for acute myocardial infarction usually included up to 6 weeks of bed rest which drastically reduced activity resulting in a decrease in cardiovascular functional capacity

because both deconditioning of the myocardium and skeletal muscle and loss of vasometer reflexes take place" (Squires et al., 1990). This period lasted until the late 1950's when detailed programs of physical activity for inpatients were formalized. By the 1960's with the proliferation of coronary care units and continuous electrocardiographic monitoring and the earlier mobilization of patients after acute myocardial infarction, rehabilitation was dominated by aerobic exercise training and included some vocational readjustment (Squires et al., 1990). In the 1970's "rehabilitation, including efforts at secondary prevention, gained widespread support as an integral component of comprehensive cardiology" (Squires et al., 1990). This brought about a more aggressive and structured approach to rehabilitation. Cardiac rehabilitation began to focus on the identification of specific risk factors associated with the development of coronary artery disease and how risk factor modification alters morbidity and mortality (Mckool and Nelson, 1985). According to the American Association of Cardiovascular and Pulmonary Rehabilitation (1999) rehabilitative care has recently been directed to the growing population of patients with heart failure. This can be attributed in part to the interest in rehabilitative care of patients following cardiac transplantation and in part to the major advances in the pharmacological therapy of heart failure in the 1980's and 1990's. "Rehabilitation is currently characterized by an earlier initiation of rehabilitative services, a lessened intensity and duration of professional surveillance, and an increased transition to independence in rehabilitative activities" (American Association of Cardiovascular and Pulmonary Rehabilitation, 1999).

Hare and Bunker (1999) acknowledge that cardiac rehabilitation programs differ in their emphasis on the specific areas they base their focus, supervision, and costs and funding. Cardiac rehabilitation programs complement usual medical care, and have been shown to provide benefits over and above usual medical care alone (Hare and Bunker, 1999). The overall goals and specific aims of cardiac rehabilitation are to "1) prevent deconditioning, enhance aerobic conditioning, and improve functional capacity in the cardiac patient; 2) diminish or eliminate established coronary risk factors in cardiac patients and those at risk for coronary artery disease; 3) educate patients and families regarding the causes of coronary heart disease and methods of preventing its progression; and 4) prevent psychologic debility in patients with acute and chronic cardiac disease" (McKool and Nelson, 1985). Reaching these goals involve "facilitating and shortening the period of physical recovery after an acute cardiac event, optimizing social and psychological recovery, promoting strategies for achieving mutually agreed goals of secondary prevention, and developing and maintaining skills for behavior change" (Hare and Bunker, 1999). According to Hare and Bunker (1999), the most common model used in the United States has been outpatient rehabilitation based primarily on aerobic training. The structure of cardiac rehabilitation programs takes into account the various stages of a patient's illness (Mckool and Nelson, 1985). There are four phases that represent these stages of illness. They are inpatient, immediate outpatient, intermediate outpatient, and maintenance outpatient. Phase I is inpatient care. It is characterized by controlled low-level exercise, patient and family education, group and individual counseling, and group discussion sessions. There are a number of objectives for this phase of rehabilitation.

They include "1) to prevent potential deleterious effects of prolonged bed rest, 2) to hasten adjustment to the hospital environment and the acute event, 3) to begin risk stratification, 4) to begin identification and modification of risk factors, 5) to facilitate return to physical activity and thereby reduce the feeling of invalidism, 6) to provide medical surveillance, and 7) to maintain neuromuscular relaxation" (Squires et al., 1990). It is usually started as soon as the patient's condition has stabilized after some type of surgical procedure. The physical activity of this phase involves following a standard written protocol, which calls for patients to complete a specific activity level or "step" each day. The exercise guidelines are similar for all patients and consist of low intensity and short duration (Squires et al., 1990). Patient education and some introduction to lifestyle changes are also included in this phase. These education classes serve as an introduction to the long-term program following discharge from the hospital (Fardy and Yanowitz, 1995). Education and counseling are also for the family and significant others. It has been shown that coronary risk factors may associated with overall family behaviors which can appear later on, therefore, the inclusion of not only the patient but family in education is important as well (Fardy and Yanowitz, 1995). The "short term benefits of phase I include reduction in impaired physical work capacity, reduced joint range of motion, improved psychologic status during convalescence, potential earlier return to previous activities and work, potential reduction in hospital stay, and increased patient sense of well-being" (Squires et al., 1990). While physical benefits may not be as obvious in phase I, the short and long-term behavior and attitudinal improvements may warrant more attention (Fardy and Yanowitz, 1995).

Phase II begins once the patient has been dismissed from the hospital and involves constant medical supervision (Squires et al., 1990). It is a supervised "outpatient program of individually prescribed exercise with continuous or intermittent electrocardiogram (ECG) monitoring that may be operated as a hospital-based program in which there is an exercise program based on individualized prescription of intensity, duration, frequency, and mode of active and patient education and lifestyle modification classes" (Fardy and Yanowitz, 1995). The objectives of phase II include 1) to enhance cardiovascular function, physical work capacity, strength, endurance, and flexibility, 2) to detect any ECG changes during the exercise programs, 3) to inform and educate patients about proper exercising techniques, 4) to work and educate the patients, family, and significant others in establishing healthy lifestyles, 5) to improve and enhance the psychosocial function and behavior of patients, 6) to prepare patients for a return to work and normal roles, and 7) to provide patients with a guide for long-term exercise (Fardy and Yanowitz, 1995). Their primary care physician, cardiologist, or surgeon generally refers patients to a phase II cardiac rehabilitation program. The components include an evaluation, exercise and education with lifestyle modification, research, and home programs.

The focus of the phase II program is regular aerobic exercise that is designed to improve muscular endurance and cardiovascular fitness (Fardy and Yanowitz, 1995). It usually involves three visits per week to the rehabilitation center for the exercise and education sessions (Squires et al., 1990). Before the exercise sessions start, an evaluation is administered to the patient that involves taking medical and lifestyle history,

a physical exam, laboratory and blood tests, physical fitness test, and an exercise stress test. The typical exercise class includes patient preparation, warm-up, exercise training, cool down, and relaxation. The patient preparation period involves preexercise instructions that are given to the patient prior to the first class as well as skin preparation, electrode placement, and the use of monitoring equipment. Before each session, the patient's body weight, resting heart rate, blood pressure, and ECG rhythm are taken also. The warm up period consists of number of stretches and exercises to the body prepared for exercise. Before the exercise training starts, patients are given their exercise prescription cards, which include information on their individual target heart rate, exercise workload, and the sequence of exercise modes that are to be completed for that session (Fardy and Yanowitz, 1995). "Aerobic activities such as treadmill walking and cycle ergometry (forms of exercise that are easily quantifiable and reproducible) constitute the core of the physical activity program" in phase II rehabilitation (Squires et al., 1990). Other areas of focus for this phase include flexibility exercises, arm ergometry, and muscle strengthening activities that involve some lightweight training (Squires et al., 1990). Some examples of the type of equipment used are bicycle egometers, arm ergometers, wall-pulleys, steps, arm cranks, rowing machines, and light weights (Fardy and Yanowitz, 1995). The patients spend approximately 5 to 10 minutes on each exercise with a 1-minute rest in between modes. The cool down is done in order to "maintain systemic blood flow at a level that doesn't increase myocardial oxygen demand which in turn enhances removal of metabolic by-products, hastens recovery, and reduces the possibility of muscle soreness after the exercise program" (Fardy and

Yanowitz, 1995). During this time, dietary counseling as well as lifestyle modification is important parts of the educational process. Depending on the patient's clinical profile, specific dietary guidelines for the proper total fat, saturated fat, cholesterol, sodium, and caloric intake are provided by a dietitian (Squires et al., 1990). The phase II program usually lasts 12 weeks. When patients near completion of the program, an exercise test is administered again in order to determine what part of the exercise prescription need to be updated and also to determine the patient's readiness to return to work and other activities (Squires et al., 1990). Once completion of phase II, the patient is then eligible for phase III.

Phase III is considered a part of the long- term cardiac rehabilitation. It lasts from 6 to 24 months following phase II and includes clinical supervision and ECG monitoring. Program objectives include 1) to improve exercise capacity of the patient, 2) to enable early return to work as well as other normal activities, and 3) continued risk factor modification and education (Squires et al., 1990). Other objective include to monitor heart rates, blood pressures, electrocardiograms, and signs or symptoms that are potential contraindications for exercise, to introduce new exercise activities, and to provide a smooth transition from the structured and monitored phase II program to the less monitored and supervised program (Fardy and Yanowitz, 1995). In this phase, patients are evaluated similar to phase II evaluation whereas the examinations include physical, physiologic, psychosocial, lifestyle, and risk factor measurements (Fardy and Yanowitz, 1995). From this evaluation, the patient is given another exercise prescription, which is similar to that of phase II also. There is still some type of monitoring and supervision but

it is limited. After physical fitness has been improved satisfactorily, maintenance becomes the next area of importance. Phase IV is an ongoing long-term program that goes beyond phase III and does not involve clinical supervision or ECG monitoring (Fardy and Yanowitz, 1995). It is considered the maintenance program in that its efforts are focused mainly on modifying risk factors and maintaining a routine program of physical activity (Squires et al., 1990). The goals of phase IV include continued improvement and maintenance of fitness, to provide the foundation for safe and effective home-based programs, to teach skills for self-monitoring and self-awareness, and to prevent recurrences and complications of coronary heart disease (Fardy and Yanowitz, 1995).

Benefits of Cardiac Rehabilitation

Many studies have shown the benefits of cardiac rehabilitation and exercise training programs on several groups and types of patients. They have been proven to reduce the risk of coronary heart disease and improve quality of life among patients following major cardiac events (Lavie and Milani, 1993). Bittner and Oberman (1993) stated, "although primary prevention studies of coronary heart disease have indicated that the decreased risk for a physically active person operated independently of other major risk factors, regular exercise can favorably modify major cardiovascular risk factors". According to the studies that have been done, the benefits include improvements in exercise capacity, weight, glucose tolerance, lipid values, and psychosocial factors as well as reduce subsequent hospitalization costs. They have also been shown to reduce

cardiovascular mortality and retard the progression and promote the reversal of coronary atherosclerosis (Allen and Redman, 1996).

Maines et al. (1997) analyzed the effects of cardiac rehabilitation on exercise capacity, coronary risk factors, behavior, and quality of life in a large cohort with known coronary artery disease. The data of 591 patients who completed a phase 2 cardiac rehabilitation programs at two institutions was reviewed and analyzed. The outpatient cardiac rehabilitation and exercise program lasted 12 weeks and consisted of 36 educational and exercise sessions. The mean age of this study population was 62 years and consisted of mostly male patients. There were statistically significant benefits of rehabilitation in exercise capacity (+33% improvement), body mass index (-1%), percentage of body fat (-6%), and triglycerides (-9%). There was a modest reduction in total cholesterol (-1.3%) and LDL cholesterol (-1.5%) as well as a marked improvement in HDL-cholesterol (+5%). Even though there were reductions shown in the total cholesterol and LDL-cholesterol, they were not statistically significant. There were also statistically significant improvements in all the factors of quality of life (total +14%). The results from this study suggested that coronary artery disease risk factors are significantly reduced as well as significant improvements in quality of life following a cardiac rehabilitation and exercise program.

Lavie and Milani have published many reports on the effects of cardiac rehabilitation on patients in the past decade. In one study by Lavie and Milani (1993) looked at the improvement in lipid values following cardiac rehabilitation and exercise training. 237 patients ranging in age 32 to 82 years from two institutions enrolled in

outpatient phase 2 cardiac rehabilitation and exercise programs were studied. 85% of the patients studied were men. Coronary risk factors improved after cardiac rehabilitation including the LDL cholesterol levels, HDL cholesterol levels, triglycerides, body mass index, percentage of body fat, and exercise capacity. They also found that those patients who had the worst baseline lipid values had the most improvements in lipid values following cardiac rehabilitation. Most studies that have been performed have focused mainly on men. Lavie and Milani (1995) also analyzed the effects of cardiac rehabilitation and exercise training on exercise capacity, coronary risk factors, behavioral characteristics, and quality of life in women. They found that women experienced significant improvements in exercise capacity and body fat distribution and there were improvements in BMI and lipid values but those were not statistically significant.

Significance of Cardiac Rehabilitation and Outcome Measurement

Pashkow (1996) defined outcomes as "those changes, either favorable or adverse, in the actual or potential health status of persons, groups, or communities that can be attributed to prior or concurrent care with health status as a measure of overall functional status and well-being." Through the many published studies to date, the benefits of cardiac rehabilitation on the decrease in symptoms, improvement of disease management, and enhanced quality of life , the positive outcomes resulting from this intervention have been recognized (Pashkow, 1996). All of the studies to date that have been done, have focused on care given in an allopathic medical institution. This area has not been researched in field of osteopathic medicine.

In today's competitive health care market the focus has shifted to acknowledge the need for outcome measurement (Barnason et al., 2000). In the near future, "rehabilitation outcome measurement systems most likely will be used to support or justify clinical decisions about length or stay or continued prescribed therapies" (Schurman, 1990). The growing interest in patient outcomes has centered on evidence of variation in health outcomes of care, resource use, and cost of care. "Cardiac rehabilitation professionals must continue to develop innovative means to deliver their services and to document what they are doing by using outcome assessment" (Froelicher and Myers, 2000).

CHAPTER III

METHODS

Description of Program and Study Population

The Life Beat Cardiac Rehabilitation Program is located at the Osteopathic Medical Center of Texas in Fort Worth, Texas. It is primarily a tertiary prevention and care program that is designed for men and women recovering from a heart attack, heart surgery or cardiovascular disease, however, it is also recommended for those patients at high risk of developing heart problems (Osteopathic Medical Center, 1998). More specifically, it provides rehabilitative services for patients aged 35 – 85 years, diagnosed with angina, myocardial infarction, coronary bypass, and angioplasty.

Patients are referred by a physician to the program prior to admission. Before entering the exercise program, patients take part in an evaluation that consists of a graded exercise test as prescribed, medical history, nursing assessment, lipid evaluation, SF-36 quality of life survey, body mass index, nutritional assessment, exercise assessment, risk factor evaluation, and patient education assessment (OMCT, 1999). Patients are re-evaluated at 6 weeks and 12 weeks and progress reports are then sent to the physician. The program consists of four basic phases of cardiac rehabilitation. Phase I is the rehabilitation for hospitalized patients, which includes patient and family education and patient exercise at approximately the 2-3 METs (metabolic equivalent) and begins in the

ICU/CCU and ends when the patient is discharged home (OMCT, 1999). Phase II is the early outpatient rehabilitation which begins post discharge from the hospital and last approximately 12 weeks or 36 sessions. It consists of patient and family education, individualized progressive exercise, and close monitoring by the nurses and exercise specialists with the aid of telemetry monitors (OMCT, 1999). Scheduled exercise classes meet for 1 ½ hour, 3 times a week, for a total of 12 weeks. The classes are structured and patients are required to exercise at assigned class times. The program is flexible allowing patients to exercise at convenient times (Osteopathic Medical Center, 1998).
Phase III is for those patients who have completed the 2nd phase and may last indefinitely. Educational lectures continue and an exercise program is prescribed and supervised by healthcare professionals, however, this phase is meant to encourage patients to continue healthy lifestyle choices and to become more independent (OMCT, 1999). Phase IV is a continuation of the 3rd phase and may refer to exercising regularly on a home program and visiting the program once per week or month with emphasis on adult fitness for lifelong wellness (OMCT, 1999).

The staff of the Life Beat Cardiac Rehabilitation Program consists of qualified allied healthcare personnel, acting upon the referring physician's individual treatment plan. All personnel must have current certification of the AHA Basic Cardiac Life Support (BCLS), and /or Advanced Cardiac Life Support (ACLS) to deliver direct patient care (OMCT, 1999).

In this retrospective study, data were examined from a cohort of patients who participated in the Life Beat Cardiac Rehabilitation Program between January 2000 and

September 2000. To be included in the study, patient had to have completed Phase II of the program and completed the baseline evaluation by September 30, 2000. Patients who participated in the program prior to January 2000 were excluded due to missing data. Data was obtained from the database maintained by the Cardiac Rehabilitation Program and the Quality Management Department at the Osteopathic Medical Center of Texas. No patient identifying information was recorded.

Description of Variables

Two main health outcome categories were analyzed: 1) the coronary risk factor variables and 2) the health related quality of life variables. The coronary risk factor variables included functional capacity, systolic blood pressure, diastolic blood pressure, weight, body mass index (BMI), total cholesterol, low density lipoproteins (LDL), high density lipoproteins (HDL), triglycerides, cholesterol ratio, heart rate, and ejection fraction. Functional capacity is an important tool in assessing a patients' psychological well-being and productivity (Fardy and Yanowitz, 1995). It is used to determine the type of physical activities the patients will be able to perform. In the program, functional capacity is measured in METS (metabolic equivalents). High blood pressure (hypertension) is considered a risk factor for cardiovascular disease, therefore it is monitored throughout the course of cardiac rehabilitation. A blood pressure of less than 140 over 90 is considered normal for adults and a blood pressure equal to or greater than 140 over 90 is considered high ("Blood Pressure", 2000). Weight is monitored because obesity is an important risk factor for cardiovascular disease. Body mass index (BMI)

has been shown to be related to risk of cardiovascular disease and therefore is monitored. It is calculated by dividing weight (kg) by height (m^2). Along with overall weight, it is also used to evaluate ideal body weight and obesity (Fardy and Yanowitz, 1995). Normal values for BMI are 21-25 for men and women. Total blood cholesterol is the most common measurement of cholesterol. Cholesterol is a substance present in cell membranes that travel in the blood in particles containing lipids and proteins (Williams et al. Eds., 1999). A desirable total cholesterol is less than 200 mg/dL. In this study we looked at two types of lipoproteins, LDL and HDL. LDL carries most of the cholesterol in the blood and is know as the "bad" cholesterol. Too much of LDL can lead to cholesterol buildup in the arteries. A desirable LDL is less than 100 mg/dL. HDL helps remove cholesterol from the blood and helps prevent fatty buildup and therefore is associated with a lowered risk of coronary artery disease (McFadden, 1999). An HDL of less than 35 mg/dL is considered low and therefore the goal is to raise the HDL levels in the blood. Cholesterol ratio is also a measurement used with blood cholesterol. It is obtained by dividing total cholesterol by HDL (American Heart Association [on-line], 2000). A desirable ratio is 3.5.

Quality of life variables were obtained from the Short Form-36 (SF-36), which is a 36 item self-administered questionnaire. This survey was developed from the Medical Outcomes Study (Ware and Sherbourne, 1992). It examines eight health concepts including physical function, role-physical, bodily pain, general health, vitality, social function, role-emotional, and mental health and are measured on a scale from 0 – 100. Other variables analyzed were race, age, gender, and ICD-9 code/diagnosis.

Description of Analysis Strategy

Statistical analyses were performed using SPSS version 10.0 for Windows. Standard descriptive statistics were calculated for the study population. Outcome variables were compared between baseline and 12 week completion of the program using paired t-tests. Analysis of variance (Repeated measure ANOVA) tests were used to determine effect and unpaired t-test was used to compare differences between ICD-9 code, surgical procedure, race, gender, and age. A p-value less than 0.05 was considered significant. Data are presented as means +/- standard deviations. All statistics procedures were performed as described in Using SPSS for Windows (2000).

CHAPTER IV

RESULTS

The characteristics of the patients that participated in the cardiac rehabilitation program are given in Table 1. There were a total of 55 patients that qualified to be a part of this study. Males constituted 58.2% whereas 41.8% were female. The mean age of the patients was 64.02±9.2 with 74.5% of the patients falling under the 70 years of age cutoff and 25.5% above it. Caucasians constituted 81.8% of the patient population, 10.9% were African-American, 3.6% were Hispanic, and 3.6% were classified as other. There was a mean pre-ejection fraction percentage of 55.6±16.3 and a post-ejection fraction percentage of 55.9±16.9. Ejection fraction is the amount of blood pumped out of the heart with each beat. A normal ejection fraction is 60%, however patients following some major cardiac event, such as heart attack, may experience a low ejection fraction percentage. 45.4% of the patient population was cardiac surgery procedures (CABG (32.7%), PTCA (9.1%), and Valve Surgery (3.6%)) and 54.5% were non-surgical (Myocardial Infarction (14.5%) and Stable Angina (40.0%)).

TABLE 1. Patient Characteristics

VARIABLE	n(%)	Mean±SD
Gender		
Male	32(58.2)	...
Female	23(41.8)	...
Age		64.02±9.2
< 70 yrs.	41(74.5)	...
≥ 70 yrs.	14(25.5)	...
Race		
Caucasian	45(81.8)	...
African-American	6(10.9)	...
Hispanic	2(3.6)	...
Other	2(3.6)	...
Diagnosis		
CABG	18(32.7)	...
Myocardial Infarction	8(14.5)	...
PTCA	5(9.1)	...
Stable Angina	22(40.0)	...
Valve Surgery	2(3.6)	...
Ejection Fraction		
Baseline	...	55.6±16.3
Post-Cardiac Rehabilitation	...	55.9±16.9

Coronary Risk Factor Variables

Table 2 shows the coronary risk factor variables at baseline and post-phase II cardiac rehabilitation. Over the 12-week period, there were improvements in most of the variables, with the exception of body mass index (BMI) and HDL cholesterol. However, not all were significant. There were significant improvements in functional capacity (+48.5%, $p<0.001$), diastolic blood pressure (-5.6%, $p=0.011$), total cholesterol (-9.9%, $p=0.017$), and LDL cholesterol (-13.4%, $p=0.010$). There were also improvements in systolic blood pressure (-3.1%, $p=0.129$), weight (-0.5%, $p=0.450$), total cholesterol ratio (-7.6%, $p=0.052$), and heart rate (-0.8%, $p=0.751$), but these were not statistically significant.

Table 3 shows the effects of phase II cardiac rehabilitation on coronary risk factor variables in gender. Males showed significant improvements in functional capacity ($p<0.01$), systolic blood pressure ($p<0.05$), diastolic blood pressure ($p<0.05$), total cholesterol ($p<0.01$), LDL ($p<0.01$), and cholesterol ratio ($p<0.05$). Weight, BMI, and HDL all increased and were non-significant. Females experienced improvements in all areas except for systolic blood pressure (1.5 ± 20.2). However, there were only significant improvements in functional capacity ($p<0.01$) and significant reductions in weight and BMI (both $p<0.01$). There was only a significant difference among females and males with weight and BMI (both $p<0.01$). In Table 4, race was separated into 2 groups, Caucasians and Non-Caucasians (African-Americans, Hispanics, others). Caucasians showed significant improvements in functional capacity ($p<0.01$), total cholesterol ($p<0.05$), and LDL ($p<0.05$). Non-Caucasians showed significant improvements in

TABLE 2. Coronary Risk Factor Variables at Baseline and Post-Cardiac Rehabilitation (Phase II)

Variables	Baseline (Mean±SD)	Post-CR (Mean±SD)	%Change	p-value
Functional Capacity(METS)	2.72±.6	4.04±1.21	+48.5	<0.001
Systolic Blood Pressure(mm HG)	127.5±18.1	123.5±15.6	-3.1	0.129
Diastolic Blood Pressure(mm HG)	73.6±11.7	69.5±9.8	-5.6	0.011
Weight (lbs.)	193.8±45.0	192.9±45.1	-0.5	0.450
BMI (kg/m^2)	29.9±6.2	29.6±5.9	-1.0	0.273
Total Cholesterol (mg/dL)	181.2±51.2	163.2±35.7	-9.9	0.017
LDL (mg/dL)	101.5±40.0	87.9±26.6	-13.4	0.010
HDL (mg/dL)	43.2±10.5	43.2±10.8	-1.0	0.965
Triglycerides (mg/dL)	204±116.2	186.6±118.7	-8.5	0.265
Total Cholesterol Ratio (chol/HDL)	4.35±1.39	4.02±1.33	-7.6	0.052
Heart Rate (bpm)	77.3±18.7	76.7±14.7	-0.8	0.751

Table 3. Effect of 12-week Phase II Cardiac Rehabilitation on Coronary Risk Factor Variables in Gender

Variable	Males Pre/Post Change	P<*	Females Pre/Post Change	P<*	P<**
Functional Capacity (METS)	1.4±.0.7	0.01	1.2±1.3	0.01	NS
Systolic Blood Pressure (mm HG)	-7.9±17.7	0.05	1.5±20.2	NS	NS
Diastolic Blood Pressure (mm HG)	-4.9±11.2	0.05	-2.8±11.9	NS	NS
Weight (lbs.)	1.9±7.5	NS	-4.6±7.4	0.01	0.01
BMI (kg/m^2)	0.3±1.5	NS	-1.1±1.6	0.01	0.01
Total Cholesterol (mg/dL)	-23.9±44.3	0.01	-8.5±59.3	NS	NS
LDL (mg/dL)	-19.1±32.9	0.01	-4.2±33.1	NS	NS
HDL (mg/dL)	-1.1±6.1	NS	1.6±6.8	NS	NS
Triglycerides (mg/dL)	-26.2±104	NS	-3.4±114.1	NS	NS
Cholesterol Ratio (chol/HDL)	-0.4±1.1	0.05	-0.2±1.3	NS	NS
Heart Rate (bpm)	-0.6±12.8	NS	-0.5±14.8	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated-measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

Table 4. Effect of 12-week Phase II Cardiac Rehabilitation on Coronary Risk Factor Variables in Race

Variable	Caucasians Pre/Post Change	P<*	Non-Caucasians Pre/Post Change	P<*	P<**
Functional Capacity (METS)	1.3±0.9	0.01	1.4±1.4	0.01	NS
Systolic Blood Pressure (mm HG)	-1.0±17.1	NS	-17.4±23.2	0.05	NS
Diastolic Blood Pressure (mm HG)	-2.5±11.4	NS	-10.8±9.1	0.01	0.05
Weight (lbs.)	-0.24±7.9	NS	-3.5±8.6	NS	NS
BMI (kg/m^2)	-0.16±1.3	NS	-0.70±2.9	NS	NS
Total Cholesterol (mg/dL)	-15.7±45.7	0.05	-28.0±71.1	NS	NS
LDL (mg/dL)	-12.7±33.4	0.05	-17.4±35.5	NS	NS
HDL (mg/dL)	-0.13±5.7	NS	0.33±9.7	NS	NS
Triglycerides (mg/dL)	-23.9±113.1	NS	11.8±77.8	NS	NS
Cholesterol Ratio (chol/HDL)	-0.31±1.1	NS	-0.42±1.5	NS	NS
Heart Rate (bpm)	0.33±13.5	NS	-4.7±13.8	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated-measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

functional capacity ($p<0.01$), systolic blood pressure ($p<0.05$), and diastolic blood pressure ($p<0.01$). The only significant difference between the two groups was diastolic blood pressure ($p<0.05$). Non-Caucasians experienced a larger reduction in diastolic blood pressure (-10.8±9.1) than Caucasians (-2.5±11.4).

Patients aged less than 70 years showed improvements in all variables except for HDL (-1.2±6.7) (Table 5). There were significant improvements in functional capacity ($p<0.01$), systolic blood pressure ($p<0.01$), diastolic blood pressure ($p<0.01$), total cholesterol ($p<0.05$), and LDL ($p<0.01$). For patients 70 years and older, there were increases in systolic blood pressure (8.9±16.4), diastolic blood pressure (1.1±9.5), and heart rate (3.8±14.9), all non-significant. However, significant improvements include functional capacity ($p<0.01$), HDL ($p<0.01$), and triglycerides ($p<0.05$). There were significant differences between the two age groups in systolic blood pressure ($p<0.01$), diastolic blood pressure ($p<0.05$), and HDL ($p<0.01$).

In Table 6, non-surgical pre-cardiac rehabilitation diagnosed patients experienced improvements in all variables but significance was only shown for total cholesterol ($p<0.05$), LDL ($p<0.05$), and cholesterol ratio ($p<0.05$). Surgical diagnosis patients only showed significant improvements in systolic blood pressure ($p<0.05$). However, non-significant, there was a reduction in HDL (-1.4±5.8) and increases in triglycerides (3.5±124.1) and cholesterol ratio (1.4±1.2). the only significant difference between both groups was in heart rate ($p<0.05$). Non-surgical diagnosis showed an increase (2.7±11.6) and surgical diagnosis showed a reduction (-4.5±14.9).

Table 5. Effect of 12-week Phase II Cardiac Rehabilitation on Coronary Risk Factor Variables in Age

Variable	<70 yrs. Pre/Post Change	P<*	≥70 yrs. Pre/Post Change	P<*	P<**
Functional Capacity (METS)	1.4±1.1	0.01	0.99±0.51	0.01	NS
Systolic Blood Pressure (mm HG)	-8.4±18.2	0.01	8.9±16.4	NS	0.01
Diastolic Blood Pressure (mm HG)	-5.8±11.6	0.01	1.1±9.5	NS	0.05
Weight (lbs.)	-0.54±8.2	NS	-1.7±7.9	NS	NS
BMI (kg/m^2)	-0.22±1.8	NS	-0.36±1.3	NS	NS
Total Cholesterol (mg/dL)	-21.8±54.7	0.05	-4.5±31.4	NS	NS
LDL (mg/dL)	-16.4±34.3	0.01	-3.3±29.5	NS	NS
HDL (mg/dL)	-1.2±6.7	NS	4.0±3.2	0.01	0.01
Triglycerides (mg/dL)	-14.5±121.5	NS	-27.2±31.0	0.05	NS
Cholesterol Ratio (chol/HDL)	-0.29±1.3	NS	-0.45±0.77	NS	NS
Heart Rate (bpm)	-2.1±12.9	NS	3.8±14.9	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated-measures ANOVA was used to determine the effect.
**The unpaired t-test was used to determine difference among groups.

Table 6. Effect of 12-week Phase II Cardiac Rehabilitation on Coronary Risk Factor Variables in Diagnosis

Variable	Non-Surgical Pre/Post Change	P<*	Surgical Pre/Post Change	P<*	P<**
Functional Capacity (METS)	1.2±1.1	NS	1.5±0.9	NS	NS
Systolic Blood Pressure (mm HG)	-3.5±17.2	NS	-4.6±21.7	0.05	NS
Diastolic Blood Pressure (mm HG)	-2.7±11.2	NS	-5.6±11.8	NS	NS
Weight (lbs.)	-1.0±9.6	NS	-0.60±6.0	NS	NS
BMI (kg/m^2)	-0.35±1.9	NS	-0.14±1.4	NS	NS
Total Cholesterol (mg/dL)	-25.5±53.3	0.05	-6.9±45.7	NS	NS
LDL (mg/dL)	-15.4±34.3	0.05	-10.3±32.6	NS	NS
HDL (mg/dL)	0.90±6.8	NS	-1.4±5.8	NS	NS
Triglycerides (mg/dL)	-31.8±94.4	NS	3.5±124.1	NS	NS
Cholesterol Ratio (chol/HDL)	-0.56±1.1	0.05	1.4±1.2	NS	NS
Heart Rate (bpm)	2.7±11.6	NS	-4.5±14.9	NS	0.05

NS: not significant.
Values are means change± standard deviation.
*The Repeated-measures ANOVA was used to determine the effect.
**The unpaired t-test was used to determine difference among groups.

Quality of Life Variables

For the health-related quality of life variables (SF-36), there was improvement in all health concepts (Table 7). There were significant improvements in physical function (+21.9%, p=0.006), physical role (+83.6%, p=0.003), body pain (+10.9%, p=0.034), vitality (+10.0%, p=0.016), social (+14.8%, p=0.038), and overall knowledge (+9.1%, p<0.01). Health (+0.3%, p=0.937), emotion (+12.3%, p=0.329), and mental (+4.6%, p=0.165) were not statistically significant.

TABLE 7. SF-36 Variables at Baseline and Post-Cardiac Rehabilitation (Phase II)

Variable	Baseline (Mean±SD)	Post-CR (Mean±SD)	%Change	p-value
Physical Function	53.9±28.3	65.7±25.9	+21.9	0.006
Physical	25.0±37.4	45.9±40.4	+83.6	0.003
Body Pain	56.6±22.9	62.8±24.3	+10.9	0.034
Health	57.7±20.3	57.9±22.1	+0.3	0.937
Vitality	49.9±22.0	54.9±18.8	+10.0	0.016
Social	62.8±26.5	72.1±23.6	+14.8	0.038
Emotion	50.4±45.1	56.6±41.5	+12.3	0.329
Mental	71.9±18.7	75.2±15.5	+4.6	0.165
Knowledge	85.8±13.6	93.6±8.0	+9.1	<0.001

Males showed improvements in the quality of life variables except for health (-0.63±11.9) and emotion (-2.5±3.4.5) (Table 8). There was a significant increase in knowledge ($p<0.01$). None of the other variables showed significance. Females experienced improvements in all areas with significance in physical function, role-physical, social function, and body pain (all $p<0.05$). There was no significant difference between males and females.

In Table 9, Caucasians experienced improvements in all areas with significance in physical function ($p<0.05$), role-physical ($p<0.01$), body pain ($p<0.05$), and social ($p<0.05$). There was also a significant increase in knowledge ($p<0.01$). Non-Caucasians experienced reductions in role-physical (-2.8±26.4), health (-3.1±12.5), and social function (-1.4±33.9). Even though there were improvements, none were significant. There was no significant difference between Caucasians and Non-Caucasians.

In patients aged less than 70 years (Table 10), there was improvement in all variables with significance in physical function ($p<0.05$), role-physical ($p<0.01$), and vitality ($p<0.01$). There was also a significant improvement in knowledge ($p<0.01$). Patients 70 years and older experienced reductions in health (-6.7±18.5) and emotion (-2.9±17.9). The only significant improvement was in physical function ($p<0.05$). There was no significant difference between the age groups.

Table 11 shows that patients with Non-Surgical pre-cardiac rehabilitation diagnosis showed improvements in all areas except for health (-1.8±15.2). There was no significance shown in the quality of life variables, but there was a significant improvement in knowledge ($p<0.05$). Surgical pre-cardiac rehabilitation diagnosed

Table 8. Effect of 12-week Phase II Cardiac Rehabilitation on Quality of Life (SF-36) and Knowledge Variables in Gender

Variable	Males Pre/Post Change	P<*	Females Pre/Post Change	P<*	P<**
Physical Function	9.3±26.0	NS	15.9±27.5	0.05	NS
Physical	18.5±48.8	NS	25.0±36.5	0.05	NS
Body Pain	3.6±17.9	NS	10.7±19.7	0.05	NS
Health	-0.63±11.9	NS	1.6±20.1	NS	NS
Vitality	3.9±12.0	NS	6.9±14.9	NS	NS
Social	5.5±28.5	NS	15.6±28.3	0.05	NS
Emotion	-2.5±34.5	NS	20.8±48.5	NS	NS
Mental	1.3±15.3	NS	6.5±14.7	NS	NS
Knowledge	8.0±10.8	0.01	7.3±14.7	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated Measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

Table 9. Effect of 12-week Phase II Cardiac Rehabilitation on Quality of Life (SF-36) and Knowledge Variables in Race

Variable	Caucasians Pre/Post Change	P<*	Non-Caucasians Pre/Post Change	P<*	P<**
Physical Function	10.3±27.4	0.05	17.2±23.1	NS	NS
Physical	27.2±46.2	0.01	-2.8±26.4	NS	0.05
Body Pain	7.5±18.7	0.05	1.6±19.0	NS	NS
Health	1.1±15.9	NS	-3.1±12.5	NS	NS
Vitality	4.6±13.1	NS	6.7±13.7	NS	NS
Social	12.1±26.8	0.05	-1.4±33.9	NS	NS
Emotion	5.9±37.1	NS	7.4±57.2	NS	NS
Mental	1.2±13.4	NS	11.1±19.4	NS	NS
Knowledge	7.0±11.7	0.01	10.6±13.2	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated Measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

Table 10. Effect of 12-week Cardiac Rehabilitation on Quality of Life (SF-36) and Knowledge Variables in Age

Variable	<70 yrs. Pre/Post Change	P<*	≥70 yrs. Pre/Post Change	P<*	P<**
Physical Function	11.9±29.8	0.05	11.4±13.4	0.05	NS
Physical	24.2±49.4	0.01	11.4±23.4	NS	NS
Body Pain	3.9±18.1	NS	13.1±19.6	NS	NS
Health	2.6±13.5	NS	-6.7±18.5	NS	NS
Vitality	6.6±13.4	0.01	0.45±11.5	NS	NS
Social	8.6±29	NS	11.3±28.3	NS	NS
Emotion	9.4±46.6	NS	-2.9±17.9	NS	NS
Mental	3.6±17.1	NS	2.2±7.5	NS	NS
Knowledge	7.9±11.8	0.01	7.3±13.2	NS	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated Measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

Table 11. Effect of 12-week Cardiac Rehabilitation on Quality of Life (SF-36) and Knowledge Variables in Diagnosis

Variable	Non-Surgical Pre/Post Change	P<*	Surgical Pre/Post Change	P<*	P<**
Physical Function	5.2±17.9	NS	20.8±33.5	0.05	NS
Physical	10.0±38.2	NS	36.1±48.7	0.01	NS
Body Pain	0.96±16.8	NS	13.6±19.1	0.01	0.05
Health	-1.8±15.2	NS	2.9±15.3	NS	NS
Vitality	1.0±10.3	NS	10.6±14.7	0.01	0.05
Social	1.9±24.7	NS	19.4±30.9	0.05	0.05
Emotion	6.7±37.2	NS	5.6±47.5	NS	NS
Mental	3.7±9.7	NS	2.7±20.8	NS	NS
Knowledge	7.5±12.5	0.05	8.1±11.7	0.01	NS

NS: not significant.
Values are means change± standard deviation.
*The Repeated Measures ANOVA was used to determine effect.
**The unpaired t-test was used to determine difference among groups.

patients experienced improvements in all areas with significance in physical function ($p<0.05$), role-physical ($p<0.01$), body pain ($p<0.01$), vitality ($p<0.01$), and social function ($p<0.05$). There was also a significant improvement in knowledge ($p<0.01$). Significant differences were shown for body pain ($p<0.05$), vitality ($p<0.05$), and social function ($p<0.05$) between non-surgical and surgical diagnosed patients.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The general makeup of the study population was similar to that of other studies with the exception of the size of the sample. It was majority Caucasian, consisting of mostly male patients and mostly patients aged less than 70 years. The population consisted mostly of patients with a pre-cardiac rehabilitation diagnosis of stable angina and CABG (coronary artery bypass graft).

Results from this analysis suggest that overall, the coronary risk factor variables and quality of life variables experienced reduction after completion of phase II cardiac rehabilitation. However, not all variables were found to be statistically significant. Previous studies have shown significant improvements in coronary risk factor and quality of life variables after completing a cardiac rehabilitation, including improvements in blood pressure, total cholesterol, triglycerides, LDL, HDL, BMI, as well as quality of life variables (Bittner, 1993; Lavie, 1994, 1995, 1996; Maines, 1997). This study showed significant improvements in functional capacity, diastolic blood pressure, total cholesterol, and LDL. Improvements in systolic blood pressure, weight, BMI, triglycerides, cholesterol ratio, and heart rate occurred but were not statistically significant. Improvements were also found in physical function, role-physical, body pain, vitality, social function, and knowledge. There were overall improvements in health, emotion, and mental but were not statistically significant.

Functional Capacity

Cardiac rehabilitation has been shown to improve exercise and functional capacity in patients (Maines et al., 1997). This study also showed a marked improvement on functional capacity with patients experiencing a 48.5% improvement between baseline and post-phase II cardiac rehabilitation. The margin of improvement between the gender, race, age, and diagnosis groups analyzed were similar, showing no major differences among the groups.

Blood Pressure

Hypertension or high blood pressure is considered a risk factor for cardiovascular disease; therefore, the reduction of blood pressure is considered a major goal in the rehabilitation and treatment of patients following a major cardiac event (Ades and Coello, 2000). In this study, overall, there was a reduction of –3.1% in systolic blood pressure and of –5.6% in diastolic blood pressure with the latter being statistically significant. These reductions following phase II cardiac rehabilitation are encouraging in suggesting the benefit of exercise training and education on blood pressure. There were major differences between males and females with females experiencing an increase in systolic blood pressure although not significant. Patients 70 years and older also experienced an increase in systolic blood pressure.

Lipids

Previous studies have shown moderate improvements in total cholesterol, LDL, HDL, and triglycerides following cardiac rehabilitation (Ades and Coello, 2000). This study showed overall improvements in total cholesterol, LDL, and cholesterol ratio. There was a reduction in HDL of –1%. With respect to gender, there were major differences between males and females although not significant. For instance, in general, males experienced a greater amount of reduction than females. Females, however, showed improvement in HDL levels. Non-Caucasians experienced greater reductions in the lipid values than Caucasians with the exception of HDL and triglycerides. The lipid values were similar between the two age groups with the exception of the increase in HDL for patients 70 years and older. Although there were no significant differences between Non-surgical and surgical diagnosis, the overall pre/post change differed greatly in total cholesterol and triglyceride levels. Regarding these many differences in lipid profiles although most non-significant, the compliance of dietary modification may factor into the results. However, this study did not look at the impact of dietary and nutritional modifications along with cardiac rehabilitation.

Body Weight and Body Mass Index

Obesity is considered a risk factor for cardiovascular disease. A reduction in weight has been "associated with favorable alterations in blood pressure levels, lipid levels, and clotting abnormalities" (Ades and Coello, 2000). Although this study showed improvements in weight and BMI, neither was statistically significant. Previous

research has shown that significant weight loss does not occur necessarily as a result of cardiac rehabilitation (Ades and Coello, 2000). There were, however, significant differences between females and males in the area of weight and BMI. There was a significant reduction in weight and BMI in females, which is an important improvement since obesity is related to cardiovascular disease events in women (Lavie and Milani, 1995). There were no significant differences between Caucasians and Non-Caucasians, as well as among the age groups and pre-cardiac rehabilitation diagnosis.

Quality of Life

There have been numerous studies of quality of life in patients with cardiovascular disease. These studies have shown improvements in quality of life following a program of exercise-based rehabilitation (Ades and Coello, 2000). This study showed an overall improvement in the quality of life variables after completion of phase II cardiac rehabilitation. Like Lavie and Milani (1995), females showed significant improvements in physical function, role-physical, body pain, and social. Also very interesting are the reductions in some of the variables with respect to some groups. For example, Non-Caucasians experienced a reduction in role –physical, health, and social function. Patients 70 years and older experienced reductions in health and emotion and Non-surgical diagnosed patients experienced a reduction in health as well.

Limitations

Several limitations of this study should be noted. Selection and referral bias since the population consisted of patients who had some type of cardiac event and completed phase II cardiac rehabilitation. This sample however was not representative of all cardiac events. The study design was retrospective and non-randomized and was performed for a short period of time with no long-term follow up examined as well. Because of the small sample size, the precision of this study may be low and the presence of random error. This study also did not involve a control group. This study did not look at other risk factors, such as smoking, and other variables, such as medications, in relation to overall effect of cardiac rehabilitation on the patients in this sample. There was also no information obtained on the compliance of dietary and behavioral modifications with respect to the effect of cardiac rehabilitation.

Conclusions and Future Research

Despite the limitations, this data and results support the beneficial effects of cardiac rehabilitation on the patients following major cardiovascular disease events. The hypothesis that patients who were enrolled in this phase of cardiac rehabilitation would have significant improvements in the coronary risk factor variables and quality of life variables can be accepted. However, not all the variables were statistically significant, there was marked improvement. The hypothesis that there were significant differences among gender, race, age, and diagnosis can not be totally accepted. This study showed

mostly non-significant findings for the coronary risk factor and quality of life variables when compared among the different groups.

For future study, it is recommended that a larger sample and a control group be utilized to better understand the effect of cardiac rehabilitation in coronary populations. Despite the declining trends of cardiovascular disease in populations, it continues to be one of the leading causes of death in this society. Fardy and Yanowitz (1995) state, "a lifetime commitment to healthful living, including regular physical activity, is the ultimate goal of cardiac rehabilitation". Cardiac rehabilitation programs are needed in order to further enhance the secondary prevention of cardiovascular disease and to improve on the quality of life.

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