A STUDY OF DROPOUT PATIENTS FROM A SUPERVISED CARDIAC EXERCISE PROGRAM: MORBIDITY, MORTALITY, AND LEVELS OF ACTIVITY

by

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My prayers of thanks to Charissa and Cally whose entry into life has led me on the most glorious path of life.

mom/C.E.M

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INTRODUCTION

Cumulative literature indicates that dynamic conditioning exercises and training programs increase the functional aerobic capacity of healthy sedentary adults. Less strenuous programs enhance the rehabilitation of patients with coronary artery disease (CAD). However, the quantity of functional improvement depends upon individual motivation and interest as well as compliance to a conditioning program for months and years. Unfortunately, the primary limitation to optimal physical conditioning is the noncompliance of most patients over a period of several months. In addition, noncompliance (the "dropout" phenomenon) introduces a significant bias in studies attempting to evaluate the long-term effects of cardiac rehabilitation programs.

A review of the current medical and nursing literature revealed a lack of follow-up documentation on the morbidity and mortality of the group of patients who have dropped out of an exercise program. A scarcity of data exists regarding the continued compliance with an exercise regimen without medical supervision. This lack of information led the investigator to follow-up the "dropout" patients from a medically supervised exercise program. The purpose of this study was to answer the following questions: What was the morbidity and/or mortality status of persons who dropped out of the medically supervised

cardiac exercise program? What percentage of persons who dropped continued to engage in an exercise conditioning program independently? What is the relationship between continued exercise and cardiac morbidity in the patients who dropped out of the supervised exercise program?

Review of the Literature

In the following review of the literature three central concepts are briefly reviewed. First, information pertaining to exercise, fitness and heart disease is presented. Secondly, a review of several cardiac rehabilitation exercise programs emphasizing program characteristics, length of study, type of study, population, reports on results and follow-up of dropout patients is undertaken. Thirdly, the area of compliance is reviewed highlighting the complexity of the problem and the importance of compliance in exercise. These areas were selected to demonstrate the potential relationship between compliance with an exercise program and alterations in morbidity and risk factors in patients who dropped out of a medically supervised exercise program.

Exercise, Fitness and Heart Disease

The National Health Statistics (1977) reported 52.5% of all deaths were related to cardiovascular causes. Approximately 1 million Americans will have a myocardial infarction (MI) this year. Since 65% will die, this leaves 350,000 survivors and at least 175,000 in need of rehabilitation.

It has been firmly established that there are certain risk factors which predispose people to developing coronary artery disease. These

risk factors may be classified as alterable and unalterable and are summarized in Table 1. Based on epidemological studies, the American

Table 1

Risk Factors Which Predispose People to Coronary Artery Disease

Alterable	Unalterable
Weight	Hereditary
Diet	Environment
Smoking	Age
Hypertension	Sex
Hyperlipidemia	
Lack of Exercise	

Heart Association identified lack of exercise as a significant alterable risk factor in CAD (Kannel, 1968). Studies comparing physical activity versus both incidence and severity of CAD reveal them to be increased among less active individuals. In comparing job-related activity to the incidence of CAD four studies concluded that people employed in sedentary jobs had 2-4 times greater incidence of CAD than those in more active jobs (Brunner, 1966; Kannel, Sorlie, & McNamara, 1971; Morris, Heady, Raffle, Roberts, & Parks, 1953; Taylor, Klepetar, Keyes, Parlin, Blackborn & Pucnher, 1962). Other researchers in this area question the reliability of these results, citing lack of adequate controls. Morris (1973) intensely investigated leisure-time activity in healthy British male executives, controlling for job-related activity. From subjective responses, his results showed 2.86 times greater occurrence of CAD in the non-exercising group compared to those exercising during their leisure time. A recent excerpt

from a subcommittee on exercise and rehabilitation reported:

> Evidence indicates moderate and vigorous occupational leisure-time physical activity may protect against coronary artery disease and improve the likelihood of survival from a heart attack. Exercise training can increase cardiovascular functional capacity and decrease myocardial oxygen demand for any given level of physical activity in normal persons as well as selected cardiac patients. Regular physical activity is required to sustain the effects of training and may serve as an adjunct to reducing the risk factors of CAD such as cigarette smoking, hypertension, lipid abnormalitieis, obesity, and emotional stress. The potential risk of vigorous physical activity can be reduced by appropriate medical clearance, education, and guidance (Erb, Fletcher, & Sheffield, 1980).

Physical fitness is an observable and predictable benefit of exercise training. It is a state of body conditioning enabling a person to vigorously exercise without fatigue for an extended time period. It also allows an individual to respond to sudden physical and emotional demands with a modest heart rate and blood pressure elevation.

Assessment of a person's physical fitness is made from relationships between cardiovascular and work parameters. The physically fit (trained or conditioned) individual performs a given work load at a lower heart rate and lower systolic blood pressure than the unfit person (Åstrand, 1960). Åstrand demonstrated that the conditioned person has the ability to safely elevate his heart rate to higher levels than the unconditioned individual.

His investigations also demonstrated that the major limiting factor in determining the amount of work a person can perform is related to one's capacity to take in oxygen. Hence the determination of maximum oxygen uptake is one measurement of physical fitness. Furthermore, the maximum oxygen uptake per kg of body weight is

significantly higher in physically trained normal men compared to untrained men or untrained cardiac patients.

Additional research by Åstrand (1960) showed that physical training not only enhances the amount of work an individual performs at a given heart rate, but also affects the basic metabolic processes of the heart muscle. Given a specific work load, the heart of a physically fit person consumes less oxygen than does the heart of an unfit person.

Interestingly, only certain types of exercises when performed regularly promote cardiovascular fitness. Extensive research by Cooper (1970) with military personnel demonstrated the necessity for exercises to be aerobic for cardiovascular benefit. By his definition, aerobic refers to "a variety of exercises that stimulate heart and lung activity." These exercises include running, swimming, cycling, and jogging.

How much exercise is sufficient to result in cardiovascular fitness? The cardiovascular system determines the body's ability to utilize oxygen. The maximum amount of oxygen which can be utilized by the body is called the maximum oxygen uptake (Åstrand, 1960). The amount of exercise necessary to achieve cardiovascular fitness occurs above 50% of the maximum oxygen capacity. Because of the difficulty in measuring maximum oxygen capacity, Åstrand developed a nomogram with which the maximum oxygen capacity correlates closely to 70-85% of the maximum achievable heart rate. Maximum achievable heart rate can be determined either by a stress test or age-predicted heart rate charts.

Cooper's (1970) extensive research stressed the importance of overloading the cardiovascular system to produce a training effect. This training effect occurs when aerobic exercises are performed at a sustained intensity (60-85% of maximum heart rate) for a period of 20-30 minutes at least three times per week. Along with the cardiovascular training program, Cooper and others recommend a 5-10 minute warm-up period so that the heart is not suddenly taxed. It is also beneficial to muscles and joints in preventing soreness and injuries and promoting flexibility. A 5-10 minute cool-down period immediately following the conditioning period is also recommended. Abruptly ceasing a vigorous exercise program may trap blood in the muscles. This pooling of blood results in potential symptoms of dizziness, faintness, arrhythmias or nausea.

In recent years the question of exactly what physiological changes occur in the body with exercise has become a major concern in medical research. Effects of exercise on the body are shown in Table 2. Primary and secondary prevention of CAD through exercise is a popular conception.

Epidemiological studies support the preventative aspects of exercise in apparently healthy individuals. In a cross-sectional study of 3,000 men by Cooper (1970), treadmill performance was found to be inversely related to lipids, glucose, body weight, percent of body fat and systolic blood pressure. In a longitudinal study, men who had undergone a treadmill test before and after an elective exercise program were analyzed to determine changes in performance. Results showed that the men who reached the upper levels of improved

aerobic fitness demonstrated decreased lipids, diastolic blood pressure, serum glucose and weight. The conclusions from this study demonstrate that regular exercise with increased aerobic capacity decreases other risk factors (Cooper, 1970).

Table 2

Effects of Exercise on the Body

Increases	Decreases
Coronary vascularization	Serum lipid levels
Major vessel diameter	cholesterol & triglycerides
Peripheral blood flow	Glucose intolerance
Fibrinolytic activity	Absolute body fat
Red cell mass and blood volume	Arterial blood pressure
Growth hormone release	Heart rate
Tolerance of stress	Dysrhythmias
Feelings of self-worth	Catecholamine responses
Cardiac stroke volume	Anxiety & depression

In a study of Harvard Alumni, Paffenbarger, Wing, and Hyde (1978), found levels of exercise characteristic of the lifestyle of each individual. Results of this study of 36,000 men between 1916-1950 on exercise habits, morbidity and mortality supported the role of vigorous exercise in reducing the risk of heart attacks.

Conclusive evidence from epidemiological studies support the role of exercise in decreasing the incidence of CAD in normal subjects. Exercise, when performed regularly and of such intensity and duration to induce a training effect results in a decreased resting heart rate, blood pressure, and increased cardiac stroke volume. With the recognition of the benefits of regular exercise,

cardiac rehabilitation exercise programs emerged. Unfortunately, the results from the studies reveal conflicting data on the benefits from exercise in cardiac patients.

Cardiac Rehabilitation Exercise Programs

Medically supervised exercise programs have emerged for the gradual conditioning of persons with CAD. Results on the benefits of conditioning have been conflicting. Wilhelmsen, Sanne, and Elmfeldt (1975), in a group of non-selected patients suggest a decrease in morbidity and mortality for those who adhere to an exercise program. However, there have been no definitive studies documenting physiological effects on morbidity and mortality in the cardiac patient (Bruce, Kusmi, & Frederick, 1977). However, for the purpose of this study, the investigator supports the idea that exercise is beneficial to renewed good health and improved quality of life. Of added importance is the continued compliance with an exercise regimen. Unfortunately, Haynes (1976) reports that only about 50% of patients comply with a medical regimen over an extended period.

Since the majority of the studies focus on patients actively participating in exercise programs, the following review will present demographic data, program regimen, and morbidity and mortality data on six frequently cited studies. A summary of these studies is found in Table 3.

Demographic. Demographic data available for comparison varies among the studies. Half the studies reported on findings from a sample of male patients. Hellerstein (1968) investigated the effects of exercise on 656 white men, 254 of whom had a known diagnosis of

Table 3

A Summary of Six Cardiac Rehabilitation Exercise Programs

Variables	Hellerstein USA, 1968	Gottheiner Isreal, 1968	Kentela Finland, 1972	Sanne Sweden, 1973	Bruce USA, 1976	Canada, 1978
Age (yrs)	mean 45 for coronary prone and 40 for coronary stricken	30-70	52.5 control 53.0 trained	under 58	53.5 men 52.9 women Drop outs 53.5 men 51.6 women	46.6 compliers 46.5 noncompliers at 1 mo. 43.4 noncompliers at 12 mo.
Sex	men	men & women	men	men & women	men & women	men
Smokers	47%	NG	52% control 48% trained	37%	NG	47%
Socioeconomic Status	32% prof 20% business 22% manager	NG	NS	NG	NS	NG
Sample Size	656 total 254 with CAD	1,103	74 control 74 training	105 hospital 7 independent	603 total 547 men 56 women	163
Type of Study	comparison of matched individuals	retrospective	prospective random	prospective nonselected	retrospective prospective	prospective
Length of Study	30 mo	5 yrs	12 mo	24 mo	4 yrs	12 mo.
Diagnosis	coronary prone coronary stricken	CAD	Acute myocardial infarction (AMI)	AMI	CAD	AMI
Type of exercise program: Supervised Regimen	yes 3x/wk 30 min warm-up 15 min conditioning 15 min cool-down	intermittent individualized warm-up, strength buildings & sports (7 levels)	yes 2-3x/wk warm-up 20 min conditioning, cool down	yes 3x/wk 30 min of dynamic work-cycling, running	yes 3x/wk 60 min warm-up dynamic conditioning cool-down	yes *LIE-1x/wk oHIE-2x/wk LIE-yoga, relaxation for 30 min. HIE 5 min warm-up 25-35 min condition 10-20 volleyball
Monitored	telemetry	self monitored	self-monitored	self-monitored	self-monitored	NG
Drop out Follow-up	no	no	no	no	yes	no/yes
Reported Results	65% improved physical fitness; abnormal ECG's improved 63%; ↓systolic BP ↓heart rate	↓heart rate ↓blood pressure	↓heart rate ↓BP	↓heart rate ↓BP ↑MVO_2	NG	NG
Morbidity	NS	1.5% non fatal MI	NS	NS	NS	NS
Mortality	11 deaths	49 deaths (9 non cardiac related)	22 deaths (11 control 11 train) NS	63 deaths (35 control 28 train) NS	NS	2 deaths (2 HIE°)

NG = not given; NS = not significant CAD = coronary artery disease AMI = acute myocardial infarction
*LIE = Low Intensity Exercise oHIE = High Intensity Exercise + = significant

CAD. Kentala (1972) followed 148 men out of an initial identified sample of 298 men in a random prospective study. Oldridge and co-workers (1978) studied all men meeting their established criteria that were admitted to the hospital with a diagnosis of acute myocardial infarction (AMI) and volunteered to participate in the study.

Coronary artery disease strikes any age. The age of the subjects from the studies ranged from 29-70 years. The data shows a predominance of subjects in the fifth decade.

Smoking has been identified as a primary contributing risk factor in the development of CAD. Data on smoking habits of patients actively participating in an exercise program showed 37-47% actively smoking cigarettes (Hellerstein, 1968; Oldridge et al., 1978; Sanne, 1973). Changes in smoking behaviors with involvement in an exercise program was not discussed.

Program Characteristics. Exercise for the purpose of CAD prevention entails endurance or aerobic type activities (Cooper, 1970; Hellerstein, 1976). Endurance activities must include several fearures; they must be performed regularly; they must be performed continuously and for a minimum period of time; and they must be progressively increased to reach a certain threshold level of intensity (Cooper, 1970). The exercise regimen varied from study to study. However, the basic concepts of intensity, duration and frequency were followed. Four studies followed a 3X/wk session with a warm-up period, a 15-30 minute dynamic conditioning session followed by a cool-down period. Gottheiner commenced his program with individualized warm-ups, progressing to strength building and then distance sports. Patients reported one time

per week for supervised instruction. This is the only study supporting non-supervised exercise programs and stressing competitive sports for selected cardiac patients. In over 30 years of managing an exercise program, Gottheiner has had several participants compete and complete a marathon without a single cardiac event occurring (1968).

Oldridge et al. (1978), in an attempt to minimize and maximize the training effect divided their sample into two groups. Subjects were randomly alloted to either a group performing high intensity exercises (HIE: exercise at sufficient intensity to produce and maintain a training effect) or low intensity exercises (LIE: relaxation and recreational type activities). The LIE group met one time per week in a supervised session. The HIE group met 2X/week for a supervised session. The men in this group were expected to exercise on their own at least 2X/week at an intensity slightly below that of the supervised sessions.

The cardiovascular benefits attributed to an exercise training program are a decrease in resting heart rate, a decrease in blood pressure, an increase in physical fitness or maximum osygen uptake, and an increase in cardiac stroke volume (Åstrand, 1960; Cooper, 1970). The results of the various studies support these findings. Patients who adhered to a conditioning program showed improved levels of physical fitness. Hellerstein had 65% of his subjects showing an improved level of fitness on the basis of stress test performance before and after training (1968). He also noted a drop in sleeping heart rate by 20 beats/min between the most fit subjects and least fit subjects (52-72 bmp respectively).

Kentala (1972) noted that in his subjects the greatest level of physical conditioning on the basis of follow-up stress tests came in the first three months of the exercise program. He attributed this improvement to the temporary sedentary lifestyle required of a person after experiencing a myocardial infarction. He also showed that patients in the training group with more frequent attendance rates demonstrated significantly improved physiologic responses to exercise. In comparing class on the basis of Rauhala's social classification to training effect, Kentala showed that 25.7% of the patients with a high class rating were in the active group, compared to 2.9% of patients with a low class rating. Patients in his control group also demonstrated an increased level of physical activity. After 12 months, 11 of 74 patients maintained physical activity at the full training level. As a result of his findings, Kentala felt supervised training appeared feasible in about 20% of patients with CAD. He did suggest that only patients with the ability to work over 600 Kpm/min be instructed in individualized exercise activities. This factor is not supported by others in the field. However, Sanne (1973) reported a clinically significant difference in the physical working capacity of his 105 subjects training at the supervised hospital based program compared to the seven subjects training independently at home. The independent group functioned an average of 100 Kpm/min greater than did the supervised group.

Morbidity: The argument over the benefits of exercise in reducing morbidity and mortality remains elusive. The non-fatal recurrence of an MI was one marker for determining mobidity. The majority of

cardiac research investigators are in agreement with the statement that exercise may not prevent a recurrence of an MI, but the chances of survival are greatly increased in people that exercise. Gottheiner (1968) in exercising over 1,103 men and women with CAD reported a 1.5% non-fatal recurrence of an MI during a five year period. There was no comparison of results for similar samples or studies.

Though not statistically significant, Kentala (1972) reported symptomatic improvement of angina in his training group. The total control and training group showed an increase in anginal symptoms while on a stress test. The training group reported a 10% decrease (50-40%) while the control group reported an increase (50-74%). There was no significance in the recurrence of an MI between the two groups (6 MI's in the training, 4 MI's in the control).

Bruce and co-authors in their prospective study of 603 men and women, showed no significant difference between the recurrence of an MI in the active group versus the drop-out group (1976).

Mortality: Proponents of exercise therapy as a secondary preventor of CAD stress the benefit of exercise in decreasing the mortality of the patients. Although this fact remains to be adequately documented the authors conclusively agree that exercise in a supervised setting does not improve or worsen morbidity and mortality. Hellerstein reported a mortality rate of 11 deaths or 1.95 deaths per hundred patient years. In a comparable study of CAD patients treated in the traditional manner, the mortality rate ranged from 4.6 to 6.0 deaths per hundred patient years (1968).

The "failure" group identified in Gottheiner's (1968) study consisted of all patients who had died. Forty-nine deaths occurred with nine deaths non-cardiac related. No deaths occurred during physical training. This 3.6% mortality rate was low compared to post-infarction patients in the same area not receiving sports training (12%). The remaining studies reported no significant difference in the mortality rate between their groups. The question of whether exercise training can cause cardiac effects in patients with coronary disease rather than just improve the response of the peripheral circulation to exercise may be answered using newer invasive techniques.

Exercise training has been effective in achieving physiological and psychological goals of cardiac rehabilitation, but beneficial effects on mobidity and mortality remain undocumented. Perhaps the greatest benefit of physical training in cardiac patients is the increase in angina threshold secondary to a decrease in heart rate, a decrease in blood pressure, and a decrease in oxygen requirement in the myocardium. Analysis of medically supervised exercise programs confirm its safety and its ability to improve the physiological, psychological, and sociological status of the participants. The inclusion of regular moderate exercise in one's lifestyle makes sense for many reasons. Exercise can improve the quality of life by preventing illness. Quality of life is definitely improved in those for whom physical fitness is important. However, the noncompliance of participants over a period of several months is a limiting factor in rehabilitation of the cardiac patient. Furthermore, noncompliance or dropout introduces a significant bias that makes evaluation of

exercise programs difficult.

Dropout Patients: In a comparison of active participants and dropouts in the Cardiopulmonary Research Institute (CAPRI) 58.4% dropped out after an average of 8.6 months for men and 5.7 months for women. Bruce et al. (1976) found in retrospect few minor differences between the active participants and the dropouts in physical characteristics, clinical diagnosis and responses to exercise stress testing at time of enrollment into the program. Dropouts were followed-up by telephone calls inquiring about their present health status, employment status, illnesses and physical activity since leaving the CAPRI program. In the follow-up analysis 38% of the men and 40% of the women remained physically active. The majority of patients experienced cardiac morbidity. Morbidity in this study was defined as hosptialization for cardiovascular or other causes. Forty-one men had cardiac by-pass surgery after enrollment with a nearly equal number among the active (7.18%) and dropout (7.3%) groups.

During their course of exercise conditioning both groups improved their physical fitness. The actual amount of jogging during training decreased in both groups. It was felt that the functional severity of the cardiovascular disease progressed despite continued compliance. Boredom with repetitive exercises may also be a reason for the decrease in activity.

Causes of dropout elicited from the former participants were divided into four categories: 1) unavoidable due to conflict with the subject's working schedule, financial problems, or moving away;

2) psychosocial (lack of interest and motivation, personal problems); 3) medical; 4) unknown (Bruce et al., 1976).

Another variable evaluated was the ability of a person to return to work. In the active group 62% of the men were employed full time, while 19% of the women had full time employment. In the dropout group 35% of the men were working full time while 51% of the women were working full time. The fact that so many participants are working and exercising outside of class suggests that progressive functional impairment from advancing disease was not a major factor in stopping the program. It also suggests that some people can maintain an exercise program without supervision.

Another major prospective study attempting to identify socio-demographic or other characteristics of patients who are early noncompliers in an exercise program was reported in the literature. Oldridge et al. (1978) evaluated the effect different levels of activity had on compliance. Patients not complying with the protocol or not attending the sessions were considered noncompliers. Non-compliance for the total group was 43% over a 12 month period. There was no difference in overall compliance between High Intensity Exercise (HIE) and Low Intensity Exercise (LIE) subjects. Reasons given for leaving the program compared with Bruce and co-workers (1976). Men leaving the program early tended to be inactive during their leisure time, smoked, and more likely experienced previous MI's. Since each of these factors is identified as a coronary risk factor, Oldridge and colleagues concluded that the person at greatest risk of another cardiac event was most likely to be an early non-complier.

The literature on the effects of physical conditioning in patients with CAD suggests that regular physical conditioning may protect against the fatal outcome of an MI, rather than in preventing the recurrence of another MI. However, maintenance of compliance has been shown to be a serious problem in supervised cardiac exercise rehabilitation programs.

Compliance

Compliance and non-compliance are highly complex behaviors. Haynes and Sackett, 1976, in a comprehensive review of medical, nursing, and behavioral publications attest to the disparities in the operational definition of compliance. Because of the scarcity of published studies concerning compliance with exercise, the investigator chose to review the literature using the definition given by Sackett and Haynes. Therefore, compliance in this review is defined simply as the "extent to which a person's behavior (in terms of following diets, risk factor reduction, taking medications or executing life-style changes) coincides with health professionals' advice." A comprehensive review of the compliance literature is beyond the scope of this study. Therefore, a limited review on areas considered relevant to the study are presented. The topics to be reviewed are disease characteristics, inconveniences, regimen and sociodemographic factors.

Disease Characteristics: The literature is not in complete accord regarding the determinants of compliance. Disease factors appear relatively unimportant. Severity of the disease produces no correlation with compliance and increased severity of symptoms shows no positive change in compliant behavior. In fact, four studies

report the greater the number of symptoms the lower the compliance responses (Backeland, Lundwall, & Shanahan, 1973; Hurtado, Greelick, & Columbo, 1973; Joyce, 1962; Lipman, Rickels, Uhlenhuth, Park, & Fisher, 1965).

However, the degree of disability produced by a disease or injury does appear to influence compliance in a positive manner (Heinzelmann, 1962). Although this concept was not studied directly, Heinzelmann felt that the increased compliance of victims with rheumatic fever in taking their prophylactic antibiotics was a result of increased supervision which usually accompanies a disability rather than a reflection of the severity of the disease (1962).

Haynes and Sackett (1976, 1979) summarized other disease features which showed no positive correlation with compliance. These features include: previous bouts of an illness; time of last attack (Heinzelmann, 1962); previous hospitalizations (Hare & Wilcox, 1967); length of stay in the hospital (Maddock, 1967); clinical improvement (Mattar, Markello, & Yaffe, 1975); and concurrent illness (Rae, 1972).

In summary, past research has shown disease factors as unclear determinants of compliance. Although decreased compliance with increased symptomatology and increased compliance with increased disability show some association, the problem is probably multifactorial.

Inconvenience: Haynes and Sackett (1976, 1979) found in their review that such factors as distance to a clinic, day of the week, time of day or time elapsed since last appointment were insignificant

compliance predictors. Although not scientifically studied, subjective responses from patients in cardiac rehabilitation exercise programs reported time of day and distance to the program as contributing factors to their decreased compliance with the exercise regimen (Sanne, 1973; Bruce et al., 1976; Oldridge et al., 1978). Delays in clinic waiting time of persons attempting to follow through with an appointment decreases compliance and increases the dropout rate (Alpert, 1964; Hurtado, 1975).

Regimen: Haynes and co-authors cite 12 studies which demonstrate that the length of the prescribed treatment affects the compliance rate. Compliance to a treatment decreases with time. This is clearly demonstrated by the poor compliance rate of patients in cardiac exercise programs which encourage a lifetime commitment to exercise (Bruce, et al., 1976; Hellerstein, 1968). Table 4 summarizes compliance data from selected cardiac exercise programs. Haynes et al. summarize the compliance rates in three sentences. "First, patients will keep approximately 75% of the appointments that they make, but only 50% of those made for them. Second, compliance with short-term regimens declines rapidly. Finally, about one-half of patients on long-term regimens are compliant."

Another factor which has not been carefully evaluated as a contributing factor towards compliance is cost. There are many obvious and hidden costs in following a prescribed regimen. Costs of transportation, child care, lost wages plus the direct costs of office visits and medications are just a sample of the monetary

Table 4

Compliance Data for Persons Who Entered a Physical Conditioning Program After Suffering a Myocardial Infarction

Investigator and Year	Compliance* (%)	Attendance** (%)	Duration of Study (mo)
Hellerstein, 1968	75	NG	36
Gottheiner, 1968	60	NG	36
Kentala, 1972	13	70	12
Sanne, 1973	45	63	9
	29	NG	24
Bruce et al., 1976	44	NG	Ongoing
Oldridge, 1978	54	71	12

Revised table from Oldridge et al., 1978, CMA Journal Feb. 18, 1978, 118

*Proportion of persons still in the program at a given time among total entered into that time.
**Proportion of sessions attended per unit of time among total possible number of sessions during that time. NG = not given.

obligations demanded of patients. Alpert (1964) found the cost of following a regimen influenced compliance adversely. Although not statistically significant, he noted failures of patients in an outpatient clinic occurred two times more frequently in individuals without health insurance as those covered. In the cardiac exercise programs reviewed, only one dealt with the problem of cost. Sanne (1973) minimized the cost of the actual program in an attempt to diminish cost as a barrier to compliance with an exercise regimen. He provided no follow-up data on the significance of this action.

Sociodemographic Factors: Sacket and Haynes' (1976) review of over 300 articles found age, sex, education, social class, occupation, income and marital status as insignificant compliance predictors. However, these studies may have sample biases. Many studies were descriptive in design. The subjects were drawn from clinics which they were already attending. Subjects showing irregular attendance or dropping out after beginning treatment were usually excluded from the investigations. Some prospective community-based projects suggest demographic features may contribute to the utilization of medical services. For example, affluent whites use health facilities more frequently than those who are both black and poor (White, Alpert, & Kosa, 1967).

A conclusive answer to the relationship of sociodemographic variables and compliance eludes researchers. Demographic factors affect the compliance rate of patients in the health care system and those with greater access to the system. However, studies from clinic-based samples compared to community based projects failed to demonstrate any significant effects of demographic factors. There is a lack of data on the noncompliers.

Three factors associated with noncompliance are the complexity of the regimen, its duration and the associated degree of behavioral changes (Haynes, 1979). Persons whose perceptions, beliefs, and social behavioral characteristics predispose them to drop a prescribed therapy earlier may be identified. Attempts to understand and control noncompliance have revealed the complexity of the problem without

yielding useful information about compliance management. Despite this pessimistic view, many researchers believe patients would comply with prescribed therapy if health professionals better understood why patients enter and continue therapeutic programs. Promising areas of research are in the interactions between clinicians and patients and patients' beliefs about their illness and prescribed regimen. This concept is being investigated utilizing Rosenstock and Becker's Health Belief Model (1974).

Intervention: Strategies to improve compliance fall into three broad categories--educational, behavioral, and combined--according to Haynes et al. (1976). For therapeutic outcomes, educational approaches have been shown to achieve a success rate of only 50%, while behavioral strategies achieve a rate of 82%, and combined strategies 75%. Educational interventions are defined as those that rely on the transmission of information and instructions as a means of changing behavior. Behavioral strategies are those procedures which attempt to influence specific noncompliant behaviors directly through the use of techniques such as self-monitoring, reminders, and reinforcement, but with information and instruction playing a secondary role. In cardiac rehabilitation exercise programs medical staff desiring to improve the patients' compliance should not only teach them about their disease and exercise requirements but motivate them to continue exercising as behavioral changes usually require time to initiate a permanent change.

Summary and Purpose

The goal of rehabilitation restores the patient to optimal physiological, psychological, and vocational status, and if possible, prevents the underlying diease from progressing. The American Heart Association concluded that over one-half of the survivors of an acute myocardial infarction have significant psychologic, or sociologic disabilities. Approximately 1 million Americans will have an MI this year. Since 65% will die, this leaves 350,000 survivors and at least 175,000 individuals in need of rehabilitation.

Exercise conditioning plays an important role in rehabilitation because of documented hemodynamic, physiologic, and symptomatic benefits. However, studies on CAD patients engaged in conditioning programs lack documentation on the beneficial effects of exercise on mobidity and mortality. Although inadequately controlled studies of cardiac exercise programs suggest a decrease in morbidity and mortality for those who comply to an exercise program, controlled large studies of cardiac exercise programs with careful identification of patients to detect differences in morbidity and mortality are required. Physical conditioning of cardiac patients in supervised exercise programs neither improves or worsens the morbidity or mortality rates.

Continued physical activity is supported for a select group of cardiac patients in a non-medically supervised setting. Patients drop out of supervised programs for four major reasons: it's unavoidable, psychosocial, medical, and unknown. People at highest risk and therefore in need of the physical conditioning are most

likely to drop out of an exercise program early.

Compliance to an exercise regimen is hampered by the complexity of the regimen, its duration and the associated degree of behavior change. As a result, cardiac programs have a high dropout rate. Because of the scarcity of information on the dropout population this investigator chose to describe and relate characteristics of cardiac patients who have dropped from the medically supervised exercise program. Therefore, the purposes of this study were to: 1) explore the relationship between compliance with exercise and cardiac morbidity in subjects who dropped out of the medically supervised exercise program; 2) identify factors related to continued compliance with exercise in a non-supervised setting; 3) describe the mobidity and mortality status of the dropout sample. In order to further explore purpose number one, the following hypotheses were tested.

Hypotheses

Hypothesis 1: Compliers had less risk factors present and less morbidity events at the time of entry into the YCT program than noncompliers.
Hypothesis 2: More compliers would be more likely to have attended 70% or more of the supervised exercise classes than the noncompliers.
Hypothesis 3: Compliers presently feel more physically fit; perceive themselves as being moderate to very active; are employed; are non-smokers or ex-smokers, have a negative history for hypertension, have a decrease in or absence of anginal symptoms; have had less MI's, CABG's, coronary arteriograms; and require either reduced amounts of

CAD related drugs or non compared to noncompliers.

Additionally, mortality rates and reasons for dropping out of the medically supervised YCT program are described. Although hypotheses were not formed for these factors the information is valuable for descriptive purposes and in future research.

CHAPTER TWO

METHODOLOGY

The amount of functional improvement achieved from a cardiac exercise program depends upon compliance to the program for months or years. Unfortunately, many patients do not benefit from exercise because of poor attendance and/or subsequent withdrawal. One of the major unsolved problems confronting health care workers is patients' poor compliance with their prescribed therapeutic regimens. The purpose of this study was to address the issues of morbidity, mortality, and leisure time activities as they related to patients who dropped out of a prescribed medically supervised supervised exercise program. The following section describes the setting, sample, operational definitions, and design of the study. The data collection instrument and procedures along with the method for data analysis are presented.

Operational Definitions

Morbidity: The documentation of angina, hypertension, myocardial infarction, coronary by-pass grafts (CABG's), coronary arteriograms, and CAD medications currently taken from the chart review and follow-up data.

Mortality: Death from all causes.

Dropout: A person who attended at least one supervised exercise session at the YMCA CArdiac Therapy Program (YCT) and had not attended a session since December 31, 1980.

Retrospective data: Data derived from the chart review at the time

the patients entered the YCT program.

Prospective data: Data obtained from patient's response to the mailed questionnaire.

Medically supervised exercise program: Program with a CCU experienced nurse, doctor, and physical fitness director instructing and supervising exercise sessions of YCT.

Non-supervised exercise program: Exercise performed outside of a medically supervised program. Patients had no contact with the YCT staff.

Compliers with the exercise regimen: Aerobic exercise done at least three times per week for at least 20 minutes according to subjective report by participants.

Noncompliers with an exercise regimen: Sporadic physical activities, no exercise at all, or exercise done less than 3 times per week.

Sample Population

The sample for the study comprised 184 participants who dropped out of the medically supervised exercise program between December 31, 1975 and December 31, 1980. All subjects attended at least one exercise class. Persons excluded form the initial sample consisted of those with excused leaves for vacation, business, or illness with a known intent to return to the program. No exclusions were made for age, sex, or race. All patients had a clinical diagnosis of CAD or were at high risk due to multiple risk factors.

Setting

The setting for the study was the Columbia Metro YMCA Fitness Center Cardiac Therapy (YCT) program located in Portland, Oregon. The YCT program provided medically supervised and prescribed exercise classes to promote cardiovascular fitness for CAD patients. This includes the ability to exercise vigorously for a long time without fatigue and the ability to respond to sudden physical and emotional demands with an economy of heartbeats and modest blood pressure elevation.

The physical setting provides an environment conducive to exercising. Facilities are spacious and convenient to a large population. A doctor, CCU trained nurse, and physical fitness director provide medical supervision. Classes are conducted four times per day (6:45 AM, 7AM, 11AM, and 7PM) Monday, Wednesday, and Friday. Participants are assigned a specific time but are encouraged to attend other sessions if a conflict arises.

All patients had a private physician referral and had undergone a treadmill stress test prior to attending the first class. They also had completed an initial medical history form and were interviewed by the program nurse.

The duration of each session is one hour. This time is divided into 3 segments. The first 10-15 minutes is a supervised group warm-up session. The next 30 minutes is aimed at cardiovascular conditioning through walking, jogging, or bicycling depending upon exercise tolerance as measured by heart rates and symptoms. The remaining

10-15 minutes is a cool-down session which is accomplished through stretching exercises and deep breathing and relaxation exercises. YCT staff actively participate in all classes. Attendance records are maintained by each participant. The nurse also records attendance, signs and/or symptoms of distress and other pertinent data. Patients are instructed and encouraged to exercise during non-class days following prescribed guidelines. Involvement of spouses is highly encouraged. After attending 12 consecutive exercise sessions patients undergo repeat treadmill stress testing and are re-interviewed. This process is repeated thereafter on a yearly basis for documentation of conditioning, disease status, motivation and prescription alterations. A monthly fee is charged, with scholarships available for those in need. Group support is encouraged through regular social functions sponsored by the participants.

Design

The design of this study is descriptive. Retrospective and prospective data were collected to demonstrate associations between past and present health status, risk behaviors, and levels of exercise in patients who dropped out of this medically supervised cardiac exercise program.

Data Collection Instrument

A thorough chart review of all patients' records were assessed. (Appendix A): Questions 1-5 covered demographic data; questions 6-9 assessed levels of fitness of each patient before starting the supervised

exercise program; questions 10-17 documented the morbidity variables; and questions 18-22 recorded class attendance.

In view of the lack of a standarized instrument it was necessary for the investigator to construct a tool to evaluate levels of activity, morbidity, and risk factors currently present in the sample (Appendix B). This tool is labeled the Patient Questionnaire. Questions 1-4 required demographic information; questions 5-8 requested risk factor behaviors; while questions 9-11 assessed current levels of physical activity; and lastly questions 12-20 required data on morbidity status.

A pilot study was conducted on 16 active participants and three medical staff in the YCT program to test for clarity, comprehension, and readability of the Patient Questionnaire. Minor changes in word usage and grouping of questions were the only suggestions recommended.

Data Collection Procedures

After obtaining verbal permission from the YCT medical advisor and YMCA Associate Director, information on patients health status, risk factors and compliance with the YCT exercise was obtained from a chart review by the investigator (Appendix A). Forms were coded for future data analysis. A Patient's Questionnaire, a letter of explanation (Appendix C) and a return stamped self-addressed envelop were mailed to 184 subjects.

Data Analysis

In order to identify those characteristics which may be related

to continued compliance with an exercise regimen in a non-supervised setting, the data from the Patient Questionnaire and chart review was analyzed in the following manner. Two groups were identified. Group 1 consisted of all the patients who continued to comply with an exercise program for 20 minutes 3X/week or more. They are labeled the compliers. Group 2 included all other subjects, except for those who died. This group is identified as the noncompliers. The past and present health status and/or morbidity events were analyzed for each group using retrospective and prospective data. These factors were placed in contingency tables for examination of possible relationships between compliers and non-compliers using the chi-square statistical test to test for significance. Descriptive data on risk and morbidity factors at time of entry into the YCT program is presented on the participants who died.

CHAPTER THREE

RESULTS AND DISCUSSION

Between December 1975 and December 1980, 188 people dropped from the YMCA Cardiac Therapy (YCT) program in Portland, Oregon. Medical and class attendance records of 184 patients meeting the selected requirements were examined by the investigator for demographic data, alterable risk factors, and morbidity events. Questionnaires were mailed to all 184 patients. Ninety-four completed questionnaires were returned from the patients and four questionnaires were answered by relatives or attorneys of the deceased. Ten questionnaires were returned address unknown even after several attempts to locate the person.

Retrospective data obtained through the chart review is presented on the total population of 184 subjects. This is done to demonstrate similarities between the total population and sample population who responded to the mailed questionnaire. Descriptive data (retrospective and prospective) on the characteristics of the sample is presented. Then the results and discussion of each of the hypotheses is given. Finally mortality rates and subjective reasons for having dropped out of the YCT class is highlighted.

Characteristics of the Total Population

One hundred sixty-seven men and seventeen women comprised the total population. No attempt was made to separate data between sexes.

Mean age for the group at the time of coronary artery disease (CAD) diagnosis was 46.2 years with ages ranging from 18 to 75 years. Average age at time of entry into the YCT program was 50.5 years with ages ranging from 31 to 75 years. Eighty-one percent of the patients were married and employed full-time. See Table 5 for a summary of the data on the total population and the sample population at time of entry into the program.

Table 5

Comparison of Retrospective Demographic Data on the Total Population Versus the Sample Population at Time of Entry Into the YCT Program

	Total Population	Sample Population	
		C	N/C
# Subjects	184	53(29%)	41(22%)
Sex	167 men 17 women	49 men 4 women	37 men 4 women
Average age at Diagnosis of CAD	46.2 yrs	50.12 yrs	44.8 yrs
Average age at Start of program	50.5 yrs	51.8 yrs	49.9 yrs
Employment Status			
employed	149 (81%)	47 (88%)	33 (80%)
non-employed	17 (9%)	2 (4%)	4 (10%)
retired	18 (10%)	4 (9%)	4 (10%)
Marital Status			
married	153 (83%)	44 (83%)	34 (82%)
divorced	14 (8%)	2 (3%)	5 (12%)
single	11 (6%)	4 (7%)	1 (3%)
widow/er	4 (2%)	2 (3%)	0
separated	2 (1%)	1 (1%)	1 (3%)

* significant differences $p < 0.05$ C = Compliers N/C = Noncompliers

Risk factors such as smoking, history of hypertension and perceived levels of leisure-time activity were evaluated (see Table 6). One hundred five people (57%) had stopped smoking 3 months to 30 years before entry into YCT. Thirty-two subjects (17%) never smoked while 47 (26%) subjects were still smoking one-half pack of cigarettes to 3 packs per day.

Table 6

Comparison of Retrospective Risk Factor Data on the Total Population To Sample at Time of Entry Into the YCT Program

	Total Population	Sample C	Sample N/C
# Subjects	184	53	41
Smoking history			
never smoked	32 (26%)	13 (25%)	6 (14%)
ex-smoker	105 (57%)	32 (60%)	23 (56%)
smoking	47 (17%)	8 (15%)	12 (30%)
History of hypertension	79 (43%)	20 (37%)	19 (46%)
Leisure-time Activity done			
active	66 (36%)	30 (56%)	15 (36%)
somewhat/never	118 (64%)	23 (44%)	26 (64%)
Perceived amount of Activity Done in Leisure-time			
very little	107 (58%)	25 (47%)	26 (63%)
moderate	68 (37%)	22 (41%)	12 (29%)
very active	9 (5%)	6 (12%)	3 (8%)
Perceived feeling of Physical fitness at Present			
unfit	112 (61%)	26 (49%)	28 (68%)
average	63 (34%)	25 (47%)	10 (24%)
very fit	9 (5%)	2 (4%)	3 (8%)

* significant difference $p < 0.05$ C = Compliers N/C = Noncompliers

Documented hypertension occurred in 79 (43%) patients. Of the total population, 66 (36%) subjects reported performing an aerobic activity at least 3X/week for 20 minutes. The remaining patients (64%) recorded either participating in some aerobic or recreational activity less than three times per week or remaining totally sedentary. In rating the amount of physical activity performed during their leisure time, 107 (58%) subjects reported very little, while only 9 (5%) subjects considered themselves very active. Similar responses were derived from the subjects self-perception of physical fitness. One hundred twelve (61%) subjects considered themselves unfit (see Table 6).

Morbidity events, specifically, a positive stress test, myocardial infarction, angina, CABG, and CAD related medications along with coronary arteriograms were evaluated (Table 7). A positive stress

Table 7

Comparison of Morbidity Events Between Total Population and Sample At Time of Entry Into the YCT Program

	Total Population	Sample C	Sample N/C
+ Stress test	90 (49%)	32 (60%)*	15 (37%)
MI	107 (58%)	29 (55%)	20 (49%)
multiple MI's	12 (7%)	2 (3%)	2 (4%)
Angina	95 (52%)	29 (55%)	23 (56%)
CABG	60 (33%)	15 (28%)	17 (41%)
CAD related drugs	107 (585%)	31 (58%)	23 (56%)
+ Coronary arteriograms	124 (67%)	41 (77%)	28 (68%)
normal	2	2	

* significant difference $p < 0.05$ C = Compliers N/C = Noncompliers

test as reported by their physician on the admission stress test was present in 90 (49%) subjects. One hundred seven subjects (55%) had experienced an MI, while 12 (7%) of the subjects had had multiple MI's. A history of angina was recorded in 95 (52%) subjects. While 124 (67%) of the subjects had undergone coronary arteriograms only 60 (33%) of the subjects had had CABG surgery.

Attendance records (Table 8) maintained by the nursing staff and subjects demonstrated that 34% (62 subjects) of the total population had attended class greater than 70% of the time. However, 122 (67%) of the subjects had participated in the supervised exercise program less than 6 months with total attendance ranging from participating in one class to exercising over a 40 month period before dropping out.

Table 8

Comparison of Percentage of Class Attendance and Months Involved In YCT Between Total Population and Sample

	Total Population	Sample C	Sample N/C
% Attendance			
>70%	62 (34%) pts	26 (49%) pts*	9 (22%) pts
<70%	122 (66%	27 (51%)	32 (78%)
# Months in Program			
3 mo.	51 (28%)	11 (20%)	11 (26%)
>3-6 mo.	71 (39%)	24 (45%)	19 (46%)
>6-12 mo.	40 (22%)	7 (15%)	4 (10%)
>12 mo.	22 (11%)	11 (20%)	7 (18%)

* significant $p < 0.05$ C = Compliers N/C - Noncompliers

Characteristics of the Sample (Compliers and Noncompliers)

Fifty-three men and women (56%) met the operational definition for the compliant group. Subjects were placed in the compliance group if they reported engaging in an aerobic activity at least 3 times per week for at least 20 minutes. Because of the failure to meet the operational criteria, 41 (46%) subjects were designated noncompliers. Even though not significant, the average age at the time of CAD diagnosis was 50.1 yrs. for the compliers and 44.8 years for the non-compliers. Average age at the start of the YCT program was 51.8 years and 49.9 years respectively. Employment and marital status were similar for both groups (Table 9) (Appendix D, Tables A and B).

Table 9

Prospective Demographic Data Between Compliers and Noncompliers

	Compliers	Noncompliers
Employment Status		
employed	40 (75%)	28 (68%)
non-employed	2 (4%)	3 (8%)
retired	11 (21%)	10 (24%)
Marital Status		
married	44	2
divorced	1	4
single	3	1
widow/er	4	0
separated	1	1

* significant $p < 0.05$

The first hypothesis predicted that compliers would have fewer risk factors present and have had fewer morbidity events at the time of entry into the YCT program than noncompliers. This hypothesis was

partially supported in relation to the presence of a positive treadmill stress test prior to admission into YCT ($X^2 = 6.12$ $p < 0.05$). Thirty-two (60%) compliers had a positive stress test noted by their physician prior to entering the YCT program. Only 15 (37%) noncompliers had a positive treadmill stress test (Table 10). Caution needs to be applied in the consideration of this positive association. Because the data was recorded from the doctors' reports, one questions their various methods of interpretation. In future studies, the investigator recommends evaluating each stress test for st-t wave changes along with signs and symptoms.

Table 10

Pre-admission Treadmill Stress Tests in Compliers and Noncompliers

	+ MSET	- MSET
Compliers	32*	21
Noncompliers	15	26

$X^2 = 6.12$ df 1 $p < 0.05$

Since this morbidity event has not been discussed in the reviewed literature, the investigator can only deduce an explanation. Rosenstock (1974), in his research with the "Health Belief Model," felt individuals were more likely to seek preventative action if they had an increased perception towards the severity of their disease. This has yet to be proven. However, a positive stress test may reinforce an individual's perception of his CAD and lead to a positive behavior

change. When subjects have had visual evidence of disease, they may be motivated to seek preventative or maintenance treatment. In fact, the YCT Protocol Manual recommends a repeat stress test to evaluate cardiovascular and functional changes and also to demonstrate to patients functional improvements that have occurred with regular exercise.

The hypothesis in relation to alterable risk factors and morbidity events was rejected (see Appendix D, Tables C, D, E, F, G, H, I, J, K, L). Compliers and noncompliers reported similar occurrences of alterable risk factors (Table 6). In addition, the following morbidity events were non-significant between the compliers and non-compliers: history of angina present, myocardial infarctions, CABG's, CAD related drugs, and positive coronary arteriograms (Table 7 and the above appendices). Although no similar studies have been published using the variables gathered in this investigation, some stuides have compared risk factors and several of the morbidity events in people actively participating in a supervised exercise program and people who had dropped out of the program. Although not significant, Bruce et al. (1976) reported an increased frequency of risk factors and hospitalizations for cardiovascular or other causes in people who had dropped the CAPRI program. Oldridge et al. (1978) reported that early and late non-compliers with a supervised exercise program were significantly more likely to have experienced two or more previous myocardial infarctions ($p < 0.01$ and $p < 0.05$ respectively) than compliers. Also, early noncompliers were significantly more likely ($p < 0.05$) to be smokers compared to active participants.

However, in checking the data published no difference was found between the early and late noncompliers in smoking history (Oldridge et al., 1978).

The second hypothesis predicted that compliers would be more likely to have attended greater than 70% of the supervised exercise classes than noncompliers. This hypothesis was accepted ($X^2 = 7.33$, $p < 0.05$). Percentage of classes attended was derived from dividing number of classes attended by the number of classes held ($\frac{\#\text{class attended}}{\#\text{ class held}} \times 100 = \%$ of classes attended). Twenty-six (49%) compliers compared to 9 (22%) noncompliers had a recorded class attendance greater than 70%. See Table 11.

Table 11

Comparison of the Number of Compliers to Noncompliers Attending YCT Classes Greater Than 70% of the Time

	>70%	<70%
Compliers	26	27
Noncompliers	9	32

$X^2 = 7.33$ df 1 $p < 0.05$

Haynes et al. (1979), after summarizing the compliance data stated "patients will keep approximately 75% of the appointments that they make . . . compliance with a short term regimen declines rapidly and about one-half of the patients on long-term regimens are compliant." Behavioral and educational changes are more likely to occur with greater exposure (Haynes, 1979).

Kentala (1972) reported over a 12 month period only an overall compliance rate with a structured program of 13% showing a >70% attendance rate. Oldridge et al. (1978) showed 54% of his subjects had attended at least 71% of the time over a 12 month period.

Interestingly, longevity in the program failed to have an impact on continued compliance with an independent exercise program (Appendix D, Table M). Although non-significant, more compliers (30 subjects, 57%) had reported engaging in leisure-time aerobic activity more frequently than the noncompliers (12 subjects, 37%) prior to starting the YCT program. See Table 12.

Table 12

Number of Subjects who Reported Participating in an Aerobic Activity at Least 3X/week for at Least 20 Minutes Prior to Starting YCT

	Active	Somewhat to Never Active
Compliers	30	23
Noncompliers	15	26

NS $X^2 = 3.68$ df 1 (for significance $X^2 = 3.841$ $p < 0.05$)

The relevance of this information could be applicable to clinical management of the subjects. Early identification of those least likely to exercise could assist health professionals in offering special advice and reinforcement to reduce noncompliance in either the structured programs or independently.

In the third hypothesis it was stated that compliers would

presently feel more physically fit, perceive themselves as being moderate to very active; would be employed, would be non-smokers or ex-smokers; have a negative history for hypertension; have a decrease in or absence of anginal symptoms; have had fewer MI's, CABG's, coronary arteriograms; and require either a reduced amount of CAD related drugs or none than the concompliers. This hypothesis was partially accepted. A significant difference was noted between compliers and noncompliers in their perception of the amount of leisure-time activity performed and how physicially fit they felt at the time data was collected ($X^2 = 10.3$, $p < 0.05$ and $X^2 = 8.03$ $p < 0.05$ respectively). See Tables 13 and 14.

Table 13

Perceived Amount of Activity Compliers and Noncompliers Performed in Their Leisure Time (Prospective Data)

	Very Little	Moderate	Very Active
Compliers	8	40*	5*
Noncompliers	18	22	1

*$X^2 = 10.3$, df 2 $p < 0.05$

Table 14

Comparison Between Compliers and Noncompliers in Self-Perception of Their Physical Fitness Status (Prospective Data)

	Unfit	Average	Very Fit
Compliers	11	34*	8*
Noncompliers	19	20	s

*$X^2 = 8.03$ df 1 $p < 0.05$

Smoking history, employment (See Table 15), anginal symptoms, frequency of MI's, CABG's, coronary arteriograms and CAD drug consumption were not significant between compliers and noncompliers (see Appendix D, Tables, N, O, P, Q, R, S, T). Although not statistically significant, but clinically relevant, was the disappearance of anginal symptoms in 15 compliers compared to 9 noncompliers; decreased symptoms in 5 compliers versus 1 noncomplier and increased symptoms in 5 compliers compared to 2 noncompliers. One of the benefits of an aerobic exercise program for cardiac patients is reduction of resting heart rates and systolic blood pressures. This results in a decreased myocardial osygen demand thus a decrease in anginal symptoms (Hellerstein, 1976). Therefore, subjects who continue exercising would be expected to show a decrease in the number of anginal symptoms. However, the noncompliers as well as the compliers could have had altered drug therapy thereby controlling the angina. Another explanation for the reported decrease in symptoms in the noncompliant group could be decreased work loads or a sub-conscious self-limiting work load change or other life-style changes. Such life style changes could include cessation of smoking, or decreased stress-producing activities. A different statistical approach for future research would be advantageous in analyzing variations morbidity events and risk factors in the two groups.

Mortality rates among dropouts was an additional purpose of this study. As earlier reported, responses from attorneys and relatives reported 4 deaths (2%) from the total population of 184 subjects.

Table 15

Prospective Risk Factor Data Between Compliers and Noncompliers

	Compliers	Noncompliers
# Subjects	53	41
Smoking history		
smoking	9 (17%)	12 (29%)
ex-smokers	31 (58%)	23 (56%)
never smoked	13 (25%)	6 (15%)
History of hypertension	22 (42%)	20 (49%)
Self-perception on the Amount of Leisure Time Activity Performed		
very little	8 (15%)	18 (44%)
moderate	40 (22%)*	22 (53%)
very active	5 (10%)*	1 (2%)
Self-perception in how Physically Fit Feel Now		
unfit	11 (21%)	19 (46%)
average	34 (64%)*	20 (49%)
very fit	8 (15%)*	2 (5%)

*significant at $p < 0.05$

Unlike other studies, all the deaths were cardiac related. See Appendix E for a summary of demographic risk factors and morbidity events present in the subjects at the time of their entry into the YCT program. No associations in risk factors or morbidity events were found in the subjects that would help predict future fatal events.

Describing reasons for dropping out of the YCT program was the final purpose of this study. Because of the cost and professional staff required to operate a program combined with the need for long term commitment to exercise, retention of subjects is extemely important. Subjects in this study responded with multiple reasons for dropping the YCT program. These reasons were grouped into categories (see Table 16).

This data may help cardiac rehabilitation nurses and other health professionals identify early subjects least likely to comply with a supervised exercise program. Certain factors such as cost and scheduling may be overcome initially thus eliminating potential barriers. Early recognition of subjects expectations and goals helps establish realistic goals for the subjects and staff. Specific behaviors could be practiced and evaluated such as helping the subjects exercise safely outside the supervised setting.

In conclusion, it is important to point out some of the inherent weaknesses that may have biased the findings of the present study. First, retrospective investigations lack the control advantage of experimental research both in terms of inability to randomize and

Table 16

Selected Reasons and Frequency Given for Dropping Out of the YCT Program by the Sample

Unavoidable:
Class time not convenient (35)
Financial (27)
Moved (14)
Psychosocial:
Boredom (18)
Would rather exercise unsupervised (20)
Had plans to attend only 3 months (6)
Class too easy (5)
Personal or amily problems (4)
Lack of progress (3)
Medical:
Medical-Orthopedic (9)
Medical-Heart (6)
Exercise was making me worse (7)
Told to stop by my physician (5)
Told to stop by the program physician (2)
Unknown:

the inability to manipulate variables. Therefore, erroneous interpretation of results is always a risk. Secondly, the prospective data were available on only 54% of the subjects. Although this number is adequate for statistical evaluation there is always the possibility that the sample was biased. Lastly, is the need to re-design the questionnaire and have a more extensive follow-up on the non-returned questionnaires. Since the investigator developed the questionnaire, it was tested for comprehension, clarity and readability but not for reliability and validity. Also, future studies may benefit from telephone follow-up and repeat mailings. Because of these limitations, it is recommended that caution be exercised in generalizing this study to other populations.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purposes of this investigation were to: 1) explore the relationship between compliance with exercise and cardiac morbidity in subjects who had dropped out of the medically supervised YCT program; 2) describe the morbidity events and mortality status of a sample of dropouts of the cardiac exercise program, and 3) identify factors related to continued compliance with exercise in a non-supervised setting.

A study sample represented 95 men and women who responded to a mailed questionnaire from a total population of 184 subjects who had dropped out of a YCT program from December 1975 to December 1980. The study was descriptive in design using retrospective and prospective data. On the basis of a self-report on the frequency with which the sample subjects engaged in aerobic activity during their leisure time, subjects were divided into two groups. Group 1, called the compliers, consisted of 53 subjects who reported exercising at least three times per week for at least 20 minutes since dropping the YCT program. Group 2, noncompliers, consisted of the 41 subjects not meeting the above requirement. All risk factor and morbidity events were obtained from a chart audit at the time of entry into the program. Attendance records were obtained from subjects' records

and nursing staff records. Follow-up data were obtained by a mailed questionnaire. The data were analyzed using descriptive statistics and chi-square.

Comparison of risk factors between the compliers and noncompliers revealed no significant differences. In evaluating the relationship of continued compliance to morbidity events the only significant finding was the presence of positive treadmill stress tests occurring more in the compliers than the non-compliers. All other mobidity events were insignificant.

The percentage of attendance at classes was a significant factor in the compliers compared to the noncompliers in that those attending greater than 70% of the classes were more likely to continue to exercise independently than those attending less than 70%. Furthermore, compliers perceived themselves as being more physically fit and moderate to very active compared to the noncompliers at the time the questionnaire was answered. Risk factors and morbidity events were insignificant indicators for continued compliance with aerobic exercise during leisure-time. (See Table 17 for summary.)

During the five years, four subjects had died since dropping out of the cardiac exercise program. All deaths were cardiac related. Additionally the most frequently marked reasons for dropping out of the supervised exercise YCT program were class time not convenient, financial (unavoidable), preference to exercise on their own and boredom (psychosocial).

Table 17

Comparison of Retrospective and Prospective Risk Factors and Morbidity Events between Compliers and Noncompliers

	Compliers		Noncompliers	
	R	P	R	P
Smoking history				
never smoked	13	13	6	6
ex-smokers	32	31	23	23
smoking	8	9	12	12
History of Hypertension	20	22	19	20
Perceived amount of leisure time activity				
very little	25	8	26	18
moderate	22	40*	12	22
very active	0	5*	3	1
Perceived level of physical fitness				
unfit	26	11	11	19
average	25	34*	34	20
very fit	2	8*	8	2
+ stress test	32*	-	15	-
MI	29	31	20	22
multiple MI's	2	4	2	4
Angina	29	17	23	15
CABG's	15	20	17	22, 1 repeat
Coronary arteriograms	41	43	28	29
repeat		11		5
CAD related medications	31	34	23	23
↑ drugs		7		7
↓ drugs		6		2

* significant at $p < 0.05$
R = retrospective data
P = prospective data

Conclusions

Conclusions drawn from the present study were: 1) selected risk factors and morbidity events were relatively similar between compliers and noncompliers at the time of entry into the YCT program; 2) having attended classes greater than 70% of the time was a significant indicator for continued compliance with an independent aerobic exercise program; 3) little difference in present health status was noted between compliers and noncompliers except in the compliers perceived level of fitness and how physically fit they feel.

Exercise training programs provide new opportunities for health care professionals. A new role for nursing has emerged. Nurses working in cardiac rehabilitation exercise programs have the opportunity to provide information, teaching and learning opportunities and counseling to persons with CAD over a period of time.

Recommendations for Further Study

1. A study comparing stress test performance at present with amount of exercise performed in leisure time.
2. A prospective study designed to identify risk factors and morbidity events between subjects who are actively participating in a supervised exercise program and subjects who drop out of the program.
3. A replication of the present study using other medically supervised cardiac exercise programs.
4. A prospective study using the HEALTH BELIEF MODEL.
5. A prospective study comparing internal and external locus of control and continued compliance with exercise.

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APPENDIX A

APPENDIX A

CHART REVIEW

1. Name_____ phone h._____ w._____
2. Address_____
3. Date of birth_____
4. Marital status _____single_____married_____divorced_____widowed _____separated
5. Employed _____yes _____no Present Position_____
6. Initial level of fitness _____mets
7. Physical activity at time of entry into the program?

dancing _____	calisthenics _____
gardening _____	climbing stairs _____
volleyball _____	handball _____
fishing _____	racquetball _____
walking _____	squash _____
cycling _____	jogging _____
swimming _____	skipping rope _____
tennis (singles) _____	basketball _____
tennis (doubles _____	

Seasonal exercises: hiking _____ snow skiing _____hunting _____
x-country skiing _____ other _____

A. does not do at all
B. does at least 3 times per week for at least 30 minutes
C. does 1-2 times per week
D. does occasionally but with no regularity

8. How would you rate the amount of physical activity performed in your leisure time? very little _____ little _____ moderate _____ active _____ very active _____.
9. How physically fit do you feel: unfit _____ below average _____ average _____ above average _____ very fit _____
10. History of Hypertension: _____ yes _____no How long _____
11. Angina: Present _____ absent _____
12. Date of first MI _____ 2nd MI _____ others _____
13. Stress test results: _____ positive _____ date symptoms _____ _____ negative _____ date
14. Arteriograms: 1 vessel _____ 2 vessel _____ 3 vessel _____ 4 or more _____
    Dates _____; _____; _____.
15. Coronary by-pass grafts: 1_____2_____3_____4 or more vessels____
16. Other medical history _____
    _____
17. Medications:_____
    _____
18. Date of nursing interview _____.

APPENDIX A (continued)

19. Date started class _____
20. # of sessions held _____
21. # of sessions attended _____
22. Date stopped class _____ reason _____
23. Patient's physician _____ phone _____
24. Did patient have symptoms (angina, dyspnea, etc.) during class _____

_____

25. Other _____

_____

APPENDIX B

APPENDIX B

PATIENT QUESTIONNAIRE

Please answer all the questions.

1. Marital Status: _____never married
   _____married
   _____separated
   _____divorced
   _____widowed

2. Presently employed? _____Yes _____No _____Retired

3. Current place of employment:_____

4. Position or type of work: _____

5. Present smoking history: _____never smoked
   _____smoking
   _____ex-smoker

6. If you are presently smoking, what are you smoking?
   _____cigarettes _____cigars _____pipe

7. How much are you smoking? _____less than 10 cigarettes per day
   _____less than 20 cigarettes per day
   _____more than 20 cigarettes per day

8. If you are an ex-smoker when did you quit: ____less than 3 months
   ____less than 1 year
   ____less than 5 years
   ____greater than 5 years

9. How would you rate the amount of physical activity you perform in your leisure time?

   _____
   very little little moderate active very active

10. How physically fit do you feel at present?

    _____
    unfit below average average above average very fit

11. Following is a list of activities. Please identify what exercises you participate in during your leisure-time by marking the activity with one of the following letters:
    A. do not do at all
    B. do at least 3 times per week for at least 30 minutes
    C. do 1-2 times per week
    D. do occasionally but with no regularity

APPENDIX B (cont)

11. (cont)

Dancing _____	Calesthenics _____
Gardening _____	Climbing stairs _____
Golf _____	Handball _____
Volleyball _____	Racquetball _____
Walking _____	Jogging _____
Fishing _____	Squash _____
Tennis (doubles) _____	Skipping rope _____
Tennis (singles)_____	Basketball _____
Cycling _____	Chopping wood _____
Cross-country skiing _____	Hiking _____
Hunting _____	Snow skiing _____
Motor cycle racing _____	Car racing _____

Other _____

12. Angina? _____present _____absent

13. If angina is present, has it _____increased _____decreased or _____remained unchanged since stopping the program?

14. Have you been told you have high blood pressure since stopping the progam? _____yes _____no

15. Have you had a heart attack since stopping the program? _____yes _____no. If yes, when _____.

16. Have you had coronary arteriograms since stopping the program? _____yes _____no If yes, when _____

17. Have you been hospitalized for angina since stopping the program? _____yes _____no If yes, when _____

18. Have you had coronary by-pass surgery since stopping the program? _____yes _____no If yes, when _____

19. Have you been hospitalized for any other reason since dropping the program? _____yes _____no If yes, what for _____
_____

20. What medications are you currently taking? _____
_____
_____

21. Did your spouse attend the exercise sessions with you? ____yes ____no

22. How supportive was your spouse in your participation?

_____

not at all little bit somewhat extremely does not apply

23. What factor(s) resulted in your stopping the YCT Exercise Program? Check any that apply.

_____have moved
_____financial
_____lack of interest
_____personal or family problems
_____told to stop by my physician
_____told to stop by the program physician
_____boredom
_____classtime not convenient
_____the class was too easy
_____lack of progress
_____exercise was making me worse
_____reached my maximal level
_____only had plans to attend for 3 months
_____would rather exercise on my own
_____other; give reason _____
_____

24. What would make you rejoin the YCT class?

_____decreased cost
_____more convenient times
_____more personal attention
_____less busy schedule
_____weather
_____do not want to rejoin
_____other _____

25. What percentage of your monthly bill was paid by an insurance company? _____none
_____less than 50%
_____70%
_____80%
_____90%
_____100%

Name of Insurance Carrier _____

APPENDIX C

YMCA of Columbia-Willamette
Metro Center
2831 SW Barbur Boulevard
Portland, Oregon 97201
503/223-9622

Dear

We are conducting a survey to obtain the views of those who have participated in the YMCA Cardiac Therapy program. We are striving to have this program as useful and enjoyable as possible for as many people as possible. Since there are many factors to be considered in a program of this size we would appreciate some information from you.

This information covers your present background and medical status. To make it as easy as possible we have listed a range of frequent choices. If these do not adequately describe your situation feel free to list your own comments.

The information obtained will be kept confidential. Your name will not appear on any report and your confidentiality will be insured by the use of code numbers. You are free to refuse to participate in this survey at any time without effecting your relationship with or treatment at the YMCA Cardiac Therapy Program.

Please complete the enclosed questionnaire and return it in the enclosed addressed stamped envelope as soon as possible.

Thank you for your help and cooperation. If you have any questions or objections please call me collect at 1-585-8333.

Sincerely,

[redacted]

Cody E. Martin, RN

APPENDIX D

Table A

Number of Compliers Employed Compared to Noncompliers at the Start of the YCT Program

	Employed	Non-employed	Retired
Compliers	47	2	4
Noncompliers	33	4	4

$X^2 = 4.7$, df 2

Probability < 0.05

Table B

Comparison of Marital Status Between Compliers and Noncompliers at Start of the YCT Program

	Married	Divorced	Single	Widowed	Separated
Compliers	44	2	4	2	1
Noncompliers	34	5	1	0	1

$X^2 = 5.01$ df 4

Probability < 0.05

Table C

Comparison of the Number of Compliers Smoking History to Noncompliers at Start of the YCT Program

	Never Smoked	Ex-Smoker	Smoking
Compliers	13	22	8
Noncompliers	6	23	12

$X^2 = 4.41$ df 2

Probability < 0.05

Table D

Number of Compliers Compared to Noncompliers With a History of Hypertension at the Start of YCT Program

	Present	Absent
Compliers	20	33
Noncompliers	19	22

$X^2 = 0.70$ df 1

Probability < 0.05

Table E

Number of Compliers Compared to Noncompliers Who Were Active or Somewhat Active to Not Active With Leisure Time Exercises at Start of the YCT Program

	Active	Somewhat/None
Compliers	30	23
Noncompliers	15	26

$X^2 = 3.68$ df 1

Probability < 0.05

Table F

A Comparison Between Compliers and Noncompliers in Their Rating of the Amount of Activity Done in Their Leisure-Time

	Very Little	Moderate	Very Active
Compliers	25	22	6
Noncompliers	26	12	3

$X^2 = 2.45$ df 2

Probability <0.05

Table G

Retrospective Data on Self-Perception of How Physically Fit the Subjects Felt Between Compliers and Noncompliers

	Unfit	Moderate	Very Fit
Compliers	26	25	2
Noncompliers	28	10	3

$X^2 = 5.21$ df 2

Probability < 0.05

Table H

Retrospective Data on Comparison of the Occurrence of Myocardial Infarctions Between Compliers and Noncompliers

	+ MI	-MI
Compliers	29	24
Noncompliers	20	21

$X^2 = 2.25$ df 1

Probability < 0.05

Table I

Retrospective Data on Comparison Between Compliers and Noncompliers On a History of Angina

	Present	Absent
Compliers	29	24
Noncompliers	23	18

$X^2 = .00$ df 1

Probability < 0.05

Table J

Retrospective Data on Comparison of the Number of CABG's Between Compliers and Noncompliers

	Have Had	Have Not Had
Compliers	15	38
Noncompliers	17	24

$X^2 = 1.73$ df 1

Probability < 0.05

Table K

Retrospective Data on Comparison Between Compliers and Noncompliers In the Usage of CAD Related Drugs

	Use	Do Not Use
Compliers	31	22
Noncompliers	23	18

$X^2 = .11$ df 1

Probability < 0.05

Table L

Retrospective Data on Comparison of Compliers to Noncompliers in Occurrence of Coronary Arteriograms

	Have Had	Have Not Had
Compliers	41	12
Noncompliers	28	13

$X^2 = .97$ df 1

Probability < 0.05

Table M

Prospective Data on Comparison of Smoking Habits Between Compliers And Noncompliers

	Ex-Smoker	Never	Smoking
Compliers	31	13	9
Noncompliers	23	6	12

$X^2 = 2.68$ df 2

Probability < 0.05

Table N

Prospective Data on Comparison of History of Hypertension Between Compliers and Noncompliers

	+ Hypertension	- Hypertension
Compliers	22	31
Noncompliers	20	21

$X^2 = .50$ df 1

Probability < 0.05

Table O

Prospective Data on Comparison of the Number of MI's Between Compliers And Noncompliers

	+ MI	- MI	Repeat MI
Compliers	31	22	2
Noncompliers	29	12	2

$X^2 = 1.54$ df 2

Probability < 0.05

Table P

Prospective Data on Comparison of Angina Between Compliers and Noncompliers

	Present	Absent
Compliers	17	36
Noncompliers	15	26

X^2 = .20 df 1

Probability < .05

Table Q

Prospective Data on Comparison of the Number of CABG's Between Compliers and Noncompliers

	+	-
Compliers	20	33
Noncompliers	22	19

X^2 = 2.40 df 1

Probability < .05

Table R

Prospective Data on Comparison of the Number of Arteriograms Between Compliers and Noncompliers

	+	- Repeat
Compliers	43	11
Noncompliers	29	5

X^2 = .46 df 1

Probability < 0.05

Table S

Prospective Data on Comparison of the Use of CAD Related Drugs Between Compliers and Noncompliers

	On	No Drugs	Decreased
Compliers	34	19	6
Noncompliers	23	18	2

$X^2 = 1.71$ df 2

Probability < 0.05

APPENDIX E

Table 1

Mortality Report (Retrospective Data)

# subjects	4
Average age at diagnosis	54.3 yrs
AVerage age at time of Program	55.5 yrs
Sex	4 males
Employment Status	
Employed	3
Retired	1
Marital Status	
Married	3
Single	1
Positive Stress Test	4
Smoking History	
Never	1
Ex-smoker	2
Smoking	1
History of Hypertension	1
MI	3
CABG's	1
Angina	1
Coronary Arteriograms	2
CAD Related Drugs	4
% Class Attendance	
70%	2
70%	2
Months Attended	
3 mo.	2
3-6 mo.	1
6-12 mo.	0
12 mo.	1

Deaths occurred from 15 days to 40 months after stopping the program.

AN ABSTRACT OF THE CLINICAL INVESTIGATION OF

CODY E. MARTIN

for the MASTER OF NURSING

Date receiving this degree: JUNE 11,1982

TITLE: A STUDY OF DROPOUT PATIENTS FROM A SUPERVISED CARDIAC EXERCISE PROGRAM: MORBIDITY, MORTALITY, AND LEVELS OF ACTIVITY.

APPROVED: _____

Mary McFarland, M.S., Associate Professor,
Clinical Investigation Advisor

The amount of functional improvement achieved from a cardiac exercise program depends upon compliance with the program for months or years. Unfortunately, many patients do not benefit from exercise because of poor attendance and/or subsequent withdrawal. One of the major unsolved problems confronting health care workers is patient's poor compliance with their prescribed therapeutic regimens. The purpose of this study was to address the issues of morbidity, mortality, and continued leisure-time activities as they relate to subjects who dropped out of a prescribed medically supervised exercise program.

The design of this study was descriptive. Retrospective and prospective data were collected to demonstrate associations between past and present health status, risk

behaviors, and levels of exercise in patients who had dropped out of the medically supervised exercise program.

A chart review on patients health status, socio-demographic data and levels of activity was gathered on 184 men and women who had attended at least one YCT class and had dropped out from Dec. 1975 to Dec. 1980. A subjective response questionnaire was mailed to all 184 subjects. Ninty-four subjects responded to the questionnaire. A comparison of selected risk factors and morbidity events at the time of entry into the program and at the time the patients responded to the questionnaire was undertaken to describe relationships between people who continued to comply with an aerobic exercise program compared to noncompliers since dropping out the the YCT program.

Subjects were divided into two groups. Group 1, compliers, consisted of 53 men and women who reported exercising at least 3 times per week for at least 20 minutes. Group 2, noncompliers, consisted of 41 subjects not meeting the above minimum requirement of aerobic exercise. Contingency tables were established to examine possible relationships between compliers and noncompliers in risk factors, morbidity events, and levels of activity using the chi-square statistical analysis test to evaluate for levels of significance.

Results showed compliers were significantly more likely to have had a preadmission positive stress test than noncompliers. Compliers were significantly more likely to have attended

greater than 70% of the YCT classes than noncompliers. Also, compliers were more likely to perceive themselves as being more active and more physically fit than nonvompliers at the time of responding to the questionnaire. Risk factors and morbidity events were nonsignificant determinates of continued compliance with an exercise regimen. Four subjects died from cardiac related causes. Anavoidable factors such as financial difficulties, inconvenience of class time and moving from the area were the most frequent reasons marked for having dropped the YCT program.

Conclusions drawn from the present study were: 1) selected risk factors and morbidity events were relatively similiar between compliers and noncompliers at the time of entry in the YCT program; 2) having attended classes greater than 70% of the time was a significant indicator for continued compliance with an independent aerobic exercise program; 3) little difference in present health status was noted between compliers and noncompliers except in the compliers perceived level of fitness and how physically fit they feel. Recommendations for further studies were made.