Continued Exercise in Non-insulin Dependent Diabetes Mellitus

By

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ABSTRACT

TITLE: Continued Exercise in Non-insulin Dependent Diabetes Mellitus

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The study was conducted to determine if adults with NIDDM continued to exercise one year after completing a 12-week walking program and to explore psychosocial characteristics of those who continued to exercise. Twenty-seven subjects were surveyed by mail and 25 subjects completed a: Personal Update Form, General Well-being Schedule, Exercise Benefits and Barriers Scale, Diabetes Self-efficacy Scale and a two-week prospective exercise log. ANOVA-RM was used to compare exercisers and non-exercisers at three times: before and after the walking program and one year later.

Results indicated that 59% of subjects continued to exercise regularly. A profile of successful exercisers was developed for use when prescribing exercise. Specific barriers to long-term exercise were identified. Self-efficacy for diabetes management improved significantly among exercisers. Self-efficacy for exercise and general well-being were found to increase and decrease in relation

to the amount of exercise performed. Inconsistent exercise may have increased exercise injuries suggesting the need for continued monitoring by clinicians. The knowledge gained from this study will aid in the design and implementation of effective exercise counseling that will foster lifelong exercise habits for people with diabetes.

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CHAPTER I

Introduction

Statement of the Problem

There are approximately 12 million adults in the United States with diagnosed or undiagnosed non-insulin dependent diabetes mellitus (NIDDM) (American Diabetes Association [ADA], 1991). To reduce the possibility of acute and chronic complications from the disease, individuals with NIDDM must be actively involved with many aspects of their care. They adopt new health behaviors and make daily decisions that can be difficult. With the demands required of this disease, it is no surprise that many people with diabetes are unable to regularly adhere to complex health regimes. Evidence of poor compliance with diabetic regimes range from one-third to three-fourths of people with diabetes (Schlenk & Hart, 1984).

Physical activity is one of three classic components of diabetes management. Regular physical activity augments the success of the other two components, diet and medication, in controlling blood glucose (Rifkin, 1988). The ADA recommends exercise for most patients with NIDDM (Rifkin, 1988). Regular exercise can: 1) improve insulin sensitivity and possibly improve glucose tolerance, 2) have a positive effect on weight loss and maintenance of weight, 3) reduce cardiovascular risk factors, 4) reduce dosage of insulin or oral hypoglycemic agents, 5) improve work capacity, and 6) improve feelings of well-being (Rifkin, 1988). Despite these many physical and psychological benefits, it can be difficult for individuals to integrate regular exercise into their daily routine. Adults with NIDDM are often obese and sedentary (Rifkin, 1988), therefore, a prescription of regular exercise represents a dramatic change in lifestyle. The challenge for nursing practice is to identify variables influencing continued exercise behavior so that people with diabetes can be effectively encouraged to initiate and maintain a long-term exercise habit.

Purpose

The purposes of this study are: 1) to determine if adults with NIDDM continued to exercise one year after a 12-week walking program and 2) to explore psychosocial characteristics of those who continued to exercise. This followup study is based on a 12-week walking program investigated by Crabtree (1991). This original study will be referred to as the parent study and described in the Methods chapter.

CHAPTER II

Review of Literature

This review includes current exercise recommendations, physical and psychological benefits of exercise, and a description of current research associated with continued exercise over time including barriers to continued exercise. The Health Belief and Self-efficacy Models will be discussed as they have been used to explain continued exercise behavior.

Exercise Recommendations

Recommendations have been suggested for the type, duration and frequency of exercise best suited for those with NIDDM. The latest recommendation for the general public is to exercise aerobically 3-5 days per week, at an intensity of 60-90% of maximum heart rate, for a continuous duration of 20-60 minutes (American College of Sports Medicine [ACSM], 1990). A written position statement by the ADA suggests people with diabetes exercise aerobically at least three times per week at 50-70% maximal oxygen consumption for 20-45 minutes including a warm up and cool down component (ADA, 1991). The ADA's approach to exercise is slightly more conservative in intensity and maximum duration than that proposed by the ACSM. This more conservative approach may be advised since most people with NIDDM are older, obese and sedentary.

Rationale for Moderate Exercise

As people age, their physical fitness level decreases (Dishman, 1988, p. 83). The typical decrease in maximum oxygen consumption with age and increase in total body mass due to increased fat weight and decreased lean body mass can be altered with exercise (ACSM, 1990). However, the elderly are more prone to injury with high impact exercises such as jogging or jumping (ACSM 1990). A longer adaptation time is needed when the elderly are increasing their physical activity (ACSM, 1990; Graham, 1991). Exercise benefits for the elderly are desirable and can be achieved safely with a low to moderate gradually increasing intensity program such as walking, swimming or cycling (Haskell, Montoye & Orenstein, 1985).

A moderate exercise routine may be more appropriate for obese individuals, due to their increased risk of coronary heart disease, increased incidence of degenerative joint disease (Horton, 1991) and increased likelihood for dropping out of a fitness program (Dishman, Sallis & Orenstein, 1985).

Graham (1991) explains that aging patients with diabetes with a history of being sedentary are at increased risk of cardiac arrest and cerebral vascular accidents when exercise is vigorous. Increased age, obesity and a history of being sedentary require a moderate, gradual approach to initiation of exercise (ACSM, 1990; Vallbona & Baker, 1984).

Special considerations in prescribing even moderate exercise to people with diabetes are needed in the presence of retinopathy, neuropathy, nephropathy, hypertension, or cardiovascular disease. Retinopathy, neuropathy and nephropathy are complications of diabetes that can be aggravated by high impact or resistance exercise (Exercise and NIDDM, 1991). Heavy resistance training exercises are often avoided for those with NIDDM even if normotensive, as this form of exercise can dramatically increase systolic and diastolic blood pressure (ACSM, 1990). Other possible problems with exercise for those with diabetes may be hyperglycemia and hypoglycemia. These acute complications can be prevented with appropriate modification of diet and medication, timing of exercise activities and blood glucose testing before and after exercise routines.

There is accumulating evidence that an exercise level less than what is recommended by the ACSM may be beneficial for healthy populations. The ACSM bases their recommendation on achieving fitness which may or may not be necessary to obtain some of the health benefits of exercise (Haskell et al., 1985). Benefits may occur with regular exercise performed more frequently, for a longer duration and at lower intensity. Lower intensity doses of exercise can improve maximum oxygen consumption and maintain body composition if the total energy costs in kilocalories are equal to a higher intensity exercise (ACSM, 1990). In the large and well-known study of 16,936 Harvard alumni over 12-16 years, Paffenbarger, Hyde, Wing and Hsieh (1986) found a lower death rate among those men who expended 500-2000 kilocalories per week in physical activity compared with those who were less active. Physical activity including walking, stair climbing, and sports was converted to a kilocalorie score and found to be negatively related to mortality. Lower intensity exercise may also promote a long-term habit because it is more acceptable to the client and produces fewer injuries that interrupt the regular performance of exercise.

King, Taylor, Haskell and Debusk (1988) studied the long-term maintenance of home-based exercise in 103 healthy middle-aged men and women and found the lower intensity exercise prescribed was positively reflected in maintenance and comfort of exercise. Positive physical outcomes were attained from low intensity exercise as demonstrated in a study by Stevenson and Topp (1990). Over nine months they studied 72 healthy subjects with a mean age of 64 years. They compared physical outcomes from a moderate (60-70% of heart rate reserve) to a low intensity (30-40% of heart rate reserve) exercise program. Heart rate reserve, defined as the percent of difference between resting and maximal heart rate, is closely correlated with percent of maximal oxygen consumption (Pollock & Wilmore, 1990). Both groups had a significant and equal training effect as measured by decreased heart rate at a constant workload. They also experienced improved perceptions of future health, feelings of adequacy of sleep and cognitive function.

Health benefits of low intensity exercise were also found by Duncan, Gordon and Scott (1991) who studied 59 women who were randomly assigned to four treatment groups: aerobic walkers, brisk walkers, strollers and sedentary controls. All three exercise treatment groups exercised five days a week for six months. Maximal oxygen uptake increased most for the aerobic walkers but increases in HDL in all three exercise groups improved significantly. In this study, even when desirable fitness levels had not been reached, health improvements were achieved. The results of these three studies support recommendations of low to moderate exercise that may be effective in achieving weight loss, improvement in lipids, fitness, psychosocial benefits and exercise maintenance over time. Although levels of exercise have not been studied in diabetes, lower levels of exercise would be easier to attain and maintain and may have health benefits for those with NIDDM.

Physical Benefits of Exercise

The potential physiological benefits of regular exercise for people with NIDDM include possible improvement in glycemic control, reduction of cardiovascular risk factors, including weight loss and blood pressure control. Recently, exercise has been viewed as delaying the onset of insulin resistance and development of NIDDM for those at higher risk of developing diabetes, as well as delaying or preventing some of the long-term complications of diabetes (Helmrich, Ragland, Leung, & Paffenbarger, 1991).

Glycemic Control

The metabolic effects of exercise benefitting people with NIDDM, such as enhanced insulin action are short-lived and only last several days (Rogers, Yamamoto, King, Hagberg, Ehsani & Holloszy, 1988). Enhanced insulin action is due to increased numbers, sensitivity and binding capacity of insulin receptors (Armstrong, 1991). However, exercise enhanced insulin action in NIDDM has not been shown to consistently lower fasting blood glucose, change glucose tolerance or have a marked impact on glucose regulation (Horton, 1988; ADA, 1990). This may be due to the short duration of enhanced insulin action and emphasizes the importance of a regular and continuous exercise habit.

Some evidence for long-term blood glucose control with exercise has been realized. Kaplan, Hartwell, Wilson and Wallace (1987) demonstrated that glycosylated hemoglobin, a measurement of blood glucose control over 6-8 weeks can be decreased with exercise. This group of investigators randomly assigned 70 volunteers with NIDDM to four groups: 1) diet, 2) exercise, 3) diet and exercise, and 4) education (control). The intervention program lasted ten weeks and evaluations were made at baseline, three, six, twelve and eighteen months. A small but non-significant decrease in glycosylated hemoglobin was found among the diet and exercise group. Horton (1991) suggests these findings may be due to the cumulative effect of exercise induced insulin action on diabetic control. Despite inconsistent findings for improvement in glucose control with exercise, enhanced insulin action may still be found to provide a substantial benefit for those with NIDDM. Hyperinsulinemia, currently considered one pathophysiological explanation for NIDDM, is thought to be related to the complication of vascular disease (Armstrong, 1991). Exercise improves insulin action and may potentially reduce hyperinsulinemia, playing a role in preventing vascular complications of diabetes.

Cardiovascular Disease

Most people with NIDDM develop the complication of accelerated atherosclerosis and related cardiovascular disease. The cardiovascular benefits of regular exercise include lower lipid levels, lower blood pressure and increased fat loss, all of which are common goals for people with NIDDM. The benefits of continued exercise in NIDDM have been shown to include increased HDL-cholesterol, decreased LDL-cholesterol, decreased VLDL-cholesterol, decreased or equal triglycerides and decreased total cholesterol levels (Romennaa, Marniemi, Puukka & Kuusi, 1988; Armstrong, 1991). Horton (1991) describes a possible 5-10 mmHg decrease in systolic and diastolic blood pressure with regular exercise in hypertensive subjects without diabetes. Wing, Epstein, Paternostro-Bayles, Kriska, Nowalk, & Gooding (1988) found in their study of 25 subjects with NIDDM, that regular exercise plus dietary management resulted in decreased weight and less increase in medication than those on diet control only. The cardiovascular benefits of exercise including favorable changes in lipid profile, decreased blood pressure and weight loss or maintenance support the importance of continued exercise for people with NIDDM.

Psychological Benefits of Exercise

The psychological benefits of exercise are quoted as being well documented in the literature by many investigators (Serfass & Gerberich, 1984; Edmunds, 1991; Haskell et al., 1985; Vasterling, Sementilli & Burish, 1984). However, Dishman (1988, p.93), an expert in the field of exercise behavior, argues that although the relationship between exercise and psychological well-being has been established, a causal relationship has not yet been documented. Studies have shown that exercise training is associated with decreased anxiety, improved mood and self-esteem, increased sense of well-being, and enhanced quality of life. The following three studies have shown a relationship between regular exercise and psychological improvement. Blumenthal, Williams, Needels and Wallace's (1982) work found regular exercise decreased anxiety, tension, depression and fatigue in 16 deconditioned middle-aged subjects participating in a ten-week walking and jogging program. In a later study, Blumenthal et al. (1991) found positive psychological benefits occurring between 8-14 months of aerobic exercise in an sample of 101 elderly subjects.

In an study of subjects with NIDDM, Wing, Epstein, Nowalk, Kaeske and Hagg (1985) randomly assigned 53 subjects to three treatment groups; 1) behavior modification, 2) nutrition education and 3) standard education. During the 16 weeks of treatment a specific exercise goal with modeling and reinforcement was given to the behavior modification group; the nutrition group was given information only. Exercise was briefly discussed in the standard care group. The Beck Depression Inventory was used to assess mood changes at baseline, 16 weeks and 16 months. Exercise and mood changes improved significantly at 16 weeks in the behavioral modification group but both returned toward baseline at 16 months. At 16 months followup, exercise declined but was still significantly increased from baseline but mood returned to baseline. These results show some limited relationship between exercise and mood. These studies are examples of many that have found a clear relationship between regular exercise and psychological benefits in different age groups that are healthy or with a chronic illness. However, under what circumstances they occur and how they motivate continuation of exercise is still unknown.

Vasterling et al. (1988) claim in their review article that exercise that reduces stress in healthy subjects may benefit the person with diabetes by improving their feelings of well-being and quality of life. At this time there is no reason to think that people with diabetes would not receive the same psychological benefits of regular exercise as the general population, however studies are needed to further document these effects and determine how much exercise is necessary to produce the desired effects. For example, in Kaplan's et al. (1987) study described earlier, increased quality of life was reported by NIDDM subjects who were exercising and dieting compared with groups not engaged in exercise. These studies showing the psychological benefits of exercise in those with NIDDM are encouraging but more studies are needed to further clarify these benefits.

Not only are feelings of well-being a benefit of regular exercise, but the experience of these benefits may be an important factor in long-term adherence (King et al. 1989). The psychological benefits of regular exercise are especially appreciated with long-term exercise as compared with short-term exercise. In the studies already described, psychological benefits occurred at 10 weeks, 4 months and 8 months of continued exercise. Studies are needed to explain how the psychological benefits enhance exercise maintenance.

Continued Exercise

Continued exercise with or without the influence of a formalized program is a common problem. Program dropout rates or exercise relapse have been examined for participants in cardiac rehabilitation programs. Dropout rates typically refer to participation ending during an ongoing program of exercise. Oldridge (1988) summarized several non-randomized studies of continued exercise after myocardial infarction and found the dropout rate to be approximately 50% after six months. Those who were still exercising after six months were likely to continue to exercise after 12 months.

Continued Exercise after a Program

The cardiac rehabilitation programs studied, unfortunately, did not include followup of exercise after the programs ended. In addition, it is not known how many of the people who dropped out of the programs continued to exercise on their own. In fact, studies show that 18-40% of program dropouts have personal exercise programs four years later (Dishman, 1986). In one of the few studies investigating exercise after program completion, Radtke (1989) surveyed a convenience sample of 35 patients who completed a hospital cardiac rehabilitation program. Of the 28 who responded to a mailed questionnaire, 89% complied with their exercise prescription six weeks after returning home. Those who were exercising at six weeks were surveyed at six months and of the 17 that responded, exercise compliance was 49%. The exercise compliance in this study was similar to dropout rates during an ongoing exercise program. A limitation of this study is a lack of exercise information about those who did not respond and a poor response rate at six months of 68%. Based on data from this study, dropout rates during a formal program were similar to rates of discontinuing exercise after an exercise program.

Exercise Relapse in Diabetes

Krug, Haire-Joshu and Heady's (1991) study was the only one located exploring exercise relapse in diabetes. The purpose of this study was to assess the exercise activity of 60 subjects with NIDDM and 60 without NIDDM. Results showed that 36% of those with diabetes exercised compared with 34.4% of non-diabetics. However, those with NIDDM had more relapses and felt more guilt about the subsequent relapses. A major problem with this study was that relapse was defined by each subject. Unfortunately, data about continuation of exercise during the 18-month study was not presented in this article. This information would be beneficial as data about continued exercise in persons with NIDDM is scarce.

Exercise Relapse in the Community

In a large community sample explored by Sallis, Haskell, Fortmann, Vranizan, Taylor and Solomon (1986), the relapse rate during the past year was about 50% for those engaged in vigorous activity and 25-30% for those engaged in moderate activity. It was found that relapse rates were similar with or without a formalized exercise program. This study is limited by its retrospective method and one year data collection period. People engaging in high intensity exercise are twice as likely to quit than those exercising at a moderate level (Serfass & Gerberich, 1984).

These data suggest that relapse rates are similar whether or not the person is participating in a formalized exercise program. Those with cardiac disease are less likely to maintain a moderate exercise program than a healthy person. More information is needed on the effectiveness of exercise programs to change behavior over time, especially when a person is no longer active in a formal program or has a chronic illness.

Exercise involves both adoption of the activity and maintenance of the exercise habit over time (Dishman, 1986). Sallis et. al. (1986) and Dishman (1986) concur that the predictors of exercise adoption and maintenance are not the same, therefore studies in this review will focus on the maintenance of exercise over time.

<u>Factors Associated with Continued Exercise</u>

There are several ways to conceptualize factors associated with continued exercise. Some investigators study factors that will predict which individuals will maintain an exercise program. Others seek to find common motivators or attitudes of long-term exercisers and identify factors that may help to maintain an exercise program. Researchers often explore reasons individuals drop out of an exercise program. Factors predicting maintenance of regular exercise, motivators of long-term exercise and causes for relapse may all be different. For example, an individual may continue an exercise program for a period of time because they exercise with a friend but later discontinues the exercise because of time constraints. Following are examples of each type of study and their results.

In a community sample of 1,411, Sallis et al. (1986) found that self-control and self-efficacy, a personal belief in ability to exercise, predicted moderate exercise program maintenance while psychological variables such as general well-being only moderately predicted exercise.

According to Dishman et al. (1985), the motivation for maintaining exercise over time is sustained by enjoyment of the program, convenience, and social support received.

Reasons for dropping out of an exercise program or abandoning an exercise habit has been explored in community, cardiac rehabilitation and diabetes samples. A later study by Sallis et al. (1990) surveyed 2,053 randomly selected community subjects to describe exercise and relapse patterns across a lifetime. In addition to relapse information, subjects were asked for the reasons they stopped exercising the most recent time. From these responses the most common reason for relapse in those who were currently exercising were: 1) injury, 2) work demands, 3) lack of interest, 4) lack of time, and 5) family demands. For those not currently exercising, the reasons given were 1) injury, 2) lack of interest, 3) work demands and 4) lack of time. Interestingly, these responses are very similar.

Current exercisers and sedentary individuals did not differ in frequency of exercise relapses, with 20% reporting three or more major relapses in their lifetime. This study found that many people begin exercise programs and subsequently relapse, pointing out the difficulty with exercise maintenance. The current non-exercisers rated lack of interest higher than exercisers which may be a key area for interventions to improve exercise maintenance. Andrew, et al. (1981) found similar reasons were reported for dropping out of a cardiac rehabilitation exercise program based on their study of 639 respondents followed over a seven year period. Reasons reported for dropping out included a lack of social support, inconvenience of facilities, lack of attention of staff and disbelief in benefits of exercise.

Ary, Toobert, Wilson and Glasgow's (1986) study with a sample of 204 persons with NIDDM and IDDM identified their most frequent reason for not exercising as negative physical concerns. This may be due to an increased frequency of illness and injury in diabetes or perhaps those with diabetes are more highly sensitized to their body signals. Similarly, injury was the most common reason for relapse among community samples, but the supervised cardiac group reported factors related to social support. These results show how careful investigators must be in generalizing results to people with chronic illnesses.

The different reasons described for dropping out of an exercise program may be accounted for by the type of exercise, the type of sample (community, cardiac, or diabetic), the presence or absence of a formal exercise program, and the different lengths of time measured. Generalizing results is not always possible. Clearly, there is not one consistent explanation for maintenance of an exercise habit as multiple reasons are being identified.

Few studies have been undertaken to investigate interventions to improve exercise maintenance. King et al. (1989) demonstrated in 52 healthy subjects that adherence to a moderate intensity home based exercise program was significantly improved by monthly phone calls to the subjects. These favorable results are an indication of the potential effectiveness of using this method to influence exercise behavior.

In the next section, literature describing the Health Belief Model is reviewed as a theory of motivation for exercise behavior.

Health Belief Model

The Health Belief Model (HBM) developed by a group of social psychologists in the 1950's has been widely used to explain health behavior in healthy populations. The model was proposed to explain why people participated in public health screening and preventative health behaviors. Thirty years later, Janz and Becker (1984) reviewed 46 studies that used the HBM and concluded that the model is a strong predictor of adherence. Of the four dimensions of the HBM, barriers, benefits, susceptibility, and severity, the strongest predictor was perceived barriers.

Various attempts have been made to improve the model's ability to predict health behavior including adding variables such as self-efficacy. Janz and Becker (1984) concluded the construct of perceived barriers is closely related to self-efficacy. Rosenstock, Strecher and Becker (1988), recommended a revision of the HBM to incorporate the concept of self-efficacy as a separate component. They believed that self-efficacy warranted separate consideration particularly when the HBM was applied to people with chronic illnesses requiring continued lifestyle changes.

More recently, the HBM has been used in studies to predict medical regimen compliance (ie. weight loss, smoking cessation and cardiac rehabilitation). An example of the HBM in predicting diabetes self-management is a study by Brownlee-Duffeck, Peterson, Simonds, Kilo, Goldstein and Hoette (1987) exploring the relationship of health beliefs, regime adherence and metabolic control in 143 subjects aged 13-64 with IDDM. Results indicated that health beliefs accounted for 41-52% of the variance in adherence. A subset of health beliefs and perceived benefits were most strongly associated with regimen adherence and metabolic control for the older subjects only. Problems with this study include the newly developed questionnaires with minimal reliability and validity and the weakness of self-report as reflected by a poor relationship between subjects' self-reported adherence and objective measures of metabolic control. The history of success of the HBM in predicting health behaviors favors continued exploration in developing reliable and valid tools specifically designed for populations with diabetes.

Self-efficacy

Self-efficacy refers to a belief in one's ability to perform specific behaviors and is assessed in relation to performance of those behaviors (Bandura, 1986). Self-efficacy expectation or self-efficacy is a component of Bandura's Social Cognitive Theory which shares many similarities with the HBM. Self-efficacy has been used to predict smoking cessation (Devins & Edward, 1988), weight reduction (Kingery & Glasgow, 1989), exercise in chronic obstructive pulmonary disease (Kaplan & Atkins, 1984) and exercise in diabetes (Crabtree, 1986). Studies are accumulating to corroborate the relationship between self-efficacy, and adoption and maintenance of behavior changes (Rosensock et al. 1988) including diabetes management. McCaul, Glasgow and Schafer (1987) explored psychosocial predictors of adherence in subjects with NIDDM and found self-efficacy was the only variable related to every area of adherence. Kingery and Glasgow (1989) explored the relationship between self-efficacy beliefs, self-care behavior and outcome expectations for 127 people with NIDDM. The measurement tool used in this study was first developed by Bandura and used by two investigators previously. They found that self-efficacy was a moderate predictor of exercise behavior.

Measurement of Self-efficacy

The following studies examined how self-efficacy is measured, relates to health behavior and to other psychosocial variables. Grossman, Brink and Hauser (1987) found that the diabetes self-efficacy of 68 adolescents with insulin dependent diabetes mellitus (IDDM) was significantly related to their perceptions of internal control, self-esteem and metabolic control. This study used an original self-efficacy scale specifically designed for adolescents. The content validity of this tool is questioned as only physicians, not familiar with self-efficacy were consulted for its construction. Validity was also examined in relation to correlations with internal locus of control ($r=.41$, $p<.001$) and self-esteem ($r=.43$, $p<.01$). The diabetes self-efficacy scale did not include self-efficacy related to maintenance of an exercise regimen and a number of the items measured self-worth rather than self-efficacy. Some of the problems with constructing a self-efficacy tool are evident in review of this study.

Crabtree (1986) developed a tool for measuring self-efficacy specific for diabetes management, the Diabetes

Self-efficacy Scale (DSES) which was tested for reliability and validity with two cross-sectional samples of adults with IDDM or NIDDM. The results are reported in the Methods section. Self-efficacy was used to predict diabetic management. Diabetes self-efficacy was found to be the only predictor of exercise behavior out of 11 predictors tested. This study provides some strong preliminary evidence for the relationship between self-efficacy and exercise in people with diabetes.

Few studies to date have used the self-efficacy concept to intervene in diabetes exercise behaviors. People with NIDDM are often obese and have sedentary lifestyles. Without experiencing the positive reinforcement obtained from successful performance of exercise, these individuals often have low self-efficacy or belief in their ability to exercise. These beliefs may also reflect fears regarding hypoglycemia or injury.

CHAPTER III

Conceptual Framework

This study examines the relationship between continued exercise, and diabetes self-efficacy for exercise, perceived benefits and barriers of exercise and a sense of general well-being. Rationale for selection of the psychosocial concepts chosen for this study is based on health beliefs and self-efficacy.

Beliefs related to self-efficacy and benefits and barriers of exercise have been shown to predict exercise behavior; however, this study will explore whether continued exercise sustains these beliefs. Improved general well-being is a proposed outcome of continued exercise.

Exercise

Continued exercise refers to aerobic exercise which is performed during the year following the 12-week exercise program. Reported exercise was evaluated by the type, frequency and duration of exercise. Anecdotal descriptive information was collected to determine how consistently the exercise was done during the past year.

Self-efficacy

Self-efficacy is defined by Bandura (1977, p.193) as "the conviction that one can successfully execute the behavior required to produce the outcomes," and has been shown to be a strong predictor of behavior (Bandura, 1986; Rosenstock, et al., 1988). This self-efficacy theory more recently renamed Social Cognitive Theory (SCT) was derived from Social Learning Theory. It describes two components that influence a person's performance of a behavior. One is the "outcome expectation," or what results a person expects from performing the behavior. The other is the "efficacy expectation" from which the concept of self-efficacy is developed. Self-efficacy refers not to how capable one is in performing the activity but how capable one believes he/she is in performing the activity. It refers not to general beliefs in abilities but to specific beliefs, such as the perceived ability to exercise.

Bandura suggests that the strength of self-efficacy determines three components of behavior: the decision to perform, the effort expended and persistence in continuing the behavior. If self-efficacy for exercise is high, the prediction is that the likelihood of continued exercise behavior will be high. In turn, the self-efficacy for exercise will be reinforced by successful personal performance, one of the four sources of self-efficacy. This relationship is described as the principle of reciprocal determinism (Bandura, 1986).

Interventions based on the self-efficacy model are appealing because they can easily be incorporated into nursing strategies. In the parent study, the intervention provided for the motivation group manipulated the four sources of self-efficacy: personal performance, vicarious experiences, verbal persuasion, and heightened awareness of physiological feedback (Bandura, 1986). The first source of self-efficacy, successful performance is thought by Rosenstock et al., (1988) to be the most powerful "efficacy enhancer."

Benefits and Barriers

The Health Belief Model (HBM) was developed to describe participation in preventative health behavior. Two of four components of this model, perceived benefits and perceived barriers, have been shown to mediate exercise behavior. Perceived barriers have been shown to be the strongest predictor of performing a health behavior (Janz & Becker, 1984). Perceived benefits describe a person's beliefs about the effectiveness of the behavior to reduce the disease threat. The perceived barriers refer to a person's beliefs in the potential negative aspects of taking action. Examples of perceived benefits of exercise include increased physical strength, endurance and flexibility, more energy and increased feelings of well-being. A perceived barrier to continued exercise may be poor weather conditions, embarrassment, cost and inconvenience. The HBM proposes that an individual's perceptions of the benefits and barriers of performing a behavior influence the actual performance of that behavior. In other words, the HBM is designed to predict outcome behavior. Conversely, the present study examines the effect of continued exercise on health beliefs. Benefits and barriers of exercise are expected to be closely related to perceived self-efficacy for diabetes.

General Well-being

People with a chronic illness such as diabetes are often plagued by depression, and anxiety about their future health. Exercise positively influences emotional well-being and may benefit people with NIDDM who are prone to feeling discouraged about management of their disease. In this study, it is expected that those who exercise will experience a greater sense of general well-being.

CHAPTER IV

Methods

Parent Study Description

The parent study, Intervention to Improve Exercise Among Adults with Non-Insulin Dependent Diabetes Mellitus (Crabtree, 1991) provided the basis for this followup study. A convenience sample of 33 volunteers with NIDDM were randomly assigned to two groups, the intervention group and the control group. The intervention group met together weekly and participated in a program focused on building self-efficacy for exercise. The subjects in the control group met individually with a nurse investigator every week and received a traditional educational session. All subjects completed a series of questionnaires and attended a one hour presentation on the risks and benefits of exercise including foot care and proper shoes. During the 12-week exercise program, both groups were encouraged to exercise with gradually increasing intensity, once with the staff during the weekly meeting and at least two additional times during the week on their own. At the end of the exercise program the subjects completed a duplicate set of questionnaires.

Sample

The parent study sample was recruited from a metropolitan area by contacting nurse practitioners, physicians, podiatrists and community diabetes clinics for referrals. Recruitment also took place at meetings of the local chapters of the American Diabetes Association, through newspaper advertisements, public service announcements and communication with diabetes educators in the area.

Adults 65 years of age or less with NIDDM who were not exercising regularly and whose diabetes was managed with diet alone or diet in combination with an oral agent were eligible for the study. Potential subjects were screened with a brief history and physical exam, a six-minute walk and glycosylated hemoglobin measurement. Consent from the subjects' personal physician and a supervised graded treadmill test with 12-lead EKG were required. Potential subjects were excluded for complicated or unstable diabetes, foot deformities or ulcers, joint disease, loss of sensation or proprioception, evidence of peripheral vascular disease, angina, cardiovascular disease, severe hypertension (diastolic > 105) or a severe respiratory condition.

Twenty-seven subjects, including 11 men and 16 women averaging 54 years of age completed the parent study. Most (93%) were obese with a body mass index >27.

Findings

During the exercise program, all subjects significantly increased their exercise duration, distance and tolerance. The psychosocial variables of general well-being and self-efficacy for exercise increased significantly from the beginning to the end of the exercise program for both groups. No significant change occurred in self-efficacy for diabetes management or perceived exercise benefits and barriers. Sixty-seven percent of the subjects reported satisfaction with the parent study. All 27 subjects planned to continue to exercise after the program.

The present followup study was designed to determine if the 27 subjects continued their exercise activities one year later. Changes in the psychosocial characteristics were evaluated in relation to reported exercise.

Exercise Prescription

The initial exercise prescription for the parent program was to walk three times per week, one mile in 20 minutes per walk. The prescribed exercise goal at the conclusion of the parent study was walking three times per week for a distance of three to four miles in 60 minutes.

Followup Study Description

A descriptive study was undertaken to explore exercise behavior and psychosocial characteristics of the subjects who had completed the parent study one year earlier. The independent variable, exercise, was quantified from prospective exercise data recorded by self-report over a two-week period. These data along with questionnaire responses were used to determine those who continued to exercise and those who did not. Those who continued to exercise at least 15 continuous minutes, three times per week for 12 or more weeks during the past year comprised the exercise group and were compared to those who did not continue to exercise, the non-exercise group. The exercise and non-exercise groups were compared on the dependent variables of diabetes self-efficacy, general well-being and perceived exercise benefits and barriers. In addition, demographics, modifications made to sustain exercise, enjoyment of exercise, changes in diabetes management, and new health problems were described for the total sample and for the two exercise groups.

Sample and Setting

The 27 subjects who completed the parent study were invited to participate in this mail survey. Subjects were free living in a large metropolitan community in the Pacific Northwest.

Procedure

Each of the 27 subjects from the parent study was sent a brief letter informing them of the followup study. Several days later the investigator contacted subjects by phone, invited them to participate and explained their help was important whether or not they were still exercising. The investigator determined their understanding of aerobic exercise and ability to take a pulse. Instructions on these topics were provided as needed, as well as explanations concerning any other aspects of the study. The subjects were told that a $1.00 bill would be mailed to them as an incentive to complete the five questionnaires. Verbal consent was obtained as required by the Committee on Human Research. After the subject verbally agreed to participate, a packet with the data collection forms was mailed immediately. Return pre-addressed stamped envelopes were provided. The mailed package included: 1) a cover letter with instructions on how to complete the questionnaires (Appendix A), 2) the Personal Update Form (Appendix B), 3) the General Well-being Schedule (McDowell & Newell, 1987) (Appendix C), 4) the Exercise Benefits and Barriers Scale (Sechrist, Walker & Pender, 1987) (Appendix D), 5) the Diabetes Self-efficacy Scale (Crabtree, 1986) (Appendix E) and, 6) a two-week prospective Exercise Record (Appendix F).

The cover letter instructed the subject to date and complete all the questionnaires as soon as possible upon receiving them and begin the prospective exercise record the next day. Subjects were to record any exercise that they considered aerobic, raised their pulse and respirations, caused sweating and lasted at least 15 uninterrupted minutes. Pulses before and 10-15 minutes after the start of exercise were to be taken for one full minute and recorded in the Exercise Record. The investigator's phone number was provided to the subjects for any questions or problems during the study.

After the questionnaires were completed and returned, the subjects were asked to record in the Exercise Record each time they exercised aerobically. A two-week time period was chosen to encompass differences in exercise from weekdays to weekends and variability in exercise patterns from week to week. The prospective approach was utilized to increase the accuracy of the reporting and avoid problems of recall.

To reduce selection bias, the participation of all 27 subjects was strongly urged. If the questionnaires and Exercise Record were not promptly returned, followup calls were made. Subjects were encouraged to return the forms even if they had not continued to exercise. Three subjects who did not return all of the questionnaires were willing to provide some information to the investigator over the phone. The recruitment procedure used by the investigator was successful in obtaining complete data from 25 subjects and incomplete data from the other two subjects. Data were collected between June and September 1991.

Exercise Groups

There were three criteria used to create two groups, exercisers and non-exercisers. To be categorized as an exerciser, the subject reported at least three exercise sessions lasting at least 15 minutes during both of the recording weeks. In addition, the subject reported that the exercise was "typical" and/or took place at least three times a week for 12 out of 52 weeks during the past year. Any subject who did not meet these criteria was considered a non-exerciser.

Instruments

The instruments for this study were identical to those used in the parent study except for the Personal Update Form and the modified prospective Exercise Record. Instrumentation might be considered a threat to validity in this study as several of the same testing forms were used at the beginning and the end of the parent study. However, after a 12-month interval, readministration would have minimal effect on the followup study results.

Personal Update Form. The Personal Update Form (PUF), in Appendix B was used to obtain information concerning changes in demographic characteristics, health status and exercise during the past year. There were many possible "historical" events during the year between the intervention and present data collection that could hinder or promote exercise behaviors. The questionnaire was designed to identify any situational or physical barriers to exercise that might have occurred during the year. Demographic changes such as divorce or altered employment status were determined as possible factors influencing exercise behavior. The health questions were asked to determine if medical conditions interfered with participation in exercise. The exercise questions were aimed at determining the regularity of exercise during the year.

Exercise Record. Exercise was measured prospectively using the modified Prospective Exercise Record (Appendix F).

Categories from the original exercise record used in the parent study included: date, time exercise began, type of exercise, time exercise ended, distance and comments. Two columns were added to provide an indication of the intensity of the exercise, heart rate before exercise and heart rate during exercise. Three categories were deleted from the original record, feelings before exercise, exertion rating and feelings after exercise, because they were not needed for this study and reduced the amount of information to be recorded by the subjects.

Diabetes Self-efficacy Scale. The Diabetes Self-efficacy Scale (DSES) is a 25-item questionnaire with six possible responses on a Likert-type scale ranging from strongly agree to strongly disagree and includes a "does not apply" choice. Subscales include self-efficacy for management of diet, exercise, medications and general diabetes care.

The reliability and validity of the DSES has been evaluated by Crabtree (1986). Test-retest with a one week interval resulted in a correlation of $r=.87$ ($p<.001$) with a sample of 39 subjects with diabetes. The internal consistency of the DSES as measured by Cronbach's alpha ranged from .71 to .79 ($N=143$ and $N=48$, respectively) for two adult samples including persons with both IDDM and NIDDM. The subscale of exercise self-efficacy had an internal consistency ranging from .60 to .74. In the parent study, the internal consistency measured by Cronbach's alpha was .88 for the total DSES and .64 for the exercise self-efficacy subscale. These results support the instrument's reliability for a NIDDM sample as stable and similar to a mixed diabetes sample.

Content validity of the DSES was assessed as adequate by ten experts in diabetes care, nursing research, instrument development and social psychology. Evidence of construct validity was provided by correlations between self-efficacy with self-esteem and social incentives for diabetes self-care as hypothesized in the pilot study (N = 48). Self-efficacy correlated with self-esteem (r=.50). The pattern of correlations indicated that self-appraisals including self-efficacy and self-esteem were more important to motivation for self-care than social incentives. It was also hypothesized in the larger study that self-efficacy would predict self-care for diabetes management and was confirmed by data which indicated the relationship in the expected direction using a predictive model and multiple regression. Furthermore, in the predictive study, diabetes self-efficacy was the only significant one of 11 predictors of exercise behavior tested and alone accounted for 35% of the explained variance.

<u>Exercise Benefits and Barriers Scale</u>. The Exercise Benefits and Barriers Scale (EBBS) measures perceptions using a 43-item questionnaire with four response choices

ranging from strongly agree to strongly disagree. Items were generated based on interviews and review of the literature. Content validity was evaluated utilizing a panel of nurse researchers with expertise in exercise. The reliability measured with Cronbach's alpha in a community sample of 650 was .95. Test-retest reliability of .89 ($p=.05$) was obtained with a sample of 63 non-diabetics using a 2-week interval (Sechrist et al., 1987).

The EBBS instrument can be divided into two subscales: perceived exercise barriers and exercise benefits. The subscale for exercise barriers includes 14 items such as feelings of stress, lack of time, fatigue, embarrassment, cost, difficulty finding places to exercise and lack of social support. The subscale for exercise benefits includes 29 items such as enjoyment, increased muscle strength, sense of accomplishment, relaxation, improved health, and increased alertness. The internal consistency measured by Cronbach's alpha was .87 for the barriers subscale and .95 for the benefits subscale. In order to combine benefits and barriers scores for a total score, the barrier subscale scores were reversed so that a higher score represents a more positive perception of exercise. Also, the higher the total EBBS score, the more positive the benefits and less the barriers to exercise were viewed.

General Well-being Schedule. The General Well-being Schedule (GWBS) developed by Dupuy (McDowell & Newell, 1987) measures general internal psychological feelings including anxiety, depression, general health, positive well-being, self-control and vitality. It is an 18-item questionnaire with six possible responses for the first 14 items and a 0-10 scale for the last four items. The scale refers to positive and negative personal feelings during the last month. The reliability and validity of this instrument was reported by Frazio (1977). A test-retest reliability of r=.85 after three months was reported for 195 college students. The internal consistency was .91 for males and .95 for females. Correlational validity of r=.69 was obtained when the General Well-being Schedule was compared to the average of six independent depression scales (Frazio, 1977).

Hypotheses

Using these instruments, the following hypotheses were tested. Those who continued to exercise one year after completing a 12-week walking program will:

1. have greater self-efficacy for exercise,
2. have greater general well-being,
3. perceive fewer barriers to exercise, and
4. perceive more benefits of exercise than those who did not continue to exercise.

CHAPTER V

Results and Discussion

The results of this study will be discussed by first describing the sample participating in the study. This description will include demographics, participation in exercise, diabetes management, medical complications and physical data for the entire sample and for the exercise groups. Then, the results addressing the research questions/hypotheses will be presented and discussed.

Baseline measures at the beginning of the parent study (T1), were repeated at the conclusion of the 12-week exercise program (T2) and again one year following completion of the exercise program (T3).

Description of Subjects

All of the 27 subjects who completed the parent study agreed to participate in the followup study, however data from two subjects were incomplete. Exercise and weight data were obtained on all 27 subjects, demographic data on 26 subjects and psychosocial measures on 25 subjects.

Demographics

The demographic characteristics of age, gender, marital status and employment status at T3 are described in Table 1. The mean age of all 27 subjects was 55 years with a range of 32-69. Sixteen (59%) subjects were female and 11 (41%) were male. Nineteen subjects (70%) were married, four (15%) divorced and three were never married or were widowed.

Table 1

Demographic Characteristics of the Total Sample and Exercise Groups

Group Characteristics	Exercisers				Non-Exercisers				Total Sample		
	M	S.D.	n	%	M	S.D.	n	%	M	N	%
Age *	55.7	9.5	16	59	53.5	12.6	11	41	55.0	27	
Gender											
Female			11	69			5	31		16	41
Male			5	46			6	54		11	59
Marital Status											
Married			13	68			6	32		19	73
Divorced			2	50			2	50		4	15
Never Married			2	100			0	0		2	8
Widowed			0	0			1	100		1	4
Employment											
Full-time			6	50			6	50		12	46
Part-time			4	67			2	33		6	23
Retired			5	83			1	17		6	23
Unemployed			1	50			1	50		2	8

* $t = -.50$, $p < .05$

During the previous year one subject retired. Twelve (44%) subjects were employed full-time, seven (26%) part-time, two (7%) were unemployed and six (22%) retired.

At T3, the majority of subjects (59%) had continued to exercise regularly. Females were more successful in maintaining an exercise habit than males. More females (11 or 69%) continued to exercise than did not (5 or 31%). Five male subjects (46%) continued to exercise, while six (54%) did not. These findings are consistent with results of previous studies showing that females tend to engage in low level exercise like the one prescribed (Dishman, 1986). The graduated aerobic walking program may have had more appeal for women than for men. Although research suggests that men may prefer more vigorous exercise (Dishman et al., 1985), no clear preference for vigorous exercise by men as a group was shown in this sample.

No subject had a change in marital status during the followup year. Thirteen (68%) of the subjects who continued to exercise were married and six (32%) of those who did not continue to exercise were married. Thus, married persons were more likely to continue to exercise. This finding is consistent with studies that show that those with spouses who are supportive are more successful maintaining exercise (Pender, 1987, p. 417). As seen in Table 1, the number of subjects in the exercise and non-exercise groups have similar employment status. However, five subjects in the exercise group were retired while only one subject in the non-exercise group was retired. Perhaps those who are retired have increased time and flexibility in their lifestyle providing more opportunity to exercise. It is unclear why some employed subjects continued to exercise while others did not. Possible reasons include differences in motivation to exercise, type of job, or other lifestyle differences.

Exercise Data

The consistency of exercise over time was characterized as the number of weeks exercised in a year, the number of days exercised in a month and interruptions in exercise exceeding two weeks. The exercise group exercised at least three times per week for a mean of 35.8 weeks of the year (range 12-48) compared with a mean of 11.5 weeks (range 3-20) of exercise reported by the non-exercise group (see Table 2). Several subjects who reported less than 40 weeks of exercise during the year were included in the exercise group. This occurred when the recorded exercise was considered typical by the subject and met the criteria of three days a week, for at least 15 minutes duration.

The mean number of days the subjects exercised during the last month was reported as 12.6 for the exercise group and 1.8 for the non-exercise group. Most subjects (19 for 73%) interrupted their exercise routine for two weeks or more during the year. No subject met the exercise

Table 2

Description of Continued Exercise of the Total Sample and of Exercise Groups

Exercise Variables	Exercisers (n=14)		Non-exercisers (n=6)		Total (N=20)	
	Weeks	Range	Weeks	Range	Weeks	Range
Weeks exercised during past year *	36	12-48	10.5	3-20	28	3-48
	Exercisers (n=14)		Non-exercisers (n=10)		Total (N=24)	
	Days	Range	Days	Range	Days	Range
Days exercised during past month	13	4-30	2	0-8	8	0-30

* Two subjects in the exercise group were hospitalized for myocardial infarction

n's vary due to incomplete responses.

prescription for more than 48 weeks during the year. Exercise even in the exercise group was not consistent throughout the year. Factors that lead to this inconsistency in exercise will be described later.

The type, frequency and duration of exercise was recorded by the subjects in their two-week prospective exercise logs. A majority (21 for 81%) of subjects continued to engage in walking as their primary form of exercise. Other types of exercise reported include aerobic dance, golf, chopping wood, gardening, swimming, hockey, volleyball and stair climbing. Subjects who continued to exercise recorded current exercise activity in their exercise log for a mean frequency of 4.3 exercise sessions per week compared to 1.1 in the non-exercise group. The duration of the exercise sessions also differed with a mean of 44.6 minutes for the exercise group and 30.4 for the non-exercise group. These data characterize the difference in exercise activity between the exercise and non-exercise groups. The variability of exercise within the exercise and non-exercise group is also apparent.

Interruptions in exercise were investigated by examining factors that interfered with or limited continued exercise in both exercise groups. Subjects often listed more than one limiting factor. Both the exercisers and non-exercisers experienced factors that limited their regular exercise program. Thirteen (81%) subjects in the exercise group reported exercise limitations compared to eight (80%) from the non-exercise group. Interestingly, nearly the same percentage of both exercise groups experienced exercise limitations but the exercise group overcame them.

The most frequently listed limiting factor was lack of time as cited by eleven subjects (see Figure 1). This finding is consistent with studies which have found lack of time as the most frequently cited hinderance to exercise (Dishman et al., 1985; Sallis et al., 1990). Sickness or surgery, injury, lack of motivation and weather were also listed as limitations by five or more subjects. Injuries that interfered with exercise for more than two weeks were reported by 5 people (31%) in the exercise group and 4 people (40%) in the non-exercise group. These injuries listed included problems that were not necessarily related to exercise performance. Injuries experienced by the subjects included an inflamed hip, back problem and foot fascitis. A need for arthroscopic knee surgery was cited by one subject. Additional information regarding these injuries would have been useful in determining their relationship to exercise. Interestingly, no one reported acute hypoglycemia related to exercise as a factor limiting exercise. Hypoglycemia is often feared by people with diabetes preventing them from participating in exercise.

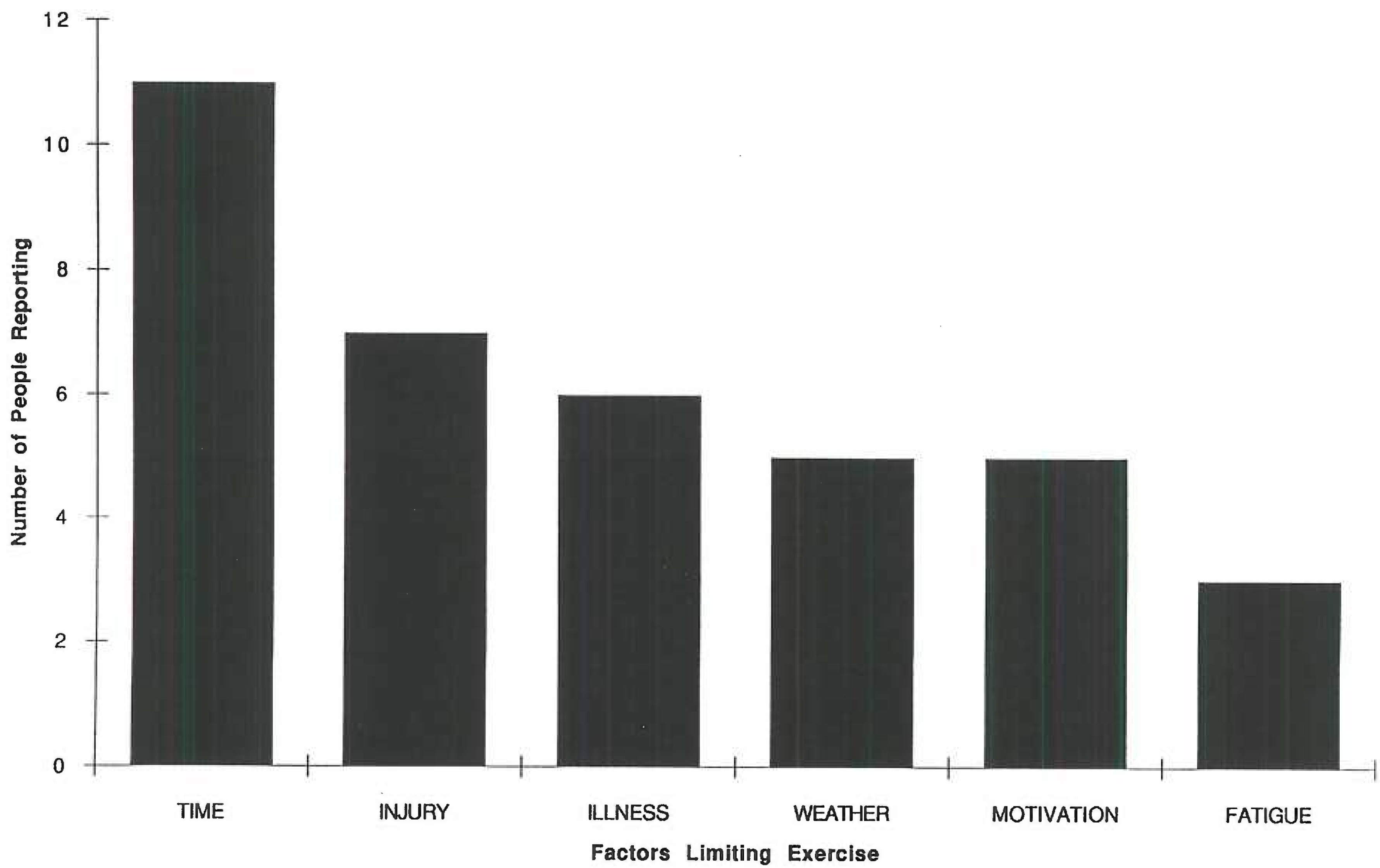

Figure 1 Self reported factors that limited exercise during one year followup for total sample

Hypoglycemia occurred rarely during the 12-week exercise program. Teaching during the program was geared to prevention, recognition and treatment of hypoglycemia which may have helped to avoid this complication.

Several factors that can sustain continuation of an exercise program were investigated, including enjoyment of exercise, joining an exercise group and exercising with a partner. Most subjects (17 or 74%) reported enjoying exercise. Of those who continued to exercise, 11 (48%) enjoyed exercise compared to 6 (35%) in the non-exercise group. Those who enjoyed exercise were more likely to continue to exercise over time as suggested by Dishman (1985). The six subjects who enjoyed but did not participate in regular exercise reported different limiting factors. Three people reported limitations due to illness or injury while others reported busy schedules or a "lazy attitude." All five subjects who joined an exercise group continued to exercise over time, suggesting joining a formal exercise program may help sustain regular exercise. Eight subjects from the exercise group reported exercising with a partner compared with four in the non-exercise group. Ninety-two percent of those exercising with a partner were married. A spouse may be a convenient, acceptable exercise partner who encourages regular exercise (see Table 1). These results confirm findings of previous studies that those who enjoy exercising, those who join an exercise group, those who exercise with a partner and those who are married are more likely to continue to exercise over time.

Adjustments in exercise routine to accommodate for environmental changes such as winter weather were explored. Adjustments were reported by 12 (48%) subjects. The most frequent adjustment reported was changing the place for exercise which was reported by six (23%). Changing the type of exercise was reported by three (12%) subjects. All those who changed the type of exercise also changed the place. For example, the most common exercise adjustment for weather was exercising at home using exercise equipment or an exercise video. Two subjects purchased rain gear.

Changing the place and type of exercise were strategies also reported most frequently for the purpose of maintaining interest in exercise (see Figure 2). Changing the place of exercise was reported by 5 (19%) and changing the type of exercise was reported by 4 (15%). There were more than twice as many reports of modifications from the exercise group (12) than the non-exercise group (5). The modifications made by the exercise group may have helped to maintain their interest in an exercise routine and enhance success in continuing the habit over time.

Diabetes Management

The subjects described their diabetes management by their current treatment and changes in treatment during the past year. Most participants were experienced with diabetes

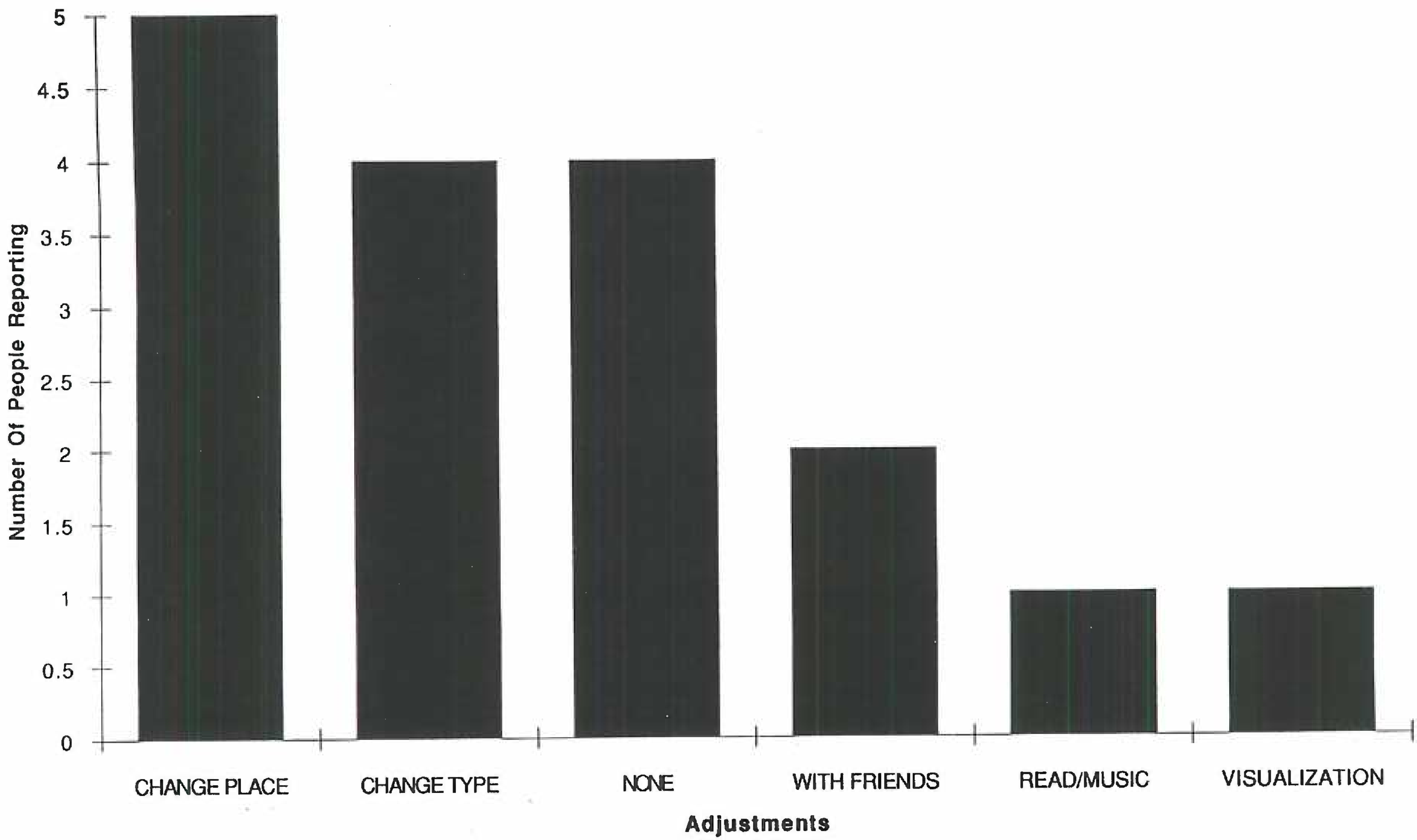

Figure 2 Modifications made to maintain interest

management given the mean duration of diabetes was 5.3 years (range 1.2-26). Most changes in treatment occurred in the area of medications. While the parent study eligibility criteria excluded subjects taking insulin, at T3 one subject was using a combination of insulin and an oral hypoglycemic agent. Fourteen (54%) were using an oral hypoglycemic agent and 11 (42%) used diet alone to control their diabetes.

Of those solely on diet management, seven (44%) continued to exercise and four (40%) did not. Of those on oral hypoglycemic agents, nine (56%) were in the exercise group compared to 5 (50%) in the non-exercise group. One subject in the exercise group was on an oral hypoglycemic agent supplemented with insulin. These findings suggest that there was no difference in continued exercise between those on oral hypoglycemic agents and those on diet management alone.

Medication changes were evaluated by comparing treatment at T1 and T3. The medication was considered increased if the subject 1) began using an oral hypoglycemic agent, 2) had the dosage of an oral hypoglycemic agent increased, or 3) had insulin therapy added during the study year. If the dosage of an oral hypoglycemic agent was reduced or if the medication was discontinued, the subject's medication was considered decreased. The diabetes medication for most (17 or 65%) of the sample stayed the same. Medication was increased for eight (31%) subjects.

One (4%) subject discontinued his oral hypoglycemic agent and was controlling his diabetes with diet alone. This individual's weight was 290 pounds at the end of the parent study and 315 pounds at followup, therefore, weight loss cannot account for his change in medication. This individual exercises vigorously once a week as part of an amateur sports team during the winter months. The higher weight at T3 was near the end of the summer when he is typically inactive.

Comparison of changes in medicine between exercise groups, shows 13 subjects (81%) from the exercise group had no change in their medicine compared to four (44%) in the non-exercise group. Also, fewer individuals in the exercise group (3 or 19%) needed to increase their medicine compared to the non-exercise group (5 or 56%). Only one person in the non-exercise group decreased their medicine. These findings suggest that those who continued to exercise were more likely to continue with the same medication and less likely to need increased medication as found by Wing et al. (1988). In the usual trajectory of NIDDM, increased medication is often required over time as previously functioning beta cells are lost (Rifkin, 1988). The possibility of reversing this trend, decreasing or discontinuing oral medication is often used to motivate participation in exercise. While most subjects in the exercise group maintained the same treatment (81%), the only subject who discontinued oral medication was not exercising regularly and the basis for the decision is unclear. Perhaps the level of exercise for most subjects was not vigorous or consistent enough to decrease blood glucose and allow discontinuation of an oral hypoglycemic agent. Furthermore, dietary intake was not controlled and only one year has passed at followup.

Medical Complications

Subjects were asked to report any new medical problems or hospitalizations that occurred during the study year. A surprising finding was that eight subjects (31%) were hospitalized. Six persons were hospitalized once during the year and two were hospitalized three times representing 12 hospitalizations for the sample. Table 3 describes the subjects who were hospitalized by the characteristics of sex, age, duration of diabetes, diabetes treatment, and body mass index (BMI). Four of the eight hospitalized subjects were in the exercise group and four were in the non-exercise group, therefore hospitalization by itself did not deter continued exercise.

Two subjects were hospitalized for myocardial infarctions (MI) with resulting coronary artery bypass graft surgery (CABG) during the same hospital admission. One subject, although not hospitalized developed chest pain. The following description of the subjects examines the possible risk factors that may have contributed to

Table 3

Description of Subjects Who Were Hospitalized During the Study Year (n=8)

Characteristic	Hospitalized		Total Sample
	n	%	N
Sex			
Female	6	38	16
Male	2 *	18	11
Age (mean years)	53		55
Duration of Diabetes (mean years)	4.7		5.3
Diabetes Treatment			
Diet	2	18	11
Oral Medication	6	43	14
Body Mass Index (mean)	35.4		28.9

* Both subjects were hospitalized for myocardial infarction

development of their coronary artery disease. Subject A and B had MIs and CABG surgery and Subject C developed chest pain. Subject A was a 57 year old male who had never smoked, was not hypertensive and had a BMI of 25.9 at T2. He had diabetes for nine years which was treated with an oral agent and had an elevated glycosylated hemoglobin of 14.8 at T1. Subject B was also a male, 59 years of age, had smoked in the past, was not hypertensive and had a BMI of 29.0 at T2. He had diabetes for four years which was treated with diet alone and had a glycosylated hemoglobin of 9.3% at T1. Subject C was a female, 65 years old, who had never smoked, had hypertension for 6 years, and had a BMI of 33.8 at T2. She had diabetes for 14.5 years, which was controlled with diet alone and her glycosylated hemoglobin was 6.0% at T1. She was using a Nitroglycerin patch. These three subjects had a slightly higher mean age (60.3) than the total sample (55); their mean BMI of 26.9 was lower than the mean of the total sample (32.0).

Although coronary heart disease (CHD) is a commonly occurring complication of diabetes, the incidence of MIs during this one year is impressive. These subjects had completed two treadmill tests less than one year before their MI or onset of chest pain. These treadmills did not exclude all persons with cardiac pathology from the parent study but identified and eliminated those with problems such as an abnormal blood pressure response to exercise for whom exercise of this type was contraindicated. There was no clear evidence related to the three subjects' exercise patterns that accounts for the cardiovascular event. The two subjects who had MIs were in the exercise group as was the person who developed new chest pain. Low level exercise for one year as prescribed in this study did not protect these individuals from CHD.

Paffenbarger et al. (1986) suggests partial protection from CHD can be achieved for normal individuals with exercise that burns as few as 500 calories per week. Optimal protection requires an exercise output of 2000 calories per week. The exercise prescription at the end of the parent study was to walk three times per week, three to four miles for 60 minutes. Using a table in McArdle, Katch and Katch, (1991), a 95 kilogram person (mean weight in kilograms for the sample was 96) burns 7.6 kilocalories per minute of walking. If a subject walked 180 minutes per week, a total of 1,368 kilocalories per week would be burned. This level of exercise is well within the range of cardiac protection suggested by Paffenbarger. All three subjects who developed coronary problems reported exercise that used 1064-1596 kilocalories per week. One year of continued exercise however did not protect these three subjects from CHD.

The incidence of CHD in individuals with diabetes reported in the literature and found in this study support using a slowly progressive exercise program to reduce the risk of cardiovascular events. In addition, there is evidence that exercise helps maintain patent coronary grafts after an MI (Nakai, Kataoka, Bando & Taki, 1988).

Two women were hospitalized for dilatation and curettage (D & C) and on subsequent admissions had hysterectomies. These two subjects each had three hospitalizations and were in the non-exercise group. Both listed medical problems as limiting their participation in exercise. These two subjects, ages 46 and 36 had a relatively short duration of diabetes of 1.3 and 2 years.

Diabetes is a disorder of fat metabolism leading to a higher incidence of gall bladder disease in this population (Podolsky, 1980, p. 530). Two subjects had gall bladder surgery. One person, age 32, was obese at T1 (BMI of 39.6), and gained weight by T3 (BMI of 42.8). The second subject had a stable BMI of 43.0. The BMI for both of these subjects was greater than the mean BMI of the sample (32.0). Being obese and diabetic may have contributed to the development of gall bladder disease in these two subjects.

Additional medical problems requiring hospitalization included one person with kidney stones, one with pancreatitis (associated with gall bladder surgery), one with pneumonia (following abdominal surgery), one with chest wall inflammation (due to injury), and one had a colonoscopy for removal of tumors.

In addition to hospitalizations, subjects were asked to list any new medical problems occurring during the study year. One subject developed asthma. One subject reported a new problem with hypertension and one had a kidney problem. Leg pain with walking, arthritis, ankle instability, neuropathy and foot problems were reported most frequently. New leg pain with walking was listed by 8 (31%) individuals. Five of the eight also described either neuropathy or arthritis which may have contributed to the leg pain. All three subjects who mentioned arthritis also reported leg pain.

Types of foot problems described by three people (19%) in the exercise group included one callous, one bunion and a heel problem requiring an orthotic device. One subject reported a series of related problems including arthritis of the ankle, a callous, ankle instability, neuropathy, and leg pain with walking. While neuropathy differs from arthritis or friction injuries, these problems are interrelated and may aggravate one another, limiting exercise ability. The high incidence of leg pain and other leg and foot problems may be attributed to diabetic neuropathy, a higher incidence of arthritis in diabetes (Horton, 1991) and obesity (mean BMI of 28.9 at T3).

Six people (38%) in the exercise group reported new leg pain and two (20%) reported leg pain in the non-exercise group. Exercisers might be expected to experience some minor muscle soreness, but it is doubtful this low level of exercise would cause pain if exercise is consistent. Three of the six exercisers with leg pain also reported newly occurring arthritis. Two of the three subjects reporting new neuropathy were in the exercise group. All subjects reporting foot problems or ankle instability were in the exercise group. These data reveal that most subjects reporting foot and leg problems were in the exercise group and were exercising regularly despite these problems. These data also suggest several interrelated problems were occurring together such as leg pain and arthritis. It is possible that exercise uncovered some already existing dysfunctions. These findings underscore the need for careful self-monitoring of foot and leg problems by people who exercise and have diabetes as recommended in the literature (ADA, 1991).

Although injuries or hospitalizations were serious and inhibited continued exercise for some subjects, other subjects viewed similarly severe physical health problems as only temporarily limiting their exercise ability. Despite these problems, walking may remain a safe form of exercise because potential injuries associated with other forms of exercise are minimized. Walking is acceptable to older, obese, and previously sedentary people.

Physical Data

Body mass index (BMI) was calculated because it takes into account the height of the subject and therefore more accurately reflects body composition. The reported mean BMI for the sample was 32.0 at T3 as seen in Table 4. Horton et. al. (1990) describes the normal BMI between 21 and 27. BMIs that fall between 26 and 31 are considered mildly obese, those between 32 and 35 are moderately obese and BMIs greater than 35 represent severe obesity. Twenty-five (93%) of the subjects at T1 were obese as defined by a BMI > 27. There were no significant differences in BMI for T1, T2, and T3 as analyzed by ANOVA-RM ($F=2.8$, $p=.07$). The greatest change in mean BMI occurred from T1 to T2 during the parent study. While not large, the drop in BMI (mean = 5 pounds) during the 12-week exercise intervention period was greater than for the following 12 months. During the exercise program, the subjects were all exercising consistently and receiving regular professional and some received peer support which may account for the decrease in weight during this time.

Differences in mean BMI between exercise groups based on ANOVA-RM were not found at followup ($F=.02$, $p=.87$). The exercise group had a mean BMI at followup of 33.2 while the non-exercise group was 30.2. The mean BMI of the exercise group increased by 4.8 between T2 and T3 while the mean BMI of the non-exercise group dropped by 1.1. At T3, the

Table 4

Body Mass Index of Subjects by Exercise Group Over Time

Body Mass Index *	Exercisers		Non-exercisers		Total	
	M	S.D.	M	S.D.	M	S.D.
Baseline (Time 1)	32.3	5.5	34.7	5.9	33.2	5.7
End of 12 Wk Program (Time 2)	29.5	9.4	30.5	11.1	29.9	9.9
1 Year Followup (Time 3)	29.4	12.0	28.2	18.1	28.9	14.5

* Body mass index = kg/ht in m^2

standard deviation for BMI was 5.9 in the exercise group indicating a limited amount of weight was gained or lost by these subjects. The standard deviation in BMI for the non-exercise group was 15.2 and included one subject who lost 44 pounds. This individual's weight loss may be responsible for the mean weight loss seen in the non-exercise group.

Weight loss is a desirable outcome of exercise, especially for those with diabetes. The finding that the non-exercise group decreased their mean BMI more than the exercise group was surprising. A lack of weight loss among the exercise group may be due to the low level of exercise being performed or a compensating dietary change. It is also possible that those who were exercising lost fat weight and built lean muscle mass resulting in a relative weight gain, as muscle contains more water and weighs more than fat. The BMI does not reflect the percent of muscle mass and will not be an indication of a loss of fat weight. The use of calipers to determine skinfold thickness would have been a measure of lean muscle mass change but was not possible with the mailed survey method used in this study.

Because data were incomplete, resting heart rate and heart rate during exercise could not be analyzed.

Research Questions

Continued exercise is expected to have desirable effects on the psychosocial characteristics of diabetes self-efficacy for exercise, diabetes management self-efficacy, general well-being, perceived barriers to exercise and perceived benefits to exercise. It was hypothesized that the exercise groups would differ in the psychosocial variables as measured over time.

The hypotheses were tested using ANOVA-RM (Table 5). These statistical analyses were used to determine differences between the exercise and non-exercise group and to evaluate changes within subjects at T1, T2 and T3. The ANOVA-RM method utilizing unweighted means was chosen because of unequal numbers of observations in the exercise groups due to a small amount of missing data.

The first dependent variable tested was self-efficacy for exercise. Self-efficacy for exercise was predicted to be higher for those who continued to exercise. Those in the exercise group had higher scores at T1, T2 and T3, but group differences were not statistically significant ($F=2.00$, $p=.18$). There was however, a statistically significant increase in self-efficacy for exercise within subjects from T1 to T2, during the exercise program. During the followup year from T2 to T3 a decline not quite returning to baseline was seen suggesting some residual benefit from the effect of the program. These findings indicate that self-efficacy for exercise improved significantly for subjects while they were participating in the program, but most of this benefit was not sustained after the program ended, even for those who continued to exercise. Subjects may have required the

Table 5

Comparison of Psychosocial Characteristics of Exercise Groups Based on ANOVA with Repeated Measures

Psychosocial Characteristics	Groups							
	Exercise Group			Non-exercise Group				
	n	M	S.D.	n	M	S.D.	F	p
Diabetes Self-efficacy Scale	16			9				
T1		78.9	14.4		56.1	18.5	7.16	.01
T2		77.5	20.6		68.2	17.7		
T3		79.8	18.1		64.0	14.1		
Diabetes Self-efficacy Scale-Exercise Subscale	15			8				
T1		25.4	4.7		24.3	6.3	1.95	.18
T2		31.3	3.9		27.4	4.8		
T3		26.8	6.7		23.9	4.3		
General Well-being Scale	16			9				
T1		85.2	12.7		79.8	25.4	1.27	.27
T2		95.7	8.7		87.3	24.7		
T3		89.8	12.9		81.9	23.1		
Exercise Barriers Subscale	10			4				
T1		43.6	4.7		38.5	8.3	4.14	.06
T2		43.5	4.0		38.0	7.4		
T3		45.2	6.3		36.5	7.6		
Exercise Benefits Subscale	14			8				
T1		92.6	10.4		86.5	13.3	3.20	.09
T2		95.5	9.3		86.5	17.6		
T3		92.9	10.2		81.5	19.8		
Exercise Benefits and Barriers Scale (total)	14			8				
T1		128.6	22.3		111.0	31.0	2.51	.12
T2		124.2	22.0		114.6	28.1		
T3		92.9	10.2		81.5	19.8		

T1 = Baseline; T2 = End of 12-week Program; T3 = One Year Followup

n's vary due to incomplete responses

structure of the exercise program or the contact with staff to sustain strong belief in their ability to exercise. Success in exercising may have been attributed to a belief in the exercise program rather than to themselves.

The next dependent variable measured was self-efficacy for diabetes management which was predicted to be higher in the exercise group than in the non-exercise group. It was predicted that subjects who continued to exercise would have a more positive belief in their ability to exercise and this belief would generalize to other aspects of diabetes care. The results showed that the exercise group consistently scored higher at T1, T2 and T3 ($F=7.16$, $p=.01$) in self-efficacy for diabetes management. At T1, before the intervention, self-efficacy for diabetes management was higher in those who later became exercisers. Baseline differences in self-efficacy for diabetes management between the exercise groups may explain in part differences at T3 but self-efficacy for diabetes management also rose over time with regular exercise. Therefore, self-efficacy for diabetes management may help to predict those who will be successful exercisers as well as increase with exercise performance.

Thirdly, it was hypothesized that the exercise group would have greater feelings of general well-being than the non-exercise group. The exercise group had higher scores for general well-being than the non-exercise group at T1, T2 and T3, but these differences were not statistically significant ($F=1.27$, $p=.27$). However, there was a significant difference in general well-being for subjects, regardless of group over time ($F=5.44$, $p=.01$). Scores for general well-being increased significantly between T1 and T2, and dropped at T3, not quite returning to baseline. This finding indicates that general well-being was positively influenced during the exercise program, but began to return to baseline after the program ended and exercise declined. Even those subjects who continued to exercise did not sustain increased feelings of general well-being that had been attained at the end of the exercise program. Perhaps those who continued to exercise at T3 were not exercising as consistently or as vigorously as they were at T2. The parallel rise in well-being with regular exercise and decline with decreased exercise underscores the relationship between exercise and well-being among obese older persons with NIDDM. Another possible explanation of the results is that increased general well-being at T2 may be related to participation in the program, where staff and for some peers provided regular encouragement and feedback.

The fourth hypothesis predicted that perceived barriers to exercise would be lower for subjects who continued to exercise than for those who did not continue to exercise. The lower the barrier score, the more negatively exercise barriers were viewed. There was no statistically significant difference in perceived barriers between the exercise groups (F=4.12, p=.07); however, missing data from seven subjects in the exercise group and five in the non-exercise group may account for this result. Subjects left items blank when they felt a question did not apply to them, such as an item pertaining to family when a subject lived alone. Due to the missing data, a t-test was used to analyze perceived barriers at T3. The mean barrier score for the exercise group was 43.9 (S.D.= 6.3) compared with 36.4 (S.D.= 5.6) for the non-exercise group which was statistically significant (t=-3.06, p=.01). The exercise group had significantly higher scores indicating fewer perceived barriers. This result supports the hypothesis that those who continued to exercise perceived fewer barriers to exercise. The exercise group may have experienced fewer barriers or successfully problem-solved to find strategies to overcome former barriers.

Exercise groups were compared according to the type of barriers perceived. Six types of barriers were viewed differently by exercise groups to a statistically significantly degree including; 1) family support, 2) looking "funny", 3) hard work, 4) too few places to exercise, 5) personal time, and 6) cost. Lack of spousal support and family encouragement was rated a significantly greater barrier for non-exercisers than exercisers (F=6.5, p=.02; F=13.6, p=.001, respectively). This result may be accounted for by the earlier finding that the exercise group was more likely to be married and exercising with a partner. Also, the result is consistent with Dishman's et al. (1985) emphasis on social support for the maintenance of exercise. These results indicate that support from sources other than the spouse was important in continuing an exercise habit.

Looking "funny" in exercise clothes was a significantly greater barrier for non-exercisers ($F=5.9$, $p=.02$), indicating that non-exercisers were more self-conscious about their appearance. However, the two exercise groups had similar BMIs which does not account for these differences in embarrassment about appearance.

Exercise as a tiring activity or a cause of fatigue was seen as a moderate barrier by both groups; however, exercise was viewed more often as "hard work" by non-exercisers than exercisers ($F=5.8$, $p=.04$). Non-exercisers may have experienced exercise as "hard work" due to infrequent exercise that prevented an increased exercise tolerance. Also, if exercise is perceived as "hard work," it is probably not enjoyable.

Finding convenient places or facilities to exercise were rated as low barriers by both groups. The convenience of walking as a form of exercise may have avoided the problems associated with scheduling a place to exercise required by other types of exercise such as swimming, bowling, tennis, etc. Although rated low, too few places for exercise was rated as a significantly greater barrier by non-exercisers (F=4.9, p=.04). Exercisers then may have been successful in changing the location of their exercise as weather or other situational constraints arose, lessening this barrier. This finding is consistent with the most frequently reported adjustment made to maintain interest in exercise and for winter weather which was changing the place of exercise.

Time for family or responsibilities were seen as barriers for both exercise groups; however, non-exercisers saw exercise taking personal time significantly more than exercisers (F=4.4, p=.05). Because the sample is older and most likely without young children at home, the barrier of time was probably related to personal time since subjects did not rate time from family or responsibilities as a barrier to exercise.

Finally, both groups perceived the cost of walking as a low barrier but the exercise group believed walking had a significantly lower cost than the non-exercise group (F=6.3, p=.02). Why the non-exercisers saw exercise as more costly is not clear.

The next hypothesis stated that the exercise group will perceive more benefits of exercise than the non-exercise group. Although the exercise group had a higher total mean score (93.7) for perceived benefits of exercise than the non-exercise group (84.8), this difference was not statistically significant ($F=3.2$, $p=.09$). Similarly, there was no significant difference in the perception of benefits over time regardless of group. It had been expected that personal experience of the benefits of exercise would increase the subjects' perception of these benefits. It may be that the level of exercise performed by the subjects was not great enough to make benefits apparent and change the subjects' perception. It was hoped that the level of fitness could be evaluated by pulse rate but most subjects did not record their pulse as requested making data unavailable for analysis.

The final hypothesis was that the exercise group would score higher on the total Exercise Benefits and Barriers Scale than the non-exercise group. This score combines the perception of benefits and barriers of exercise; a higher score indicates a more positive perception of exercise and a lower score a more negative perception of exercise. Even though the scores for the exercise group were higher than the non-exercise group at T1, T2 and T3, these group differences were not statistically significant ($F=2.5$, $p=.13$).

Perceptions of benefits and barriers for exercise significantly decreased over each data collection time ($F=31.61$, $p=.01$). In other words, the subjects had their most positive perceptions of exercise before the parent program began. These perceptions became less positive after the program and even less positive one year later. It is important to recall that at the beginning of the parent program the subjects were not participating in regular exercise but were sufficiently motivated to volunteer for a 12-week exercise program. While this downward trend in perceived benefits and barriers of exercise was unexpected and may appear undesirable, participation in the parent program may have increased the subjects' awareness of both benefits and barriers of exercise. After a year, these beliefs became more negative whether they were exercising or not and may reflect a year of experience with personal barriers and benefits of exercise.

Most of the results related to combined scores on total EBBS were due to the effect of barriers. Barriers to exercise are experienced immediately while the benefits are usually experienced some time later. Another explanation for increased barriers over time is the psychological theory of congruency, a striving for consistency between attitudes and behavior (Shaver, 1981, p.173). If subjects were not exercising, their attitude moved toward a negative perception of exercise to match their behavior. In addition, the level of exercise may have been too low to experience the obvious benefits of exercise, such as increased energy and stress reduction or even discontinuation of oral hypoglycemic agent. Since patients did not record pulse rates the benefits of training the cardiovascular system may not have been apparent to them either.

Discussion and Recommendations

Long-term maintenance of exercise remains a major challenge for our entire population and particularly for those with diabetes who can obtain additional benefits from exercise over time. This study found slightly more subjects continued to exercise after one year than what was expected in review of the literature. This may be due to many factors: the self-efficacy intervention, the criteria used to define continued exercise, the method of data collection by self-report or other characteristics of the diabetic sample. However, many subjects did not continue to exercise. Further investigations are needed to identify factors sustaining the exercise habit. Enjoying exercise, belonging to a formal exercise group and having an exercise partner were all related to continued exercise in this study. These social benefits of exercise should be provided and reinforced in educational programs.

Walking is the most popular form of exercise in America and was the most frequent type of exercise performed by this sample. Walking has many strengths that counter factors known to discourage or interfere with exercise such as convenience. The flexibility of a walking program can provide low to moderate exercise which is effective in achieving health benefits. Health professionals and exercise programs promoting walking for exercise may be more successful in maintenance of a long-term exercise habit.

Frequent interruptions or relapses in exercise behavior have been found in the community, as well as in this study of diabetics. Exercise relapse should be addressed by health professionals with their patients to increase awareness of the problem and to devise methods to prevent their occurrence. Lack of time and injuries were the most common limiting factors reported in this study and should be addressed specifically.

The group of people with diabetes in this study had many medical problems during the year including injuries, particularly of the feet and legs and hospitalizations, most dramatically two people who had MIs. These findings serve as a reminder of the importance of evaluation of underlying pathology and education for preventing injuries for those with diabetes desiring to begin an exercise program. Developing exercise habits early in life to reduce the accumulation of years of disease progression, as with CHD, would be ideal.

Self-efficacy for exercise and general well-being appeared to be program dependent, increasing during the 12-week exercise program and decreasing at followup. Self-efficacy for diabetes management may be a predictor of continued exercise, therefore those with negative perceptions of self-efficacy for diabetes management may need additional intervention and support from health professionals to change their exercise behavior.

Maintenance of exercise can be encouraged through education of people with diabetes, choosing types of exercise which minimize exercise barriers and training people with diabetes to overcome barriers to exercise. Innovative research to discover interventions to achieve an exercise habit over time is needed.

References

American College of Sports Medicine. (1990). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. Medicine and Science in Sports and Exercise, 22(2), 265-272.

American Diabetes Association. (1991). Clinical practice recommendations. Diabetes Care, 14(Suppl. 2), 1-80.

Andrew, G. M., Oldridge, N. B., Parker, J. O., Cunningham, D. A., Rechnitzer, P.A., Jones, N. L., Buck, C., Kavanagh, T., Shephard, R. J., & Sutton, J. R. (1981). Reasons for dropout from exercise programs in post-coronary patients. Medicine and Science in Sports and Exercise, 13(3), 164-168.

Armstrong, J. J. (1991). A brief overview of diabetes mellitus and exercise. The Diabetes Educator, 17(3), 175-178.

Ary, D. V., Toobert, D., Wilson, W., & Glasgow, R. E. (1986). Patient perspective on factors contributing to nonadherence to diabetes regimen. Diabetes Care, 9(2), 168-172.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.

Blumenthal, J. A., Williams, R. S., Needels, T. L., & Wallace, A. G. (1982). Psychological changes accompany aerobic exercise in healthy middle-aged adults. Psychosomatic Medicine, 44(6), 529-536.

Blumenthal, J. A., Emery, C. F., Madden, D. J., Schniebolk, S., Walsh-Riddle, M., George, L. K., McKee, D. C., Higginbotham, M. B., Cobb, J. R., & Coleman, E. (1991). Long-term effects of exercise on psychological functioning in older men and women. Journal of Gerontology, 46(6), 352-536.

Brownlee-Duffeck, M., Peterson, L., Simonds, J. F., Kilo, C., Goldstein, D., & Hoette, S. (1987). The role of health beliefs in the regimen adherence and metabolic control of adolescents and adults with diabetes mellitus. Journal of Consulting and Clinical Psychology, 55(2), 139-144.

Crabtree, M. K. (1986). Self-efficacy and social support as predictors of diabetic self-care. Doctoral dissertation, University of California, San Francisco, CA. (University Microfilms, Ann Arbor, MI, DAO 58785).

Crabtree, M. K. (1991, March). Intervention to improve exercise among adults with non-insulin dependent diabetes mellitus. Paper presented at the meeting of the Society of Behavioral Medicine, Washington, DC.

Devins, G. M., & Edwards, P. J. (1988). Self-efficacy and smoking reduction in chronic obstructive pulmonary disease. Behavior Research Therapy, 26(2), 127-135.

Dishman, R. K. (1985). Medical psychology in exercise and sport. Medical Clinics of North America, 69(1), 123-135.

Dishman, R. K. (1986). Exercise compliance: A new view for public health. The Physician and Sports Medicine, 14(5), 127-145.

Dishman, R. K. (Ed.). (1988). Exercise adherence: Its impact on public health. Champaign, Illinois: Human Kinetics Books.

Dishman, R. K., Sallis, J. F., & Orenstein, D. R. (1985). The determinants of physical activity and exercise. Public Health Reports, 100(2), 158-171.

Duncan, J. J., Gordon, N. F., & Scott, C. B. (1991). Women walking for health and fitness. Journal of American Medical Association, 266(23), 3295-3299.

Edmunds, M. W. (1991). Strategies for promoting physical fitness. Nursing Clinics of North America, 26(4), 855-866.

Exercise and NIDDM. (1991). Diabetes Care, 14(2), 52-56.

Frazio, A. F. (1977). A concurrent validational study of the NCHS general well-being schedule. Hyattsville, Maryland: U. S. Department of Health, Education and Welfare.

Graham, C. (1991). Exercise and aging: Implications for persons with diabetes. The Diabetes Educator, 17(3), 189-195.

Grossman, H. Y., Brink, S., & Hauser, S. T. (1987). Self-efficacy in adolescent girls and boys with insulin-dependent diabetes mellitus. Diabetes Care, 10(3), 324-329.

Haskell, W. L., Montoye, H. J., & Orenstein, D. (1985). Physical activity and exercise to achieve health-related physical fitness components. Public Health Reports, 100(2), 202-212.

Helmrich, S. P., Ragland, D. U. Leung, R. W., & Paffenbarger, R. S. (1991). Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. New England Journal Medicine, 325(3), 147-152.

Horton, E. S. (1988). Exercise and diabetes. Medical Clinics of North America, 72(6), 1301-1321.

Horton, E. S. (1991). Exercise in the treatment of NIDDM: Applications of GDM? Diabetes, 40(2), 175-178.

Horton, E. S., & Jeanrenard, B. (1990). Obesity in diabetes mellitus. In H. Rifkin, & D. Porte (Eds.), Diabetes mellitus: Theory and practice (4th ed.) (pp. 457-463). New York: Elsevier.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. Health Education Quarterly, 11(2), 1-47.

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

Kaplan, R. M., Hartwell, S. L., Wilson, D. K., & Wallace, J. P. (1987). Effects of diet and exercise interventions on control and quality of life in non-insulin-dependent diabetes mellitus. Journal of General Internal Medicine, 2, 220-227.

King, A. C., Taylor, C. B., Haskell, W. L., & Debusk, R. F. (1989). Influence of regular aerobic exercise on psychological health: A randomized, controlled trial of healthy middle-aged adults. Health Psychology, 8(3), 305-324.

Kingery P. M., & Glasgow, R. E. (1989). Self-efficacy and outcome expectations in the self-regulation of non-insulin dependent diabetes mellitus. Health Education, 20(7), 13-19.

Krug, L. M., Haire-Joshu, D. & Heady, S. A. (1991). Exercise habits and exercise relapse in persons with non-insulin-dependent diabetes mellitus. The Diabetes Educator, 17(3), 185-188.

McArdle, W. D., Katch, F. I., & Katch, V. L. (1991). Exercise physiology: Energy, nutrition, and human performance. Philadelphia: Lea & Febiger.

McCaul, K. D., Glasgow, R. E., & Schafer, L. C. (1987). Diabetes regimen behaviors. Medical Care, 25, 868-881.

McDowell, I., & Newell, C. (1987). Measuring health: A guide to rating scales and questionnaires. New York: Oxford University Press.

Nakai, Y., Dataoda, Y., Bando, M., & Take, H. (1988). The benefits of physical exercise training after coronary artery bypass grafting. Comprehensive Therapy, 14(8), 45-51.

Oldridge, N. B. (1988). Cardiac rehabilitation exercise programme: compliance and compliance-enhancing strategies. Sports Medicine, 6, 42-55.

Radtke, K. L. (1989). Exercise compliance in cardiac rehabilitation. Rehabilitation Nursing, 14(4), 182-186.

Paffenbarger, R. S., Hyde, R. T., Wing, A. L., & Hsieh, C. (1986). Physical activity, all-cause mortality and longevity of college alumni. New England Journal Medicine, 314(10), 605-613.

Pender, N. J. (1987). Health promotion in nursing practice. Norwalk, Connecticut: Appleton & Lange.

Podolsky, S. (Ed.). (1980). Clinical diabetes: Modern management. New York: Appleton-Century-Crofts.

Pollock, M. L., & Wilmore, J. H. (1990). Exercise in health and disease: Evaluation and prescription for prevention and rehabilitation. Philadelphia: W. B. Saunders Co.

Rifkin, H. (Ed.). (1988). Physician's guide to non-insulin-dependent (Type II) diabetes: diagnosis and treatment. Virginia: American Diabetes Association, Inc.

Rogers, M. A., Yamamoto, C., King, D. S., Hagberg, J. M., Ehsani, A. A., & Holloszy, J. O. (1988). Improvement in glucose tolerance after one week of exercise in patients with mild NIDDM. Diabetes Care, 11(8), 613-618.

Ronnemaa, T., Marniemi, J., Puukka, P., & Kuusi, T. (1988). Effects of long-term physical exercise on serum lipids, lipoproteins and lipid metabolizing enzymes in type 2 (non-insulin-dependent) diabetic patient. Diabetes Research, 7, 79-84.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. Health Education Quarterly, 15(2), 175-183.

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

Sallis, J. F., Hovell, M. F., Hofstetter, C. R., Elder, J. P., Faucher, P., Spry, V. M., Barrington, E., & Hackley, M. (1990). Lifetime history of relapse from exercise. Addictive Behaviors, 15, 573-579.

Schlenk, E. A., & Hart, L. K. (1984). Relationship between health locus of control, health value, and social support and compliance of persons with diabetes mellitus. Diabetes Care, 7(6), 566-574.

Sechrist, K. R., Walker, S. N., & Pender, N. J. (1987). Development and psychometric evaluation of the exercise benefits/barriers scale. Research in Nursing & Health, 10, 357-365.

Serfass, R. C., & Gerberich, S. G. (1984). Exercise for optimal health: Strategies and motivational considerations. Preventive Medicine, 13, 79-99.

Shaver, K. G. (1981). Principles of social psychology. Cambridge, MA: Winthrop Publishers, Inc.

Stevenson, J. S., & Topp, R. (1990). Effects of moderate and low intensity long-term exercise by older adults. Research in Nursing and Health, 13, 209-218.

Vallbona, C., & Baker, S. B. (1984). Physical fitness prospects in the elderly. Archives of Physical Medicine and Rehabilitation, 65, 194-200.

Vasterling, J. J., Sementilli, M. E., & Burish, T. G. (1988). The role of aerobic exercise in reducing stress in diabetic patients. The Diabetes Educator, 14(3), 197-201.

Wing R. R., Epstein, L. H., Nowalk, M. P., Koeske, R., & Hagg, S. (1985). Behavior change, weight loss, and physiological improvements in Type II diabetic patients. Journal of Consulting and Clinical Psychology, 53(1), 111-122.

Wing, R. R., Epstein, L. H., Paternostro-Bayles, M., Kriska, A., Nowalk, M. P., & Gooding, W. (1988). Exercise in a behaviourial weight control programme for obese patients with type 2 (non-insulin-dependent) diabetes. Diabetologia, 31, 902-909.

APPENDIX A

Cover Letter

OREGON
HEALTH SCIENCES UNIVERSITY
3181 S.W. Sam Jackson Park Road, Portland, OR 97201-3098
Mail Code L-456, (503) 494-7839 / 494-7846

School of Nursing
Department of Adult Health and Illness

July 1, 1991

Dear ,

THANK YOU, for agreeing to participate in this followup study titled, "Continued Exercise in Non-Insulin Dependent Diabetes Mellitus." The enclosed one dollar bill is a small token of my appreciation.

1. Please date and complete the following items in this order:

   Demographic and Diabetes Update (green)
   General Well-Being Schedule (white)
   Exercise Benefits and Barriers Scale (buff)
   Diabetes Self-Efficacy Scale (pink)

2. Place all the completed forms in the enclosed LARGE brown stamped envelope and return them to me. The envelope is already addressed, so just seal and drop it in any mailbox. There should be 4 forms returned in the envelope, all EXCEPT the yellow Exercise Records.

3. Starting tomorrow, record your exercise for two weeks on the yellow Exercise Record. Record any activity that you consider aerobic exercise. Include any exercise that raises your pulse and respirations, causes you to sweat and lasts at least 15 uninterrupted minutes. You may notice that this form looks similar to the one you used in last year's study but has fewer columns. Record the date, the type of activity, the time you started the activity, the time it ended and the distance if it applies. Also, record a full minute pulse before you begin AND take your pulse again for one full minute after 10-15 minutes of aerobic activity. Comments in the last column are welcome.

4. When the 2 weeks are over, complete the questions on the second page, put the exercise record in the SMALL white stamped addressed envelope and return to me. IMPORTANT! If the records are blank and you have not exercised during the weeks, please return them anyway!

If you have any questions, please call me at 635-8904 and leave a message. I will return your call as soon as possible.

Many Thanks Again!

Cindi A. Ballas, RN, BSN

APPENDIX B

Personal Update Form

ID____________
Date____________

PERSONAL UPDATE FORM

A. Exercise During the Past Year

1. Have you been exercising regularly since July 10, 1990?
   ....___Yes(1)___No(2)
2. Estimate the number of weeks you exercised at least 3 times in the last year? (One year has 52 weeks)________
3. How often did you exercise during the last month?________________
4. Have you stopped exercising for more than 2 weeks in a row?
   ....___Yes(1) ___No(2)
   If yes, how many times during the last year did this happen?______
5. Have you had any injuries since July 10, 1990 that required you to stop exercising for more than 2 weeks in a row? ___Yes(1) ___No(2)
6. What limits or interferes with your exercise? ____________________
   ____
   ____
7. Did you make adjustments in your routine to continue to exercise during the winter months?..........................___Yes(1) ___No(2)
   If yes, describe____
8. Do you enjoy your exercise routine? ....___Yes(1) ___No(2)
9. How have you modified your exercise routine to maintain your interest?____
   ____
10. Have you joined a walking organization or other exercise group?
    ....___Yes(1) ___No(2)
11. Do you usually exercise with someone?.............___Yes(1) ___No(2)

ID ______________
Date ______________

B. Medical Problems - Check problems that are <u>new</u> since July 10, 1990.

Problem	No(1)	Yes(2)	Current Treatment or Medication
1. High blood pressure........	_____	_____	______________
2. Chest pains................	_____	_____	______________
3. Heart attack...............	_____	_____	______________
4. Stroke.....................	_____	_____	______________
5. Leg pain with walking......	_____	_____	______________
6. Pain, numbness or tingling in feet (neuropathy).......	_____	_____	______________
7. Eye problems related to diabetes..................	_____	_____	______________
8. Kidney problems............	_____	_____	______________
9. Amputation.................	_____	_____	______________
10. Lung disease or asthma.................	_____	_____	______________
11. Arthritis..................	_____	_____	______________
12. Foot problem (Ulcer, bunion, callous)...........	_____	_____	______________
13. Ankle instability..........	_____	_____	______________

14. Other, describe, ____

____

ID______________
Date______________

15. Has your diabetes treatment changed since July 10, 1990?

....___Yes(1)___No(2)

If yes, what was changed? Diet__________________________________

Medication______________________________

Other__________________________________

16. Have you been hospitalized since July 10th, 1990? ___Yes(1)___No(2)

If yes, Date____

Reason for hospitalization______________________________

Length of stay____

C. Personal History

1. Has your marital status changed during the last year?___Yes(1)___No(2)

If yes, what is your current status? ___Single(never married)(1)

___Married(2)

___Separated/Divorced(3)

___Widowed(4)

2. Has your employment changed during the last year? ___Yes(1)___No(2)

If yes, what is your current type of work?____________________

How many hours per week do you work?___________

3. What is your current weight (in morning with shoes off)?___________

APPENDIX C

General Well-being Schedule

ID:________________

DATE:______________

THE GENERAL WELL-BEING SCHEDULE

(Please circle the number that best applies to you)

1. How have you been feeling in general? (DURING THE PAST MONTH)..
    - 1 In excellent spirits
    - 2 In very good spirits
    - 3 In good spirits mostly
    - 4 I have been up and down in spirits a lot
    - 5 In low spirits mostly
    - 6 In very low spirits

2. Have you been bothered by nervousness or your "nerves"? (DURING THE PAST MONTH)...
    - 1 Extremely so—to the point where I could not work or take care of things
    - 2 Very much so
    - 3 Quite a bit
    - 4 Some—enough to bother me
    - 5 A little
    - 6 Not at all

3. Have you been in firm control of your behavior, thoughts, emotions OR feelings? (DURING THE PAST MONTH) ....
    - 1 Yes, definitely so
    - 2 Yes, for the most part
    - 3 Generally so
    - 4 Not too well
    - 5 No, and I am somewhat disturbed
    - 6 No, and I am very disturbed

4. Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile? (DURING THE PAST MONTH)...
    - 1 Extremely so—to the point that I have just about given up
    - 2 Very much so
    - 3 Quite a bit
    - 4 Some—enough to bother me
    - 5 A little bit
    - 6 Not at all

5. Have you been under or felt you were under any strain, stress, or pressure? (DURING THE PAST MONTH) ....
    - 1 Yes—almost more than I could bear or stand
    - 2 Yes—quite a bit of pressure
    - 3 Yes—some, more than usual
    - 4 Yes—some, but about usual
    - 5 Yes—a little
    - 6 Not at all

6. How happy, satisfied, or pleased have you been with your personal life? (DURING THE PAST MONTH) ....
    - 1 Extremely happy—could not have been more satisfied or pleased
    - 2 Very happy
    - 3 Fairly happy
    - 4 Satisfied—pleased
    - 5 Somewhat dissatisfied
    - 6 Very dissatisfied

ID: ______________
DATE: ______________

7. Have you had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel, or of your memory? (DURING THE PAST MONTH) ....

1 Not at all
2 Only a little
3 Some—but not enough to be concerned or worried about
4 Some and I have been a little concerned
5 Some and I am quite concerned
6 Yes, very much so and I am very concerned

8. Have you been anxious, worried, or upset? ((DURING THE PAST MONTH) ....

1 Extremely so—to the point of being sick or almost sick
2 Very much so
3 Quite a bit
4 Some—enough to bother me
5 A little bit
6 Not at all

9. Have you been waking up fresh and rested? (DURING THE PAST MONTH) ....

1 Every day
2 Most every day
3 Fairly often
4 Less than half the time
5 Rarely
6 None of the time

10. Have you been bothered by any illness, bodily disorder, pains, or fears about your health? (DURING THE PAST MONTH) ......

1 All the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

11. Has your daily life been full of things that were interesting to you? (DURING THE PAST MONTH) ....

1 All the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

12. Have you felt downhearted and blue? (DURING THE PAST MONTH) ....

1 All the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

ID: ______________
DATE: ______________

13. Have you been feeling emotionally stable and sure of yourself? (DURING THE PAST MONTH) ....

1 All the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

14. Have you felt tired, worn out, used-up, or exhausted? (DURING THE PAST MONTH) ....

1 All the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

For each of the four scales below, note that the words at each end of the 0 to 10 scale describe opposite feelings. Circle any number along the bar which seems closest to how you have generally felt DURING THE PAST MONTH.

15. How concerned or worried about your HEALTH have you been? (DURING THE PAST MONTH) ....

0 1 2 3 4 5 6 7 8 9 10

Not concerned at all — Very concerned

16. How RELAXED or TENSE have you been? (DURING THE PAST MONTH) ....

0 1 2 3 4 5 6 7 8 9 10

Very relaxed — Very tense

17. How much ENERGY, PEP, VITALITY have you felt? (DURING THE PAST MONTH) ....

0 1 2 3 4 5 6 7 8 9 10

No energy at all Listless — Very energetic dynamic

18. How DEPRESSED or CHEERFUL have you been? (DURING THE PAST MONTH) ....

0 1 2 3 4 5 6 7 8 9 10

Very depressed — Very cheerful

APPENDIX D

Exercise Benefits and Barriers Scale

ID ____________ Date: ______________

EXERCISE BENEFITS/BARRIERS SCALE

DIRECTIONS: Below are statements that relate to ideas about exercise. Please indicate the degree to whic you agree or disagree with the statements by circling SA for strongly agree, A for agree, D for disagree, c SD for strongly disagree.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I enjoy exercise.	SA	A	D	SD
2. Exercise decreases feelings of stress and tension for me.	SA	A	D	SD
3. Exercise improves my mental health.	SA	A	D	SD
4. Exercising takes too much of my time.	SA	A	D	SD
5. I will prevent heart attacks by exercising.	SA	A	D	SD
6. Exercise tires me.	SA	A	D	SD
7. Exercise increases my muscle strength.	SA	A	D	SD
8. Exercise gives me a sense of personal accomplishment.	SA	A	D	SD
9. Places for me to exercise are too far away.	SA	A	D	SD
10. Exercising makes me feel relaxed.	SA	A	D	SD
11. Exercising lets me have contact with friends and persons I enjoy.	SA	A	D	SD
12. I am too embarrassed to exercise.	SA	A	D	SD
13. Exercising will keep me from having high blood pressure.	SA	A	D	SD
14. It costs too much money to exercise.	SA	A	D	SD
15. Exercising increases my level of physical fitness.	SA	A	D	SD
16. Exercise facilities do not have convenient schedules for me.	SA	A	D	SD
17. My muscle tone is improved with exercise.	SA	A	D	SD
18. Exercising improves functioning of my cardiovascular system.	SA	A	D	SD
19. I am fatigued by exercise.	SA	A	D	SD
20. I have improved feelings of well being from exercise.	SA	A	D	SD
21. My spouse (or significant other) does not encourage exercising.	SA	A	D	SD
22. Exercise increases my stamina.	SA	A	D	SD
23. Exercise improves my flexibility.	SA	A	D	SD

ID ________ Date: ____________

	Strongly Agree	Agree	Disagree	Strongly Disagree
24. Exercise takes too much time from family relationships.	SA	A	D	SD
25. My disposition is improved by exercise.	SA	A	D	SD
26. Exercising helps me sleep better at night.	SA	A	D	SD
27. I will live longer if I exercise.	SA	A	D	SD
28. I think people in exercise clothes look funny.	SA	A	D	SD
29. Exercise helps me decrease fatigue.	SA	A	D	SD
30. Exercising is a good way for me to meet new people.	SA	A	D	SD
31. My physical endurance is improved by exercising.	SA	A	D	SD
32. Exercising improves my self-concept.	SA	A	D	SD
33. My family members do not encourage me to exercise.	SA	A	D	SD
34. Exercising increases my mental alertness.	SA	A	D	SD
35. Exercise allows me to carry out normal activities without becoming tired.	SA	A	D	SD
36. Exercise improves the quality of my work.	SA	A	D	SD
37. Exercise takes too much time from my family responsibilities.	SA	A	D	SD
38. Exercise is good entertainment for me.	SA	A	D	SD
39. Exercising increases my acceptance by others.	SA	A	D	SD
40. Exercise is hard work for me.	SA	A	D	SD
41. Exercise improves overall body functioning for me.	SA	A	D	SD
42. There are too few places for me to exercise.	SA	A	D	SD
43. Exercise improves the way my body looks.	SA	A	D	SD

APPENDIX E

Diabetes Self-efficacy Scale

Item	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree	Not Apply
14. I have trouble finding ways to add exercise to my daily routine	1	2	3	4	5	6	NA
15. I have difficulty taking my diabetes medicine(s) when away from home so I avoid eating out	1	2	3	4	5	6	NA
16. I can adjust my diet to prevent low blood sugar reactions when I exercise	1	2	3	4	5	6	NA
17. The diabetic diet is too confusing for me to follow	1	2	3	4	5	6	NA
18. I have trouble adjusting my diabetic medicine(s) to prevent low blood sugar reactions when I exercise	1	2	3	4	5	6	NA
19. I can't exercise because I worry about having a low blood sugar reaction because of my diabetes	1	2	3	4	5	6	NA
20. I have the skills necessary to take care of my diabetes	1	2	3	4	5	6	NA
21. It's difficult for me to stay on my diabetic diet around people who are not aware I'm diabetic	1	2	3	4	5	6	NA
22. I can safely adjust my diabetes medicine(s) when I need to, without calling the doctor or nurse	1	2	3	4	5	6	NA
23. I can't stay on my diabetic diet when I eat out	1	2	3	4	5	6	NA
24. I can adjust my diabetic diet when I get sick	1	2	3	4	5	6	NA
25. Matching my diabetes medicine(s) to what I eat and my activity is too hard for me	1	2	3	4	5	6	NA

DIABETES SELF-EFFICACY SCALE

by

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APPENDIX F

Exercise Record

Date Week One Began ____________ Date Week One Began ____________ ID ______________

EXERCISE RECORD

Date	Pulse before exercise	Type of exercise	Time began exercise	Pulse during exercise	Time ended exercise	Distance (if appro-priate)	Comments

Date Week One Began ________ Date Week One Began ________ ID ________

EXERCISE RECORD

Date	Pulse before exercise	Type of exercise	Time began exercise	Pulse during exercise	Time ended exercise	Distance (if appropriate)	Comments

Does this exercise record describe a typical two weeks of physical activity for you? ___Yes ___ No

If no, please indicate what your typical week's physical activity would consist of?

Type of activity ________

Duration in minutes ________

Times per week ________

How strenuous _____Light _____Moderate _____Heavy