THE EFFECTIVENESS OF A MOTIVATIONAL-TARGETED FEEDBACK MESSAGE INTERVENTION ON INCREASING PHYSICAL ACTIVITY IN LONG-TERM MAINTENANCE CARDIAC REHABILITATION PATIENTS

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ABSTRACT

THESIS: The Effectiveness of a Motivational-Targeted Feedback Message Intervention on Increasing Physical Activity in Long-Term Maintenance Cardiac Rehabilitation Patients.

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Purpose: The aim of the study was to determine the relative effectiveness of a motivational-targeted (MT) message intervention designed to increase physical activity (PA) in cardiac patients beginning a long-term maintenance cardiac rehabilitation (CR) program to enable them to meet recommended PA levels.

Methods: Fifty two individuals (34 males, 18 females) volunteered for the study and were randomly assigned to either the Usual Care Group (UC), or the Motivational Message Group (MM). Participants in the MM group received, in addition to the usual long-term maintenance CR program, 12 –standard, MT newsletters at the beginning of each week during the intervention period. Thirty-three individuals (mean age: 61.4 ± 11.4 years) completed the study with viable data. PA was assessed for 12 weeks with the use of a Lifecorder PLUS
accelerometer. Baseline and post measures of weight, body mass index (BMI), body fat percentage, resting heart rate and blood pressure measures, and fasting blood measures were completed on all subjects. Subjects also completed an exercise self-efficacy questionnaire and a stage of change of physical activity readiness questionnaire at these timeframes. **Results:** Independent sample t-tests indicated there were no significant differences between baseline characteristics between the UC group and MM group. Results indicated slight increases in the MM group in steps/day, and moderate-vigorous minutes/day, with slight decreases in resting heart rate, blood pressure, and blood lipid values compared to the UC group. Two-way repeated measures ANOVA tests determined there was a significant main effect for time for resting heart rate, however, there were no other significant differences between the two groups or within either group, showing no time by group interaction for any variables measured. **Conclusions:** MT messages may have the ability to increase PA levels and adherence in CR patients, however, more research is needed to determine the significant value of motivational-targeted messages for these individuals. **Key Words:** PHYSICAL ACTIVITY, CARDIOVASCULAR DISEASE, MOTIVATIONAL-TARGETED INTERVENTION, MAINTENANCE CARDiac REHABILITATION, SELF-EFFICACY.
CHAPTER I
INTRODUCTION

Cardiovascular disease (CVD) is the number one cause of death globally. In the United States, CVD is the leading cause of death among both men and women and accounts for 1 of every 3 deaths, killing an average of 1 American every 37 seconds (4, 57). CVD is a major national health concern, with an estimated number of 12.4 million patients diagnosed with the disease in 2001 (64). According to the National Center for Health Statistics, if all forms of major CVD were eliminated, life expectancy would rise by almost 7 years (58). Clinical trials by the American Heart Association (AHA) and American College of Cardiology (ACC) have shown that aggressive risk factor management clearly improves CVD patient survival, reduces recurrent events, and the need for interventional procedures, while improving a patient’s quality of life. Risk factor management includes targeting dietary patterns, weight reduction, and physical activity habits (4, 64).

Physical inactivity has been established as a major coronary artery disease (CAD) risk factor (68). In the year 2000, the annual estimated direct medical cost of physical inactivity was $76.6 billion (4). CVD risk factors, such as
physical inactivity, however, can be combated and controlled by adherence to current AHA and ACC lifestyle recommendations. Physical activity (PA) can help treat established atherosclerotic risk factors including elevated blood pressure, insulin resistance, glucose intolerance, elevated triglyceride concentrations, low high-density lipoprotein cholesterol (HDL-C) concentrations, and obesity (68). Regular aerobic PA that involves large muscle groups has been determined to have positive effects on reducing the development of CAD and reducing symptoms in individuals with established CVD (21, 32, 52, 68). It has been shown in those individuals who accumulate a moderate amount of PA on a regular basis that the risk of developing CAD decreases by 20-50% (70).

Studies on PA have consistently documented a reduced incidence of CAD events in more physically active and fit subjects. Large scale observational studies which include the College Alumni Health Study (48), the Health Professionals’ Follow-up Study (65), the Nurses’ Health Study (44), the Women’s Health Study (31) and the Women’s Health Initiative (34), have all clearly documented a dose-response relation between PA and risk of CVD and premature mortality in men and women. These studies observed significantly lower levels of risk factors with greater amounts of PA (22). The evidence indicates that sufficient amounts of PA on a regular basis benefits individuals, showing a dose-response relationship with higher doses of PA showing decreased risks for CVD and mortality (22, 32, 45, 70).

The AHA and the ACC recommends a minimum of 30-60 minutes of PA at least 3-4 days/week supplemented by an increase in daily lifestyle activities (64).
The minimum threshold of PA for health benefits is the attainment of at least 1,000 kcals/week of energy expenditure from PA. This quantity of PA is approximately equal to 30 minutes/day of exercise (1, 69). Additionally, a study conducted by Hambretcht et al (21) determined that patients with CAD exceeding 1,500 kcals/week in exercise energy expenditure noted a halt in progression of coronary lesions, whereas those who exceeded 2,200 kcals/week in exercise energy expenditure noted a regression of coronary lesions (21). Therefore, evidence supports that cardiac patients should reach aggressive target exercise energy expenditure levels each week.

Cardiac rehabilitation (CR) programs have been a successful means for increasing PA and energy expenditures in cardiac patients. A recent meta-analysis indicated that such programs reduce total and cardiac mortality by 20 - 27% compared to standard medical care (27, 67). PA resulting from participation in CR programs also has numerous other health benefits including improvements in functional capacity, body composition, blood lipids, and quality of life (5, 21, 32, 64).

Although CR programs benefit cardiac patients by increasing caloric expenditure during exercise sessions, these sessions are generally only performed 3 days/week for 30-40 minutes, and thus do not provide enough caloric expenditure to reach weekly target levels (5, 28). Ayabe et al (2004)(5), determined that the amount of PA is generally adequate on CR program days, but participants failed to reach target levels on non-CR program days (5). In the study by Savage et al (61), 112 patients with CAD completed an exercise CR
program of 36 hourly sessions over a 12-week period. It was reported however that only 270 ± 112 kcal/session resulted, ultimately determining that exercise-related energy expenditure in early outpatient CR is remarkably low (61). Patients did not achieve the minimum weekly caloric expenditure of 1,000 kcal recommended by the American College of Sports Medicine (ASCM) (69).

Similarly, our laboratory, in conjunction with our local hospital, recently completed a study which revealed that patients participating in a maintenance CR program obtained significantly fewer steps/day (5,287 ± 520) on days they did not attend CR compared to days attended (10,087 ± 631) (28). It was observed, however, that those who reported exercising at least once/week outside of the CR program performed better (6,366 ± 667 vs 3,668 ± 529 steps/day), however, they did not reach a minimal threshold of 10,000 steps/day on these non-CR days. Studies have supported that 10,000 steps/day is comparable to 30 minutes/day of moderate intensity activity (25, 71). Multiple investigations have also demonstrated that the PA levels of individuals who participate in CR programs are often considerably less than the more aggressive PA goals of > 2,200 kcal/week. Often this occurs because the individuals’ lack of PA on non-CR program days (5, 61). An important goal, therefore, of a CR program should be to promote PA outside the structured CR program.

Maintaining a regular PA program that meets recommended PA levels has proven difficult for all populations. Data from 2005 indicate that less than half (49.1%) of United States adults met the Center for Disease Control/American College of Sports Medicine (CDC/ACSM) physical activity recommendations, and
that only 32% of United States adults engage in regular leisure-time PA (22, 42). Data shows that younger individuals are more likely to be physically active than older individuals, with 59.6% of 18-24 year olds meeting the recommendation, and only 39.0% of those 65 years and older meeting the recommendation (22). PA benefits accrue over time, and long-term adherence maximizes individual benefits, however it has been shown that PA habits are often not translated into long-term behavioral maintenance, with at least a 50% drop out within 6 months of those who begin a formal exercise program (4, 30). Therefore, it is imperative that interventions be designed that effectively promote not only adoption but maintenance of active lifestyles.

Mediating in the adoption and maintenance of PA in individuals can be challenging. However, developing psychological mechanisms such as motivational messages that center on cognitive-behavioral strategies focusing on how an individual thinks about them self, their behaviors, and surrounding circumstances may help facilitate this adoption and promote adherence. These mechanisms may therefore encourage and increase PA in a structured CR program with little added cost.

Mediated interventions involving print-based programs and intervention content through non-face-to-face contact, have been shown to be successful and are considered a promising approach for enhancing PA behavior (11, 37, 38, 41, 72). PA interventions have shown to be effective when matched to needs and interests of the target group (38). Marcus et al (1992) demonstrated the efficacy of motivational- matched interventions by showing that self-help books that were
matched to motivational stages enhanced movement toward PA adoption in a community setting of women (36). According to Williams et al (2008) (72), print and telephone-based interventions for PA have been effective in promoting PA (11, 37). Limited face-to-face time and personal patient to staff sessions exist in CR program settings. These print and auditory interventions allow for information to reach and motivate the patient while bypassing barriers such as lack of time and resources that are often associated with traditional face-to-face interventions (72). These interventions also provide a clear cost benefit. With continual escalating medical costs, and the demand of third party payers for evidence of cost-effectiveness in healthcare service and procedures; non-face-to-face interventions could be a very cost effective approach in CR facilities.

Individuals joining a maintenance CR program are often adopting a new behavior. An individual’s readiness to become physically active is an important determinant of successful participation in PA (35). Therefore the intervention should first start with education and move towards more behavior changes. Individuals first starting a program are often sedentary and tend to need greater emphasis on cognitive processes (education), and as activity increase the individuals incorporate more behavioral processes (37). Research has shown that educational interventions, such as motivational messages that are targeted to either cognitive or behavior strategies work well to increase an individual’s knowledge base regarding PA (35). Cognitive-behavioral strategies have been successful in behavior change interventions in enhancing PA adoption in both men and women (4, 37, 38). These approaches are successful because they are
based on cognitive and behavior stages and work with the dynamic process of how individuals first come to adopt and then maintain changes in health behavior. Cognitive strategies focus on increasing knowledge about PA, and are used in the earlier stages of adoption, whereas behavioral strategies focus on substituting PA pursuits for sedentary behavior, and are used in the later stages of adoption of PA (38). Using this knowledge base, motivational message interventions can be created that target individuals at the appropriate stage and can be used to help individuals adopt PA as a new behavior.

Long-term maintenance CR patients could greatly benefit from these interventions. Although information regarding the success of motivational-targeted intervention content is well documented for healthy individuals, the benefits information for cardiac patients in long-term maintenance CR programs is lacking. However, evidence indicates that designing interventions that are motivational-targeted could be one way to increase PA in maintenance CR patients that is easy and effective, allowing cardiac patients to increase PA to target levels for optimum benefits.

PURPOSE

The purpose of this research project was to determine the relative effectiveness of a motivational-targeted message intervention designed to increase PA in cardiac patients beginning a long-term maintenance CR program in order to meet recommended levels.
**Hypothesis 1:** Cardiac patients attending long-term maintenance CR that receive PA feedback through motivational-targeted messages would have higher levels of PA than patients who received usual care recommendations.

**Specific Aim 1:** To test a comparison between motivational-targeted message interventions to a usual exercise recommendation designed to increase PA levels in cardiac patients.

**Specific Aim 2:** To evaluate if changes in PA levels resulted in improvements in cardiovascular health (body composition, and risk factors [resting heart rate, blood pressure, lipids]).

**Hypothesis 2:** Cardiac patients who achieved higher levels of PA would have improvements in selected health, function, and behavioral measures.

**DELIMITATIONS**

1. The cohort consisted of 52 males and females enrolled in maintenance CR program at Indiana University Health (IU Health) Ball Memorial Hospital in Muncie, Indiana with a primary diagnosis of myocardial infarction (MI), coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI), heart valve repair/replacement, or stable angina.

2. Each subject completed a health history questionnaire (HHQ), stage of change of physical activity readiness questionnaire, exercise self-efficacy questionnaire, quality of life Index (QOL), and received resting
blood pressure, fasting blood sample, body composition assessment, and a 6-minute walk test before and after the 12 week intervention.

3. The study intervention period consisted of 12 weeks of either Motivational Message (MM) or Usual Care (UC) with each subject’s objective PA measured using Lifecorder PLUS downloadable accelerometers (New-Lifestyles, Inc. Lee’s Summit, MO)

DEFINITIONS

Accelerometer- an electronic motion sensor that is worn on the waistband at the hip and used for determining activity level (steps/day, and intensity) and energy expenditure

PA- any bodily movement that is produced by the contraction of skeletal muscle and that substantially increases energy expenditure (69).

CR- Coordinated, multifaceted interventions (PA, exercise training; lipid, hypertension, weight, diabetes, and smoking management) designed to optimize a cardiac patient’s physical, psychological, and social functioning, in addition to stabilizing, slowing, and even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality (32).

Mediated intervention- information content delivered through non-face-to-face media (i.e. telephone, print, and internet).

Self-Efficacy- a person’s confidences that they can maintain healthy behaviors, i.e. abstain from an unhealthy behavior (smoking), or maintain a healthy behavior (exercise) (47, 53).
CHAPTER II
LITERATURE REVIEW

Multiple research studies have shown the importance of PA for individuals with CVD. CR centers provide individuals with the PA programs and educational and motivational guidance to facilitate activity. Minimum recommended values of PA for cardiac patients are 30-60 minutes of activity, at least 3-4 times/week supplemented by an increase in daily lifestyle activities. Adherence to PA programs and behavior is a major factor of success. CR facilities are addressing adherence by promoting PA through various motivational interventions. The primary objective of this study was to assess a cost effective, motivational-targeted, non-face-to-face message intervention for increasing PA in CR patients.

Cardiovascular Disease

CVD is the leading cause of death among both men and women in the United States, claiming more lives each year than cancer, chronic lower respiratory disease, and accidents combined (57). Approximately 1 in 3 Americans have CVD, accounting for 1 of every 2.9 deaths in the United States.
According to the American Heart Association’s (AHA) statistics on heart disease and stroke update from 2011 (57), CVD includes CAD, stroke, hypertension, and congestive heart failure. CAD accounts for 1 of every 6 deaths in the United States. Every 25 seconds an American will have a coronary event, and approximately every minute, someone will die of one (57). In 2004, coronary atherosclerosis was estimated to be responsible for 1.2 million hospital stays and was the most expensive condition treated. More than half of the hospital stays for coronary atherosclerosis were among patients who also received percutaneous coronary intervention or cardiac revascularization. The estimated direct and indirect cost of CVD for 2007 was $286 billion (57).

**CVD Patients, Physical Activity and Cardiac Rehabilitation Programs**

A major risk factor for CVD is physical inactivity. Physical inactivity is responsible for 12.2% of the global burden of MI after accounting for other CVD risk factors such as cigarette smoking, diabetes mellitus, hypertension, abdominal obesity, lipid profile, no alcohol intake, and psychosocial factors (57). CVD patients benefit from PA. A 1997 study by Niebauer et al. (46) examined the long-term effects of PA and a low fat diet on the progression of CAD. The study investigated the 6-year impact of a multifactorial risk intervention on changes in angiographically documented atherosclerotic lesions and the contributions made by PA (46). The study consisted of an intervention group (n=56), and a control group (n=57) composed of all males with a mean age of 53.5 (range, 35 to 68) years who were recruited after angiography for suspected
Patients in the intervention group were maintained on a metabolic ward for 3 weeks where they were instructed how to lower the fat and cholesterol content of their regular diet following the AHA recommendations (protein 15%, carbohydrates 65%, fat < 20% energy, total cholesterol < 200 mg, polyunsaturated/saturated fatty acids ratio > 1). Individuals were also asked to exercise daily on a provided cycle ergometer for a minimum of 30 minutes, as well as to participate in at least 2 group exercise training sessions of 60 minutes each per week. Patients were instructed to keep a log book of all their exercise. Leisure-time PA was also estimated by the use of a modified Minnesota leisure-time PA questionnaire.

After 6 years, repeat coronary angiograms were completed in 66 of the 92 patients. Relative stenosis diameter was used to compare stenotic segments, and only changes between sequential measurements exceeding 10% were considered relevant. “Progression”, “no change”, and “regression” were calculated as the averages of the changes in all individual lesions. The results determined that after 6 years, in the intervention group, 59% (N=19) of the patients showed progression, 22% (n=7) showed no change, and 19% (n=6) had regression of coronary lesions. In the control group, 74% (n=25) of the patients had progression and 26% (n=9) had no change, while regression of the coronary lesions was not observed (46). It was determined that patients in the intervention group showed a significant retardation of lesion progression.

Other variables were also seen to have significant differences. After 6 years, patients in the intervention group increased their maximal, symptom-
limited physical work capacity significantly (166 ± 59 vs 212 ± 89 watts) compared to the control group (165 ± 51 vs 170 ± 60 watts). The intervention group also improved levels of triglycerides (142 ± 79 vs. 164 ± 85 mg/dL; -17% vs. -18%), total cholesterol (502 ± 89 vs. 513 ± 78 mg/dL; -6.0% vs. -4.3%), HDL-C (94 ± 29 vs. 90 ± 27 mg/dL; +14.6% vs. +12.5%), LDL-C (348 ± 71 vs. 374 ± 65 mg/dL; -7.0% vs. +1.08%) and VLDL-C (51 ± 39 vs. 62 ± 36 mg/dL; -37% vs. -30%), however, these levels were not significant compared to the control group.

Looking at the exercise related variables of all individuals it was determined that patients who showed regression in their lesions significantly increased their physical work capacity (86 ± 53 watts) compared with patients with no change (2 ± 42 watts) and progression (14 ± 56 watts). It was also determined that patients who showed regression expended significantly more energy (1784 ± 384 kcal) during leisure-time PA than those patients with no change (1239 ± 607 kcal) or those with progression (1260 ± 425 kcal; P<.05) (46).

CR programs were first developed in the 1960’s after realizing the benefits of ambulation during prolonged hospitalization for coronary events (55). After patient discharge, the individual was encouraged to continue an exercise regimen, however, concern about safety of unsupervised exercise led to the development of highly structured rehabilitation programs that were supervised by physicians, included electrocardiographic monitoring, and were exclusively focused on exercise. Present day hospital stays for coronary syndromes have been shortened to 3 to 5 days. With shorter stays, the opportunity to educate an
individual about risk reduction and exercise importance is diminished. Therefore, the benefits of CR programs that focus on secondary prevention are compelling (3).

CR programs today are rehabilitation/secondary prevention programs. They are recognized as integral to the comprehensive care of patients with CVD, and are recommended as useful and effective by the AHA, and ACC (6). CR is defined as a “coordinated, multifaceted intervention designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality” (32). The program's main focus is an exercise training program but it also includes multifaceted strategies aimed at reducing modifiable risk factors for CVD. Therefore, CR prevention programs include baseline patient assessments, nutritional counseling, aggressive risk factor management (i.e., lipids, hypertension, weight, diabetes, and smoking), psychosocial and vocational counseling, and PA counseling and exercise training (32). CR programs consist of both an early outpatient program and a maintenance outpatient program. Early outpatient (Phase II) programs are more structured and involve more staff-to-patient ratio. Maintenance (Phase III) outpatient programs are more focused on patients maintaining their exercise program with less face-to-face staff ratio. Candidates for CR early outpatient and maintenance programs are patients who have recently had a MI, undergone coronary artery bypass graft surgery (CABG), had percutaneous coronary interventions (PCI), had surgical procedures on
valvular heart disease, or heart transplantation candidates or recipients, or have stable chronic heart failure (CHF), peripheral arterial disease (PAD), or other forms of CVD (3, 32).

**Outcomes and benefits of PA in Cardiac Rehabilitation**

Aerobic exercise training in outpatient CR is typically of moderate intensity exercise for 30-40 minutes and has been associated with increases in peak VO$_2$ of 11-36%, which is independently associated with benefits in cardiovascular events and in quality of life (55). Over 50% of candidates for CR are over the age of 65, and many have coexisting disorders and are severely de-conditioned. Therefore, exercise training begins with multiple sessions of low-intensity exercise, with a gradual increase in the duration of the sessions (3). Rates of coronary events in rehabilitation settings have been exceedingly low. CR programs occurrence rates of major cardiovascular events during supervised exercise ranges from 1/50,000 to 1/120,000 patient hours of exercise. Exercise performed in medically supervised settings, such as CR programs, are equipped to handle emergencies (3, 20, 32).

A meta-analysis of all randomized controlled trials of exercise-based CR versus conventional care with a follow up period of greater than 6 months was sought. This systematic review was an update to an earlier meta-analysis to allow for updated information and increasing numbers of patients from approximately 4500 in the earlier meta-analyses to 8440 patients. It included both men and women of all ages, in both hospital-based and community-based
settings with individuals who had MI, CABG, PCI, or who had angina pectoris. Electronic databases were searched from the earliest date available to December 31st, 1998 and 32 trials were found (27). Of those, the pooled effect estimate for total mortality for the exercise only intervention showed a 27% reduction in all cause mortality. Total cardiac mortality was reduced by 31% and 26% in the exercise only and comprehensive CR intervention groups respectively when compared to usual care (27). Trials that also looked at total blood cholesterol determined that there was a significant net reduction in total cholesterol in the comprehensive CR group (weighted mean difference (WMD): -50.5 mg/dL), but not the exercise only group (WMD: -2.66 mg/dL). LDL-C was significantly reduced in the comprehensive CR group (WMD: -45.2 mg/dL), with no significant effect of intervention in the exercise only rehabilitation group. There was also a small, but significant reduction in triglycerides in the comprehensive CR group (WMD: -25.7 mg/dL) (27). Blood pressure was also examined in some trials. Only 1 trial reported blood pressure as an outcome in the exercise only group and no effect was seen, however, 4 trials reported blood pressure changes in the comprehensive CR group. Two trials (WHO Helsinki, SCRIP) showed significant effects with reductions in systolic blood pressure of -9 mm Hg, and -6.4 mm Hg, respectively. Diastolic blood pressure was significantly reduced in the comprehensive CR group (WMD: -2.24 mm Hg) (27).

A recent study done in the UK by Yohannes et al (73), examined the long term benefits of CR on PA, depression, anxiety, and quality of life. A group of 147 patients (mean age of 61.6 ± 8.0 years) completed a twice weekly, 6 week (12
session) multidisciplinary outpatient CR program following an MI. Clinically relevant outcome measures were administered at 4 specific points within 12 months. PA measure used a 7-day recall activity self-administered questionnaire adapted for cardiac patients; where resting activity was rated as 0.7 metabolic equivalents (METs). The tool calculates the number of hours spent/day in sleep and in light, moderate, hard and very hard activity (based on METs), as well as estimates of kcals/day with acceptable test-retest reliability (10, 60). QOL was assessed using a self-administered disease-specific questionnaire (MacNew), of 27 questions in 3 domains: emotional, physical, and social, with lower scores corresponding to impaired QOL. The Hospital Anxiety and Depression scale (HADs) was used to assess anxiety and depression, with a non-symptom-related questionnaire. Scores between 8-10 indicate probable depressive and anxiety symptoms with a score of ≥ 11 considered indicative of a clinical “case” for depression or anxiety. Results indicated clinically significant improvements in PA status (1943.58 ± 337.50 vs. 1767.48 ± 274.51 kcals/week), quality of life (5.25 ± 1.16 vs. 4.15 ± 0.92 (MacNew)), and anxiety and depression (11.34 ± 6.37 vs. 14.22 ± 6.42 (HADs)) in patients with CAD within 6 months compared to baseline values, with the effects, remaining significantly higher at 12 months (1906.82 ± 331.57 kcal/week; 5.18 ± 1.17; 12.09 ± 6.84, respectively) (73).

While studies have shown the importance of PA in the treatment of CVD, and CR facilities have shown success in providing PA programs; patients aren't always reaching recommended PA levels for optimum health benefit.
PA Recommendations for Cardiac Patients

The American College of Sports Medicine (ACSM) recommends accumulating a minimum of 1000 kcal/week of PA to result in health and fitness benefits (69). The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recommends that an endurance exercise program should exceed a caloric expenditure of 1000-2000 kcal/week (63). Hambrecht et al (21), also determined minimal energy expenditure for CAD individuals, determining that progression of coronary atherosclerotic lesions could be halted if 1533 ± 122 kcal/week of energy expenditure was met, and regression of coronary lesions could occur after expending an average of 2200 kcal/week (21).

Hambrecht et al (21) studied 62 individuals with CAD who had a routine coronary angiography. These individuals were randomized into either a regular physical exercise group (n=29) or to a control group (n= 33) to determine the effects of energy expenditure on their coronary lesion dimensions after 12 months of exercise training using digital image processing. The study sought to identify ‘no change’ ‘progression’ or ‘regression’ of coronary lesions. The recruited individuals in the study were male, and had stable angina pectoris. Energy expenditure in leisure time PA was estimated using a modified Minnesota leisure time PA questionnaire. The metabolic cost of a specific activity was estimated as the product of the intensity score and the duration of exercise in minutes/day. Intensity scores were based on experiments in which rates of VO₂ were measured while subjects performed various specific activities (21). The
exercise group had training sessions supervised individually, exercising 6 times daily for 10 minutes on a cycle ergometer. Workloads were adjusted so that 75% of the symptom-limited VO\textsubscript{2max} was reached. After hospital discharge the patients were given a cycle ergometer and asked to exercise daily for a minimum of 30 minutes at a rate close to their target heart rate at 75% of their VO\textsubscript{2max}. In addition they were expected to participate in at least 2 group exercise training sessions of 60 min/week, with each session consisting of jogging, calisthenics, and ball games. These PA recommendations match the recommendations for cardiac patients to obtain 30-60 minutes of PA at least 3-4 times/week supplemented by an increase in daily lifestyle activities. The control group spent 1 week on the metabolic ward where they adjusted to a low fat diet based on the AHA recommendation (Low fat, Low Cholesterol Diet: protein 15%, carbohydrates 65%, fat < 20 energy%, cholesterol < 200 mg, polyunsaturated/saturated fatty acids ratio > 1). They also received daily instruction about the necessity of regular physical exercise. The individual’s lesions were determined during follow-up angiography at 12 months; identical projections were reproduced according to the protocol followed initially. The results showed that the mean weekly energy expenditure in leisure time PA was 1876 ± 163 kcal/week in the exercise group, and 1187 ± 97 in the control group (P < 0.001). Energy expenditure was higher in patients with no change to the lesions (exercise group 1758 ± 190 kcal/week; control group 1279 ± 121 kcal/week) and highest in patients with regression to lesion dimension (exercise group 2445 ± 275; control 1735 ± 134 kcal/week). The lowest PA level was noted
in patients with progression of lesions (1022 ± 142 kcal/week) compared with patients with no change (1533 ± 122 kcal/week) or regression (2204 ± 237 kcal/week) (21). While a limitation to this study was the use of a leisure time PA questionnaire, the study is very strong using invasive techniques to determine atherosclerotic risk after 12 months of exercise training.

The Hambrecht et al (21) study indicates a dose response relationship exists in energy expenditure with minimal expenditure being helpful, but even more energy expenditure indicating greater health benefits. However, even with the minimum recommendations, it has been shown through multiple studies that maintenance CR participants do not get these recommended amounts of PA per week.

**PA in Cardiac Rehabilitation**

Schairer et al (63) investigated caloric expenditure during maintenance CR. The study involved 30 patients (19 men, 11 women) for an average of 3 weeks, with a mean age of 64 ± 8 years, mean body mass of 90 ± 19 kg, and mean length of participation in the program of 19 ± 17 months. Fifteen patients had previously undergone CABG surgery, 5 patients had undergone a PCI, 3 patients suffered an MI, 5 patients had angina pectoris, and 1 patient was part of a risk factor modification program. The exercise program consisted of 3 days/week with each session beginning with a 5-minute warm-up after which exercise intensity increased to achieve a heart rate between 60%-80% of the maximum heart rate achieved from a previous graded exercise treadmill test. The
patients exercised using 2 to 4 different pieces of stationary equipment based on individual preference, which included: motor-driven treadmills, dual-action ergometer, an upright stepper, and a reclining stepper. Measurements of expired gases to determine VO$_2$ was one method used to determine caloric expenditure in individuals. Exercise sessions, exercise settings, exercise duration, and the number of kilocalories expended (per LCD display) were recorded, and these values were then summed to produce total caloric expenditure. The last method used to determine energy expenditure was a combined method, the kilocalorie values derived from the LCD display from all equipment, except the treadmill were used again in computing total session kilocalorie expenditure, while the treadmill kilocalories was estimated using the ACSM metabolic equation (69).

The results showed that the average duration of an exercise session among patients was 47 ± 8.7 minutes. The average Kilocalories expended when using the VO$_2$ method was 230 ± 88 kcal/session, with individual differences when comparing the combined method versus the VO$_2$ method was 15 ± 40 kcal, and the LCD method to the VO$_2$ method was 17 ± 49 kcal. Based off the VO$_2$ data alone, 5 (17%) of the 30 patients were exercising at or above 300 kcal/session, and 12 (40%) of the 30 patients were exercising below 200 kcal/session. Therefore it is shown that most patients in this maintenance CR program would not reach the minimum recommended 1000 kcal/week, and are therefore exercising below what is believed to be necessary for health benefits. Although this study was short in length, it is a reliable study based on a typical
CR program, using the VO\textsubscript{2} method for energy expenditure calculation, a more accurate technique for indirectly assessing caloric expenditure (63).

A similar study by Ayabe et al (5) examined the PA patterns of CR program participants in a university setting on CR program days and non-CR program days. It has been determined that CR programs should strive to have participants supplement their center based exercise training sessions with increased lifestyle PA outside of the CR program in order for weekly energy expenditures to reach the values consistent with secondary prevention of CAD. PA was measured in this study by means of a uniaxial accelerometer (Life-Corder, Suzuken Co., Japan), looking at the amount and time spent in light, moderate, and vigorous intensity PA. Enrolled in the study were 53 men and 24 women between the ages of 46 and 88 years who were clinically stable and had been participating in the CR program at Wake Forest University for $\geq$ 3 months. The program consisted of supervised endurance exercise 3 days/week in the morning, with a 10 minute warm-up which included slow walking and light stretching. The participants walked on an indoor track for approximately 40 minutes at a pace required to maintain a target heart rate range at 50-85% of the heart rate reserve (HRR), which was calculated from measures made during a symptoms-limited graded exercise test. A 10 minute cool-down of stretching and lightweight training completed the exercise training session. The accelerometer was worn for 10 consecutive days, with the last 7 consecutive days being used for the investigation. All subjects wore the uniaxial accelerometer continuously on a belt at waist level just above the leg except while sleeping and bathing. The
Life-Corder accelerometer determines a level of movement intensity every 4 seconds on a scale of 1 (minimal intensity movement) to 9 (maximal intensity movement). These intensity levels are closely related and approximated to metabolic equivalents (METs), with light activity (< 3 METs), moderate activity (3-6 METs), and vigorous activity (> 6 METs). The caloric expenditure associated with PA was estimated according to the intensity level and body weight of each subject for each 4 second interval (5). Two-minute averages of MET levels between 7 and 9 AM (CR program sessions) and between 9 AM and midnight (non-CR program period) were determined in order to separate the CR program sessions from the other times of the day.

The results showed that the average weekly kilocalories for men was 1778 ± 877 kcal/wk and for women was 1197 ± 622 kcal/wk. The amount of light, moderate, and vigorous PA for men was 385 ± 134, 137 ± 116, and 7 ± 14 min/wk, respectively, and for women 355 ± 100, 100 ± 91, and 4 ± 10 min/week respectively. It was also determined that the amount of PA for the men and women combined was significantly higher on CR program days (299 ± 161 kcal/day) than on non-CR program days (176 ± 112 kcal/day). The amounts of time spent in light, moderate, and vigorous PA were, respectively 60 ± 20, 26 ± 20.4, and 1.4 ± 3.0 minutes/day on CR program days, as compared with 49.3 ± 19.3, 10.5 ± 14.6, and 0.4 ± 1.7 minutes/day on non-CR program days. Studies such as this one have demonstrated that although CR participants commonly increase caloric expenditure on CR program exercise sessions, these sessions are generally performed only 3 days/week for 30-40 minutes and therefore do not
provide enough caloric expenditure for the subjects to reach weekly target levels. Although this study showed 1500 kcal/week was exceeded by 43% and 2200 kcal/week by 16% of the participants, on non-CR program days, PA at moderate or higher intensity averaged only 36% of the recommended levels, in contrast to the CR program days where individuals were on average at 92% of the recommended level of PA at moderate or higher intensity (5). It should be noted that the energy expenditure values were calculated using a formula based on an individual's calculated basal metabolic rate. Studies have shown that total energy expenditure calculated in this way overestimates energy expenditure approximately 9-14% (2). These results indicate that a traditional CR program alone may not be enough to maximize the target caloric expenditure and patients should be encouraged to increase PA levels on non CR program days. This study shows that CR program participation successfully increases the amount and intensity of PA of patients while participating in a traditional center-based program while PA on non-CR program days is lacking. This study was the first to use accelerometers to look at the cardiac population, and some limitations to the study include: CR program times and non CR program times could not be divided cleanly into groups, causing the average MET value calculated for the CR program period to have been underestimated; Uniaxial accelerometer device tend to underestimate the energy expenditure when significant upper bodywork is performed, leaving actual time and caloric expenditure to have been underestimated in some cases as well.
Consistent with the previous study mentioned, our laboratory (Human Performance Lab, Ball State University, Muncie, Indiana), in conjunction with our local hospital (IU Health Ball Memorial Hospital, Muncie, Indiana), recently completed a study to assess and characterize the PA levels and patterns of participants in a hospital-based maintenance (Phase III) CR program making comparisons between CR days and non-CR days using step counts. Recruited for this study were 25 males with a mean age of 60 ± 8.3 years, a BMI of 29.6 ± 4.6 kg/m², and with a history of CAD who participated in maintenance (Phase III) CR. The subjects were chosen if they were clinically stable and attended CR at least 2 days/week. The primary diagnosis of this population included: 13 individuals with PCI, 7 with CABG surgery, 2 with defibrillator or pacemaker, and 1 each with MI, congestive heart failure, and valve replacement. PA was assessed using an ActiGraph Model GT1M (ActiGraph, Fort Walton Beach, Fl) accelerometer for 7 consecutive days, as one week has been shown to provide a reliable measurement of PA in adults (28). Subjects wore the accelerometers on the waist using an elastic strap or belt clip aligned with the anterior iliac crest during all waking hours. Subjects also used a log to report duration, intensity, and mode of exercise that they completed at CR and the duration and mode of any PA they participated in outside CR. On days when subjects attended CR, the midpoint of the CR session was determined and 1 hour pre-midpoint and post-midpoint was used to describe a rehabilitation session. The results revealed that patients participating in a maintenance CR program obtained significantly fewer steps/day on days they did not attend CR (5,287 ± 520) compared to days
attended (10,087 ± 631) (28). It was also observed that those who reported exercising at least once/week outside of the CR program performed better (6,366 ± 667 vs 3,668 ± 529 steps/day), however, they did not reach a recommended minimal threshold of 10,000 steps/day on these non-CR days (28). Studies have supported that 10,000 steps/day is comparable to 30 minutes/day of moderate intensity activity, or approximately 1,000 kcal/day (25, 71). As this was a pilot study, a limitation to this study however was the sample size and limited measurement period of only 7 days.

Multiple investigations (5, 28, 62) have also demonstrated that the PA levels of individuals who participate in CR programs are often considerably less than the more aggressive PA goals of > 2,200 kcal/week. Often this occurs because of the individuals’ lack of PA on non-CR program days (5, 61). An important goal, therefore, of a CR program should be to promote PA by increasing CR program attendance and PA outside the structured CR program. Patient adherence and continued participation in PA is a major factor of success.

**Adherence is a Factor of Success**

Maintaining the proper amount of exercise for optimum health benefits and staying motivated and committed to an exercise program for a lifetime can be challenging for many. However, a study by Bosch et al (12) suggests that the more intensive the program, and the more information given to individuals, the more likely they may be to make a lifetime lifestyle change and to maintain an exercise program with enough time and energy to maintain health benefits.
Bosch et al (12) looked at PA patterns 2 years after completion of a concentrated intensive CR residential rehabilitation program in Switzerland. Participants in the study were 78 patients (86% males, mean age= 57 ± 11). Of those, 39 (50%) had sustained an MI, 39 (50%) had undergone PCI, and 41 (52%) had undergone CABG surgery. The center had its own staff, consisting of a medical director, 3 medical residents, and 3 exercise physiologists. The program components included: education, exercise, and low-fat meals prepared onsite (12). Training duration was for 1 month. The individuals performed 5 indoor cycling sessions weekly for a duration of 30 minutes, and walking outdoors for 45 minutes twice daily. The subjects were divided randomly into 3 groups to compare self-regulation of exercise intensity to standardized methods. Group 1 exercise intensity was determined at 70% of HHR. Indoor cycling sessions were heart rate controlled through resistance and was adjusted automatically at 10-second intervals to maintain a desired heart rate. During walking sessions, a polar heart rate device (Woodbury, NJ) was used to monitor heart rate and walking pace was adjusted so that heart rate was kept within ± 5 bpm. Group 2 indoor and outdoor exercise intensity was determined using only the patient’s perception of a Borg scale of 12-14. Group 3 exercise intensity was determined using both objective (heart rate reserve and work rate targeted at 60-80% of maximal) and subjective (Borg 12-14 scale) responses and work rate was adjusted accordingly. The quantification of PA performed was assessed by a questionnaire modeled after the Harvard Alumni Studies of Paffenbarger and colleagues. The questionnaire responses were entered into a database file,
where metabolic costs of both occupation and recreational actives were computed and expressed as energy expenditure in kcals/week. This calculation of energy expenditure is less reliable and accurate compared to measuring energy expenditure. Of the 78 subjects, 70 returned for repeat evaluation after 2 years. Results for repeat evaluation showed that peak watts achieved (171.2 ± 46 Watts) and exercise time (10.2 ± 1.7 minutes) were similar to those after rehabilitation (162.8 ± 4.5 Watts; 10.7 ± 2.0 minutes, respectively), and remained significantly higher when compared with baseline values (127.7 ± 39 Watts; 8.3 ± 1.8 minutes, respectively) (12). Energy expenditures for recreational activity 2 years after completing the rehabilitation program were similar between each of the 3 groups and were highly contrasted from their prior expenditure before the cardiac event. Recreational activity after the two years was 3127 ± 1689 kcals/week compared to 977 ± 842 kcal/week previously. A major limitation to this study was the absence of a control group, and those subjects who came to the rehabilitation center and agreed to return, represented a sample that was particularly motivated to make lifestyle changes after a cardiac event (12).

As adherence is a factor of success, CR professionals need to both increase their educational efforts to help patients understand how much PA is needed to achieve health benefits, and increase motivational efforts to individuals to maintain their exercise programs. Motivational messages can be a useful supplementary tool for professionals to use to increase patient education and bring about behavioral changes without extra face-to-face contact. A better
understanding of how individuals change behaviors enables message interventions to be more effectively designed and utilized.

**Behavioral Change Models to Improve Adherence**

The benefit of exercise for cardiac patients is well established, however, the challenge, particularly in a CR setting, is how to help these individuals change exercise behavior and obtain the recommended values. Multiple research studies have led to developed models of behavior change, such as the Transtheoretical model of behavior change, the Social Cognitive theory model, and the Stages of Change in Exercise Adherence (STAGES) model, to help identify how individual's behavior changes.

Prochaska and DiClemente developed the Transtheoretical model of behavior change; a test for measuring basic processes of change in the context of a common addictive behavior problem, such as smoking cessation (53). The model is an integrative and comprehensive framework. There are 3 major components of the Transtheoretical model: (1) stages of change, (2) decisional balance (pros and cons of behavior) and (3) self-efficacy (24). The first component of the model consists of 5 stages of change: 1) precontemplation (unaware of the need for behavioral change or not thinking about it) 2) contemplation (thinking about the behavioral change but not ready to make it) 3) preparation (planning to make the change in the near future, at a set point in time) 4) action (already begun to engage in behavioral change) and 5) maintenance (engaged in changed behavior for at least 6 months). Individuals
are in 1 of the 5 stages when starting a behavior and as they receive more information and education about the behavior, they can move through the 5 stages. The stages form a pattern in which adjacent stages are more highly correlated with each other than any other stages. The flow of the stages of change recognizes the dynamic nature of change, and the potential for relapse and recovery. This enables the health practitioner to measure progress towards the desired health behavior (30). The second component, decisional balance focuses on central constructs proposed by Janis and Mann (26) and reduced to a factor structure (pros and cons), where pros represent the perceived positive aspects, or facilitators of behavior change, while cons represent the perceived negative aspects, or the barriers to change (24). The final component of the Transtheoretical model is self-efficacy. Self-efficacy consists of a person’s confidence that they can abstain from an unhealthy behavior (i.e. smoking), or maintain a healthy behavior (i.e. exercise) (30, 53). This process of change has been shown to exist in individuals participating in smoking cessation. Prochaska et al (53) involved 970 individuals in a study to identify processes of change. Different stages of change (i.e contemplation, preparation) using different processes of change (i.e. decisional balance, self-efficacy) were identified as individuals moved through the stages in order to meet the final goal of cessation (16, 53, 54). Just as with smoking cessation, PA behavior requires long-term attention rather than one-time performance, and is relevant to large numbers of people and represents major health behavior challenges (54).
The Transtheoretical model has been adapted to address PA adherence, and can be utilized to understand how individuals come to adopt and maintain health behaviors such as PA (37). Despite the numerous benefits, only 32% of United States adults engage in regular leisure-time PA (42), with less than half of the United States adult population meeting ACSM PA recommendation (4, 22). It has also been shown that 50% those individuals who begin a formal exercise program will drop out within 6 months (15, 17, 30). Physical inactivity remains a public health concern. Therefore the need to address PA adherence and to evaluate the effectiveness of PA promotion strategies is great. Marcus et al (39) determined that this pattern of exercise program relapse is similar to the negatively accelerated relapse curve often seen in addictions. Marcus et al (39) examined the potential for extending the Transtheoretical model of behavior change based on cognitive and social learning constructs to the area of PA adoption for intentional behavior change. This model is a dynamic model that suggests not an all-or-none phenomenon, that is, individuals who stop performing a behavior may have intentions to start again. The results of the study determined that the model translates well to PA with the initiation of a positive behavior (adoption of exercise program) rather than an elimination of a negative behavior (smoking cessation) (39). In a follow-up study, Marcus et al (41) returned to further understand the stages of exercise adoption behavior and its importance in enhancing participation by looking at the PA of individuals in each stage of change of the model. Subjects included males (36%) and females (64%), average age of 40.6 ± 12.9 years, recruited as part of a worksite health
promotion project emphasizing health risk appraisal and smoking cessation from a retail outlet and an industrial manufacturer. Subjects were placed in 1 of the 5 stages of exercise adoption behavior based on their pattern of responding to 5 questions (see Appendix B). This scale has been shown to be related to individuals’ self-efficacy and decision making for exercise (40, 41). Subjects were then grouped into three categories (Precontemplation/Contemplation, Preparation, Action/Maintenance) based upon their expected differences in time spent in vigorous and moderate activity. Vigorous activity was classified as 5-7 metabolic equivalents (METs), e.g. jogging, running, and swimming, while moderate activity was classified 3-4.9 METs, e.g. golfing, doubles tennis, yard work, and brisk walking. Both types of activity were measured in terms of the total number of minutes of participation for the past 7 days. A 7 day self-administered Physical Activity Recall (PAR) questionnaire (9, 10, 66) was used, which is administered in an interview format, in which subjects were asked to describe in detail their activity level in terms of moderate, hard, and very heard intensity (10). The results revealed that there were significant differences in participation in PA among the 3 levels of stages. The Action/Maintenance group reported significantly more vigorous (173.5 ± 169.8 minutes/week) and moderate (345 ± 269.9 minutes/week) PA compared to subjects in the Precontemplation/Contemplation group (42.3 ± 103.4 minutes/week of vigorous; 214.3 ± 319.8 minutes/week of moderate PA). This study, while showing significant results, does have a few limitations. First, this study only looks at individuals PA over a 1 week period using a recall questionnaire, while second, it
does not mention how the PA was divided between the 3 different stages, only reporting that significant PA results were seen between groups. However, this study does suggest that using this stage model could be an effective way to enhance the design and delivery of exercise interventions (41).

Self-regulatory skills, such as goal setting, self-reinforcement, and self-monitoring, have also been found to predict exercise participation (35). Self-efficacy, a factor of the Transtheoretical model, which is the degree of confidence an individual has in his/her ability to be physically active under a number of specific circumstances, is positively associated with PA behavior and motivational readiness for PA adoption. Decisional balance, the individual's evaluation of benefits and barriers related to PA behavior, is also differentially associated with motivational readiness of PA adoption (37). Research using the Transtheoretical model has found that self-efficacy scores correlate highly to stages of change. For example, in the precontemplation state, self-efficacy scores tend to be low, but in the maintenance stage high (24). Self-efficacy can be a particularly important aspect for predicting exercise participation, as efficacy cognitions play a central role in determining which tasks an individual will engage in and the amount of effort an individual will demonstrate in the face of obstacles or aversive conditions (47). Numerous studies have reported a significant, positive relationship between self-efficacy and exercise program adherence. A higher level of self-efficacy can lead to greater program adherence. Previous research has determined that self-efficacy is a significant predictor of future exercise participation. Oman et al (47) determined the
influence of self-efficacy and past exercise adherence on subsequent exercise participation over the adoption and maintenance phases of exercise behavior. The study involved a 2 year randomized trial involving 63 subjects. Subject’s mean age was 56.2 ± 4.2 years and eligibility criteria included being healthy, and sedentary. The subjects were randomly assigned to one of 3 exercise conditions: higher-intensity home-based exercise training (n=20), higher-intensity class-based exercise training (n=21), or lower-intensity home-based exercise training (n=22). Subjects in the higher intensity class-based and supervised home-based conditions were assigned an exercise prescription that entailed exercising at 65-80% of max heart rate measured by a VO$_{2\text{max}}$ symptom limited treadmill test, exercising 3 days/week for 60 minute sessions with an included 40 minute endurance component. Individuals in the lower intensity home-based condition were asked to exercise at 50-60% of max heart rate for 30 minutes sessions 5 days/week. The results indicated that self-efficacy had significant effects on adherence during adoption and early maintenance phases of exercise behavior. Subjects in the supervised home-based conditions reported higher baseline self-efficacy compared to subjects in the class-based condition (77% vs. 71%) and had greater adherence during months 1 to 6 (88% vs. 66%) and 7 to 12 (80% vs. 52%). The results also suggest that baseline self-efficacy, independent of the effect of past exercise adherence, significantly predicted exercise adherence during the adoption phase, but not early maintenance phase of exercise behavior. The results demonstrate the importance of an individual’s cognitive and behavioral experiences in an exercise program and how these experiences may
affect exercise adherence (47). This study reveals the importance of increasing an individual’s confidence levels with PA in order to increase an individual’s PA.

The formation of the pattern of the Transtheoretical model combines both a cognitive and behavioral process (30, 53). Aspects of the Social Cognitive theory model highlight cognitive and behavioral strategies in behavior change (34). The cognitive and behavioral strategies are used to help bring about changes in an individual’s thinking about an activity and actual participation in an activity. Cognitive strategies focus on increasing knowledge and are used more in the earlier stages of change, whereas those in the later stages use more behavioral strategies (38). The amount of progress people make as a result of the intervention is a function of the stage they are in at the start of treatment.

Cognitive and behavioral processes of change models have been effectively used in PA adoption where sedentary individuals, those in the earlier stages of motivational readiness (i.e. Precontemplation and Contemplation), tend to place greater emphasis on cognitive processes, while regularly active individuals, those in the later stages of PA adoption (i.e. Action and Maintenance), tend to endorse more behavioral processes (37). The cognitive and behavioral strategies are then used to help bring about changes in an individual’s thinking about activity and actual participation in activity. Cognitive strategies focus on increasing knowledge about PA and its benefits, and behavioral strategies target substituting active pursuits for sedentary behaviors (38).
Educational interventions have been shown to work well to increase an individual's knowledge base regarding PA, however, behaviorally tailored interventions have shown to be more effective in bringing about actual activity (35). Utilizing separate interventions that address both the knowledge base and the behavioral side, such as goal setting and overcoming barriers, incorporates process of change and the cognitive and behavior stages to increase an individual's PA behaviors.

While the Transtheoretical model has shown to be effective as a framework in healthy populations, the STAGES model has been shown to be a most effective model with cardiac patients. The STAGES model was developed to focus on the dynamic nature of the health behavior change, examining the different transitions in the initiation and maintenance of exercise behavior. The 5 stages of change in exercise adherence in the STAGES model is similar to the other Transtheoretical model with stages being: 1) precontemplation: currently not exercising with no intention of beginning to exercise; 2) contemplation: currently not exercising but thinking about starting to exercise sometime in the future; 3) preparation: starting to participate in limited or inconsistent amounts of exercise; 4) action: less than 6 months of regular (three or more times per week for at least 20 minutes each time) exercise; and 5) maintenance: more than 6 months of regular exercise. Psychological variables are also associated with exercise participation and embedded within the STAGES model: perceived benefits of exercise (pros), perceived barrier to exercise (cons), perceived self-efficacy for exercise, and experiential and behavioral processes of change (23).
Researchers have determined that individuals in different stages of change in exercise adherence have different psychological beliefs regarding benefits and barriers to exercise, and have different levels of confidence in their ability to overcome barriers to exercise, and use different processes of change. Pender et al (50) found that perceived benefits of exercise, perceived barriers to exercise, and perceived self-efficacy for exercise were predictive of CR exercise adherence and were significantly different between participants initiating and those maintaining a CR exercise program (50). Hellman (23) determined that the STAGES model was valid for CR patients aged 65 years and older who were inpatients within the past 18 months, and ambulatory. The results showed perceived self-efficacy, perceived benefits of exercise, interpersonal support for exercise, and perceived barriers to exercise were significant predictors of stages of change in exercise adherence. The validity of these results was also demonstrated by the significant differences between average daily energy expenditures in the stages of change in exercise adherence, with older adults in the maintenance stage having significantly higher energy expenditures (24 ± 6.0 TKcal · kg⁻¹ · day⁻¹) than older adults in other stages (Action 21.1 ± 4.7; Preparation 20.1 ± 3.9; Contemplation 20 ± 4.1; and Precontemplation 21.5 ± 4.7 TKcal · kg⁻¹ · day⁻¹). Older adults in the maintenance stage also exercised significantly longer (233.7 ± 30.7 minutes/week) each week than older adults in the action (155 ± 87.5 minutes/week), preparation (67.3 ± 58.2 minutes/week), contemplation (0.0 minutes/week), or precontemplation (0.0 minutes/week) stages; those in the action stage exercised longer than those in the preparation,
contemplation, or precontemplation stages; and those in the preparation stage exercised longer than non-exercisers. This indicates that Individuals in CR should have their stage of change in exercise adherence monitored. Identification of exercise behavior states will then allow initiation of adherence-improving strategies geared toward the individual’s stage of exercise (23). This study demonstrates that the STAGES model can be applied to the study of exercise behavior among older adults with a cardiac diagnosis.

As the progress that people make is a function of the stage they are in, use of stage motivational-targeted interventions have shown improvement in PA adherence.

**Motivational Message Interventions as Adherence Tool**

Motivational-targeted interventions have been shown to significantly improve PA adoption. In the 1998 study by Marcus et al (37), healthy, sedentary men and women (n=194) with a mean age of 44.3 ± 10.8 years were randomly assigned to either an individualized motivationally-tailored (IT) or a standard treatment (ST) condition group. The individuals self reported assessments of PA using a self-report instrument adapted from the 7-day physical activity recall questionnaire (60). Individuals were asked to report the number of days/week they engaged in PA and the number of minutes/session spent in PA. The individuals also self reported psychological constructs associated with PA adoption including decisional balance (using a 16-item inventory assessment of perceived benefits and perceived barriers to PA), self-efficacy (using a 5-item
instrument of areas including negative affect, resisting relapse, and making time for PA), and use of 10 cognitive and behavioral strategies for behavioral change determined stage. The IT group received individually-tailored reports generated by a computer expert system and self-help manuals which were matched to the participant’s stage of motivational readiness for PA adoption. The manuals included exercise adoption and adherence literature and utilized processes of change used by subjects in different stages of behavioral change, self-efficacy, and decision-making. The ST group received 4 self-help booklets promoting PA which were developed by the AHA. Each book focused on a specific topic related to PA and cardiovascular fitness. The booklets were comparable in length to the motivational-tailored manuals. The order of the booklets for the standard group was randomly determined. The booklets contained information on starting an exercise program and behavioral skills for maintaining regular participation in an exercise program: goal-setting, avoiding injuries, using rewards, and relapse prevention strategies. Only the first 3 stages (Precontemplation, Contemplation, Preparation) were represented at baseline as the subjects needed to be sedentary for this study. The results showed that an individualized, motivational-tailored intervention increases PA participation significantly more than standard self-help materials. At 6-months, the ST group reported a mean of 97.6 minutes of PA, while the IT group reported a mean of 151.4 minutes/week of PA. More individuals in the IT group also reached ACSM criteria (accumulate 30 minutes or more of moderate-intensity PA on most, preferably all, days of the week) for PA compared to the ST group (43% in the IT group versus 18.1% in the ST
group). Significant changes in the cognitive processes were also observed for both groups over time. Results showed that cognitive processes of change were significantly higher at 3 months versus 6 months in both groups (IT group: 3 months mean value was 3.0 ± 0.7, 6 months 2.9 ± 0.7; ST group: 3 months was 2.8 ± 0.7, 6 months 2.7 ± 0.8). The behavioral processes also changed significantly over time for both groups, however, the IT group showed a significant increase in the use of behavioral processes from 1 month to 3 months compared to the ST group (IT group: 1 month mean value was 2.1 ± 0.5, 3 months was 2.7 ± 0.7; ST group: 1 month was 2.2 ± 0.6, 3 month was 2.5 ± 0.7). The IT group utilized significantly more behavioral processes compared to the ST subjects (37). The results indicated that compared to participants in the ST group, participants given the motivational-tailored individualized feedback plus manuals showed greater increases in self-reported time spent in PA, were more likely to achieve levels of participation recommended by ACSM, and were more likely to have reached the Action stage. Limitations to this study include PA being measured with a self-report questionnaire, and having a population of healthy, primarily white, middle-class individuals leaving generalizability of other populations to be unknown. Lastly, the standard self-help materials (AHA manuals) helped promote PA adoption with 20% of individuals receiving the manuals achieving ACSM recommendations by the end of the treatment, showing wide-scale use of standard print materials could potentially increase PA participation in the general population and could have significant public health impact (37).
One of the most frequently identified psychosocial determinants of adherence to PA is an individual's perceptions and confidence of personal capabilities, or self-efficacy. Studies have proposed that exercise adherence in the first few stages of the exercise behavior model can be affected by self-efficacy. A study by McAuley et al. (43) looked at exercise adherence through the different stages with self-efficacy. Subjects (n=125) were selected using stratified sampling restrictions in which approximately equal numbers of males and females from four different age cohorts (45-49, 50-54, 55-59, 60-64) were included to participate in a 5-month exercise program for middle aged, sedentary adults. Measures of exercise behavior (adherence) and self-efficacy for exercise were assessed to examine the effects of the intervention on adherence. Program attendance was the primary measure recorded looking at frequency of exercise. This measure was attained using daily attendance records by exercise leaders, and subjects own records completed at the end of each exercise session. The two measures correlated highly (r= 0.97) together. Duration and distance of exercise participation were also measured with subjects recording their values from a map provided of all walking routes to reliably calculate and record their walking distances. Additionally, all subjects recorded their resting and exercise heart rates and their rating of perceived exertion. Exercise related self-efficacy was assessed by a measure of adherence efficacy comprised of 10 items reflecting subjects' beliefs in their capability to continue to exercise on a regular basis (i.e., following prescribed frequency, intensity, and duration of activity) for biweekly periods (from 2 to 20 weeks). The reliability of the internal measure of
consistency indicated it was highly reliable \( (r = 0.92) \). Subjects were randomly assigned to 1 of 4 exercise classes (2 treatment, 2 control). The 20 week exercise program employed low-impact aerobic exercise, i.e. walking, 3 days/week for 10-15 minutes and progressed up to 40 minutes by the mid-point of the program. The exercise class consisted of a warm-up, an aerobic activity period, and then a cool-down phase. Self-efficacy measures were assessed at the beginning of the program and at the end of each month. Forms of feedback, public posting of performance, social support, and goal setting have all been identified as possible sources of efficacy based information (43). Subjects were randomly assigned to 1 of 2 groups for adherence intervention, an adherence intervention group (treatment), or an attention control group. The treatment condition group content was based in the tenets of self-efficacy theory (8). The primary focus of the intervention was the provision of efficacy-based information from the 4 primary sources including mastery accomplishments, social modeling, social persuasion, and interpretation of physiological states. The intervention began at the end of week 3 of the exercise program and continued into the third month of the program with 6,15-minute biweekly meetings prior to exercise. These meetings were followed up by “booster letters” at the next session which reinforced the primary information presented at the previous session (43).

The results showed that overall attendance was significantly greater for the treatment condition (61.66%) than the control group (38.33%). Repeated measures multivariate analysis indicated significant results that the intervention group exercised more frequently, more minutes/month, and walked more
miles/week than the control group (43). This study shows the effects of efficacy-based information on enhancing exercise adherence in a large sample of sedentary males and females.

Research has shown self-efficacy to be implicated in exercise adherence in CAD patients (14, 19, 43). Carlson et al (14) reported that psychosocial factors including self-efficacy and social support have been shown to be important predictors of exercise behavior in CAD patients. According to Bandura et al (7), if people lack self-efficacy they will behave ineffectually, even if they know what to do. For example, a CAD patient who has previously developed exercise skills may lack the self-efficacy to maintain an independent exercise program long term, with possible low self-efficacy stemming from concerns of a recurrent cardiac event (14). Carlson et al (14) looked at self-efficacy in CAD patients enrolled in a CR program. The study involved a 6-month randomized clinical trial. Participants included 90 patients who were first time referrals to a Phase II CR program and were recruited within 2 weeks of initiating CR. The participants included both men and women with a mean age of 59 ± 10 years who were classified as low-to-moderate risk according to the American Association of Cardiovascular and Pulmonary Rehabilitation guidelines. For the first 4 weeks, the rehabilitation was identical for all patients and included 3 exercise sessions/week with continuous electrocardiogram (ECG) monitoring that included a warm-up, 30-40 minutes of aerobic exercise, and a cool-down. During week 2, patients completed questionnaires to evaluate factors that may be predictive of exercise compliance, including employment status, smoking status, social
support, income, and transportation barriers. Week 3 participants completed baseline exercise testing. All patients were encouraged to achieve 5 or more aerobic exercise sessions/week (≥ 30 min/session) and were instructed to document their off-site exercise duration, intensity and frequency via exercise logs. Patients also received education in 3 forms: individual, 3-group CVD risk factor/nutrition classes, and educational videos. The education exercise classes included information on: exercise training principles, CVD risk factors, nutrition principles, pharmacological therapy, and target outcome values (lipids, blood pressure). Week 5, the patient’s were divided into 2 separate protocols (traditional protocol (TP) or modified protocol (MP)) according to randomization. For weeks 5-12, the TP patients were instructed to continue the same regimen as the initial 4 weeks. For weeks 13-25, the patients were encouraged to attend a Phase III maintenance regimen that included 3 exercise sessions/week without ECG monitoring and staff supervision reduced, however education follow-up was continued. Patients were asked to document their exercise intensity and duration. Patients, who chose not to attend Phase III, were instructed to follow an independent exercise program. The MP was based on Bandura’s self-efficacy theory designed to enhance confidence for independent exercise. The MP addressed 4 components of self-efficacy theory including: 1) verbal persuasion was used to promote the benefits of regular exercise and other health behavior, 2) vicarious learning was encouraged through discussions of their successes and barriers relative to exercise and other health behaviors, 3) performance accomplishments were addressed by discussing exercise test results, and
discussion of written feedback on exercise logs, 4) physiological states were addressed by reviewing normal and abnormal physiological responses to exercise. The protocol integrates principles from other models that have cost effectively promoted adherence to health behaviors (14). The MP group discontinued ECG monitored exercise sessions at week 5 and were given a personal heart rate monitor (Polar, Port, Washington, NY) to use for 3 weeks for both on-site and off-site exercise sessions. In week 6, MP patients’ on-site exercise sessions were reduced to a maximum of 2 sessions/week with weekly education and support meetings initiated. Exercise adherence was documented weekly for supervised on-site exercise and off-site exercise was self-reported on logs, ≥ 30 minutes of aerobic activity a day counted as a session. Psychosocial measures of exercise behavior were measured using questionnaires that looked at exercise self-efficacy, outcome expectancy, perceptions of physical condition, social support, and peer support. All questions were designed specifically for CR patients (7, 14).

The results concluded that the MP patients demonstrated higher rates of off-site independent exercise frequency over 6 months (83.5 ± 25.6 vs. 69.5 ± 33.6 days) and total exercise (on-site and off-site) during the final 3 months (4.2 ± 1.5 vs. 4.4 ± 1.4 days/week) as compared with the TP patients. The MP patients also had significantly higher levels of self-efficacy while exercising without continuous ECG monitoring as compared with the TP patients over 3 months (4.43 ± .85 vs. 4.03 ± .97 composite mean of questions). Correlations among the different psychosocial variables and the total exercise frequency at 3
and 6 months were assessed. The strongest association was found between exercise behavior at 3 and 6 months for self-efficacy and for independent exercise frequency ($r=0.46$ and 0.43, respectively). This study indicates that self-efficacy may play a factor for CAD patients in increasing their PA, and CR programs should perhaps emphasize educational and monitoring methods that promote self-efficacy for independent exercise (14).

**Successful maintenance of PA has been defined as “engaging in regular PA for at least 6 months following the end of an intervention” (11) Maintenance of the activity is just as important as initiating the activity. Bock et al. (11) examined the maintenance of PA using a self-reported instrument adapted from the 7-day physical activity recall questionnaire (60) during the 6 months following the end of an active intervention period. Bock et al (11) followed the previous study by Marcus et al (37) with the intervention comparing the two print based intervention formats: IT (individualized, motivationally tailored intervention materials) and ST (Standard exercise promotion materials). The 6 month follow-up data was divided into four categories: regressed (achieved ACSM criteria during the intervention but not after 6 months follow up; $n=17$), progressed (had not achieved criteria during the intervention but did by 6 months follow-up; $n=19$), stable underactive (did not achieve criteria at either time; $n=63$), and stable active (met or exceeded criteria at both times; $n=21$) (11). Of those who achieved ACSM criteria for PA during the intervention period, 55.3% maintained their PA at the 6 month follow-up period (12 months), whereas 44.7% regressed to below ACSM participation levels. Among those who had not achieved ACSM criteria by the end of the
intervention, the majority (76.9%) remained underactive throughout the follow-up period. Only 23.1% of those not meeting criteria during the intervention were able to increase their PA participation to meet these criteria by the 6 month follow-up period. Chi-Square analyses showed stable active individuals, those who met or exceeded criteria at both times, were largely individuals assigned to the IT treatment condition (81%), where as the majority (59%) of the stable underactive, did not achieve criteria at either time, were in the ST condition. Significant differences were also shown between maintenance groups in perceived benefits, and endorsement of both the behavioral and cognitive processes of change. The stable active individuals reported significantly greater endorsement of the cognitive processes of change and benefits of PA than the stable underactive individuals, and greater endorsement of the behavioral processes than all other groups. Post Hoc tests revealed that compared to the stable underactive individuals, stable active individuals had significantly greater endorsement of the cognitive processes of change, higher self-efficacy scores, perceived fewer barriers to PA, and had somewhat fewer depressive symptoms. Results of this study conclude that high-quality intervention materials (ST or IT materials) through repeated exposure can be an effective means of increasing participation in PA. The IT intervention appears to have an advantage over the ST intervention for promoting PA maintenance. Participants in the IT intervention were more likely to participate in PA at or above the ACSM criteria after 6 months without any further intervention. While both intervention groups addressed similar topics, the more tailored intervention motivated participants to become more active by
targeting relevant psychological factors. This individualized intervention method of print materials provides a lower-cost method of administering individualized, public health messages to a broad range of multiple individuals. The limitations to the study include a small sample size for the follow-up data, and self-reported PA data.

Although cognitive and behavioral change motivational interventions have successfully identified factors that promote change for both healthy and cardiac individuals, studies of their usage in a CR program are lacking. Therefore, more information regarding motivational message interventions in CR settings is needed to further assess its role in increasing PA adherence in cardiac individuals.
CHAPTER III

METHODOLOGY

Although information regarding motivational message content success is well documented in healthy individuals, the benefits information for cardiac patients in long-term maintenance CR programs is lacking. However, evidence indicates that designing interventions that are motivationally-targeted could be one way to increase PA in maintenance CR patients that is easy and effective, allowing cardiac patients to increase PA to target levels for optimum benefits.

The purpose of this research project is to determine the relative effectiveness of a motivational-targeted feedback intervention designed to increase PA in cardiac patients beginning a long-term maintenance CR program in order to meet recommended levels.

Subjects and recruitment

The subjects recruited for the study were patients who were enrolling in the maintenance CR program at IU Health Ball Memorial Hospital in Muncie, Indiana. The study population consisted of 52 men and women between the ages of 34 and 82 years with a primary diagnosis of MI, CABG, PCI, heart valve...
repair/replacement, or stable angina. Subjects were excluded from the study if they had a diagnosed functional impairment: documented ejection fraction < 20%; a secondary diagnosis of Chronic Obstructive Pulmonary Disease (COPD) which limited their function; any substantial orthopedic limitation; or other medical condition that limits the ability to sustain ambulation determined from historical questionnaire, physical exam, and verified through referring physician clearance prior to study enrollment.

**Study Procedures**

Recruited subjects who met criteria for the study were randomly assigned to either the Usual Care Group (UC), or the Motivational Message Group (MM). Participants assigned to the UC group entered the usual long-term maintenance CR program, and were given usual information regarding home exercise prescription for the need to be active outside of CR days. This included a recommendation of 40-50 minutes 5-6 days/week which may include their rehabilitation days. Participants in the MM group received the usual long-term maintenance CR program, and in addition also received 12 –standard, motivational-targeted newsletters (Appendix E) at the beginning of each week during the intervention period. The same motivational-targeted newsletter was given to each participant in the MM group at each subsequent week. Each of the 12-standard motivational-targeted newsletters was based on basic themes of increasing PA through education, overcoming barriers, and goal setting. This approach represents a progression from week-to-week, trying to increase a
participant’s understanding (cognitive) of the benefits of PA, and then strategies (behavioral) to increase their PA behavior.

**Measurements**

*Initial screening*

PA measurements were assessed at baseline, and 12 weeks post. Each subject underwent an initial screening completing a health history questionnaire (HHQ) (Appendix A) inquiring about past and current health, family health, and medications; patient interview related to inclusion/exclusion criteria; as well as a mobility function test consisting of walking a set distance to examine gait speed, and whether the participant is able to walk 50 feet unaided. At the initial screening subjects were also to complete a stage of change of physical activity readiness questionnaire (Appendix B) inquiring about the participants’ readiness to change their activity behavior; and an exercise self-efficacy questionnaire (Appendix C); however this was initiated later in the study and only later subjects completed. Subjects meeting the inclusion criteria received physician clearance and were randomly assigned into the study. Two visits to the HPL were required for baseline and post PA measurements.

*Baseline and Post measures*

Measurements were performed after the initial screening, and the week following the 12th week of the intervention. Physical activity monitoring, resting blood pressure, fasting blood sample, body composition assessment, quality of
life index, and a 6-minute walk test were recorded. During post intervention measures, a review of all medical information also accompanied the previous measures.

Physical Activity Monitoring: Objective measurements of PA were made with Lifecorder PLUS downloadable accelerometers (New-Lifestyles, Inc. Lee’s Summit, MO). The Lifecorder PLUS downloadable accelerometers were used throughout the 12-week study and for baseline and post PA measurements. All subjects were provided an individualized instruction session, with a written hand-out, as to how to properly position each accelerometer at waist level (Appendix D). For each data collection period the accelerometer was worn for 7 consecutive days during waking hours. Measures of steps/day and the number of minutes in moderate and vigorous PA each day were obtained from the Lifecorder PLUS downloadable accelerometers.

Resting Blood Pressure: Blood pressure was measured under quiet, controlled conditions conforming strictly to the American Heart Association Guidelines (51). Blood pressure was measured in duplicate using standard sphygmomanometry techniques.

Fasting Blood Measures: A blood sample was taken after a 10-hour fast and analyzed by LabCorp (Muncie, IN) for blood glucose, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, and total cholesterol. LabCorp analyses meet federal and state standards for quality control and proficiency.
Body Composition: Height, weight, and waist circumference were assessed using standardized procedures. Body fat percentage was determined using dual-energy x-ray absorptiometry (DXA, Lunar Prodigy, Milwaukee, WI, software version 11.1; iDXA, Lunar iDXA, Madison, WI, software version 13.40). All measures took place in the morning, following standardized DXA quality assurance procedures, with subjects having removed any jewelry and clothing containing metal (29).

Quality of Life Index: A component of IU Health Ball Memorial Hospital’s CR program, certified by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), is the use of a cardiac Quality of Life index, consisting of two parts (Part 1 (“How Satisfied”: 35 items; Part 2 “How Important”: 40 items) that is administered in paper form with patients circling ratings (1-6 scale) for each item. These questions allow the assessment to be scored/evaluated in four domains: Health and Functioning, Social and Economic, Psychological and Spiritual, and Family.

Six-Minute Walk Test: IU Health Ball Memorial Hospital’s CR program also administers a six-minute walk test to access patient’s functional ability. Standardized instructions were read to the patient prior to the test and encouragement prompts were verbally provided to the patients every 30 seconds. Heart rate and blood pressure, and Borg rating of perceived exertion were recorded immediately after the six-minute walk. The total distance walked was recorded to the nearest foot.
**Intervention Period**

Following completion of baseline procedures, the subject was initiated into the study-related intervention (UC, or MM). Individuals initiated into the MM group received their first specific aim newsletter. Throughout the intervention, both UC and MM group’s PA were measured using the Lifecorder PLUS downloadable accelerometers (New-Lifestyles, Inc. Lee’s Summit, MO). At the beginning of each week of the intervention period, subjects in both groups had their accelerometers downloaded. Subjects in the MM intervention group also received their specific aim intervention newsletters at this time. Individuals in both the UC and MM group were blinded to their step data and were not receiving feedback. Bi-weekly throughout the study, subjects in both groups were also assessed for acute illness/new symptoms, serious adverse events, changes in medications, and visits to health care providers.

**Data Validation Criteria**

Each of the subject’s Lifecorder PLUS accelerometer data was assessed for validation purposes. For the Lifecorder PLUS accelerometer data to be considered valid, the individual had to obtain at least 1,000 steps/day for at least 4 days/week. Data was assessed from the time the individual put the device on for the day until the individual took it off at night.
**Statistical Analysis**

All data is presented as mean ± the standard deviation. Data analysis was performed using SPSS 17.0 for windows (SPSS Inc. Chicago, Illinois). An alpha of 0.05 was used to denote statistical significance.

Independent t-tests were done to denote if any statistical significance was present at baseline between the UC group and the MM group.

A two-way ANOVA with repeated measures was used to assess differences in Lifecorder PLUS accelerometer average steps/day, days/week worn, weekly hours/day worn and moderate-vigorous activity minutes achieved/day between the baseline week and post week of the intervention between the UC group and the MM group. A two-way ANOVA with repeated measures was also used to assess any interaction main effects between the UC group and the MM group from baseline to post in the intervention for all step data.

A two-way ANOVA with repeated measures was also used to assess the difference between the baseline week and post week between the UC group and the MM group, as well as any interaction main effects between the UC group and the MM group from baseline to post in the intervention for self-efficacy, resting blood pressure, resting heart rate, weight, waist circumference, BMI, body fat percentage, and fasting blood measures.
CHAPTER IV

RESEARCH MANUSCRIPT

Journal Format: Journal of Cardiopulmonary Rehabilitation
Title: The Effectiveness of a Motivational-Targeted Feedback Message Intervention on Increasing Physical Activity in Long-Term Maintenance Cardiac Rehabilitation Patients.

Abstract

Purpose: The aim of the study was to determine the relative effectiveness of a motivational-targeted (MT) message intervention designed to increase physical activity (PA) in cardiac patients beginning a long-term maintenance cardiac rehabilitation (CR) program to enable them to meet recommended PA levels.

Methods: Fifty two individuals (34 males, 18 females) volunteered for the study and were randomly assigned to either the Usual Care Group (UC), or the Motivational Message Group (MM). Participants in the MM group received, in addition to the usual long-term maintenance CR program, 12 –standard, MT newsletters at the beginning of each week during the intervention period. Thirty-three individuals (mean age: 61.4 ± 11.4 years) completed the study with viable data. PA was assessed for 12 weeks with the use of a Lifecorder PLUS accelerometer. Baseline and post measures of weight, body mass index (BMI), body fat percentage, resting heart rate and blood pressure measures, and fasting blood measures were completed on all subjects. Subjects also completed an exercise self-efficacy questionnaire and a stage of change of physical activity readiness questionnaire at these timeframes. Results: Independent sample t-tests indicated there were no significant differences between baseline characteristics between the UC group and MM group. Results indicated slight
increases in the MM group in steps/day, and moderate-vigorous minutes/day, with slight decreases in resting heart rate, blood pressure, and blood lipid values compared to the UC group. Two-way repeated measures ANOVA tests determined there was a significant main effect for time for resting heart rate irrespective of group, however, there were no other significant differences between the two groups or within either group, showing no time by group interaction for any variables measured. **Conclusions:** MT messages may have the ability to increase PA levels and adherence in CR patients, however, more research is needed to determine the significant value of MT messages for these individuals. **Key Words:** PHYSICAL ACTIVITY, CARDIOVASCULAR DISEASE, MOTIVATIONAL-TARGETED INTERVENTION, MAINTENANCE CARDIAC REHABILITATION, SELF-EFFICACY.
Introduction

Cardiovascular disease (CVD) is the number one cause of death globally. In the United States, CVD is the leading cause of death among both men and women and accounts for 1 of every 3 deaths, killing an average of 1 American every 37 seconds. It’s been shown that aggressive risk factor management clearly improves CVD patient survival, reduces recurrent events and the need for interventional procedures, while improving a patient’s quality of life.

Physical inactivity has been established as a major coronary artery disease (CAD) risk factor. CVD risk factors, such as physical inactivity, however, can be combated and controlled by adherence to current American Heart Association (AHA) and American College of Cardiology (ACC) lifestyle recommendations. Regular aerobic physical activity (PA) that involves large muscle groups has been determined to have positive effects on reducing the development of CAD and reducing symptoms in individuals with established CVD. The minimum recommended level of PA is 30-60 minutes at least 3-4 days/week supplemented by an increase in daily lifestyle activities. Evidence supports that cardiac patients should reach target exercise energy expenditure levels of at least 1,000 kcals/week, an equivalent to 30 minutes of exercise per day.

Cardiac rehabilitation (CR) programs have been a successful means for increasing PA and energy expenditures in cardiac patients. Although CR programs benefit cardiac patients by increasing caloric expenditure during exercise sessions, these sessions are generally only performed 3 days/week for
30-40 minutes, and thus do not provide enough caloric expenditure to reach recommended weekly target levels \(^{10, 11}\). An important goal, therefore, of a CR program should be to encourage participants’ PA outside the structured CR program.

It is challenging for individuals to maintain a regular PA program that meets recommended levels. Regularly received motivational and educational feedback may improve maintenance of PA. These interventions help to motivate the patient while bypassing the barriers of lack of time and resources. Mediated interventions involving print-based programs and intervention content through non-face-to-face contact, have been shown to be successful and are considered a promising approach for enhancing PA behavior \(^{12-16}\). These interventions have been shown to be most effective when they are matched to the needs and interests of the target group. An individual’s readiness to become physically active is an important determinant of successful participation in PA \(^{17}\). As individuals joining a maintenance CR program are often adopting a new behavior, interventions are most effective when they involve a progression from educational information to behavioral strategies. These interventions are based on cognitive and behavior stages and work with the dynamic process of how individuals first come to adopt and then maintain changes in health behavior. Cognitive strategies focus on increasing knowledge about PA, and are used in the earlier stages of adoption, whereas behavioral strategies focus on substituting PA pursuits for sedentary behavior, and are used in the later stages of adoption of PA \(^{14}\).
Adherence is a factor in the ability of individuals to successfully maintain PA. In the CR setting, patients are able to reach recommended levels of activity and energy expenditure but as that is often only 3 days a week, patients must increase their PA on non-CR days. Motivational interventions may facilitate increased and continued PA and enable patients to reach optimum health benefits. Therefore, this study was designed to determine the relative effectiveness of a motivational-targeted feedback intervention designed to increase PA in cardiac patients beginning a long-term maintenance CR program in order to meet recommended PA levels. It was hypothesized that long-term maintenance CR patients that received targeted feedback messages would have higher levels of PA than patients who received usual care recommendations, and those with higher levels of PA would have improvements in selected health, function, and behavioral measures.

**Methods**

**Subjects**

The subjects recruited for the study were patients who were enrolling in the maintenance CR program at IU Health Ball Memorial Hospital in Muncie, Indiana. The study population consisted of 52 men and women between the ages of 34 and 82 years with a primary diagnosis of myocardial infarction (MI), coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI), heart valve repair/replacement, or stable angina. Subjects were excluded from the study if they had a diagnosed functional impairment: documented ejection
fraction < 20%; a secondary diagnosis of Chronic Obstructive Pulmonary Disease (COPD) which limited their function; any substantial orthopedic limitation; or other medical condition that limits the ability to sustain ambulation determined from historical questionnaire, physical exam, and verified through referring physician clearance prior to study enrollment.

**Procedures**

Recruited subjects who met criteria for the study were randomly assigned to either the Usual Care Group (UC), or the Motivational Message Group (MM). Participants assigned to the UC group entered the usual long-term maintenance CR program, and were given usual information regarding home exercise prescription for the need to be active outside of CR days. This included a recommendation of 40-50 minutes 5-6 days/week which may include their rehabilitation days. Participants in the MM group received the usual long-term maintenance CR program, and in addition also received 12 –standard, motivational-targeted newsletters (Appendix E) at the beginning of each week during the intervention period. The same motivational-targeted newsletter was given to each participant in the MM group at each subsequent week. Each of the 12-standard motivational-targeted newsletters was based on basic themes of increasing PA through information, overcoming barriers, and goal setting. This approach represents a progression from week-to-week, trying to increase a participant’s understanding (cognitive) of the benefits of PA, and then strategies (behavioral) to increase their PA behavior.
Measurements

Initial screening

PA measurements were assessed at baseline, and 12 weeks post. Each subject underwent an initial screening completing a health history questionnaire (HHQ) (Appendix A) inquiring about past and current health, family health, and medications; patient interview related to inclusion/exclusion criteria; as well as a mobility function test consisting of walking a set distance to examine gait speed, and whether the participant is able to walk 50 feet unaided. At the initial screening subjects were also to complete a stage of change of physical activity readiness questionnaire (Appendix B) inquiring about the participants’ readiness to change their activity behavior; and an exercise self-efficacy questionnaire (Appendix C); however this was initiated later in the study and only later subjects completed. Subjects meeting the inclusion criteria received physician clearance and were randomly assigned into the study. Two visits to the HPL were required for baseline and post PA measurements.

Baseline and Post measures

Measurements were performed after the initial screening, and the week following the 12th week of the intervention. Physical activity monitoring, resting blood pressure, fasting blood sample, body composition assessment, quality of life index, and a 6- minute walk test were recorded. During post intervention
measures, a review of all medical information also accompanied the previous measures.

*Physical Activity Monitoring:* Objective measurements of PA were made with Lifecorder PLUS downloadable accelerometers (New-Lifestyles, Inc. Lee’s Summit, MO). The Lifecorder PLUS downloadable accelerometers were used throughout the 12-week study and for baseline and post PA measurements. All subjects were provided an individualized instruction session, with a written handout, as to how to properly position each accelerometer at waist level (Appendix D). For each data collection period the accelerometer was worn for 7 consecutive days during waking hours. Measures of steps/day and the number of minutes in light, moderate, and vigorous PA each day were obtained from the Lifecorder PLUS downloadable accelerometers.

*Resting Blood Pressure:* Blood pressure was measured under quiet, controlled conditions conforming strictly to the American Heart Association Guidelines (51). Blood pressure was measured in duplicate using standard sphygmomanometry techniques.

*Fasting Blood Measures:* A blood sample was taken after a 10-hour fast and analyzed by LabCorp (Muncie, IN) for blood glucose, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, and total cholesterol. LabCorp analyses meet federal and state standards for quality control and proficiency.
**Body Composition:** Height, weight, and waist circumference were assessed using standardized procedures. Body fat percentage was determined using dual-energy x-ray absorptiometry (DXA, Lunar Prodigy, Milwaukee, WI, software version 11.1; iDXA, Lunar iDXA, Madison, WI, software version 13.40). All measures took place in the morning, following standardized DXA quality assurance procedures, with subjects having removed any jewelry and clothing containing metal\(^{19}\).

**Quality of Life Index:** A component of IU Health Ball Memorial Hospital’s CR program, certified by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), is the use of a cardiac Quality of Life index, consisting of two parts (Part 1 (“How Satisfied”: 35 items; Part 2 “How Important”: 40 items) that is administered in paper form with patients circling ratings (1-6 scale) for each item. These questions allow the assessment to be scored/evaluated in four domains: Health and Functioning, Social and Economic, Psychological and Spiritual, and Family.

**Six-Minute Walk Test:** IU Health Ball Memorial Hospital’s CR program also administers a six-minute walk test to access patient’s functional ability. Standardized instructions were read to the patient prior to the test and encouragement prompts were verbally provided to the patients every 30 seconds. Heart rate and blood pressure, and Borg rating of perceived exertion were recorded immediately after the six-minute walk. The total distance walked was recorded to the nearest foot.
**Intervention Period**

Following completion of baseline procedures, the subject was initiated into the study-related intervention (UC, or MM). Individuals initiated into the MM group received their first specific aim newsletter. Throughout the intervention, both UC and MM group’s PA were measured using the Lifecorder PLUS downloadable accelerometers (New-Lifestyles, Inc. Lee’s Summit, MO). At the beginning of each week of the intervention period, subjects in both groups had their accelerometers downloaded. Subjects in the MM intervention group also received their specific aim intervention newsletters at this time. Individuals in both the UC and MM group were blinded to their step data and were not receiving feedback. Bi-weekly throughout the study, subjects in both groups were also assessed for acute illness/new symptoms, serious adverse events, changes in medications, and visits to health care providers.

**Data Validation Criteria**

Each of the subject’s Lifecorder PLUS accelerometer data was assessed for validation purposes. For the Lifecorder PLUS accelerometer data to be considered valid, the individual had to obtain at least 1,000 steps/day for at least 4 days/week. Data was assessed from the time the individual put the device on for the day until the individual took it off at night.
**Statistical Analysis**

All data is presented as mean ± the standard deviation. Data analysis was performed using SPSS 17.0 for windows (SPSS Inc. Chicago, Illinois). An alpha of 0.05 was used to denote statistical significance.

Independent t-tests were done to denote if any statistical significance was present at baseline between the UC group and the MM group.

A two-way ANOVA with repeated measures was used to assess differences in Lifecorder accelerometer average steps/day, days/week worn, weekly hours/day worn and moderate-vigorous activity minutes achieved/day between the baseline week and post week of the intervention between the UC group and the MM group. A two-way ANOVA with repeated measures was also used to assess any interaction main effects between the UC group and the MM group from baseline to post in the intervention for all step data.

A two-way ANOVA with repeated measures was also used to assess the difference between the baseline week and post week between the UC group and the MM group, as well as any interaction main effects between the UC group and the MM group from baseline to post in the intervention for self-efficacy, resting blood pressure, resting heart rate, weight, waist circumference, BMI, body fat percentage, and fasting blood measures.
**Results**

There were a total of 25 male subjects and 8 female subjects (mean age: $61.4 \pm 11.4 \text{ years}$) included in the final analysis. Their characteristics are reported in Table 1. There were no significant differences between groups at baseline.

**Adherence/ compliance**

Fifty two (25 UC, 27 MM) individuals were selected for this study involving a 12 week intervention. In the UC group, 72% were compliant (7 subject dropouts; 3 males and 4 females), and of those compliant, 83% ($n=15$) of their data was usable. Incomplete data and Lifecorder criteria not met resulted in 17% unusable data in the UC group. In the MM group, 70% were compliant (8 subject dropouts; 3 males and 5 females), and of those compliant, 95% ($n=18$) of their data was usable, and 5% unusable. Reasons for individual dropouts included medical issues (hospitalization, illness), family issues, relocation, and scheduling conflicts.

**Effect of Motivational-targeted intervention on physical activity**

**Step Data**

There was no main effect of time, no main effect of group, and no time by group interaction for step data including average steps/day and moderate-vigorous activity minutes/day for both the UC group and MM group from baseline.
to post intervention. While there were no significant differences, the MM group did increase their average steps/day by 19.6% from baseline to post and increased moderate-vigorous activity minutes/day by 37.8%. In comparison, the UC group had only a 3.7% increase in steps/day and had a 5.5% decrease in moderate-vigorous activity minutes/day (Table 2). These data are represented in Figure 1 and 2.

Resting Measures

There was a main effect for time for resting heart rate irrespective of group (P = .018). Resting heart rate decreased 6.6% from baseline to post. There were no significant differences between baseline and post measures within or between the UC group and the MM group for systolic or diastolic blood pressure. There was no time by group interaction for any resting measures (Table 3).

Body composition Data

There were no significant differences between baseline and post measures within the UC group or within the MM group for weight, waist circumference (WC), body mass index (BMI), or body fat percentage. There were no significant differences between baseline and post measures between the UC group and the MM group, showing no time by group interaction for any body composition measures (Table 4).
**Fasting blood measures**

Fasting blood measures were not obtained in all completed subjects. Eleven subjects in the UC group and 16 subjects in the MM group obtained all fasting blood measures and were analyzed (Table 5). There were no significant differences between baseline and post measures within the UC group or within the MM group for total cholesterol (TC), LDL-cholesterol (LDL-C), HDL-cholesterol (HDL-C), VLDL-cholesterol (VLDL-C), triglycerides (TG), and glucose measures. There were no significant differences between baseline and post measures between the UC group and the MM group for any fasting blood measures. There was also no time by group interaction for any fasting blood measures (Table 5).

**Behavioral Data**

The self-efficacy questionnaire and the stage of change of physical activity readiness questionnaire were administered later in the study, resulting in a smaller sample size for behavioral data. There were no significant differences between baseline and post measures within the UC group or within the MM group for self-efficacy, showing no time by group interaction for self-efficacy (Table 6). Descriptive statistics indicates the percentage of individuals in each stage of change of exercise behavior from baseline to post for both the UC group and MM group (Table 7). The results demonstrated positive movement from early stages of change (contemplation, preparation) to later stages of change (action, maintenance) from baseline to post in both groups. In the UC group, 50%
of the individuals at baseline were in the early stages and 50% in the later stages of change. At post, the UC group had 29% in the early stages and 71% in the later stages of change. The MM group at baseline had 31% of individuals in the early stage, with 69% in the later stages of change. At post, 12% of the individuals were in the early stages and 88% in the later stages of change. In the UC group, 57% of the individuals moved up at least one stage from baseline to post. In the MM group, 44% of the individuals moved up at least one stage from baseline to post, with 44% of them already starting in a later stage (action, maintenance) compared to 22% in the UC group already starting in a later stage.

**Discussion**

Regular PA contributes to reduced risk of CVD. Over the past decade, print based motivational materials focused on stage of change of exercise behavior have been validated to increase and maintain PA levels in healthy individuals \(^{12, 13, 15, 16, 20}\). However, few studies have examined their use for chronic disease populations. As it has been determined that cardiac patients do not meet optimal weekly recommended levels of PA, identifying positive use of motivational print based materials to increase PA in cardiac patients is valuable for the prevention and non-reoccurrence of CVD \(^{10, 21, 22}\). The aim of the current study was to test a comparison between motivational-targeted message intervention usage to a usual exercise recommendation designed to increase PA levels in cardiac patients.
Objective Physical Activity Assessment

The Lifecorder PLUS accelerometer was used as an objective measure of PA levels during the 12 week study. The minimum threshold of PA for health benefits is the attainment of at least 1,000 kcals/week of energy expenditure from PA. This quantity of PA is approximately equal to 30 minutes/day of exercise\(^8,9\), with studies supporting that 10,000 steps/day is comparable to 30 minutes/day of moderate intensity activity\(^{23,24}\). There is also evidence that suggests that the value of 10,000 steps/day translates to approximately 300 kcal/day, roughly translating to 2,000 kcal/week\(^25\). Cardiac patients, however, are not reaching these recommended PA levels of at least 1,000 kcal/week or 10,000 steps/day on a regular basis\(^{10,11,22,26}\).

In the present study, the mean baseline steps for the UC group was 5,527 ± 3,016 steps/day, and for the MM group was 5,028 ± 2,263 steps/day. The mean baseline moderate-vigorous activity minutes for the UC group was 19.7 ± 16.9 minutes, and for the MM group was 19.8 ± 10.9 minutes (Table 2). These findings are consistent with many studies showing low average steps/day and minutes in moderate-vigorous PA in CR patients. Jones et al\(^{11}\) reported similar findings in cardiac patients participating in a Phase III CR program using accelerometry measures to determine PA levels during a day when the CR program was attended (10,087 ± 632 step/day) and a day when the CR program was not attended (5, 287 ± 520 steps/day). Ayabe et al\(^{10}\) found that the mean moderate intensity in CR participants is 17 ± 15 minutes/day, while vigorous
intensity minutes/day is 1 ± 2 minutes/day. These findings, along with the current study support the notion that CR patients do not meet the recommended PA levels.

In the present study, in the MM group, the average steps/day increased 19.6% from baseline to post from 5028 ± 2263 steps/day to 6016 ± 2838 steps/day in the MM group, although neither group showed statistical significance. The average moderate-vigorous activity minutes/day increased by 37.8% from baseline (19.75 ± 10.97 minutes/day) to post (27.21 ± 15.99 minutes/day) in the MM group, without statistical significance. While not significant, the present study was limited by a small sample size. With the limited sample size, however, the percentage increase from baseline to post in both steps/day (Figure 1) and moderate-vigorous activity minutes/day (Figure 2) shown in the MM group compared to the UC group should be noted. Study participation and treatment motivation in individuals could account for some increases in step data. Therefore, due to the lack of significant differences, while these results may suggest the potential for print based motivational message interventions to make an impact on CR participants’ PA, more research is necessary to determine the actual effect of motivational print based messages for a cardiac population. It is also important to note that the average step counts achieved in both the UC group and the MM group is still not reaching the standard 10,000 steps/day to achieve optimum benefits of moderate activity. The Tudor-Locke and Basset step indices is a good standard of activity with step counts.
< 5,000 Steps/day  |  Sedentary  
5,000-7,499 Steps/day  |  Low Active  
7,500-9,999 Steps/day  |  Somewhat Active  
10,000-12,999 Steps/day  |  Active  
≥12,500 Steps/day  |  Highly Active  

While these cardiac individuals in the present study, even with an average increase in steps are still considered low active\textsuperscript{27}, they are only 12 weeks into their CR program compared to the Ayabe et al\textsuperscript{10} individuals who had been part of the program for at least 3 months or more when the study began.

**Resting Heart Rate and Blood Pressure**

Increased resting heart rate and blood pressure create an excess workload on the heart due to increased pumping action of the heart to sustain blood flow. Previous studies have indicated beneficial changes in resting heart rate and blood pressure values after an exercise program in cardiac patients\textsuperscript{28, 29}. Bosch et al\textsuperscript{28} demonstrated these benefits after a residential program for cardiac patients over a 2 year period involving education and exercise sessions for 1 month. The results showed a decrease of 5.2\% (-4 bpm) in resting heart rate at post rehabilitation and a further significant decrease of 15.6\% (-12 bpm) after 2 years compared to both baseline and post rehabilitation values. There was a slight increase in systolic blood pressure from baseline to post rehabilitation .81\% (+ 1 mm Hg), and a significant increase of 14.6\% (+18 mm
Hg) after 2 years from both baseline and post rehabilitation values. The same pattern was true in diastolic blood pressure which showed a slight increase of 1.28% (+1 mm Hg) at post rehabilitation compared to the significant increase of 15.4% (+12 mm Hg) after 2 years. While, Jolliffe et al saw a decrease up to 9 mm Hg in systolic blood pressure, as well as a decrease of 2.24 mm Hg in diastolic blood pressure in the comprehensive CR group compared to a control group. The current study is consistent with these results showing a decrease in resting heart rate from baseline to post in both the UC group of -3.73 bpm (-5.8%) and the MM group, having a greater decrease of -5.11 bpm (-7.3%). There was also a decrease from baseline to post in the MM group in both the systolic blood pressure (-2.94 mm Hg; -2.3%) and diastolic blood pressure (-2.22 mm Hg; -3.0%) compared to the UC group (+4.74 mm Hg; + 3.9% and + 3.4 mm Hg; + 4.9%, respectively) (Table 3). All results are irrespective of medication. While resting heart rate had a significant main effect for time irrespective of group (P= .018), systolic and diastolic resting measures were not statistically significant. The significant main effect for time for resting heart rate, along with the decrease in resting systolic blood pressure, and diastolic blood pressure in the MM group may be suggestive of an effect of the intervention group’s increased steps and moderate-vigorous activity minutes/day. A larger sample size in future studies may be necessary to determine significance.
Body Composition Measures

As the primary focus of the current study was motivational-targeted messages on PA data, the emphasis for individuals was not on weight loss or diet; however, body composition and fasting blood lipids are important secondary measures to report as increased PA can also impact these measures over time and are important risk factors for cardiac patients. In the study, for the UC group, weight, WC, BMI, and body fat % were similar from baseline to post (Table 4). In the MM group, weight decreased by 1.0% and body fat % decreased by 2.5% from baseline to post compared to an increase of 0.5% and a decrease of 1.1% respectively in the UC group. The MM group had a 0.7% decrease in WC and a + 0.7% change in BMI, from baseline to post compared to a + 0.12% and a − 0.12% change in the UC group in WC and BMI, respectively (Table 4). While the present study showed no significant losses from baseline to post in body composition measures between groups or within group over 12 weeks, individuals weight and body composition was maintained with a < 3 % change in body weight. Evidence from the American College of Sports Medicine (ACSM) has shown that primary prevention of obesity starts with maintenance of current weight, and not weight reduction. Individuals in this study were successful in the first step of maintaining their weight; a longer study might report further weight reduction. Another factor to consider is that diet was not controlled for in this study, although education related to diet is available to all CR participants, diet could be a factor in why weight and body composition measures were not
reduced more. Congruently a review article by Ross et al.\textsuperscript{31} also determined the same results as the current study, determining that the weekly weight loss over 12 weeks averaged 2.3 kg and abdominal fat reductions on average of only 2 cm showing only modest reduction if any at all through PA alone.\textsuperscript{31}

\textbf{Fasting Blood Lipids}

In the present study, individuals in the MM group showed reductions in VLDL-C and TG levels, with an increase in HDL-C from baseline to post, but results were not statistically different from the UC group (Table 5). Increases in TC, LDL-C, and glucose were seen in both the UC group and MM group from baseline to post, with increases in the MM group being smaller without statistical significance (Table 5). All results are irrespective of medication. These values are similar to other PA studies on blood lipids. In a meta-analysis by Leon et al.\textsuperscript{32}, with individuals completing moderate-vigorous PA 3 days/week for 12 weeks to up to 2 years with a range of 500- >5,000 kcal/week in energy expenditure, showed that the most commonly observed lipid change was an increased HDL-C without dietary manipulations with a mean increase of 4.6% across the studies. Results from the meta-analysis also showed that significant reduction in LDL-C, TG, and TC levels with exercise training were observed less frequently than an increase in HDL-C. The results showed that exercise training in the absence of simultaneous dietary interventions resulted in mean reductions in TG, LDL-C, and TC of about 3.7%, 5.0%, and 1.0%, respectively, across studies.\textsuperscript{32} A study by Niebauer et al.\textsuperscript{33} reported similar findings as well while looking at lipid values.
in CAD patients after 3 weeks on a metabolic ward with PA and diet instruction and found that the intervention group improved levels of TG (142 ± 79 vs. 164 ± 85 mg/dL; -17% vs. -18%), TC (502 ± 89 vs. 513 ± 78 mg/dL; -6.0% vs. -4.3%), HDL-C (94 ± 29 vs. 90 ± 27 mg/dL; +14.6% vs. +12.5%), LDL-C (348 ± 71 vs. 374 ± 65 mg/dL; -7.0% vs. +1.08%) and VLDL-C (51 ± 39 vs. 62 ± 36 mg/dL; -37% vs. -30%), however, these levels were not significant compared to the control group.

**Self-Efficacy Measures**

The present study indicated an increase in self-efficacy for PA. Subjects in the present study demonstrated mean scores in self-efficacy of 2.9 ± .8 at baseline, and 3.2 ± .5 at post for the UC group; and 3.2 ± .8 at baseline, and 3.3 ± 1.2 at post for the MM group based on a 5-question exercise self-efficacy questionnaire (Table 6; Appendix C). Both groups showed increases from baseline to post in self-efficacy measures, UC group (8.6%) and MM group (1.9%), without statistical significance (Figure 3). This finding supports the work of DiClemente et al (1985) in the area of smoking, and Marcus et al who found that those individuals in earlier stages of PA adoption had lower self-efficacy scores than those in the later stages of PA adoption, without clear differentiation between stages revealed. In the current study the self-efficacy scores of the UC group increased more than the values in the MM group over time, however, this data was not significant. Oman et al and McAuley et al found the opposite occurrence in self-efficacy scores over time. They noted that self-
efficacy was higher during the beginning of an exercise program in comparison to the end of an exercise program. This difference could be due to their longer follow-up protocol and different self-efficacy questionnaire.

**Stage of Change of Behavior**

It has been suggested that determining an individual’s stage of change of exercise behavior through theoretical constructs derived from the Transtheoretical model and social cognitive theory, prior to starting an exercise program and targeting information to an individual based on their stage of change will increase an individual’s likelihood of moving towards action and maintenance of PA. It is then thought that those in later stages of adoption of PA obtain greater amounts of PA. Marcus et al.\(^{16}\) determined that subjects in the action, and maintenance stages reported significantly more vigorous and moderate PA compared to subjects in precontemplation, contemplation, or preparation stages\(^ {16}\). Studies have also shown that helping people progress just one stage can double the chances of successful action in the near future. A study by Marcus et al.\(^ {36}\) showed just that, where 30% of those in the contemplation stage at baseline and over 60% of those in the preparation stage at baseline were in the action stage after a 6-week intervention program that included written materials to encourage participants to increase PA based on the stage of change of exercise adoption they were part of. Furthermore, another 30% of baseline individuals in contemplation progressed to the preparation stage\(^ {36}\). The current study showed similar progression. At baseline there were 29% and 12% of
individuals in contemplation and 21% and 19% of individuals in preparation, the
earlier stages of adoption of PA in the UC group and MM group respectively, as
opposed to 21% and 44% of individuals in action, and 29% and 25% of
individuals in maintenance, the later stages of PA adoption (Table 7). After the
intervention, more individuals moved from the earlier stages of adoption
(contemplation 0%, 0%; preparation 29%, 12%) to the later stages of adoption in
both the UC group and MM group, respectively, with a greater percentage of
individuals in action and maintenance in the MM group (44%, 44% respectively)
than in the UC group (29%, 42% respectively) (Table 7; Figure 4). This may
suggest that individuals of the MM group transitioned faster into the later stages
of PA adoption.

**Limitations of the Study**

The aim of the present study was to determine the relative effectiveness of
a motivational-targeted message intervention designed to increase PA in cardiac
patients beginning a long-term maintenance CR program in order to meet
recommended PA levels. Although the study consisted of both male and female
subjects, there were fewer females enrolled in CR at IU Health Ball Memorial
Hospital, and there was a lack of female participation in the study. This is a trend
seen in rehabilitation centers nationwide. Another limitation to this study was the
inconsistency of wearing the activity device. Not all of the patients who
participated in the study wore the activity device each day during all waking
hours. There were differences from day to day as to what time subjects placed
the monitors upon their waistbands, when they took them off and if they remembered to wear them at all.

**Conclusions**

The current study examined the effectiveness of motivational-targeted print-based materials in a long-term maintenance CR program to increase individuals’ PA levels. The study demonstrated positive results for steps/day, moderate-vigorous activity minutes/day, stage of change of behavior, resting heart rate, blood pressure, and lipid values in the motivational-targeted message intervention group. However, only heart rate reached significance for time irrespective of group. Therefore, the main conclusions of the present study are that although the data didn’t reach statistical significance, average steps/day and moderate-vigorous activity minutes/day increased 19.6% and 37.8%, respectively from baseline to post in the MM group, showing clinical significance that usage of motivational-targeted print based messages for increasing PA in long-term maintenance CR participants may be useful and effective.

A longer study with a greater sample size may be needed to determine significant benefits of a motivational print based message intervention. Possible tailoring of the motivational messages to a participant’s specific stage in this study might have potentially produced more significant results.
Table 1: Descriptive Characteristics of the subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>UC Group (n=15)</th>
<th>MM Group (n=18)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 12 males, 3 females</td>
<td>n= 13 males, 5 females</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>58.4 ± 10.7</td>
<td>64.3 ± 12.2</td>
<td>0.152</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.1 ± 9.7</td>
<td>172.0 ± 7.5</td>
<td>0.729</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>93.4 ± 15.4</td>
<td>89.7 ± 14.8</td>
<td>0.487</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.4 ± 5.4</td>
<td>29.8 ± 4.4</td>
<td>0.366</td>
</tr>
</tbody>
</table>

UC= Usual Care
MM= Motivational Message
Table 2: Step data at baseline and Post of intervention

<table>
<thead>
<tr>
<th>Variable</th>
<th>UC Group</th>
<th>MM Group</th>
<th>% Δ</th>
<th>UC Group</th>
<th>MM Group</th>
<th>% Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Steps/day</td>
<td>5526.7 ± 3015.6</td>
<td>5732.4 ± 2556.9</td>
<td>3.7%</td>
<td>5028.4 ± 2262.8</td>
<td>6015.6 ± 2838.2</td>
<td>19.6%</td>
</tr>
<tr>
<td>MV Activity Minutes/day</td>
<td>19.7 ± 16.9</td>
<td>18.6 ± 15.5</td>
<td>-5.5%</td>
<td>19.8 ± 10.9</td>
<td>27.2 ± 15.9</td>
<td>37.8%</td>
</tr>
<tr>
<td>Avg Days/week LC worn</td>
<td>6.2 ± .9</td>
<td>5.6 ± .8</td>
<td>-9.7%</td>
<td>5.7 ± .9</td>
<td>5.6 ± .7</td>
<td>-1.9%</td>
</tr>
<tr>
<td>Avg Weekly Hours/day LC worn</td>
<td>13.7 ± 1.9</td>
<td>12.9 ± 2.3</td>
<td>-6.5%</td>
<td>13.7 ± 3.4</td>
<td>13.1 ± 3.2</td>
<td>-4.2%</td>
</tr>
</tbody>
</table>

Mean ± S.D.
MV= Moderate-Vigorous
LC= Lifecorder accelerometer
Table 3: Resting Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure measurement at Baseline and Post

<table>
<thead>
<tr>
<th>Measurement</th>
<th>UC Group</th>
<th>MM Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>64.4 ± 10.1</td>
<td>60.7 ± 9.1</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>120.1 ± 18.1</td>
<td>124.8 ± 17.9</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>69.5 ± 9.2</td>
<td>72.9 ± 11.7</td>
</tr>
</tbody>
</table>

Mean ± S.D.
HR = Heart rate
BP = Blood Pressure
<table>
<thead>
<tr>
<th>Measurement</th>
<th>UC Group</th>
<th>MM Group</th>
<th>%Δ</th>
<th>UC Group</th>
<th>MM Group</th>
<th>%Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>93.4 ± 15.4</td>
<td>93.9 ± 15.9</td>
<td>0.5%</td>
<td>89.7 ± 14.8</td>
<td>88.9 ± 12.9</td>
<td>-1.0%</td>
</tr>
<tr>
<td>WC (cm)</td>
<td>106.8 ± 11.4</td>
<td>106.9 ± 14.0</td>
<td>0.1%</td>
<td>102.3 ± 13.4</td>
<td>101.6 ± 11.7</td>
<td>-0.7%</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.4 ± 5.4</td>
<td>31.2 ± 5.6</td>
<td>-0.4%</td>
<td>29.8 ± 4.4</td>
<td>29.9 ± 3.4</td>
<td>0.7%</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>36.9 ± 8.9</td>
<td>36.5 ± 9.8</td>
<td>-1.1%</td>
<td>38.0 ± 6.9</td>
<td>37.1 ± 6.1</td>
<td>-2.5%</td>
</tr>
</tbody>
</table>

Mean ± S.D.
WC = Waist Circumference
Table 5: Fasting Blood Measurements at Baseline and Post

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Baseline</th>
<th>Post</th>
<th>%Δ</th>
<th>Baseline</th>
<th>Post</th>
<th>%Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>153 ± 35</td>
<td>157 ± 48</td>
<td>2.6%</td>
<td>157 ± 47</td>
<td>159 ± 48</td>
<td>1.3%</td>
</tr>
<tr>
<td>LDL-C</td>
<td>79 ± 29</td>
<td>83 ± 40</td>
<td>5.1%</td>
<td>82 ± 34</td>
<td>86 ± 40</td>
<td>4.9%</td>
</tr>
<tr>
<td>HDL-C</td>
<td>44 ± 16</td>
<td>42 ± 7</td>
<td>-4.5%</td>
<td>42 ± 11</td>
<td>45 ± 9</td>
<td>7.1%</td>
</tr>
<tr>
<td>VLDL-C</td>
<td>30 ± 14</td>
<td>31 ± 13</td>
<td>3.3%</td>
<td>34 ± 13</td>
<td>29 ± 10</td>
<td>-14.7%</td>
</tr>
<tr>
<td>TG</td>
<td>149 ± 71</td>
<td>153 ± 63</td>
<td>2.7%</td>
<td>168 ± 67</td>
<td>142 ± 50</td>
<td>-15.5%</td>
</tr>
<tr>
<td>Glucose</td>
<td>108 ± 21</td>
<td>120 ± 46</td>
<td>11.1%</td>
<td>102 ± 17</td>
<td>105 ± 19</td>
<td>2.9%</td>
</tr>
</tbody>
</table>

Values in mg/dL
TC = Total Cholesterol
LDL-C= LDL cholesterol
HDL-C= HDL cholesterol
VLDL-C= VLDL cholesterol
TG= Triglycerides
<table>
<thead>
<tr>
<th>Measurement</th>
<th>UC Group (n=11)</th>
<th>MM Group (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>2.9 ± .8</td>
<td>3.2 ± .7</td>
</tr>
</tbody>
</table>

Mean ± S.D.
Table 7: Stage of Change of Behavior Percentage at Baseline and Post

<table>
<thead>
<tr>
<th>SOC Category</th>
<th>UC Group (n= 14)</th>
<th></th>
<th>MM Group (n= 16)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post</td>
<td>Baseline</td>
<td>Post</td>
</tr>
<tr>
<td>Precontemplation</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Contemplation</td>
<td>29%</td>
<td>0%</td>
<td>12%</td>
<td>0%</td>
</tr>
<tr>
<td>Preparation</td>
<td>21%</td>
<td>29%</td>
<td>19%</td>
<td>12%</td>
</tr>
<tr>
<td>Action</td>
<td>21%</td>
<td>29%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>29%</td>
<td>42%</td>
<td>25%</td>
<td>44%</td>
</tr>
</tbody>
</table>

SOC = Stage of Change of Behavior
Figure 1. Comparison of the Change in Average Steps/Day from Baseline to Post of a 12 Week Intervention in the Usual Care Group and Motivational Message Group. The values are expressed as means ± SD.
Figure 2. Comparison of the Change in Moderate-Vigorous Activity Minutes/Day from Baseline to Post of a 12 Week Intervention in the Usual Care Group and Motivational Message Group. The values are expressed as minutes ± SD.
Figure 3. Comparison of the Change in Mean Self-Efficacy Values from Baseline to Post of a 12 Week Intervention in the Usual Care Group and Motivational Message Group. The values are expressed as means ± SD.
Figure 4. Comparison of the Stage of Change of Exercise Behavior from Baseline to Post of a 12 Week Intervention in the Usual Care Group and Motivational Message Group. The values are expressed as percentages.
REFERENCES


As CVD continues to increase, resources and treatments are strained. CVD’s economic burden continues to rise. Low-cost solutions such as print-based motivational messages to help increase PA levels in cardiac patients and decrease risk factors are a promising opportunity.

In the present study, CR patients who received a motivational message, increased average steps/day 19.6% and moderate-vigorous activity minutes/day 37.8%. This may suggest that cardiac individuals who receive a targeted motivational message may be able to increase their PA to recommended levels of 10,000 steps/day of moderate intensity PA over time. The present study consisted of a 12-week long intervention study with a small sample size. Therefore, while the study did not result in any significant differences over the 12-week long intervention, except for heart rate, the slight improvements in step data and health and function in that time may suggest that CR programs that include increased education and motivational information from print-based materials that are targeted to stage of exercise behavior could increase knowledge and PA behavior and adherence in the long run. While motivational
targeted messaging may be promising, the method on its own may not be
enough to cause increased PA behavior and may best be an adjunct to other
methods of increasing PA.

Recommendations for further study

Many studies (11, 37, 38, 73) have examined the potential of print-based
motivational material for increasing PA in healthy individuals with effective results
for enhancing PA participation, however limited knowledge exists for the use of
these materials in cardiac individuals. Longer-term studies involving 12-24
months are needed to fully determine the value of using psychosocial
motivational measures for predicting long-term PA behavior in cardiac patients.

A few studies have shown that individuals who receive a theory-based
motivational intervention that is either tailored to their specific stage of change of
PA behavior, or involves a more aggressive in nature including more face-to-face
and telephone motivation, have shown to be more physically active individuals at
follow-up compared to usual care (11, 37, 56).

Therefore, an area of future interest is to study a cardiac cohort with
tailored motivational messages customized for a participant’s specific stage of
change. An intervention that is tailored is more specific and could have more
potential than a targeted intervention, as an individual would receive a message
that is particularly tailored for the specific stage they are in, and receive specific
information. Designing separate interventions to specifically meet the needs of
individuals at each stage of behavior to adopt activity, such as pedometer feed-
back, telephone contact, or written messages, may be a more effective way to help people change sedentary lifestyles.

Other interventions used alongside motivational messages could potentially help increase PA in cardiac individuals. Pedometer feed-back messaging interventions have been shown to be effective when step goal and step diaries are used as key motivational factors (13). Interventions including internet and telephone interventions and individual and group interventions have also been shown to be effective in increasing PA behavior in the short term (42, 56, 73). Researchers should further explore the most effective channel or combination of these channels (e.g. pedometer feed-back, print, telephone, internet) for intervention delivery and whether preferences for a particular delivery channel impacts effectiveness in increasing PA behavior and adherence.

A further recommendation would be to recruit a more diverse population. A more diverse cohort including more females, and racial/ethnic minorities would be more applicable to the general population. A possible further tailoring of the intervention studies for populations, making them gender or ethnically specific could be considered. Researchers could also examine behavioral differences between males and females to a motivational message intervention.

Lastly, further studies should investigate a longitudinal analysis and re-assess the same patients after 1 year post the 12 week intervention to assess the long-term effects of motivational message intervention on PA maintenance.
REFERENCES


41. **Marcus BH, Williams DM, Dubbert PM, Sallis JF, King AC, Yancey AK, Franklin BA, Buchner D, Daniels SR, and Claytor RP.** Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity); Council on Cardiovascular Disease in the Young; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research. *Circulation* 114: 2739-2752, 2006.


44. **Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, Macera CA, and Castaneda-Sceppa C.** Physical activity and public health in older adults: recommendation from


55. **Reeves GR and Whellan DJ.** Recent advances in cardiac rehabilitation. *Curr Opin Cardiol* 25: 589-596.


APPENDIX A

MEDICAL HISTORY QUESTIONNAIRE
MEDICAL HISTORY QUESTIONNAIRE

Innovative Strategies to Increase Physical Activity of Cardiac Patients

The following questions are designed to obtain a thorough medical history. The information you provide will help us to make the best determination about your eligibility for this research study. Please answer all questions and provide as much information as you possibly can. This questionnaire, as well as any other medical information you provide, will be kept confidential and will not be shared with any unauthorized person or organization unless you specifically request us to do so.

Date Completed: ______________________________________

Name: ________________________________

Street Address: __________________________________________

City, State, Zip: _________________________________________

Telephone number: Home (   )__________ Work (   )____________

Date of Birth: __________ Age: _____

   mm-dd-yyyy

Sex:  M _____ F _____

Personal Physician's Name: ___________________________ Phone___________

   Address:_____________________________________________________

Cardiac Physician's Name: ___________________________ Phone___________

   Address:_____________________________________________________
Education

Last grade completed in elementary or high school: ____________

Education completed since leaving elementary or high school:

_____  None  
_____  Vocational School  
_____  Community or Junior College  
_____  Four-Year College  
_____  Graduate School  
_____  Professional School

Occupation

Current occupation or if retired what was your occupation at retirement: ____________

Current Family Income (Dollars per year): (check level)

< $20,000  ___  $20,000-39,999  ___  $40,000-59,999  ___  $60,000-79,999  ___  > $80,000  ___

Marital Status

_____  Married  _____  Single, never married
_____  Divorced  _____  Separated
_____  Widowed

Living Situation

_____  Alone
_____  With family member(s)
_____  With non-family members(s)

Do you have any pets? No _____ Yes _____ (please describe)
__________________________________________________________
__________________________________________________________
__________________________________________________________
Ethnic and Racial Background

Please place a mark next to the categories below that apply. Please note we request this information as different grant funding agencies require this information. You may choose to leave this section blank.

Ethnic Category

_______ Hispanic or Latino: A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.

_______ Not Hispanic or Latino

Racial Category

_______ American Indian or Alaska Native: A person having origins in any of the original peoples of North, Central, or South America and maintains tribal affiliation or community.

_______ Asian: A person having origins in any if the original peoples of the Far East, Southern Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

_______ Black or African American: A person having origins in any of the black racial groups of Africa.

_______ Native Hawaiian or Other Pacific Islander: A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or the Pacific Islands.

_______ White: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.
**Personal Health History**

Have you ever been hospitalized or had surgery?  Yes _____  No _____

Please list all hospitalizations and surgeries to the best of your recollection:

<table>
<thead>
<tr>
<th>Disease/Operation</th>
<th>Duration</th>
<th>Hospitalized</th>
</tr>
</thead>
<tbody>
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</table>

List any disease or illness you have had not listed above (e.g., mumps, measles, broken bones, etc.)

<p>| |</p>
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Are you allergic, sensitive, or intolerant of any foods or nutritional supplements, products, or substitutes? Yes___  No___

If yes, please describe: __________________________________________________________

Are you allergic, sensitive, or intolerant of any medications? Yes___  No___

If yes, please describe: __________________________________________________________

Are you allergic, sensitive, or intolerant of latex? Yes___  No___

Are you allergic, sensitive, or intolerant of any kind of tape or adhesive? Yes___  No___

Are you currently seeing a doctor or other health care provider for any reason?  Yes _____  No _____
If yes, please explain:

____________________________________________________________________________________

____________________________________________________________________________________

Do you have, or have you ever had any of the following conditions?

Alteration of your ability to remember  Yes _____  No _____

Recurring headaches  Yes _____  No _____

Recent changes in your vision  Yes _____  No _____

Numbness of an arm or leg  Yes _____  No _____

Weakness of an arm or leg  Yes _____  No _____

Difficulty in speaking or slurred speech  Yes _____  No _____

Fainting or dizziness  Yes _____  No _____

Difficulty in walking (staggering)  Yes _____  No _____

Shortness of breath  Yes _____  No _____

Lung or Respiratory Disease  Yes _____  No _____

Rheumatism or arthritis  Yes _____  No _____

Heart disease  Yes _____  No _____

Epilepsy  Yes _____  No _____

Tumors  Yes _____  No _____

Mental illness  Yes _____  No _____

Bleeding or clotting disorders  Yes _____  No _____

Risk for infectious diseases  Yes _____  No _____

(AIDS, IV drug use, blood transfusions, hemophilia, hepatitis)

Skin: rashes, lumps, moles, itching, eczema  Yes _____  No _____

Nose, sinuses: frequent colds, sinus trouble  Yes _____  No _____
nose-bleeds, deviated septum

Neck lumps, swollen glands, pain or stiffness

Yes _____  No _____

Breasts: lumps, nipple discharge, pain or discomfort

Yes _____  No _____

For women: Date of last mammogram ___________

High blood cholesterol

Yes _____  No _____

Date of last reading _____  Value _____

Stomach: chronic indigestion, ulcer, hiatal hernia, heartburn, trouble swallowing, vomiting.

Yes _____  No _____

Intestine: constipation, diarrhea, change in bowel habits, irritable bowel disorder, colitis, polyps.

Yes _____  No _____

Rectum: hemorrhoids, bleeding, polyps

Yes _____  No _____

Liver, gallblader: hepatitis, gallstones

Yes _____  No _____

Urinary: frequent urination, urgency, burning, pain, blood in urine, infection, kidney stones

Yes _____  No _____

Incontinence: Loss of bladder or rectal control

Yes _____  No _____

Have you ever had any form of cancer, skin or other?

Yes _____  No _____

If yes, what kind: ______________________________

Do you have diabetes mellitus (high blood sugar)?

Yes _____  No _____

If yes, when and what kind of treatment did/do you receive:

Insulin _____  Diet _____  Pills _____  No treatment _____

Is there a family history of diabetes mellitus?

Yes _____  No _____

Have you ever had or been told that you had high blood pressure?

Yes _____  No _____

If yes, when and what kind of treatment or medicine did/do you receive:

________________________________________________________________________
Have you ever had or been told that you had high cholesterol or triglycerides?

Yes _____   No _____

If yes, when and what kind of treatment or medicine did/do you receive:

_____________________________________________________________

Do you have any other (not mentioned above) chronic illnesses?

Yes _____   No _____

If yes, please explain: __________________________________________

_____________________________________________________________

_____________________________________________________________

List all the prescribed medications you are currently taking:

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Reason for Medication</th>
</tr>
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<tbody>
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</tbody>
</table>

List all the over-the-counter medications you are currently taking:

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Reason for Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
Specifically, are you currently taking any pain medications, such as Tylenol or Advil, on a regular basis? Yes _____ No _____ If yes, how much and how often do you consume these medications?

________________________________________________________

Do you have any problems with constipation or diarrhea? Yes _____ No _____ If so, how do you usually remedy it?

________________________________________________________

**For Females Only**

Do you or have you ever had menstrual problems, vaginal discharge, or irregular bleeding.

Yes _____ No _____ If yes, please explain:

________________________________________________________

Age of menopause (if applicable): ________________

Type of menopause: _____ natural _____ surgical _____ other

Estrogen replacement: Yes (current) _____ Yes (past) _____ No _____

If yes, please explain:

________________________________________________________

Last PAP smear: ____________________________

Number of pregnancies: ____________________________

Number of births: ____________________________

Type of delivery: ____________________________

Your age at time of birth(s): ____________________________
Date of Hysterectomy (if applicable): ____________________________________________

Reason:  ________________________________________________________________

For Males Only

Have you ever had prostate problems, hernias, or testicular pain.

Yes _____ No _____

If yes, please explain:

________________________________________________________________________

________________________________________________________________________

Dietary Information

Are you currently taking any vitamins, minerals or health food supplements at least once per week on a regular basis?  Yes _____ No _____

If yes, please describe:

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Amount</th>
<th>How often</th>
<th>How long</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Reason

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Are you currently following a special diet (i.e., vegetarian, diabetic, low fat, lactose free)?

Yes _____ No _____  If yes, what kind?________________________________________

Has this diet been prescribed by your health care provider?  Yes ____ No ____

Have you had a weight loss or gain in the last 6 months?  Yes _____ No _____

If yes, how much?  _____lbs.  Gain _____ Loss _____ (check one)

How do you describe your appetite?  Poor _____ Fair _____ Good _____
Do you have any food allergies/intolerance? Yes _____ No _____

If so, please explain:

____________________________________________________________________

____________________________________________________________________

Do you drink caffeinated beverages? (coffee, tea, soda) Yes _____ No _____

If yes, how many caffeinated beverages do you drink in an average day?
______/day

Do you drink alcoholic beverages? Yes _____ No _____

If yes, how many alcoholic beverages do you consume in an average week?
______/wk

Do you have a problem drinking milk or eating dairy products?

Yes _____ No _____

**Smoking History**

Do you smoke cigarettes at present? Yes _____ No _____

If yes, how many packs per day? (check one)
- less than 1/2 pack _____
- 1/2 to 1 pack _____
- 1 to 2 packs _____
- more than 2 packs _____

Do you inhale? Yes _____ No _____

How long have you been smoking? (check one)
- less than 1 year _____
- 1 to 5 years _____
- more than 5 years _____

Did you smoke cigarettes in the past and quit permanently? Yes _____ No _____

If yes, how many packs per day did you smoke? (check one)
- less than 1/2 pack _____
- 1/2 to 1 pack _____
- 1 to 2 packs _____
Did you inhale?  Yes _____ No _____

When did you quit? (check one)  
less than 1 year _____
1 to 5 years _____
more than 5 years _____

Do you smoke cigars at the present?  Yes _____ No _____

If yes, how many cigars per day? (check one)  
less than 2 _____
2 to 5 _____
more than 5 _____

Did you smoke cigars in the past and quit permanently?  Yes _____ No _____

Do you smoke a pipe at present?  Yes _____ No _____

If yes, how many pipefulls do you smoke per day? (check one)  
less than 2 _____
2 to 5 _____
more than 5 _____

Did you smoke a pipe in the past and quit permanently?  Yes _____ No _____

**Exercise History**

Do you participate in a regular exercise program? Yes _____ No _____

If yes, please describe the exercise that you usually participate in (e.g., walking, running, weightlifting).

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
If you are not currently participating in a regular exercise program, have you participated in one in the past? Yes _____ No _____

If yes, when was the last time you participated in the exercise on a regular basis?

Could you please describe the type of activity that you performed (e.g., walking, running, weightlifting).

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

How often did you exercise (days/week)? _______

At what intensity did you exercise? Light _______

   Moderate _______

   Hard _______

On days that you did exercise, how long did you usually exercise for (hours)?______

Have you ever participated in competitive sports (e.g., football, basketball)?

Yes _____ No _____

If yes, when was the last time that you participated in this sport? _______

Could you please list the sport that you played and briefly describe your role (e.g., distance runner, outfielder, linebacker) and how many years you participated in the sport.____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
APPENDIX B

PHYSICAL ACTIVITY STAGES OF CHANGE QUESTIONNAIRE
Staff: Read the instructions to the subject and ask them to respond to the 4 statements [be sure they understand the definitions of physical activity (#1&2) and regular physical activity (# 3&4)]

**PHYSICAL ACTIVITY STAGES OF CHANGE**

For each of the following statements, please circle Yes or No. Please be sure to read the statements carefully.

*Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other activity in which the exertion is at least as intense as these activities.*

<table>
<thead>
<tr>
<th>Statement</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am currently <em>physically active</em>.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2. I intend to become more <em>physically active</em> in the next 6 months.</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE if they answer YES to #1, do not ask them question 2**

<table>
<thead>
<tr>
<th>Statement</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. I currently engage in <em>regular physical activity</em>.</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE if they answer NO to #1, do not ask them questions 3 and 4**

*For activity to be regular, it must add up to a total of 30 minutes or more per day and be done at least 5 days per week. For example, you could take one 30-minute walk or take three 10-minute walks for a daily total of 30 minutes.*

<table>
<thead>
<tr>
<th>Statement</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. I have been regularly active for the past 6 months.</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE if they answer NO to #3, do not ask them question 4**
APPENDIX C

SELF-EFFICACY QUESTIONNAIRE
Confidence (Self-efficacy)

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other activity in which the exertion is at least as intense as these activities. Circle the number that indicates how confident you are that you could be physically active in each of the following situations:

Scale

1 = not at all confident
2 = slightly confident
3 = moderately confident
4 = very confident
5 = extremely confident

1. When I am tired 1 2 3 4 5
2. When I am in a bad mood 1 2 3 4 5
3. When I feel I don’t have time 1 2 3 4 5
4. When I am on vacation 1 2 3 4 5
5. When it is raining or snowing 1 2 3 4 5
APPENDIX D

PHYSICAL ACTIVITY MONITOR INSTRUCTIONS & LOG FORM
**Ball State University / Ball Memorial Hospital**  
*Strategies to Increase Physical Activity of Cardiac Patients*

- As soon as you wake up each morning, slide both of the physical activity monitors on your belt or waistband at the *midline of the thigh* (if you wear a belt, slide the physical activity monitor on the belt, otherwise just slide it on to your waistband, we can provide an elastic belt for you to use) – *be sure to clip the safety strap to a part of your clothing*. Place one on the *right* side and one on the *left* side.

- Please do your normal activities while wearing the physical activity monitors.

- The physical activity monitors should be worn at all times except when swimming, showering, or sleeping. You do not need to do anything to the physical activity monitors (like pushing a button), just wear them.

- If you have any questions please call the *Clinical Exercise Physiology Program* staff at 285-1140.

- Record responses to each of the 3 items below for each day you wear the physical activity monitors. We ask that you wear the physical activity monitors for at least 7 consecutive days.

- Bring this log form with you when you return the physical activity monitors to your first day of the *Cardiac Rehabilitation Program* at the Ball Memorial Hospital.

<table>
<thead>
<tr>
<th>Date</th>
<th>Removed or left off for a period of the day?</th>
<th>Performed a bout of exercise?</th>
<th>Did any unusual or atypical physical activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES  NO</td>
<td>YES  NO</td>
<td>YES  NO</td>
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<td>YES  NO</td>
<td>YES  NO</td>
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<td>YES  NO</td>
<td>YES  NO</td>
<td>YES  NO</td>
</tr>
</tbody>
</table>

For any items circled YES, please list the date and an explanation. For example:

5/26 – forgot to wear it from 1pm to 3 pm.

5/27 – walked on the Cardinal Greenway for 60 minutes

5/28 – participated in an adult vs. kids soccer game for 45 minutes
APPENDIX E

MOTIVATIONAL NEWSLETTERS
Physical Activity Program
Ball Memorial Cardiac Rehabilitation
Week 1, November 23, 2009

Convincing yourself you can be physically active

It's easier than you think

The good news is that gaining health benefits from physical activity is much easier and less time consuming than most people believe.

Recently, the American Heart Association recommended that cardiac patients obtain a minimum of 30-60 minutes of moderate-intensity (or higher) physical activity on 5 or more days/week and should supplement this by increases in daily lifestyle activities. The Physical Activity Guidelines for Americans also recommends that 2 ½ hours per week (roughly 30 minutes on 5 days of the week) of moderate intensity aerobic physical activity, or one hour and 15 minutes per week of vigorous intensity physical activity will promote health benefits.

By definition, physical activity does not have to be structured exercise, nor does it have to be done in a fitness center! It is literally any whole body activity resulting in energy expenditure.

Examples include:
- Walking briskly
- Robust housework
- Gardening
- Certain occupational tasks

- A variety of daily living activities (like taking the stairs)

These activities can be performed in long blocks of time (like 30 minutes) or in shorter episodes (like 8-10 minutes) a few times per day.

The evidence is clear

Regular physical activity over months and years produces long-term health benefits and reduces the risk of many diseases, including heart disease.

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.

Regular physical activity helps cardiac patients:

- Life longer
- Increase their stamina
- Control their cholesterol
- Control their blood pressure
- Control their type 2 diabetes
- Experience Quality of Life
- Prevent or lessen depression

It can improve thinking ability in adults and the ability to engage in activities needed for daily living

So get moving!
Preparing yourself to be physically active

Examine Your Intentions, Motives, & Commitment

We know that deciding to change a behavior and knowing what to do is often not enough to make that change a permanent part of your life.

Being armed with "how to" information and learning some behavioral skills to support your best intentions greatly increases your chances of being successful.

Before you actually take action, you need to prepare yourself for being physically active and begin to plan how you will take control and manage that change.

Intentions are the best predictors of actions. Only you can determine your intentions, motives and goals.
- What do you want to achieve?
- Do you want to be healthier?
- Do you wish to become physically active and fit?

What are your intentions and your motives? (Write them here!)

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

FAST FACTS: The Use of Role Models
Another useful tactic for staying motivated is to pick a role model. Maybe there is a friend or family member who is regularly physically active. Talk to that person and ask them what work, and doesn’t work, for them.

Information in this brochure is based on original work by:
Physical Activity Program
Ball Memorial Cardiac Rehabilitation
Week 2, November 2, 2009

Reasons to be more physically active

Reasons to stay inactive:
"I don’t have time to be more active" Making physical activity a priority means making time to do it, and this may seem difficult. However, consider that you only need 150 minutes per week of moderate (or higher) intensity physical activity to gain health benefits, remembering that Cardiac patients should strive for 300 minutes per week. This can be performed all at once for 30-60 minutes, or in multiple times of at least 10 minutes throughout the day.

"I never liked to exercise" Many of us have bad memories of running or doing calisthenics in our high school gym classes. The good news is that you don’t have to exercise that hard if you don’t want to. There are other ways to improve your health like walking or gardening. Try taking the stairs, or parking farther away from your destination and walking.

Reasons to be more active:
It’s fun! Let yourself feel young. Physical activity can help you bring back those good feelings of youth when playing was fun. Try some activities that you did as a child. Toss around the baseball, jump rope or skip. If you have children or grandchildren, enjoy doing something active with them.

It’s good for your body! Your weight is much easier to manage when you are physically active. It can also help control your blood pressure, blood sugar, and cholesterol.

It’s good for your mind! Regular physical activity helps increase your confidence and give you a stronger sense of pride for your healthier body. It also helps decrease stress and decrease feelings of sadness.

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.

PHYSICAL ACTIVITY TIPS
Week 2

- Walk or ride a bike in your neighborhood
- Join a walking club at a mall or senior center
- Play golf at a local course
- Join a dance class
- Work in your garden
- Use facilities at the YMCA or local senior or community center
- Buy exercise equipment or videos for your home
- Join a hiking or biking club
- Try yoga or Tai Chi classes
- Take a self-defense class like Karate or Tae Kwan Do
- Take your grandkids to the park and play actively with them
- Take a walk during your lunch break
- Volunteer!
Do I need more physical activity?

The Pros and Cons of Physical Activity

The following are some negative statements about being more active. What do you think?
1. Regular physical activity would take too much of my time. (Circle One)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</table>

2. At the end of the day I am too exhausted to be physically active. (Circle One)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</tbody>
</table>

3. I would have less time for my family and friends if I was more regularly active. (Circle One)

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<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Add up your answers to these three questions. This is your “CONS” score.

TOTAL: 

The following are some positive statements about being more active. What do you think?
1. I would feel more confident if I was regularly physically active. (Circle One)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
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<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
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</tbody>
</table>

2. I would feel less stressed if I was more physically active. (Circle One)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. I would feel more comfortable with my body if I was more physically active. (Circle One)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Strongly Agree</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add up your answers to these three questions. This is your “PROS” score.

TOTAL: 

If your CONS score was higher, you may want to spend more time thinking about physical activity. Over the next week try making a list of all the GOOD things you can think of about being physically active. If your PROS score was higher, you may want to begin reading more about different activities and opportunities for physical activity in your neighborhood. You could also ask your friends or family about why they are active or how they got started.

Want to burn 100 calories today?
- Walk around the block = 30
- Climb up 2 flights of stairs = 15
- Dance to your favorite, fast song = 25
- Walk around the block again = 30

100 calories!

Information in this brochure is based on original work by:
Physical Activity Program
Ball Memorial Cardiac Rehabilitation
Week 3, November 11, 2009

Overcoming barriers to physical activity

It's been a couple of weeks since you enrolled in this study. Have you been increasing your physical activity levels or are you having trouble doing more? Are you running into barriers to making improvements? Barriers are obstacles that hamper our efforts to accomplish our goals, and they may be personal, social, or environmental.

"Not enough time"
Being active doesn’t take as much time as you think. Brief periods of physical activity (as short as 10 minutes at a time) have been found to be effective, and can accumulate over the day.

Try fitting in some physical activity into your day by:
- Parking your car farther from your destination.
- Walk to your destination instead of driving.
- Taking the stairs instead of the elevator.

It is important to find your best time (for yourself). Set aside time for your own health and well-being; give yourself permission. For many people, early morning is ideal—before the daily demands pile up. Others enjoy a mid-day or late afternoon time to break up the day. Whatever works for you is fine.

"I don't have enough money to spend on exercising"
Although some forms of exercise, like joining a health club or buying equipment for your home can be very costly, there are lots of other ways you can be physically active which can cost you very little. Try gardening, doing housework or taking a walk or biking around in your neighborhood.

"My muscles will get sore if I become physically active"
You may get sore muscles when you first become more active. Most soreness can be avoided by stretching enough before and after physical activity and not pushing too hard while exercising. Listen to your body!

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Preparing yourself to be physically active

Overcoming barriers and obstacles

Take some time to think about the obstacles that are most likely to get in your way. Then try to find a way to deal with them, while still remaining active. Overcoming barriers can often be an exercise in thinking “outside the box” or being creative.

**OBSTACLE:**

Solution:

**OBSTACLE:**

Solution:

**OBSTACLE:**

Solution:

**OBSTACLE:**

Solution:

**Role Models:**

Another useful tactic for staying motivated is to pick a role model. Maybe there is a friend or family member who is regularly physically active. Talk to that person and ask them what works... and doesn't work... for them.

Information in this brochure is based on original work by:
Goal setting and making plans

You’ve been active now for a while, but still for less than 6 months. This is a time when a new behavior is a little vulnerable, so it is important to stay actively engaged in maintaining the progress you have worked so hard to achieve. The purpose of this sheet is to help you find ways to keep up (or make improvements) the hard work, stay motivated, and remember the benefits you are gaining by being regularly physically active.

Set Goals
- This is one of the best ways to stay focused and motivated.
- Make a plan of what you want to accomplish in the next month, and then write out the steps you will take to get there.
- Choose a simple and reasonable goal, and then break it down into small, easy tasks. Each task is a short-term goal. As you accomplish each short-term goal, reward yourself for taking another step toward your long-term goal.
- When you accomplish your long-term goal...reward yourself and then set a new one!

How do I meet my goals?
- Remember to start easy and use progression.
- Progression means gradually extending your walk from 10 minutes to 15 minutes, and eventually up to 60 minutes, or adding an activity to your day. Eventually you may walk, bike, climb steps a little faster.
- Increase the duration first, then increase the intensity (how long before how fast!)
- Remember the goal is to be active on most (at least 5), if not all days of the week.

Use reminders
Take time to set up reminders if you think you will be too busy for physical activity during the day
- Plan ahead by putting time to exercise on your calendar each week
- Put up sticky notes where you will be sure to see them (bathroom mirror)

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Setting goals and deciding what to do

Setting goals

Challenging, but manageable goals are more likely to be achieved than goals that are too easy or too hard. It is best to use short-term, process goals first (for example goals for actually doing the activity). Be sure to reward yourself!

Now focus on your long term goals which result in successful long-term change (like being more active or healthy rather than “losing 8 lbs. by the holidays”). This is what comes from the short-term goals.

MY LONG TERM GOAL:

<table>
<thead>
<tr>
<th>Plan for goal 1:</th>
<th>Plan for goal 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reward for goal 1:</td>
<td>Reward for goal 3:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plan for goal 2:</th>
<th>Plan for goal 4:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reward for goal 2:</td>
<td>Reward for goal 4:</td>
</tr>
</tbody>
</table>

Specific, written plans work better than vague promises. Find a way to make it part of your daily lifestyle. Use the table below to write down what you plan on doing, only you can decide what works for you and your lifestyle. Be specific!

Weekly Activity Plan

<table>
<thead>
<tr>
<th>Tomorrow</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
</tr>
</thead>
</table>

Don’t forget to reward yourself for meeting your goals! Examples of rewards:
- Visit a friend
- Buy some flowers or a plant
- Enjoy a long hot bath
- Go to a movie or rent a video

Information in this brochure is based on original work by:
Planning to be more physically active

How can you fit some activity into your schedule?
- Take a walk before your morning coffee or after dinner before you settle in for the evening.
- Try to think of the little things you can do to add more activity into your daily life.
  - Take the stairs instead of the elevator.
  - Park a little further away from the store.
  - Could you walk to church or the corner drug store instead of driving?

These things add up… and are easy to fit into your daily schedule!

Do you prefer to be active alone or to share your activity with a family member or friend?
- Some prefer the peace and solitude of being active alone.
- Others see activity as an opportunity for socialization and fun with friends and/or family.
- Whatever YOU prefer is fine. However, sometimes it is easier to be active with a friend, especially at first.
- If you do like to be active alone, pair up with a buddy who is like you and make similar plans for activities. Then check in on each other from time to time. Letting someone else know your plans helps you stick to them!

What activities have you enjoyed in the past?
- Why did you stop?
- How can you start those activities again?
- You may also enjoy other activities that are better suited to your current lifestyle.
- The most important point is to try several different activities until you find a few that YOU really like.
- Activity can… and should be FUN!

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Deciding what to do

Time to brainstorm

Make a list of activities you would like to try in the next two weeks. Do your best to try each one at least once, and make some notes about the experience in the space on the right. You will use these activities later on when making a more inclusive physical activity plan.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date Tried</th>
<th>Time Spent</th>
<th>Notes (what did you like/dislike and why?)</th>
</tr>
</thead>
</table>

Begin to visualize yourself as a physically active person, someone who makes it a priority!

The more you see yourself as a regularly active person, the more you will make the small changes needed to become one.

Information in this brochure is based on original work by:
Physical Activity Program
Ball Memorial Cardiac Rehabilitation

Week 6, Date, 2009

Being physically active

You have been active for awhile now and hopefully you are ready to make physical activity a lifelong habit!

You are more likely to succeed if you are in control and program your own lifestyle change(s).

Your chances of succeeding are much better if you approach a new behavior with the confidence that you will be able to accomplish it.

Build your confidence by:
- Selecting an activity that is FUN and enjoyable to you.
- Vary your activities if you prefer variety.
- Find a partner and make the event social.
- Recognize how good it feels to succeed!

Social support
- Make a public statement of your intent and gain the social support of others such as your spouse, a good friend, or co-worker.
- A physical activity partner serves as your conscience and you make a “contract” with him/her making it more difficult to cancel.
- It’s easier to cancel on yourself than on someone else!
- But remember...if you prefer your solitude time, that works just as well.

Think About Your Past Successes
- By now, you have had plenty of good weeks where you’ve been active almost every day.
- You’ve also had some harder weeks where you might have fallen a little short of your goals. What worked for you to get back on track and overcome obstacles...remember those things and use them!
- How has it felt to observe yourself succeeding and becoming healthier? Use those feelings as motivation when it is hard to get up and going.

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.

TIPS FOR PHYSICAL ACTIVITY
Week 6

- Drink plenty of water while you are active
- If it is too hot or too cold outside, do your activity indoors.
- Use proper equipment. Safety equipment, like a bike helmet, is very important.
- Wear loose fitting, comfortable clothes. Wear several layers when it is cold outside.
- Wear sneakers, not everyday or dress shoes while walking.
- Be gentle with your body. The saying "no pain, no gain" is NOT true. If you feel pain while doing activity, stop!
## Make a game plan

### Social support

Use this space to determine what activities you will do with a partner and which activities you will do on your own.

<table>
<thead>
<tr>
<th>Activities I will do with a partner:</th>
<th>Activities I will do on my own:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
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<tr>
<td>2.</td>
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</table>

If your list for activities with a partner is much longer than your list for activities you do alone, realize social support is important for you becoming regularly active. It may be time to go and find a physical activity partner.

If you are already regularly physically active, maybe it's time to mentor someone who is not active. Just as you looked for a mentor, be a mentor to someone who needs help. If you are still struggling to stay active, talk to your mentor again.

Information in this brochure is based on original work by: Blair SN, Dunn AL, Marcus BH, Carpenter RA, & Jaret P, (2001) Active living every day: 20-weeks to lifelong vitality. Human Kinetics: Champaign, IL.

Increasing physical activity

The purpose of this guide is to help you make activity a more regular part of your life. This guide will help you find the most fun and healthy ways to be more regularly active.

Remember, one way to meet the physical activity recommendations is to get 30-60 minutes of moderate-intensity (or higher) physical activity on 5 or more days/week and to supplement this by increases in daily lifestyle activities.

How can you meet the physical activity recommendations?

- Thirty to sixty minutes may seem like a lot of time, but remember that you can add up little bouts of activity throughout the day (i.e. 3 x 10 minute bouts = 30 minutes).

- What does “moderate-intensity physical activity” mean?
  - Requires some effort. You will feel your heart beat a little faster and might sweat a little toward the end of the activity, but you can still carry on a conversation while doing the activity.
  - Examples are listed to the left.

You are already doing some activity each week. How can you add to what you are already doing to reach the recommendations?

- Turn LIGHT activities into MODERATE whenever possible:
  - Try to get a little faster when taking your daily walk(s).
  - Be more animated when doing housework such as vacuuming...try playing fast music!
  - When shopping, take one “lap” around the mall quickly, looking in the windows of stores to see where you want to go.

- Choose some days where you complete your activity all at once (30 -60 minute exercise class or walk, for example). Choose other days where you add up several 10-15 minute bouts of activity throughout the day.

Report Any Problems

Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
# Increasing your physical activity

**My Daily Activities**

The purpose of this task is to help you become more aware of what you do during a typical day. Then you can identify times where you could increase either the length or intensity of those activities to help you reach the minimum recommendations for achieving the many health and lifestyle benefits of physical activity (i.e., 30-60 minutes of moderate activity on at least 5 days of the week).

Use the activity log below to make a list of each activity you complete throughout the course of one day. It is best if you can do this as you go along instead of trying to remember everything you did at the end of the day. The first line shows you an example of how to use the log.

At the end of the day, look back over the activities you completed that day. Identify each activity as light, moderate or vigorous. Indicate in the space provided on the log whether you think you could increase either the LENGTH of time or the INTENSITY at which you complete the activity, and indicate how you plan to do this in the space provided on the log.

Finally, decide how you will reward yourself for accomplishing your daily goals, and obtaining a full week of recommended activity.

<table>
<thead>
<tr>
<th>TIME</th>
<th>ACTIVITY</th>
<th>LENGTH (mins/hrs)</th>
<th>INTENSITY</th>
<th>COULD I INCREASE?</th>
<th>HOW WILL I INCREASE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.15 am</td>
<td>Took dog for a walk</td>
<td>15 mins</td>
<td>moderate</td>
<td>yes</td>
<td>take dog for extra trip around the block</td>
</tr>
</tbody>
</table>

**Rewards:**

**Daily Reward(s):**

**Week’s Reward(s):**

Information in this brochure is based on original work by:


Physical Activity Program
Ball Memorial Cardiac Rehabilitation
Week 8, Date, 2009

Maintaining your physical activity level

Great job! You've been at it for about 2 months now. The purpose of this page is keep you motivated and to instruct you on how to vary your activities so you don't get bored. If you've had some trouble sticking to it, review some of the previous pages you were given and get back to it.

A good way to stay motivated to be physically active is to try different activities.
- You might bicycle one day, walk the next and swim on another day.
- You might walk 60 minutes one day, and walk 30 minutes the next day making up the rest of your activity with 30 minutes of heavy housework.
- Do some outdoor housework like mowing the lawn, gardening or raking leaves when the weather allows.
- Consider some major indoor housework like vacuuming the whole house or washing all the windows.

You can also change up your routine by performing the activities for a longer period of time or at a different intensity. Refer to the scale to the left.

Changing up your routine will help prevent you from getting bored, and it also will help you use different muscles. Use the tips below to help you prevent soreness and injury.

Stretch before and after activity. Gentle stretching will help you limber up before activities, and prevent soreness or injuries.
- Hold each stretch for 15-20 seconds
- Do not bounce while stretching
- Slowly apply pressure until you feel a gentle stretch
- Exhale as you apply pressure, then breathe in and out deeply (don't hold your breath!)
- Focus on the muscles that you will be using

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Increasing your physical activity

My Daily Activities

The purpose of this task is to help you determine multiple combinations of activities you can try to avoid boredom. For example, tomorrow you could walk 60 minutes. Day 2 you could walk 30 minutes and bicycle 30 minutes. This is the time for you to be creative. You could even combine moderate and vigorous intensity activities. Use the Borg Scale on the front of this page to determine which activities are moderate and which are vigorous.

<table>
<thead>
<tr>
<th>Activity Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomorrow</td>
</tr>
<tr>
<td>-----------</td>
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<tr>
<td></td>
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</tbody>
</table>

**Bonus:** Most people become physically active for any number of reasons but are often surprised by some unexpected “feelings” such as a sense of well-being, more pep and energy, greater alertness, relaxation, and sleeping better.

Information in this brochure is based on original work by:
Physical Activity Program
Ball Memorial Cardiac Rehabilitation

Week 9, Date, 2009

Avoiding Injury

Follow these tips while being physically active:

- Drink plenty of water while you are active and afterwards
- If it is too hot or too cold outside, do your activity indoors.
- Use proper equipment. Safety equipment, like a bike helmet, is very important.
- Wear loose fitting, comfortable clothes. Wear several layers when it is cold outside.
- Wear sneakers, not everyday or dress shoes while walking.
- For most people, a good pair of sneakers can be the most important piece of equipment. Look for:
  - Proper fit – Keep ¼ inch between your longest toe and the front of the shoe.
  - Width – Women with wide feet may find men’s sneakers to be a better fit.
  - Firm heel – Good sneakers are easy to bend in half.
  - Arch Support – The arch support should fit the natural curvature of your foot.
  - Ventilation – Mesh or leather sneakers allow your feet to breathe
- Be gentle with your body. The saying “no pain, no gain” is NOT true. If you feel pain while doing activity, stop!

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Avoiding injury

Vigorous exercise and stretching

Maintaining good habits while you are physically active will help prevent injury and keep you active. The more active you are, the more health benefits you will see! If you have chosen to increase the intensity of your activities to a vigorous intensity, it is suggested that you stretch before and after exercise. Also make sure to add a warm-up and cool down.

Tips for Stretching:

- Hold each stretch for 15-30 seconds.
- Do not bounce while stretching.
- Slowly apply pressure until you feel a gentle stretch.
- Focus on the muscles you will be using during your activity.

Examples of these stretches are:

**Hurdler Stretch:** This is a hamstring stretch.
  - Sit with right leg extended.
  - The bottom of left foot is touching right knee.
  - Lean forward at the hips until you feel a stretch.
  - Repeat on the left leg.

**Calf Stretch:** This is very important for walking/jogging.
  - Stand facing the wall with your hands against the wall.
  - Lunge one leg back.
  - Bend your front leg and lean into the wall.
  - Press the heel of the back foot down until you feel the stretch in your calf.
  - Repeat on the other leg.

The 3 parts of your activity session

- Allow your body to warm-up during the first 2-5 minutes of your activity.
- After this warm-up, increase to your **workout pace** (if you are feeling good, go ahead and pick up the pace for a few minutes).
  - This pace should be at least at a moderate intensity, however you may use a vigorous intensity, too.
- You should always gradually slow down your pace as you finish your activity session.
  - This **cool-down** period helps your body to gently return to normal.
- If you decide to take multiple 10 minute, moderate-intensity walks, you won’t need to “warm up” or “cool down” as long.
  - You can easily fit these ‘mini’ walks into your day!

The Right Way to Walk for Fun and Fitness...

- Hold your head up and your back straight.
- Bend your elbows as you swing your arms.
- Take long, easy strides.

Information in this brochure is based on original work by:
Physical Activity Program
Ball Memorial Cardiac Rehabilitation

Week 10, Date, 2010

Avoiding Relapse

You have been doing a great job of staying active. But everyone knows that it's easier to make a New Year's Resolution than to keep it! Knowing what to do to prevent or reverse relapse is just as important as deciding to become physically active. Those who take action and relapse are obviously more likely to ultimately succeed as those who don't take action at all!

Avoiding & Preventing Relapse –

Establishing a regular routine is an excellent way to stay with your program. However you need to be prepared for disruption – it happens to everyone! Holidays, travel, sickness, or visitors can disrupt your routine...so be prepared to deal with it. Change your schedule if necessary and don’t feel guilty if you take a day or two off but also plan AND DO return to your regular routine ASAP.

Keep stress from interfering with your good intentions. Periods of stress and disruptions will cause some people to relapse into old habits. Stressful periods are the very times when regular activity is even more important to help cope and provide those feelings of well-being and relaxation. By the way, physical activity is also recommended for managing stress.

Be Flexible & Opportunistic –

If you have an early morning appointment that disrupts your activity time, find time later in the day to be active. If it rains, don’t despair – find something to do inside. Be flexible!

Look for unexpected opportunities to be active during your day. Traveling to another city on business or vacation typically means that you are without your car so you can do more walking just getting from place to place. Don’t forget to choose the stairs when possible!

Report Any Problems
Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
Avoiding Relapse

Dealing with Relapse

Despite our best intentions, everyone’s life has disruptions and relapses. We all get ill or injured, or a work project or family event overwhelms us for a time. One of the most important behavioral skills is being prepared to deal with relapse when it occurs, and the critical message is that “all is not lost”. You can pick up where you left off. Use the space below to revisit some of the potential obstacles you may encounter and your solution to deal with them.

**OBSTACLE:**

Solution:

**OBSTACLE:**

Solution:

**OBSTACLE:**

Solution:

Think positively about yourself and know that relapse is not failure. Refocus and keep on going. Perhaps what distinguishes those who succeed in maintaining from those who don’t is how they view relapse. Those who don’t succeed view a setback as a “catastrophe” and quit. Those who succeed view relapse as merely a “temporary interruption”.

**Tip:**
Don’t get discouraged if you miss your planned activity. Use that as an opportunity to try a new activity that you have not tried before. Who knows…it could be fun!

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Information in this brochure is based on original work by:

REASONS TO STAY ACTIVE

Week 11

Your weight is easier to control.
Physical activity can be lots of fun!
You can be with other people when you are active.
You feel better when you are physically active.
You look better when you are physically active.
Physical activity is good for your heart.
Physical activity is a great way to burn off steam and stress.
Physical activity helps you prevent the blues.
You may feel more confident when you are active.
You have more energy when you are active.

The Road Ahead…

No matter how good your intentions are, at certain points along the way you are likely to falter. It is normal and expected, so don’t give up just because you’ve lost your momentum. There will be times when it is tough to stick to your plan, it’s unavoidable. Don’t let a momentary lapse turn into a total collapse. The following list outlines what you can do to help get back on track:

- **Be honest & analyze**: Admit that you’ve hit a snag. Figure out how long you’ve lapsed, and what knocked you off track.
- **Turn to your support troops**: If you’ve received support and encouragement from friends and family, now is the time to turn to them for a pep talk. It is hard to admit that you’ve faltered, but telling someone else just might help enlist the support you need to get out of the rut.
- **Start self-monitoring immediately**: Start keeping a daily activities log again. What has changed in your routine to throw you off course? What can you do to fit physical activity back into your new schedule? Are there new obstacles? How will you work around them or overcome them?
- **Set new goals**: Maybe you just leveled off because you didn’t have an ultimate goal in mind. If so, set a new one that is realistic, but challenging. Perhaps your long-term goal wasn’t exactly realistic, or you didn’t plan out the best short-term steps to get there. If you shoot too high without a good plan, you will get frustrated when your progress isn’t as fast as you think it should be. Be patient, set more easy short-term goals, and make sure your long-term goal is realistic in the time frame you have planned. It always helps to have someone who knows you and is positive but realistic about your ability evaluate your goals as well.
- **Avoid negative messages**: Program your mind to think positive thoughts. If you are thinking discouraging thoughts, immediately change them to a motivating thought. For example: Change “I am too out of shape to go to the zoo” into “I can’t wait to work myself into good enough shape to be able to go to the zoo!”

Report Any Problems

Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
The Road Ahead…

Avoiding Pitfalls

Often, the potholes on the way to success are easy to anticipate. As long as you prepare for these situations, you can have a plan to avoid or work through them. Below is an activity to help you identify situations that may throw you off course. Identify specific times where these things could occur and how you will adapt to prevent a lapse in your regular physical activity, or how you will get back on track should you be prevented from activity for a bit.

Emotional Upsets: A bad mood can hinder your motivation for activity. When might this occur:

Can you avoid it, if so, how?

What will you do to work through it?

Good Samaritan: Helping a friend in need can take time away from activity. When might this occur:

Can you avoid it, if so, how?

What will you do to work through it?

On the Mend: Getting sick or injured requires rest. Once well, how will you get back on track? When might this occur:

Can you avoid it, if so, how?

What will you do to work through it?

Holiday Madness: There is a lot going on and it is a special time. What will happen to your activity plan? When might this occur:

Can you avoid it, if so, how?

What will you do to work through it?

Remember: 1) It's easier than you think, 2) It takes less time than you think, and 3) The GOAL is to stay active, and the KEY to maintaining is working through pitfalls!
Physical Activity Program
Ball Memorial Cardiac Rehabilitation

Week 12, Date, 2010

I Won’t stop now!

You’ve been active for a while now… make a list of your favorite benefits from physical activity:

1.

2.

3.

4.

5.

You are on your way to meeting the physical activity guidelines of 30 minutes of moderate intensity physical activity for at least 5 days a week. Once you have been doing that for 6 months or more, you have really started to make physical activity a lifelong habit. Congratulations!

This last page is designed to help you keep physical activity a permanent part of your life.

Stay Healthy!

- Wear proper clothing for the weather. Avoid extreme hot or cold, and exercise indoors when the weather is bad.
- Keep your equipment in working condition. When used frequently, sneakers need to be replaced once they start to wear out. If your joints are aching all of a sudden when you walk, see a doctor, but you might want to try a new pair of shoes!
- Drink plenty of fluids when you are active.
- Stretch before and after activity.

Stay on Track

- Vary your activity to keep things fun and exciting.
- Set goals and follow your progress.
- Reward yourself... Exercise can become its own reward too!
- Keep friends and family involved, maybe mentor someone and become their physical activity role model.
- Keep an activity log and use a pedometer. Record your progress and how you feel about activities. Seeing your progress and accomplishment can feel great!

Think positively and problem solve when:

- The weather is bad.
- You hurt yourself or get sick.
- You’re in a bad mood or stressed.
- It’s a holiday or you’re on vacation.

Report Any Problems

Did you have any problems doing physical activity last week? Did anything hurt? If so, be sure to report this to the Cardiac Rehab Program staff.
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Prepare to keep it going

Fill in the following worksheet and use it when needed to stay on track!
Have you ever stopped regular activity in the past?

What caused you to stop?

What did you do to get started again?

What obstacles are likely to be a problem now?

What can you do to prepare for these obstacles?

What will help you get back on track if you stop exercising/doing your daily physical activity?

If you find yourself becoming inactive for a week or a couple of weeks, it can be difficult to get started again. When an activity schedule is interrupted, it can really break up the “habit” of being active. If this happens to you, make a plan to become active again as soon as possible. Set a date and time and pick a specific activity. Once you have gone on that first walk the following ones will be easier and easier!

Congratulations! You are doing what it takes to live a healthier, happier life. Think about the rewards you are giving yourself simply by doing physical activity, and the gift you are giving to your friends and family by staying healthy and being able to enjoy time and life with them!

Information in this brochure is based on original work by: