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## Prehabilitation (Prehab): Prevention in Motion

Billie Russell  
*University of Central Florida*

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PREHABILITATION (PREHAB): PREVENTION IN MOTION

by

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A dissertation submitted in partial fulfilment of the requirements  
for the degree of Doctor of Philosophy  
in the College of Nursing  
at the University of Central Florida  
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## ABSTRACT

Cardiovascular disease is the leading cause of death for U.S. adults. It adds greater than \$100 billion to U.S. health care costs annually. Rates of morbidity, mortality, and economic burden of the disease could be dramatically reduced with improvements in sedentary behaviors among adults with coronary artery disease (CAD). A regular commitment to moderate physical activity can reduce ischemic heart events up to 50%. Although the benefits of physical activity are well-known for individuals with coronary artery disease, an estimated 70% of this population remains relatively sedentary. Hospital-based cardiac rehabilitation programs are the single secondary prevention option offered to improve physical activity habits in persons with CAD. Although effective, cardiac rehabilitation is inaccessible for the majority of CAD sufferers and is offered only after an acute cardiac event.

Different from rehabilitation, prehabilitation (prehab) programs use physical activity as a means to deter a worsening condition or prevent injury before an acute event occurs. These programs have proved successful in other areas of medicine but there are currently no such secondary prevention programs available for stable persons with CAD in the U.S. A home-based prehab program could help adults with CAD establish improved physical activity habits and circumvent many of the barriers associated with admission and attendance of a hospital-based cardiac rehabilitation program.

Researchers have indicated that self-efficacy is key to initiation and sustenance of a regular physical activity habit, regardless of the physical activity program that one attends. These habits are more likely to last when participants receive self-efficacy based support for an average of 66 days. The purpose of this study was to determine if a nurse-practitioner-led, home-based,

prehab program could assist adults with CAD to improve and maintain increased physical activity habits and levels of self-efficacy for physical activity.

The five primary facilitators of self-efficacy were used to devise a 10-week prehab program. A convenience sample of 54 adults with diagnosed CAD was recruited from cardiology practices in St. Johns County, Florida. The research population was 68.5% (n=37) male, 88.9% (n=48) Caucasian, and 74% (n=40) married with a mean age of 68.57 years. Participants attended a 90-minute prehab class which offered health education and group discussion of barriers and goals for regular physical activity. Following the class, participants were contacted weekly for 10-weeks to discuss goal progress, assist in circumventing barriers, and revise physical activity goals as needed. After the 10-week call period, participants were contacted 30-days later to assess for physical activity habit maintenance and any sustained benefit in self-efficacy for physical activity.

Self-efficacy for exercise was measured before the prehab class, after the prehab class, and after the 10-week intervention period using the Short Self-Efficacy Expectations scale (SSEE), Multidimensional Outcomes Expectations for Exercise Scale (MOEES), and the Barriers Self-Efficacy Scale (BARSE). All baseline measures of self-efficacy (MOEES, BARSE, SSEE) improved significantly immediately following the prehab class. Baseline physical outcome expectations of the MOEES (m=21.87, sd=4.67), self-evaluative outcome expectations of the MOEES (m=16.70, sd=4.15) and SSEE (m=12.75, sd=4.02) remained significantly improved after the 10-week intervention period ( $p<.05$ ). At the 10-week assessment, mean significant self-efficacy scores were 24.39 (sd=1.26,  $p<.01$ ) for physical outcome expectations, 18.39 (sd=2.27,  $p<.02$ ) for self-evaluative outcome expectations, and 15.06, (sd=3.25,  $p<.001$ ) for SSEE. The SSEE was reassessed 30-days after the study and remained significantly improved

compared to baseline ( $m=15.65$ ,  $sd=3.42$ ,  $p<.01$ ). Qualitative data collection coincided with the quantitative self-efficacy findings. Participants reported satisfaction with physical activity goal attainment and increased confidence to continue with a regular physical activity plan.

The Godin Leisure-Time Exercise Questionnaire (GLTEQ) was used to assess activity levels at baseline, during each weekly phone call, at the end of 10-weeks, and 30-days after the study. Repeated-measures ANOVA ( $F(2,90) = 21.86$ ,  $p<.001$ ) revealed that participant's baseline physical activity volume measured by GLTEQ ( $m=18.39$ ,  $sd= 16.93$ ) improved significantly after 10 weeks in the prehab study ( $m=41.10$ ,  $sd=24.11$ ,  $p<.001$ ) and remained significantly improved when re-measured 30-days after the study ( $m=39.02$ ,  $sd=21.87$ ,  $p<.001$ ). Qualitative data concurred with quantitative data with participants reporting physical activity habit formation and maintenance of self-regulatory skills. Qualitative data also demonstrated that participants in prehab experienced very similar facilitators and barriers compared to other adults with CAD attempting an exercise program.

In summary, the prehab study findings coincided with other research findings in this area. Self-efficacy based support can assist individuals with CAD to improve and maintain physical activity habits. The ease of the intervention likely contributed to lower cost and attrition rates (7%) compared to hospital-based cardiac rehabilitation programs. Although more research is needed, study findings suggest that a nurse-practitioner-led, home-based program could be a viable secondary prevention strategy for stable adults with CAD. This should be considered for the future given that even modest improvements in physical activity can substantially reduce all-cause mortality in this population.

Foremost, I must dedicate this paper to my husband, James T Russell IV,  
who has tolerated my going to school for the majority of our marriage  
(I promise no more college. . . for a while).

I also dedicate this dissertation to my mother, Carol J. North,  
who convinced me I could do anything that I set my mind to and was willing to work for.

Finally, this is dedicated to my friends and coworkers, Jenny Geller and Susan Romanelli,  
who assisted with the study just because they are spectacular human beings. There is no way I  
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## LIST OF ABBREVIATIONS

BARSE	Barriers Self-Efficacy Scale
CAD	Coronary Artery Disease
CDC	Centers for Disease Control
GLTEQ	Godin Leisure-Time Questionnaire
MI	Myocardial Infarction
MOEES	Multidimensional Outcomes Expectations for Exercise Scale
SSEE	Short Self-Efficacy Expectations Scale
WHO	World Health Organization

## CHAPTER 1 INTRODUCTION

### Introduction

Cardiovascular disease is the leading cause of death worldwide claiming approximately 17.3 million lives in 2008 (World Health Organization [WHO], 2013). Although coronary artery disease (CAD) is the most preventable form of cardiovascular disease, it is responsible for one in every four deaths in the U.S. The effects of CAD add more than \$108 billion annually to U.S. medical costs (Centers for Disease Control [CDC], 2014a). Without substantial changes in measures aimed at CAD prevention, these statistics are expected to increase over the decades to come (Mohamad, Afonso, Ramappa, & Hari, 2013).

The pernicious quality of CAD is partially due to the fact that it progresses insidiously throughout adolescence and adulthood (WHO, 2013). Every year approximately 515,000 U.S. adults unexpectedly experience their first myocardial infarction (MI, “heart attack”). Primary prevention for these individuals is arduous given that they may feel otherwise healthy until the MI. Secondary prevention for the greater than 200,000 adults in the U.S. with known CAD is significantly more straightforward since they can be readily identified by medical providers (CDC, 2014a).

Secondary prevention measures are imperative for adults with known CAD given that they are at high risk for future cardiovascular events (Fleg, Aronow, & Frishman, 2011). One of the most effective and affordable prevention measures of secondary cardiovascular events is regular physical activity. Regular, moderately vigorous, physical activity can reduce the incidence of ischemic heart events up to 30% to 50%. The majority of persons with CAD fail to engage in even the minimal amount of recommended regular physical activity despite the



compelling evidence to support the health benefits (Mohamad et al., 2013; Thompson et al., 2003; WHO, 2011).

Finding a solution to improve sedentary behaviors among adults with CAD is daunting since there are a myriad of individualized barriers to regular physical activity. This problem is further compounded by the fact that there is limited research available that explores how to help individuals with CAD overcome these barriers. Among the research that is available, self-efficacy has proven to be a particularly powerful motivator to overcome physical activity barriers (D'Angelo, Reid, & Pelletier, 2007; Martin & Woods, 2012; Mildestvedt, Meland, & Eide, 2007; Reid et al., 2006; Reid et al., 2007; Reid et al., 2012; Sniehotta et al., 2005; Sweet, Fortier, Strachan, & Chris, 2012). Research in this area has shown that levels of self-efficacy and physical activity participation can be increased through rendering health education (Orakzai et al., 2008), teaching self-regulatory skills (Barkley & Fahrenwald, 2013; Drbošalová et al., 2010), increasing task control with flexible exercise plans (Jolly et al., 2009; Smith, McKelvie, Thorpe, & Arthur, 2011), and offering social support through motivational counseling (Martin & Woods, 2012; Mildestvedt et al., 2007; Reid et al., 2012; Russell & Bray, 2010; Sniehotta et al., 2005). There may be an additive positive effect on physical activity habits when these interventions are combined (Lee, Kuo, Fanaw, Perng, & Juang, 2012; Sniehotta et al., 2005).

The available research findings do not offer a consistent theory-driven method to improve physical activity behaviors in adults with CAD. The most successful methods noted in the literature are consistent with the themes found in self-efficacy theory. The purpose of this study was to explore the effect of an intervention based on self-efficacy theory to improve physical activity behaviors in American adults with known CAD. In accordance with self-efficacy theory, this researcher employed the use of past experiences, verbal persuasion, vicarious learning, and a

positive psychological state in order to improve self-efficacy judgments. According to Bandura (1977) when these self-efficacy facilitators are combined with self-regulatory skills, the likelihood that meaningful behavioral change will take place is greatly increased. Although self-efficacy can facilitate behavior change, it can still take considerable time to turn a major behavior change into a habit. It is proposed that a habit formation, such as adopting a committed practice of regular physical activity, takes an average of 66 days (Lally, Van Jaarsveld, Potts & Wardle, 2010). This research study examined the impact of a self-efficacy based intervention over a 10-week period on the physical activity habits of American adults with diagnosed CAD.

### Background

The rate and severity of CAD is strongly influenced by a few main risk factors: dyslipidemia, hypertension, tobacco use, diabetes, obesity, psychosocial factors, dietary choices, and inactivity. These risk factors, that are largely modifiable, contribute to approximately 80-90% of all myocardial infarctions to some degree (WHO, 2014; Yusuf et al., 2004). Increasing physical activity is likely the most effective and affordable intervention to curtail the majority of these modifiable CAD risk factors and improve CAD related outcomes (Eriksson & Gard, 2011; National Institutes of Health, 2013; Lavie & Milani, 2011; Thompson, et al. 2003; WHO, 2014).

Physical inactivity is so deleterious that it is established as the fourth leading cause of global mortality (WHO, 2014). In the U.S., sedentary behavior adds more than \$24 billion in annual medical costs. It is proposed that even a 10% increase in physical activity among sedentary adults would save more than \$5 billion annually (Chenoweth, & Leutzinger, 2006; Pratt, Macera, & Wang, 2000). Despite the well-known financial and health benefits to regular physical activity, 80% of average American adults (U.S. Department of Health and Human

Services, 2013) and 70% of U.S. adults with known CAD (Beswick et al., 2004) do not participate in even the minimum amount of recommended physical activity.

Research aimed at helping adults with CAD improve their physical activity habits is necessary given that it can slow, reduce, or possibly reverse atherosclerotic disease (Lavie & Milani, 2011; Thompson et al., 2003). Research findings support that individuals with increased physical activity have a reduced incidence of CAD events and CAD related symptoms (Chenoweth & Leutzinger, 2006; Thompson et al., 2003). In part, this occurs because regular exercise can increase atrial natriuretic peptide and decrease cardiac inflammatory markers that correlate with a decreased risk of cardiovascular mortality (Almeida et al., 2012; Luk et al., 2012; World Heart Federation, 2014). Exercise additionally improves cardiovascular outcomes by reducing low-density lipoprotein levels, raising high-density lipoprotein level, improving the body's insulin usage, decreasing body weight, decreasing depression, building collateral circulation, and lowering blood pressure (Jolly et al., 2009; Tudor-Locke et al., 2004; World Heart Federation, 2014). Although the medical benefits of regular physical activity are well-documented, there is a lack of available research which examines how to help others develop lasting physical activity habits. Future research that can help people establish a more active and healthy lifestyle for secondary cardiovascular event reduction is needed.

Acknowledging known barriers and facilitators to establishing a regular physical activity habit are essential building blocks for a future program aimed at helping others change sedentary behaviors. Health care providers are better able to develop successful interventions aimed at improving the health habits of individuals when they can help others avoid known pitfalls and maximize on known facilitators to regular physical activity practices. Although the research that examines this for adults with CAD is limited, there is a larger body of research available that

addresses barriers and facilitators to exercise experienced by the general population from which to draw upon.

Motivation is the cardinal factor that differentiates individuals who remain committed to exercise and individuals who do not (Reid et al., 2012). Socio-economic, physical, personal, and environmental elements contribute to a person's motivational drive. Items that are known to correlate with increased motivation for regular physical activity include postsecondary education, increased income, exercise enjoyment, social interaction during physical activity, access to facilities, and knowledge of physical and emotional benefits of physical activity (Soni et al., 2004; U.S. Department of Health and Human Services, 2013). Factors negatively associated with motivation to exercise include advancing age, lower income, lack of time, rural residency, increased weight, perception of poor health, and physical disability (Soni, 2004; Trost, Owen, Bauman, Sallis, & Brown, 2002; U.S. Department of Health and Human Services, 2013).

Researchers have suggested that motivation for physical activity commitment varies by age group (Soni, 2004). In adolescence, individuals are motivated by desires to improve fitness. As people transition to young adulthood, interpersonal reasons as well as desired fitness promote physical activity behaviors. Individuals between 18 and 44 are the most likely to engage in moderate physical activity three times a week and maintain a healthy weight. During middle adulthood there is an uptick in reasons to exercise that include fitness, interpersonal influences, desire for improved body image, and psychological and physical health. After age 50, exercise motivation is dictated by desires for fitness and health (Louw, Van Biljon & Mugandani, 2012; Segar, Spruijt-Metz, & Nolen-Hoeksema, 2006; Soni, 2004).

Factors such as gender, ethnicity, and disease process can influence physical activity motivation in the general population. Men are more often motivated by competition and strength

whereas women are more motivated by appearance and weight management (Egli, Bland, Melton, & Czech, 2011; Quindry, Yount, Bryant, & Rudisill, 2011). Ethnicity trends show that Caucasians are more likely to engage in regular physical activity compared to Hispanics and African Americans (Soni, 2004). Chronic disease is a major deterrent to regular physical activity. Among adults with at least one chronic disease, 50% reported that their health problem was a barrier to regular exercise (Murphy, Sheane, & Cunnane, 2011; Crizzle & Newhouse, 2012).

### Statement of the Problem

CAD events can be dramatically reduced with improved physical activity behaviors (Thompson et al., 2003), but this action is rarely practiced (CDC, 2014b). In fact, 40% of adult Americans report that they participate in no leisure-time physical activity. Sedentary behaviors are often worse in individuals with CAD, as they are more likely to be older and have more comorbidities (CDC, 2010). Additionally, persons with CAD have concerns about pain, injury, or worsening their cardiovascular condition which further hampers their physical activity habits (Reid et al., 2006; Reid et al., 2007; Rogerson, Murphy, Bird, & Morris, 2012).

Cardiac rehabilitation programs offer an exceptional opportunity for individuals with CAD to overcome concerns about regular physical activity. Cardiac rehabilitation offers education, social support, and access to exercise equipment that positively influence physical activity habits long term (American Heart Association, 2014; Mampuya, 2012; Martin & Woods, 2012; Rogerson et al., 2012; Russell & Bray, 2010; Throw, Rafferty, & Kelly, 2008). The success of cardiac rehabilitation programs is so dramatic that they are a class I recommendation by cardiovascular societies worldwide (Mampuya, 2012). Despite their success, these programs are either underutilized or inaccessible to most adults with CAD (Mampuya, 2012). Many adults

with CAD who may benefit from rehabilitation do not receive a referral. Middle aged Caucasian men are more likely to receive a referral than individuals of other age groups, ethnic backgrounds, and gender. Of individuals who receive a referral, greater than 50% fail to attend or complete their cardiac rehabilitation program (Menezes et al., 2014). Other factors related to underutilization include lack of accessibility, depression, high insurance co-payments, poor health education level, and low socioeconomic status. Individually tailored home-based exercise programs have shown promise at circumventing many of these barriers (Mampuya, 2012), but they are not widely used in the U.S. (Karjalainen et al., 2012).

There are several reasons to consider implementation of home-based physical activity programs for individuals with CAD. First, home exercise allows individuals to perform activities of their own choosing that they will be more likely to enjoy. Secondly, this type of program does not necessarily require expensive equipment. Rather, many home activities such as gardening and walking require little more than proper shoes. Third, individuals who initiate their own home exercise program are able to enjoy greater schedule flexibility. Although on the surface a home program appears less rigorous compared to a hospital-based program, more moderate forms of activity still result in substantial health benefit (Franklin, Balady, Berra, Gordon, & Pollock, n.d; Jolly et al, 2007; World Heart Federation, 2014). Fourth, home-based programs which allow adults with CAD to form their own independent physical activity plan, may lead to greater persistence of physical activity expenditure over a six-year period compared to a hospital-based program (Smith et al., 2011). Finally, home based programs could allow a broader inclusion of stable adults with CAD who would benefit from a prevention program.

The idea of prevention programs before injury or illness occurs is a relatively new concept in the research literature. These programs are often termed prehabilitation (prehab).

Unlike rehabilitation where treatment is offered after a problem, prehab focuses on improving and individual's current condition or deterring a worsening condition. The focus of these programs are to improve functional capacity through the use of increased physical activity before injury or illness occurs (Gill et al., 2003; Kibler, Chandler, & Stracener, 1992; Sawatzky et al., 2014). Prehab programs have been used to focus on a muscle group that is anticipated to undergo overtraining and be high risk for injury such as a pitcher's arm muscles (Kibler, et al., 1992). Prehab has also been used to focus on frail homebound elderly to thwart future falling and injuries (Gill, et al., 2003). In the cardiovascular area, the idea of prehab has been used to improve the physical status of adults with known CAD preparing to undergo elective coronary bypass surgery (Sawatzky, et al., 2014).

Despite the benefits of regular physical activity and the ease of maintaining a physical activity regimen at home, the majority of individuals with CAD remain sedentary. The recurrent factor found in the literature that differentiates individuals who overcome physical activity barriers and those who do not is self-efficacy (Martin & Woods, 2012; Mildestvedt et al., 2007; Reid et al., 2007; Sweet et al., 2011; Tulloch et al., 2009). Self-efficacy beliefs are responsible for shaping the way in which one processes physical activity impeders and facilitators. Self-efficacy determines the extent to which an individual perceives control over their own exercise habits and ability to overcome setbacks. Self-efficacy levels can be increased by outside influences when its facilitators are applied (Bandura, 2004). Although self-efficacy plays a fundamental role in the process of personal change and health promotion practices, there is exiguous research available that examines how to improve this in the CAD population.

### Purpose of the Study

This prehabilitation study builds upon primary research findings discussed in the background literature:

- There are recurring motivators and barriers experienced by individuals who struggle with maintaining a regular physical activity habit.
- Establishing a regular physical activity practice can dramatically improve cardiovascular health.
- With an improvement in levels of self-efficacy, individuals can change the way they perceive barriers to physical activity and are more likely to establish long term health habits (Bandura, 1977).

The research is limited in regard to how outside influences can inspire improved self-efficacy for physical activity in adults with CAD. Research is also limited in regard to how self-efficacy based interventions can produce sustained change in physical activity habits among this population (Sharp, & Freeman, 2009). Exploring this area of research further is paramount given that regular physical activity can dramatically reduce secondary cardiovascular events and in turn, decrease rates of morbidity, mortality, and economic burden in the U.S. (U.S. Preventive Services Task Force, 2002; WHO, 2007). The purpose of this dissertation was to test a self-efficacy based intervention to assist adults with CAD improve their self-efficacy for physical activity and physical activity behaviors.

### Research Questions and Aims

1. What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of self-efficacy for physical



- activity after a 10-week intervention, and can it be maintained for 30-days after the study?
2. What is the effect of a nurse-practitioner-led prehab program for persons with coronary artery disease (CAD) on physical activity volume after a 10-week intervention, and can it be maintained for 30-days after the study?

### Definitions of Terms

Physical Activity. Throughout the CAD research, the terms “physical activity” and “exercise” are often used interchangeably. However, there are subtle differences that should be considered. Physical activity is defined as any musculoskeletal movement greater than resting expenditure (Thompson et al., 2003). It is motion that burns calories through a variety of activities such as play, work, household chores, exercise, and recreational activities (WHO, 2011). It is imperative to consider all forms of physical activity for the CAD population since increases in any type of physical activity can result in healthy benefits. In fact, moderate physical activity of 150 minutes a week can reduce CAD up to 30% and reduce premature death due to CAD up to 50% (World Heart Federation, 2014).

Exercise. Exercise, which is a subset of physical activity, can provoke negative connotations. Exercise is physical activity that is planned and repetitive for the purpose of improved health and physical fitness (Thompson et al., 2003). In general, exercise is defined as “a potential disruption to homeostasis by muscle activity that is either exclusively, or in combination, concentric, eccentric, or isometric (Winter & Fowler, 2009, p. 447).” Encouraging physical activity rather than exercise alone allows for individuals to include a wider variety of desired activities into their routine that still produce substantial health benefit (CDC, 2014).

Cardiac Rehabilitation. Cardiac rehabilitation is discussed at length in the review of CAD literature as a beneficial physical activity program aimed at secondary prevention. These programs include, but are not limited to, diet teaching, exercise training, as well as social and psychological support to individuals with CAD. The goals of cardiac rehabilitation include promotion of autonomy, increased regular physical activity, improvement of modifiable cardiovascular risk factors, education surrounding the benefit of healthful lifestyle changes, and management of health related psychological concerns with CAD (Mampuya, 2012). The strict admission criteria and poor referral processes contribute to a substantial underutilization of the program. The vast majority of adults with CAD, who have not had a recent acute cardiovascular problem, are excluded from the benefits of cardiac rehabilitation. (Centers for Medicare and Medicaid Services, 2014; Jhavar et al., 2013; King, & Lichtman, 2009; Lavie, & Milani, 2011).

Prehabilitation. Prehab programs are preventive programs aimed at improving functional capacity through the use of increased physical activity (Gill et al., 2003; Kibler, Chandler, & Stracener, 1992; Sawatzky et al., 2014). The premise of prehab programs is imperative as the U.S. health care environment shifts from one of problem treatment to one of wellness and prevention. For the purposes of this research endeavor, prehab refers to measures taken to improve physical activity behaviors in adults with known CAD in order to reduce cardiovascular risk factors and deter future cardiovascular events. Prehab will focus on prevention of a worsening CAD condition. The primary focus of prehab is on physical activity with an understanding that physical activity indirectly improves other processes that worsen one's cardiovascular condition. Prehab can be performed from home without structure and rigorous supervision (Gill et al., 2003; Kibler, Chandler, & Stracener, 1992; Sawatzky et al., 2014).

Motivation. Several terms are used in the literature to describe motivation to maintain regular physical activity. These include, intrinsic motivation, extrinsic motivation, self-efficacy, self-determination, and exercise adherence. Motivation is the desire that incites a person to action. Motivation causes direction and can result in persistent behavior or cessation of behavior (Cheng & Yeh, 2008; Janpour, 2009; Whitehead, 1993). Motivation is driven by the innate desire to be competent and effective. When an individual experiences a feeling of efficacy they are more likely to experience further motivation to continue the behavior (Bandura, 1991; White, 1959). Motivation is considered the principle behavioral influence for initiation and persistence of physical activity (Amireault, Godin, & Vezina-Im, 2013; Whipple, Combs, Dowd, & Elliott, 2011).

Motivation for physical activity is measured by examining two primary indicators in the literature: self-efficacy and physical activity volume. Higher levels of self-efficacy have been found to correlate with initiation and continuation of exercise practices. Self-efficacy is linked to the confidence and perceived capability that one can be successful with an exercise regimen (Bandura, 1977; Resnick, 2008). Physical activity volume is the most objective measure of motivation. Physical activity volume refers to the time and duration that an individual maintains a regular physical activity practice. When an individual adheres to physical activity long term, it is assumed that they are outwardly displaying motivation (WHO, 2007).

Much of the motivational research differentiates motivation by intrinsic and extrinsic motivation. Intrinsic motivation refers to motivation that occurs because one receives pleasure or satisfaction from doing a particular activity. Intrinsic motivation can be propelled by self-efficacy and self-determination. Conversely, external motivation is influenced by winning, reward, or to avoid punishment or disease (Deci, 1976; Pelletier et al., 1995; Sebire, Standage, &

Vansteenkiste, 2009). Discussion of external motivation is limited in the CAD literature likely due to the fact that internal motivation has shown to be more effective at sustaining exercise motivation. However, external motivation should be considered given that the threat of disease and desire for health can be a powerful driver to initiate a physical activity practice (Reid et al., 2007).

Self-determination. Self-determination refers to motivation that originates from within oneself. Although self-determination is self-driven, it is influenced by support from others, psychological needs, and motivational level. According to Ryan and Deci (2000), motivation that is self-driven is more likely to result in goal attainment. Perceived confidence is one of the major determinants of one's level of self-determination (Sweet, et al., 2012). The definition of self-determination overlaps greatly with the premises surrounding self-efficacy.

Self-efficacy. Self-efficacy, which was the most frequently used term to describe motivation in the literature, is quite similar to the definitions of self-determination and motivation. It is the belief that one has control over his or her health practices despite adversities. Self-efficacy determines how one is motivated and behaves. A robust sense of self-efficacy assists an individual to persevere and succeed at a given task. Self-efficacy beliefs fuel motivation especially when individuals believe that they can achieve the outcomes they desire (Bandura, 1977, 1988).

Health Behavior Change. Considerable time and effort are generally required in order to break existing unhealthy habits and replace them with new healthy behaviors. Health behavior change refers to the “the long term process characterized by initiation of a new health-promoting behavior and maintenance of this behavior over time (Lally & Gardner, 2013, p. S138)” When individuals were followed over time to assess how long it would take to make a health behavior

change a habit the range was considerable, from 18 to 254 days. It is proposed that the more frequently that an action is performed, the sooner the health behavior change will become an automatic response. In a study performed by Lally et al. (2010) when health behavior changes occurred (e.g., healthier diet and exercise), it was determined that the median time to reach asymptote was 66 days.

### Importance of the Study and Knowledge to be Gained

According to Bandura (2005), the quality of life is influenced in large part by the lifestyle habits that one chooses. If medicine were able to place just a few of the benefits positive lifestyle changes such as regular physical activity into a medication, it would be considered a major medical advancement (Bandura, 2005). Although the benefits of a healthy lifestyle have been documented, current research does not adequately address how to assist adults to initiate and sustain the needed lifestyle change. More research is needed to determine how individuals improve their efforts at sustaining a regular physical activity program (McAuley et al., 1992).

The timeliness of this study is influenced by recent changes in the healthcare environment through the implementation of the Affordable Care Act. Specifically, there has been a growing focus on health promotion and disease prevention as a means of controlling healthcare costs (U.S. Center for Medicare and Medicaid Services, 2013). Testing an intervention designed to increase physical activity for persons with CAD is timely and warranted, as payment models become increasingly based on patient outcomes. It is expected that three main goals will be obtained through the implementation of a theoretically-based intervention to improve physical activity adherence among adults with CAD. First, this study was intended to add to the current body of research that examines motivation to exercise in this population. Second, this study was

a further exploration of how to improve self-efficacy for physical activity and thus produce improved activity adherence for secondary prevention of CAD events. Third, this study was intended to demonstrate a realistic intervention for use in practice with this population in the primary care setting under the direction of a nurse practitioner.

## CHAPTER 2 REVIEW OF THE RELEVANT LITERATURE

### Overview of the Chapter

Chapter 2 contains an overview of the relevant research available in the area of physical activity behaviors in adults with CAD. The goal of Chapter 2 is to critically evaluate the most significant findings in regards to motivators, barriers, relevant theoretical research, and interventions that affect physical activity behaviors. An appendix is offered at the end of this dissertation that outlines each of the studies found in this area of research (Appendix A) This chapter is divided into several sections. First, the theoretical research findings related to self-efficacy are discussed. Second, a synthesis of the research is provided and linked to the five primary facilitators of self-efficacy theory: previous experience, vicarious learning, verbal persuasion, favorable psychological state, and self-regulatory skills. Third, the studies are compared in terms of study setting, design, and intervention. Forth, strengths and weaknesses of the studies are discussed in order to evaluate the significance of study findings. Finally, suggestions to address gaps in the current research are discussed along with ideas for future research direction.

### Review of Theoretical Literature

#### Self-efficacy Theory.

Self-efficacy theory is a sub-theory of the larger social cognitive theory (Bandura, 1994). Self-efficacy theory has been used frequently in the research to explain and predict physical activity incentive and commitment in adults with CAD (D'Angelo et al., 2007; Mildestvedt et al., 2008; Reid et al., 2007; Sniehotta et al., 2005). This theory proposes that environmental,

behavioral, personal, and cognitive factors work together to shape an individual's self-efficacy for health practices (Bandura, 2004). One's level of self-efficacy is the core determinant of behavior change (Bandura, 2004). Self-efficacy level is influenced by knowledge of health benefits and risks, perceived control over one's health practices, anticipated outcome expectations of health practices, and perceived facilitators and barriers to a change in health behaviors. Self-efficacy is impacted by confidence, social norms, and outside positive encouragement (Bandura, 1977).

According to Bandura (1977), self-efficacy regulates human behavior in four major ways. First, self-efficacy affects cognitive function. Individuals with high self-efficacy tend to accept difficult challenges, set high expectations for themselves, and remain committed to meeting those expectations. Second, self-efficacy determines motivational tendencies. Individuals who have higher levels of self-efficacy stay motivated by setting goals and planning how to meet those goals. Self-efficacy determines how high goals are set, the energy expenditure to reach goals, and how long one will persevere to meet those goals. Third, self-efficacy influences coping abilities. This is because self-efficacy drives the magnitude in which people perceive motivators and barriers toward reaching their desired goal. Fourth, self-efficacy is linked to one's mood. Individuals with higher self-efficacy exert more control over their depressive feelings or threat perception (Bandura, 1977).

Self-efficacy is negatively affected when people set unrealistic expectations for themselves, see themselves as vulnerable, or perceive their performance poorly (Bandura, 1988). Self-efficacy progresses negatively when individuals lack knowledge about health risks and benefits of a particular health practice. Without knowledge of the risks and benefits of a particular health activity, one is more likely to engage in unhealthy activity and less likely to



adopt new health habits. Individuals who have low self-efficacy expect their efforts to be futile in improving their health outcomes, which culminates in cessation of positive health practices (Bandura, 2004). Additionally, lower levels of self-efficacy correlate with greater levels of depression, feelings of defeat, and unsatisfying social relationships (Bandura, 1997).

Self-efficacy can be fostered through the use of several modeling techniques. These include being able to see others perform the desired task, being able to practice the technique in a safe environment, and being able to obtain guidance when needed. As practice continues, self-efficacy improves and eventually task mastery is obtained. The result of higher levels of self-efficacy is a feeling of empowerment to control health circumstances even in the setting of adversities (Bandura, 2004; Plonczynski, 2000). Additionally, higher levels of self-efficacy result in higher levels of work expenditure, greater activity participation, and more activity interest (Zimmerman, 2000).

Self-efficacy can be developed through psychological measures. These psychological measures are aimed at providing needed tools to manage barriers and assist one in taking control over their own behavior through self-regulatory processes. The 4 primary psychological measures which determine one's self-efficacy and ability to adopt self-regulatory behaviors include: previous experience, vicarious learning, verbal persuasion, and maintaining a favorable psychological state (Bandura, 1977, 1997). Previous experience pertains to one's previous success at overcoming obstacles and achieving success at meeting goals. Individuals who have persevered through difficulties are less likely to be discouraged by failures. Vicarious learning refers to the power of social modeling. In other words, if an individual can identify a person who succeeds at a task, they are more likely to believe that they also have the capacity to succeed. Alternatively, when a person observes another person fail at an activity, it can instill doubt that

the goal can be achieved. Verbal persuasion is the encouragement one receives to believe in his or herself. Verbal persuasion also includes helping people avoid situations where they are likely to fail. Maintaining a favorable psychological state pertains to taking measures to reduce stress and depression (Bandura, 1977). Together, these four primary facilitators of self-efficacy shape one's self-efficacy judgements.

In addition to the four primary facilitators of self-efficacy, one of the primary determinants that promotes sustained behavior change is self-regulation. Self-regulation relates to the practice of being able to adopt standards, keep track of behavior, and set incentives for meeting one's goals. Self-regulation skills are necessary in order to sustain efforts until the goal is achieved. Self-evaluation is critical to self-regulation in that it allows a person to gain a sense of well-being when goals are accomplished (Bandura, 1991). Self-regulatory skills are linked to goal setting, goal comprehension, higher self-efficacy, and goal attainment (Blanchard, 2012). Short-term, internally motivated goals tend to be the most effective type of goals to produce behavior change (Bandura & Schunk, 1981). In summary, Bandura's social cognitive theory proposes that stronger perceived self-efficacy, which is driven by self-regulatory skills equates to higher activity goals and a firmer commitment to those goals (Bandura, 2004).

### Review and Evaluation of Research Literature

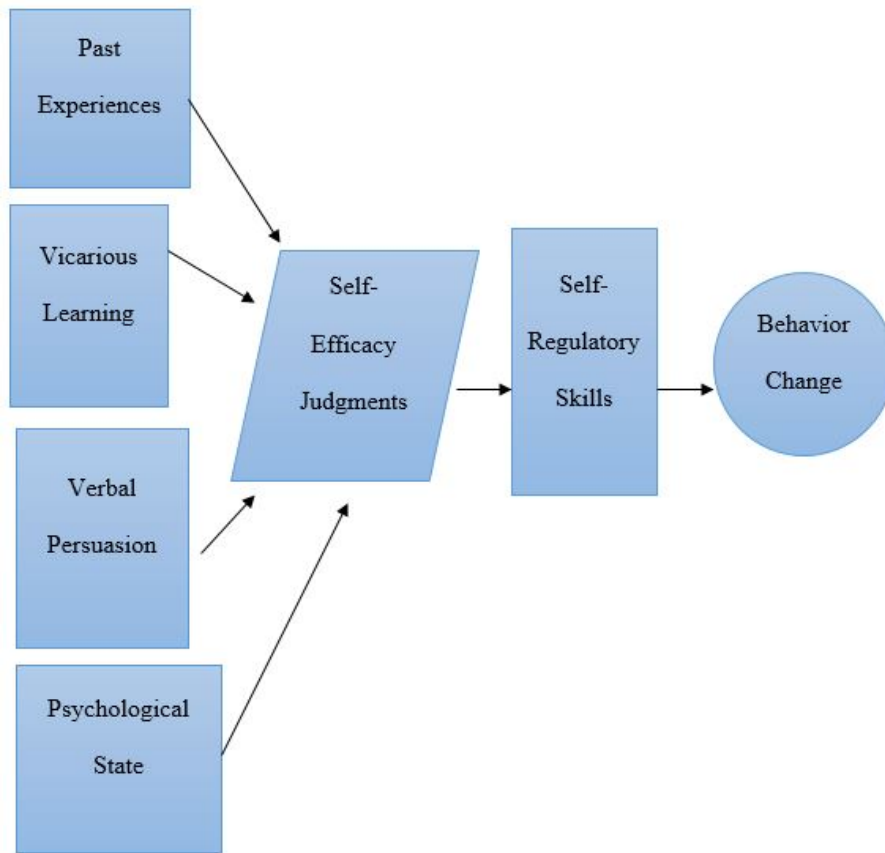
A total of 20 studies were identified which examined themes associated with improved and sustained physical activity behaviors in adults with CAD. These themes were consistent with self-efficacy theory even when the theory was not specifically used. All studies that were retained for the review investigated physical activity behaviors beyond four weeks, because it is known that it may take at least that long to establish a new health behavior change (Lally et al.,

2010). In the studies that were retrieved, self-efficacy for physical activity was consistently measured either by exercise volume, self-reported exercise adherence, or a survey measures. A chart outlining each study size, sample, research technique, length, results, and theoretical measures used is provided in Appendix A.

Self-efficacy was repeatedly linked to exercise intentions and planning (D'Angelo et al., 2007; Sweet et al., 2011), exercise behavior change (Mildestvedt et al., 2007), and exercise adherence (D'Angelo et al., 2007; McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; Mildestvedt et al., 2007; Reid et al., 2007; Sniehotta et al., 2005; Sweet et al., 2011; Throw et al., 2008; Tulloch et al., 2009). When those with CAD complied with a long-term exercise plan, they were consistently found to have high levels of self-efficacy (Martin & Woods, 2012; Mildestvedt et al., 2007; Reid et al., 2007; Sweet et al., 2011; Tulloch et al., 2009). Studies in this area of research indicate that self-efficacy is the primary mediator between exercise motivation and behavior change.

Given the strong influence of self-efficacy on exercise behaviors in the CAD population, it is imperative to examine what measures can assist others in increasing self-efficacy for physical activity. Only a few of the research studies in this area were examined what improves self-efficacy. More often, studies retrospectively interviewed persons with CAD and found that social support, health knowledge, structured class, and self-regulatory skills correlated with higher levels of self-efficacy (Martin & Woods, 2012; Woodgate, Brawley & Westen, 2006). When intervention attempts were made to improve self-efficacy, it was found that social support, education, (Barkley & Fahrenwald, 2013; Mildestvedt et al., 2007; Reid et al., 2012) and encouraged self-regulatory skills (Barkley & Fahrenwald, 2013; Drbošalová et al., 2010; Sniehotta et al., 2005) were persuasive measures resulting in increased physical activity

behaviors. Figure 1 shows the self-efficacy model and the facilitators that contribute to behavior change.



*Figure 1.* Self-efficacy Model: Facilitators That Contribute to Behavior Change

### Past Experiences

According to Bandura (1977), previous experience is an influential motivator of self-efficacy and positive health behaviors. Previous experience is built upon performance exposure, a safe environment to model behavior, and an opportunity for self-instructed practice. When individuals identify previous experience as a personal mastery the effects of occasional failures diminishes (Bandura, 1977). In accord with self-efficacy theory, previous physical activity behavior was one of the most powerful predictors of future physical activity habits among

individuals with CAD (Reid et al., 2007; Tulloch et al. 2009). This helps explain the success of both home and hospital-based cardiac rehabilitation programs given that they allow for a safe environment in which to practice physical activity behavior that in turn builds confidence for sustained behavior change (Jolley et al., 2007; Martin & Woods, 2012; Mildestvedt et al., 2007; Rogerson et al., 2012; Throw et al., 2008; Russell & Bray, 2010).

### Vicarious Learning

One of the best examples of successful vicarious learning suggested in the research was cardiac rehabilitation. Cardiac rehabilitation was a compelling motivator of sustained physical activity in individuals with CAD (Barkley & Fahrenwald, 2013; Martin & Woods, 2012; Reid et al., 2006; Reid et al., 2007). Cardiac rehabilitation provides an ideal environment for live and symbolic modeling where others with CAD are participating in regular physical activities despite obvious barriers. These programs reduce anxiety, improve self-efficacy, and increase self-reported physical activity (Parent & Fortin, 2000). Individuals with CAD who attend cardiac rehabilitation have cited that the company of others and sharing a similar experience results in improved motivation for continued physical activity (Jolly et al., 2007).

### Verbal Persuasion

Verbal persuasion is vital to improving physical activity behaviors in adults with CAD. One way in which verbal persuasion was instituted in the research was through the use of education. Education about health risks associated with CAD correlated with an uptick in initial exercise behavior change (Orakzai et al., 2008; Reid et al., 2007; Sniehotta et al., 2005; Tulloch et al. 2009). Education about the long-term benefits of exercise and its ability to reduce further

risk resulted in longer-term benefits compared to disease threat alone. Individuals with CAD who understood the health benefits of physical activity were more likely to display a sustained commitment to regular physical activity (Martin & Woods, 2012; Reid et al., 2007; Rogerson et al., 2012; Throw et al., 2008).

Other forms of verbal persuasion were found in the literature in the form of encouraging statements from rehabilitation staff (Barkley & Fahrenwald, 2013), motivational counseling (D'Angelo et al., 2007; Jolly et al., 2007; Mildestvedt et al., 2007; Reid et al., 2011; Russell & Bray, 2010), individually tailored exercise plans (Karjalainen et al., 2012), group therapy, and individualized therapy (Mildestvedt et al., 2008). When long time exercisers with CAD were interviewed, verbal persuasion in the form of social support obtained from others in cardiac rehabilitation was cited as vital to long term exercise commitment (Martin & Woods, 2012; Throw et al., 2008). Regardless of the verbal persuasion provided, exercise expenditure improved to at least some degree in individuals with CAD in the examined studies.

### Psychological State

Adults with CAD reported a variety of conditions which directed their psychological state toward habitual physical activity. In general, higher levels of self-efficacy were associated with a more positive psychological state toward physical activity (Barkley & Fahrenwald, 2013; Woodgate et al., 2007) Factors found that swayed one's psychological state toward physical activity maintenance included desire to stay nimble, improve strength, have increased energy, and receive enjoyment (Throw et al., 2008). Psychological state for physical activity was also found to be influenced by perceiving fewer barriers to physical activity and understanding the

psychological and physical benefit of regular physical activity (Reid et al. 2007; Throw et al., 2008; Orakzai et al., 2008; Rogerson et al., 2012).

There were several factors noted in the research literature that negatively affected the psychological state of adults with CAD attempting to establish a physical activity regimen. Inadequate social support, depression, boredom (Drbošalová et al, 2010; Rogerson et al., 2012), and lacking knowledge of the benefits of exercise (Sharp & Freeman, 2009) were frequently cited as reasons to desert a physical activity plan. When CAD adults felt fearful of exercise or mistakenly believed their health condition hampered their ability to exercise they were more likely to remain sedentary (Karjalainen et al., 2012; Mildestvedt et al., 2008; Rogerson et al., 2012). Ethnic minorities and adults over the age of 70 were more likely to cite health-related problems as a reason for not adhering to an exercise program. Women tended to report domestic tasks as a reason for being too time-constrained for regular physical activity (Jolly et al., 2007). Time was repeatedly found to be one of the most significant psychological barriers to regular physical activity. In every study found in this area of research, adults with CAD decreased their exercise commitment as time passed (Drbošalová et al, 2010; Karjalainen et al., 2012; Russell & Bray, 2010; Sharp, & Freeman).

Cardiac rehabilitation programs offer several methods of reducing these stressors that can affect one's psychological state for physical activity. Rehabilitation programs offer social support, structured exercise environments, education, and access to exercise equipment that reduce psychological barriers to activity adherence (Martin & Woods, 2012; Rogerson et al., 2012; Throw et al., 2008; Russell & Bray, 2010). Cardiac rehabilitation programs promote important factors related to adherence such as schedule, routine, and habit. Attendees of this type of program, particularly adults who are retired, cite that cardiac rehabilitation instills a sense of

purpose and identity (Jolly et al., 2007). Cardiac rehabilitation programs offer supportive autonomy, in which theories have linked to increased self-determination and long-term exercise adherence (Russell & Bray, 2010; Mildestvedt et al., 2008). Although hospital-based cardiac rehabilitation can be instrumental in providing a favorable psychological state for individuals who are attempting to form new exercise habits, rehabilitation programs present insurmountable barriers for others. Lack of transportation, lack of practitioner referral, long travel times, and cost have all been cited as deterrents to cardiac rehabilitation attendance (Jolly, 2007; Martin & Woods, 2012).

Home-based cardiac rehabilitation programs have offered one method to circumvent barriers to attending a hospital-based cardiac rehabilitation program. Home-based rehabilitation offers flexible scheduling and therefore are particularly useful for individuals who work or have other time constraints. Additionally, home-based programs offer individuals a way to implement physical activity behaviors of their own choosing (Jolly et al., 2007; Smith et al., 2011). In fact, when home-based cardiac rehabilitation programs have been evaluated against hospital-based programs they produce equal (Jolly et al, 2007; Mildestvedt et al., 2007; Sweet et al.,2011) or better (Smith et al., 2011) outcomes in terms of CAD risk reduction, exercise participation, and long term exercise adherence.

### Self-Regulatory skills

Self-regulatory skills are the tools which transition increased self-efficacy into sustained health behavior change (Bandura, 2004). Self-regulatory skills are linked to greater exercise expenditure (Sniehotta et al., 2005; Drbošalová et al., 2010) and long term exercise maintenance (Mildestvedt et al., 2008; Russell & Bray 2010; Sweet et al., 2011) in individuals with CAD.



Learning to set goals and overcome barriers through the use of self-regulatory skills is indispensable for long term exercise adherence (Jolly et al., 2007; Martin & Woods, 2012). These skills have been fostered by asking individuals with CAD to keep activity diaries (Barkley & Fahrenwald, 2013; Reid et al., 2011; Sniehotta et al., 2005), make action plans (Sniehotta et al., 2005), measure activity via accelerometers (Karjalainen et al., 2012), record pedometer activity (Drbošalová et al., 2010; Reid et al., 2011) and initiate goal setting (Reid et al., 2011). Goal setting, both short term and long term, are vital in self-regulation. It is known that short term obtainable goals with options for revision assist individuals in meeting their long term goals (Bandura & Schunk, 1981; Manderlink & Harackiewicz, 1984; Miller & Brickman, 2004; Williams, Donovan, & Dodge, 2000). The research additionally demonstrates that when adults with CAD are asked to engage in a combination of self-regulatory behaviors that physical activity improved more than a single self-regulatory practice alone (Sniehotta et al., 2005; Drbošalová et al., 2010).

#### U.S. Based Study

The literature review yielded one research study which was conducted in the U.S. (Barkley & Fahrenwald, 2013). This study was notable given that it coalesced the five primary facilitators to self-efficacy into the intervention and demonstrated success at improving physical activity habits in U.S. adults with CAD. Participants were divided into two groups who participated in three classes each. One group received an action control intervention while the other received a social cognitive theory intervention aimed directly at improving self-efficacy for physical activity. Exercise habits improved significantly in both groups examined. However, there were no statistically significant between group differences in terms of exercise self-

efficacy, barriers self-efficacy, and minutes of exercise. The authors admit that the lack of between group differences may have been a result of all study participants being enrolled in cardiac rehabilitation and therefore receiving similar interventions in many respects (Barkley & Fahrenwald, 2013).

Despite the lack of statistically significant difference between groups, this study is important for the direction of future research in the area. This demonstrated that U.S. adults with CAD improve activity habits when outside influences encourage the five primary facilitators of self-efficacy. In this study cardiac rehabilitation staff implemented the five primary facilitators of self-efficacy theory by:

- Previous experience: rehabilitation staff pointed out when task mastery was achieved for a set time period of exercise.
- Vicarious learning: rehabilitation staff members pointed out when other rehabilitation members were completing exercise tasks
- Verbal persuasion: rehabilitation staff assessed confidence levels that participants could complete exercise tasks
- Psychological state: rehabilitation staff discussed methods to overcome barriers and discussed participant's concerns about exercise
- Self-regulation: participants were asked to keep a log of number of minutes exercised daily and set exercise goals (Barkley & Fahrenwald, 2013).

## Relevance of the Research Literature to the Study

### Study Setting

Several factors regarding study settings must be considered when interpreting the findings from the research literature surrounding CAD and physical activity adherence. For example, many of the studies were set in cardiac rehabilitation or interviewed long-term cardiac rehabilitation attenders (Barkley & Fahrenwald, 2013; Jolly et al., 2007; Martin & Woods, 2012; Mildestvedt et al., 2008; Reid et al., 2006; Reid et al., 2007; Rogerson et al., 2012; Russell & Bray 2010; Sharp & Freeman., 2009; Smith et al., 2011; Sniehotta et al., 2005; Sweet et al., 2011; Throw et al., 2008; Tulloch et al. 2009; Woodgate, Brawley, & Westen, 2006). This is an important consideration because the education and support provided in cardiac rehabilitation programs varies greatly by country, region, and facility. For example, in Germany, following a cardiac event, all patients receive three to four weeks of inpatient care followed by once-weekly exercise sessions that are supervised by a cardiologist (Sniehotta et al., 2005). Conversely, in the U.S., cardiac rehabilitation lasts approximately 12 weeks which is the time period paid by most insurers and is self-pay on a long-term basis (Medicare.gov, 2014; Thomas et al., 2007). The assorted rehabilitation interventions likely helps explain the difference in physical activity behavior outcomes noted among individuals with CAD.

The singular study in this research area performed in the U.S. was set in a hospital-based cardiac rehabilitation (Barkley & Fahrenwald, 2013). To date, no home-based programs focusing on physical activity improvement in adults with CAD in the U.S. have been attempted. It is unknown if a home-based physical activity program tailored for adults with CAD could be a viable secondary prevention option in the U.S.

## Study Population

Population structure should also be considered when interpreting research results. Much of the research performed was with small sample sizes that may affect the ability to generalize results to the larger CAD population (Drbošalová et al, 2010; Martin & Woods, 2012; Mildestvedt et al., 2008; Sniehotta et al., 2005). The majority of the studies assessed a disproportionate amount of Caucasian men (D'Angelo et al., 2007; Martin & Woods, 2012; Russell, & Bray, 2010; Tulloch et al., 2009) who were well educated (D'Angelo et al., 2007; Drbošalová et al., 2010; Smith et al., 2011; Sweet et al., 2011; Reid et al., 2011), which further decreased the generalizability of study findings. Attrition was another study population factor that undoubtedly influenced research results. All longitudinal studies sustained high attrition rates ranging from 21% to 83%, and as the studies progressed it was likely that the research focus was on only the most motivated CAD sufferers (Drbošalová et al., 2010; Reid et al., 2011; Russell, & Bray 2010; Sweet, et al., 2011).

## Study Interventions

Research interventions differed widely between studies which likely contributed to the extensively different physical activity outcomes among participants. For example, the interventions that were applied in the various studies ranged from: no direct intervention to improve exercise habits (D'Angelo et. al., 2007; Orakzai et al., 2008), home cardiac rehabilitation (Drbošalová et al., 2010; Karjalainen et al.,2012; Reid et al., 2011), hospital-based cardiac rehabilitation (Martin & Woods, 2012; Mildestvedtet et al., 2008 Reid et al., 2006 Reid et al., 2007; Rogerson, et al., 2012; Russell, & Bray 2010; Sharp & Freeman.,,2009; Smith et al., 2011; Sweet et al., 2011; Throw et al., 2008; Tulloch et al., 2009; Woodgate et al., 2006), or

interventions where participants could pick the treatment group they desired (Drbošalová et al., 2010; Jolly et al., 2007). Despite the wide range of interventions examined in this area of research, there was one clear consistency. All of the research in this area that made any attempt at educating or encouraging individuals with CAD to improve their physical activity was met with some degree of increased physical activity behavior among participants, even if it was only temporary.

Hospital-based cardiac rehabilitation is well known to improve physical activity behaviors in adults with CAD. Although these programs vary to some degree between facilities they have several commonalities: meeting regularly for weekly exercise, access to equipment, support from medical personnel, and social interaction. This has allowed for reproducible outcomes to be assessed in attendees of an inpatient program (Turk-Adawi, Oldridge, Tarima, Stason, & Shepard, 2013). Assessing what qualities make a home-based program successful is much more cumbersome. The available research for outpatient care ranges from simply informing adults of their coronary calcium score (Orakzai et al., 2008) to having physical therapist follow outpatients weekly by phone (Reid et al., 2011). Other outpatient interventions have included simply encouraging participants to independently make action plans and keep activity diaries (Sniehotta et al., 2005). Even the least of these interventions, simply informing a person of their cardiac calcium score, resulted in some degree of physical activity improvement in adults with CAD (Orakzai et al., 2008).

There was a single study found that directly compared outcomes of an outpatient program to a hospital-based cardiac rehabilitation program. The hospital-based program contained the standard intervention of weekly supervised group exercise at a facility over a 12-week period. The home-based cardiac rehabilitation program included written educational information, three

nurse visits, and one phone call over a 12-week period. When patients were followed up to 24 months after their program, there was no statistically significant difference found in activity habits between groups (Jolly et al., 2007).

### Study Design

The type of research conducted differed greatly between studies and deserves scrutiny when examining results. For example, several studies were not longitudinal in nature. Rather, they interviewed individuals with CAD retrospectively to determine their motivators and impeters to regular physical activity (D'Angelo et al., 2007; Martin & Woods, 2012; Reid et al., 2006; Reid et al., 2007; Rogerson et al., 2012; Throw et al., 2008; Woodgate et al., 2006). Although these studies offer valuable information, they relied heavily on self-report and may not offer the most accurate analysis of physical activity motivation and commitment. Additionally, in prospective studies, the time that participants were followed ranged greatly. Studies followed the exercise habits of CAD adults over time periods ranging from four weeks to six years (Drbošalová et al., 2010; Jolly et al., 2007; Karjalainen et al., 2012; Jolly et al., 2007; Mildestvedt et al., 2008; Reid et al., 2011; Sharp & Freeman., 2009; Smith et al., 2011; Sniehotta et al., 2005; Sweet et al., 2011; Tulloch et al. 2009). This resulted in varied results but one consistency was noted, as time passed attrition increased.

### Study Strengths

There are many strengths found in the available literature that should be acknowledged. First, several studies followed adults with CAD a year or beyond their program entrance (Drbošalová et al., 2010; Jolly et al., 2007; Mildestvedt et al., 2008; Reid et al., 2011; Smith et

al., 2011; Sweet et al., 2011), which reasonably assesses sustained behavior change. Second, although studies predominantly examined Caucasian men, Jolly et al. (2007) studied multiple ethnic groups in the United Kingdom and found similar reasons for exercise non-adherence among persons of differing ethnicities. This suggests that levels of exercise motivation may not differ substantially between ethnic groups. Third, several studies either implemented theory-based interventions (Barkley & Fahrenwald, 2013; Mildestvedt et al., 2008; Reid et al., 2011; Sniehotta et al., 2005) or used theory to describe their findings (D'Angelo et al., 2007; Martin & Woods, 2012; Reid et al., 2007; Russell & Bray 2010; Sweet et al., 2011; Tulloch et al. 2009; Woodgate et al., 2006), which substantiates the application of motivation theories to improve or explain exercise behaviors in this populace. Finally, qualitative studies identified that individuals with CAD expressed the usefulness of social support, self-regulation, and education (Jolly et al., 2007; Martin & Woods, 2012; Rogerson et al., 2012; Throw et al., 2008). This finding is relevant considering that long term physical activity adherers with CAD unknowingly confirmed the long-standing ideals associated with self-efficacy theory. A full summary of each study is provided in Appendix A.

#### Gaps to be Addressed in Future Research

One of the most significant gaps discovered in the research was an absence of attention to improving physical activity in adults with CAD from home. The only available research which examined home-based physical activity programs was performed outside the U.S. (Drbošalová et al., 2010; Jolly et al. ,2007; Karjalainen et al., 2012; Reid et al., 2011). The lack of research is problematic given that Americans have less access to cardiac rehabilitation programs due to strict admission criteria and health insurance limitations when compared to adults with CAD in

many other countries (Bjarnaspn-Wehrens et al., 2010; Medicare.gov, 2014; Thomas, et al., 2007). Future research that considers home-based physical activity for individuals with CAD in the U.S. is crucial in order to offer a method to reduce attrition and cost associated with hospital-based cardiac rehabilitation programs (Jolly et al., 2007; U.S. Center for Medicare and Medicaid Services, 2013). Home-based physical activity can offer individuals with CAD control over their work-out schedule, intensity, and duration. Additionally, home activity programs offer creativity, opportunity for growth of intrinsic motivation, and freedom to choose desired activities and outcomes. Although a home-based physical activity program may have a less rigorous and structured environment compared to a hospital-based rehabilitation, even moderate activity can decrease CAD symptoms, improve depressive symptoms, increase perceived quality of life, and a decrease the likelihood of future cardiovascular events (Briffa et al., 2006; World Heart Federation, 2014).

The lack of U.S. based research in this area has additionally led to a gap in research that examines the role of medical providers to influence the physical activity behaviors in individuals with CAD. This is critical given that the intervention of the health care provider is indispensable. Periodic assistance to help individuals with CAD to set goals, prevent relapse, problem solve, and direct safe physical activity options are helpful in improving exercise compliance (Hughes, 2007). Additionally, practitioners are positioned to help provide motivational counseling, foster self-determination, increase confidence, assist in positive coping mechanisms, and encourage motivation (Plotnikoff & Higginbotham, 2002; Rozanski, 2005; Sniehotta et al., 2005).

Practitioners can be integral in assisting patients to be task oriented and involved in their exercise behavior (Boyd, Weinmann, & Yin, 2002). One of the most vital roles for practitioners may be education, because they are poised to integrate research findings into an intervention for persons



with CAD. Periodic interaction with a health care provider is paramount, as over time the benefit of these interactions quickly diminishes (Krannich et al., 2008).

The current research offers limited direction for theory-driven, efficient, interventions to improve exercise adherence. For example, most of the researchers have surveyed individuals at a set point in time to assess their motivational facilitators and barriers. These researchers did not explore what type of interventions could improve exercise behaviors (D'Angelo et al., 2007; Reid et al., 2006, 2007; Russell & Bray, 2010; Sharp & Freeman., 2009; Sweet et al., 2011; Tulloch et al., 2009). Other studies attempted motivational interventions but were not theory-driven (Drbošalová et al., 2010; Jolly et al., 2007; Karjalainen et al., 2012; Smith et al., 2010). Only five research studies available used theory-driven motivational interventions to improve exercise adherence in individuals with CAD (Barkley & Fahrenwald, 2013; Mildestvedt et al., 2008; Reid et al., 2011; Sniehotta et al., 2005; Throw et al., 2008). Of these studies, interventions were often complex and unrealistic for general practice. It is unlikely that medical providers will have the resources to institute multiple phone contacts, oxygen capacity measurements, use of accelerometers, or prolonged motivational counseling.

In summary, there are many gaps to address in this research area. It is likely beyond the scope of any one study to address all of the deficiencies that were found. However, the current study is the first of its kind to examine a home-based physical activity prehab program for adults with CAD in the U.S. The findings of this study add to the limited body of theory-based interventions that aim to improve physical activity adherence among individuals with CAD and offer a realistic and affordable method to reduce secondary events in adults with known CAD, offering an alternative to underutilized conventional cardiac rehabilitation. It is hoped that by offering this novel approach to improving physical activity behaviors in individuals with CAD

that a wider variety of ethnicities and genders will have access to this secondary prevention measure.

## CHAPTER 3 METHODOLOGY

### Framework to Guide Study

Self-efficacy theory and pertinent findings from research in this area were used to guide the framework of this study. Self-efficacy theory is the appropriate framework for this area of research given that level of self-efficacy is linked to physical activity initiation, participation, and sustenance (Bandura, 1993). The role of self-efficacy has been widely discussed in the literature review and is specifically linked to improvements in physical activity habits in individuals with CAD (Sol et al., 2011).

The five primary sources from which self-efficacy is derived, according to Bandura (1977), were used to develop this study's intervention. First, one's previous experience shapes self-efficacy beliefs. Previous experience relates to modeling a behavior, being exposed to a behavior, or performing a behavior. Repeated success or mastery of a physical activity task is influential to self-efficacy. Second, vicarious experience influences self-efficacy beliefs. Seeing others perform activities without adverse consequences can create an expectation that a physical activity can be performed with similar outcome. Third, verbal persuasion contributes to self-efficacy. This pertains to the power of suggestion. When individuals struggle to achieve a task, outside persons can persuade them that they can cope with the situation and achieve their physical activity goal. This is further facilitated when conditions are arranged to facilitate effective performance. Fourth, psychological state can regulate self-efficacy levels. This involves providing information, coping skills, and stress reduction techniques about physical activity (Bandura, 1977).

The fifth facilitator of self-efficacy which will guide the intervention for this study is self-regulation. Self-regulation is the central factor in thought, affect, motivation, and action (Bandura, 1991). Although the previous four facilitators of self-efficacy pertain mostly to one's motivational state and self-efficacy judgments, self-regulation is what transitions motivation to action and eventual behavior change. Self-regulation is obtained through setting realistic goals and evaluating progress toward those goals. When attempting to improve physical activity behaviors, self-regulation can be fostered by knowing how to alter behavior and modify the environment to help people meet goals. When individuals attend closely to their performance either individually or with the help of others, they are more likely to alter habitual thought patterns and set goals of progressive improvement. One key factor to this progressive improvement is goal attainment (Bandura, 1991). Outside observers can play an important role in helping others recognize the evidence of progress during the self-regulation process. All five of the mentioned facilitators of self-efficacy work together to reframe the way an individual perceives motivators and barriers to physical activity and thus are necessary building blocks to guide future study.

The key motivators for physical activity in an adult population with CAD found in the literature review coincided with the facilitators of self-efficacy and were implemented in the study intervention. Emphasis was placed on social support, health knowledge, structured class, and self-regulatory skills that are known to correlate with improved levels of self-efficacy and increased physical activity behaviors (Barkley & Fahrenwald, 2013; Drbošalová et al., 2010; Martin & Woods, 2012; Mildestvedt et al., 2007; Reid et al., 2012; Sniehotta et al., 2005; Woodgate et al., 2006). In review, this study addressed the facilitators of self-efficacy for physical activity in the following ways:

- Previous experience: In group discussion format, participants recalled their previous mastery experiences with making a significant life-style improvement. Researchers have demonstrated that this is an important component to build upon when attempting to gain task mastery and achieve a feeling of empowerment to control health circumstances even in the setting of adversities (Bandura, 2004; Plonczynski, 2000).
- Vicarious learning: Participants viewed a video tape of community exemplars with CAD who have overcome substantial physical activity barriers. Participants additionally listened to others in group format share their previous experiences with meeting physical activity goals. The film and the group discussion provided live and symbolic modeling where others with CAD had participated in regular physical activities despite obvious barriers (Parent & Fortin, 2000).
- Verbal persuasion: Participants received education surrounding the benefits of physical activity and threat of physical inactivity in the setting of CAD. Additionally, participants received weekly encouragement to continue their efforts toward meeting their physical activity goals during each phone conversation. This was crucial considering that people are more likely to adopt unhealthy habits when there is a lack of knowledge about health risks and benefits of a particular health practice (Bandura, 2004).
- Psychological state: Participants discussed how to overcome barriers and concerns with regards to regular physical activity. Medical support and screening for cardiac problems was provided by the principal investigator (PI) and the research assistants during the class and during follow-up phone calls. Weekly encouragement was given to each participant to increase their activity even if it was not strenuous or lengthy,

because even moderate forms of increased activity result in substantial health benefit (Franklin et al., n.d; Jolly et al, 2007; World Heart Federation, 2014).

- Self-regulation: Participants were encouraged to keep a weekly diary of their physical activity and were asked to report the activity type and duration during weekly phone calls. Participants were asked to make their own weekly goals for improved physical activity. Participants were encouraged to make easily obtainable goals each week in order to build upon a sense of mastery. This was imperative given that setting unrealistic goals can lead to a self-perception of vulnerability and poor performance (Bandura, 1988).

Intervention duration was dictated by research performed that reports that health habit formation takes an average of 66 days for most people to turn a new life-style change into a lasting habit. This considers that during real life scenarios adults will experience a lack of extrinsic rewards for the behavior change and missed opportunities to perform the behavior (Lally et al, 2010). In order to assist prehab participants to establish an improved physical activity habit, they were asked to accept weekly phone calls for a 10-week intervention period. This allowed for all participants to receive weekly support which encouraged habit maintenance for 66-days in an effort to help establish a lasting commitment to regular physical activity.

### Research Overview

Many factors influence physical activity behaviors in persons with CAD. Higher levels of self-efficacy for physical activity appear to be the primary determinant how those factors are interpreted. Persons with higher levels of self-efficacy tend to experience greater confidence that they can be successful with an activity program, believe that they can overcome setbacks, and

persevere above barriers to meet their activity goals (Bandura, 1977; 2004). Self-efficacy theory suggests that previous experience, vicarious learning, verbal persuasion, a favorable psychological state, and self-regulation all contribute to one's level of self-efficacy and success at sustained behavior change. This was further confirmed when the results of research in this area were assessed. Previous studies have shown when one or all of these self-efficacy facilitators are instituted, physical activity behaviors can improve. Prior to the present study, this had not been examined in vast majority of U.S. adults with CAD who were either unable or unwilling to participate in hospital-based cardiac rehabilitation.

#### Research Question 1

What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of self-efficacy for physical activity after a 10-week intervention, and can it be maintained for 30-days after the study?

#### Research Aim 1

Evaluate the effect of a self-efficacy based class on self-efficacy for physical activity levels in adults with known CAD.

#### Research Aim 2

Evaluate the effect of a self-efficacy theory based intervention on self-efficacy for physical activity levels in adults with known CAD following a 10-week period.

#### Research Aim 3

Evaluate if there is a lasting effect on levels of self-efficacy for physical activity 30 days after the study intervention.

## Research Question 2

What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of physical activity volume after a 10-week intervention, and can it be maintained for 30-days after the study?

### Research Aim 4

Evaluate the effect of a self-efficacy theory based intervention on physical activity volume after a 10-week prehab program

### Research Aim 5

Evaluate if there is a lasting effect on physical activity volume 30 days after the study intervention.

## Research Question 3

What barriers and facilitators were described by participants in the prehab study?

### Variables

Independent Variable: intervention based on self-efficacy theory

Dependent Variable 1: physical activity volume

Physical activity volume will be measured by minutes and type of physical activity behavior performed and computed by the Godin Leisure-Time Exercise Questionnaire (GLTEQ).

Dependent Variable 2: self-efficacy

Self-efficacy for physical activity will be measured by three self-efficacy for physical activity measures: Short Self-Efficacy Expectations Scale (SSEE), Multidimensional Outcomes Expectations for Exercise Scale (MOEES), and the Barriers Self-Efficacy Scale (BARSE)



### Design

This was a mixed method study. Quantitative information was gathered using a quasi-experimental, pre-intervention/post intervention single cohort design. Qualitative information was obtained throughout the course of the study and evaluated using thematic analysis.

### Setting

St. Johns County, Florida is a mix of both urban and rural areas and is home to an estimated 200,000 residents. There are approximately 316 persons per square mile which is less populated than the state of Florida as a whole. This area is located just south of the Jacksonville metro area (United States Census Bureau, 2014). The ethnic composition of the St. Johns County area is approximately 89.5% Caucasian, 5.7% African American, and 5.7% Hispanic. There is a large population of retired adults in this area with an estimated 32,638 of adults over the age of 65 (Florida Charts, 2012; United States Census Bureau, 2015). According to Florida Health (n.d.), it is estimated that greater than 25% of adults over the age of 65 in Florida have been told by their medical provider that they have CAD. Behavioral risk factors reported by adults in this area are slightly better compared to statistics for the overall state of Florida. An estimated 36.7% of St. Johns County adults report participating in the recommended amount of moderate activity compared to 34.6% for most Florida adults. Sedentary lifestyles were reported among 18% of St. Johns county adults compared to 26.4% of most Florida adults (Florida Department of Health, 2012).

There is one hospital available in St. Johns County which is less than a 15-minute drive for most residents. The initial intervention classes were held after work hours in a conference room at the primary hospital serving this area. The room was large enough to comfortably seat

15 to 20 people in a semi-circular fashion with a door that could be locked for privacy during the group sessions.

### Sample

A convenience sample of adults with a known diagnosis of CAD who self-reported that they struggle to maintain a regular physical activity practice were invited to participate in this study. G-power analysis was used to determine that with an effect size  $f=.25$ ,  $\alpha=.05$ ,  $\beta=.95$  that a minimum of 43 participants were needed. According to Polit & Beck (2012), an expected attrition rate of 12.5% can be expected. However, other research suggested that for behavioral interventions attrition rates less than 30% may be acceptable (Amico, 2009). A total of 54 participants were enrolled in the program to help accommodate a potential 30% attrition rate.

### Inclusion Criteria

Adults with diagnosed CAD between the ages of 50-80 who were interested in improving their physical activity behavior were invited to enter the study. Interested participants were required to be able to read, write, and understand English so that they could comprehend the consent process and educational material. All participants were required to have written permission from their medical provider stating that they: were medically stable for unsupervised physical activity, had diagnosed CAD by heart angiography or computerized tomography (CT scan), and had no documented evidence of limiting cognitive impairment. Once individuals were referred to the study, the principal investigator (PI) contacted potential participants over the phone to give details of the study and ensure that inclusion and exclusion criteria were met.

## Exclusion Criteria

Participants were excluded from the study if they were severely learning disabled or had significant cognitive impairment. Individuals were also excluded if they had unstable angina or were thought to be unstable for exercise as decided by their health-care provider. Persons who were imprisoned or institutionalized were excluded given that an independent exercise schedule would be difficult for those individuals. Individuals who were pregnant or unable to gain permission from their medical provider confirming their medical stability to exercise were likewise excluded in order to maintain participant safety. Exclusion criteria were also applied to any individual who was enrolled in cardiac rehabilitation in order to obtain clear results of the intended intervention. This was necessary, as it is well known that cardiac rehabilitation can provide its own form of motivation that may skew a study's results.

Participants were informed that they would be administratively withdrawn from the study if they had a hospital admission during the study period for any CAD related medical problem, development of unstable angina, or development or presence of severe medical conditions that curtailed the ability to exercise as determined by the participant or their health-care provider. This was done in order to maintain participant safety. Participants were informed at time of consent that if they entered cardiac rehabilitation during the study that they would be administratively withdrawn. Again, this was done in order to obtain clear results of the intended intervention.

## Procedures

Participant recruitment occurred in a variety of ways. A total of 25 medical providers from six cardiology practices and one large family practice agreed to participate in recruitment

for the study. Additionally, the local cardiac rehabilitation program was willing to refer individuals who were unwilling or unable to participate in traditional hospital-based cardiac rehabilitation. Advertisement posters were placed in patient examination rooms and medical lobbies. A locked box was available at all of the mentioned medical facilities for interested parties to drop off their contact information. Regardless of the recruitment method, all individuals' medical providers were contacted for their signed permission that the participants had diagnosed CAD, were stable enough for unsupervised activity, and that they were not significantly cognitively impaired. The PI made weekly visits to the referring offices to remind providers about the study and collect signed consents.

### Intervention

There were four primary components to the intervention: a single self-efficacy based group class, weekly phone calls for 10 weeks from a nurse, a luncheon to discuss the experience of being in the study, and a 30-day follow up assessment by phone to determine the level of physical activity maintenance achieved by being in the study. Each participant who entered the study was required to attend the 90-minute self-efficacy based class. The first 10 participants who were recruited were considered to be the pilot group. They were surveyed after the intervention class to assess any needed revisions to the program. The response was largely positive, and no major revisions to the intervention were made.

Following the pilot group class, small classes containing 6 to 12 people were held approximately every other week for new enrollees. This was done until 54 people were enrolled in the study. Each class was conducted in the same manner, using the same outline of information. Two research assistants, who are nurses with greater than 10 years of experience in

the cardiology field and who had completed the Collaborative Institutional Training Initiative (CITI), were available to help with the classes and follow-up phone calls. Once participants arrived at the class, the consent process was explained, and baseline self-efficacy measures (SSEE, MOEES, and BARSE) and activity volume (GLTEQ) were completed.

After baseline measures were taken, introductions and a brief explanation of the study was given to the group. A nine-minute informational video then followed. The video was created in order to offer participants key promoters of self-efficacy: verbal persuasion, a favorable psychological state, and vicarious learning. The video covered basic medical information about the dangers of sedentary behavior. This was done because the research literature suggests that avoidance of ill health and threat of disease can be a powerful external motivator for initial behavior change and is thus a valuable form of verbal persuasion (Throw et al., 2008; Tulloch et al., 2009). The video also addressed the benefits of regular physical activity such as collateral circulation, CAD event reduction, and CAD related symptom reduction as a form of verbal persuasion. This is done because the research suggests that the health benefit of regular physical activity influences long term motivation for regular physical activity and is thus important for encouraging a favorable psychological state for physical activity (Throw et al., 2008; Tulloch et al., 2009). Next, the video contained interviews of community exemplars with CAD to demonstrate vicarious learning. Each person interviewed for the video was over the age of 80 and had overcome significant obstacles to achieve a habit of regular physical activity over many years. Individuals who were interviewed discussed their motivators and barriers to their long standing routine and were videoed during their exercise program. The video finished with warning signs of a cardiac problem during activity with instructions to call 911 for any sustained symptoms. Following the video, the PI spoke to the group further about the cardiovascular

system using a set power point presentation. True life stories of how regular physical activity benefits adults with CAD were given during the presentation. Heart and blood vessel models were used as visual aids during the discussion. Questions were encouraged throughout the class. Classes were small and conducive to group discussion.

Following the presentation, a group discussion commenced in order to address the self-efficacy promoters of previous experience, vicarious learning, and favorable psychological state. Each individual was asked to give an example of previous success with a physical activity goal. For example, if participants had completed a previous physical activity goal such as military boot camp or a race, they were encouraged to share their stories. If participants were unable to identify a past physical activity goal that was met, they were encouraged to find an example of a healthy life-style change that they were successful at, such as smoking cessation. This was used to help participants recall their previous experience and encourage continued success at achieving their goals (Bandura 1977). Additionally, this was a form of vicarious learning, as participants were able to identify with the experience of others during the discussion. Next, participants were asked to discuss and write what they felt was their primary barrier to staying committed to regular physical activity. The written barrier statements were collected at the end of each prehab class. The group, as well as the PI and research assistants, brainstormed methods to circumvent these barriers. For example, if persons identified osteoarthritis pain as a barrier, local water aerobics classes were suggested. Community opportunities for physical activity such as walking paths, Silver Sneaker programs, chair exercises, and cost of local gym memberships were discussed and given to participants in writing. These measures were taken to encourage a favorable psychological state.

The final portion of the class was dedicated to self-regulation. Participants were asked to make a physical activity goal that they felt was an improvement from their current routine and write it down. Participants were encouraged to make a goal that was easy to obtain for the first week and share it with the group. This was done in order to promote self-regulation and positive psychological state. The stated barriers and goals were recorded by the research staff for reference during the follow-up phone calls. Participants were encouraged to complete a weekly log of their progress and include the type and duration of activity performed so that it could be divulged during follow-up weekly phone calls. At the conclusion of the class, all participants were asked to complete the self-efficacy measures again to ascertain if any immediate benefit from the class took place. All persons who attended the class received a \$15 gift certificate to help reimburse them for their participation, time, and effort.

One week after each participant attended the self-efficacy based class, they were contacted by the PI or one of the research assistants. These phone calls were completed weekly for 10 weeks. The same question format and approach was taken for each interaction with participants. Participants were reminded of the goal that they set for themselves, and they were asked how they progressed toward meeting their goal. If the goal was met, participants were encouraged to set a new and more active goal for the next week until they were satisfied with their level of activity. If participants discussed what was keeping them motivated during the study, it was recorded by the caller for later qualitative analysis. Whenever plausible, participants were encouraged to strive for 150 minutes a week or more of moderately vigorous activity as encouraged by CDC guidelines (CDC, 2015).

If the participants' goals were not met, they were encouraged to discuss what barriers were experienced; ideas were offered to circumvent barriers, and they were encouraged to start

with a new goal for the following week. The number of activity sessions longer than 15 minutes that were beyond their normal routine were recorded and calculated using the GLTEQ.

Participants were screened during phone calls for any medical problems such as pain, chest discomfort, or unusual shortness of breath. Experienced barriers were recorded by the PI or research assistant during the weekly phone calls for later qualitative analysis.

When participants were reached for their 10th weekly phone call, they were asked several additional questions (Appendix B). Participants were asked to compare their activity level before entering the study to their present activity level. These levels were recorded using the GLTEQ measure. Then participants were asked to rate the four questions of the Short Self-Efficacy Expectations Scale (SSEE) indicating their confidence level (1=not confident at all, 5=very confident) to continue regular physical activity if they had pain, if they were tired, if they were depressed, and if they had to exercise alone. Finally, they were asked to discuss aspects of the program that they felt were motivating and what they felt could improve the program. The Multidimensional Outcomes Expectations for Exercise Scale (MOEES) and the Barriers Self-Efficacy Scale (BARSE) questionnaires were mailed to participants after the 10-week phone call along with a \$15 gift certificate to help reimburse them for their time and encourage the return of the questionnaires.

Research participants were contacted 30 days after the 10-week phone call to determine if any lasting physical activity habits or impact on self-efficacy for physical activity had been maintained. This phone conversation followed the same format for each phone call. Participants were asked to compare their activity at the 30-day mark to their activity level during the study. This information was calculated using the GLTEQ measure. If their activity level had changed, they were encouraged to discuss why. If their activity had decreased, they were asked what could



have kept them motivated better during this time. Participants were then asked to rate their responses to the four-question SSEE Scale. The exact format for the 30-day phone call can be found in Appendix C.

After all participants completed the study they were invited to attend a celebration luncheon to discuss their experience in the study. Ten participants (18.52%) attended the luncheon. Discussion topics included personal experience in the study, recommendations for improvement in the program, participants' continued commitment to an activity regimen, and the impact of contact with a medical provider for the weekly contacts. The qualitative question format can be found in Appendix D. Individuals who were willing to participate in the luncheon were given a \$10 gift certificate to help reimburse them for their time and effort.

### Instruments

There were three primary categories of measurements taken in the prehab study: (a) demographic data, (b) physical activity volume collected by activity log and the Godin Leisure-Time Exercise Questionnaire [GLTEQ], (c) information in regards to self-efficacy for physical activity collected by self-efficacy measures and qualitative data collection throughout the study.

Participants completed demographic information using a checkbox format. Information about age, gender, relationship status, educational background, income level, employment status, severity of coronary artery disease, and the approximate time they received their CAD diagnosis were requested. Severity of CAD was assessed by asking all individuals if they had a history of coronary artery disease, angioplasty, percutaneous artery stent placement, or coronary artery bypass surgery.

Exercise volume was measured by asking participants to record and report the type and duration of leisure time physical activity that they performed each week. This self-reported activity was computed using the GLTEQ. A copy of the GLTEQ is provided in Appendix E. The GLTEQ has been used extensively in the literature and in different cultures with acceptable levels of validity and reliability (Godin & Shepard, 1997). This is a two-question form that first asks the participant to fill in how many times they do more than 15 minutes of strenuous, moderate, or mild activity. The second question asks the participant to report how often during a typical seven-day period a person would engage in activity long enough to work up a sweat categorized by often, sometimes, or never/rarely. Scores derived from the GLTEQ are calculated by multiplying the number of physical activity episodes by 3, 5, or 9 metabolic equivalents (METs) depending on the level of exertion placed on the activity. These numbers are summed and used for ranking an individual's level of physical activity. The North American public health physical activity guidelines suggest that scores of 24 or less are classified as being inactive, whereas scores greater than 24 are considered active (Amireault et al., 2015).

The GLTEQ reliability measures have ranged .62 (Jacobs, Ainsworth, Hartman, & Leon, 1993) to .74 (Godin & Shepard, 1985) with test retest reliability at .81 (Sallis, Buono, Roby, Micale, & Nelson, 1993). Validity coefficients of GLTEQ are reported as follows: .32 with accelerometer, .43 with Vo2 Max, and .43 with body percentage fat (Jacobs, et al., 1993). For this study, the total number of minutes spent doing physical activity was additionally recorded since this is a possible limitation of the GLTEQ, and many who use this measure add this information (Amireault et al., 2015).

Self-efficacy for physical activity was assessed using physical activity self-efficacy measures of Multidimensional Outcome Expectations for Exercise Scale (MOEES), Short Self-

efficacy for Exercise Scale (SSEE), and the Barriers for Self-efficacy Scale (BARSE) as well as gaining qualitative information. Gaining information about how an individual perceives barriers and motivators to physical activity is considered to be one of the primary determinants of physical activity initiation and continued behavior change. The MOEES is a 12 item, 5-point Likert scale (1=strongly disagree, 5= strongly agree) with items that assess motivators for physical activity in the form of physical outcome expectations, social outcome expectations, and self-evaluative expectations. For example, participants are asked to evaluate how exercise will improve their: ability to perform daily activities, body functioning, bone strengthening, muscle strength, cardiovascular system, social standing, psychological state, mental alertness, stress management, and sense of personal accomplishment. The scale items are provided in Appendix F. When factor analysis was performed with this tool on older adults there was found to be an excellent fit to the data ( $\chi^2_{51} = 68.54, p = .05, RMSEA [95\% CI] = .06 [.00-.09], CFI = 0.97$ ). When examined in older adults, increased functional status correlated with physical outcome expectations ( $r=.37, p<.01$ ) and self-evaluative expectations ( $r=.25, p<.01$ ) but not with social outcome expectations ( $r=.01, p=0.33$ ) (Hall, Wojcicki, Phillips, & McAuley, 2012). These findings were similar when applied to older adults in a separate study (Wojcicki, White, & McAuley, 2008). Researchers of this measure speculated that the social outcome findings may not correlate with increased functional status in the populations examined due to their age and medical diagnosis that inhibit social interaction to some degree. The internal consistency of the three outcome-expectations scales have been reported as, physical  $\alpha = .75$ , social  $\alpha = .82$ , and self-evaluative  $\alpha = .84$  (Hall, et al., 2012).

The SSEE is an assessment of perceived barriers to exercise. This is a four-item Likert type measure with the items addressing challenges associated with exercise such as pain, feeling

alone, feeling tired, or feeling depressed. The scale items are provided in Appendix G. This tool has a reported internal consistency alpha coefficient of .88. Reliability measures with this instrument have ranged from  $R^2 = .38$  to .70. The items in this Scale are estimated to account for 13% of the variance in exercise. This tool has been used in other cultures including China and Thailand (Resnick et al., 2007).

Perceived barriers for physical activity was also measured with the BARSE Scale (Appendix H). This scale was derived from social cognitive theory to assess the intensity of perceived activity barriers for individuals. When studied over a 20-week period, variables in the model accounted for 38% of the variance in exercise attendance and 60.54% of the variance for perceived physical exertion. Initial investigation of this measure revealed that perceptions of personal capability in physical activity mediated adoption and initial participation in an exercise plan. Once an exercise habit was established, it was a major predictor of future exercise behaviors (McAuley, 1992). When this measure was used to predict long-term maintenance of physical activity in older adults, its internal consistency was 0.92 (McAuley, et al., 2003). This measure has been used to explain physical activity behaviors in individuals with multiple sclerosis (Ferrier, Dunlop, & Blanchard, 2010) as well as in older adults (McAuley, et al., 2003). This scale evaluates one's confidence level that they can participate in activity given a variety of barriers. For example, on a 0-100 scale individuals are asked to reveal their confidence level that they can perform an activity while on vacation, bored, or experiencing bad weather (McAuley, 1991). The reason for including a measure for barriers is because both theory and research have demonstrated barrier perception to be a powerful influence on activity behaviors (Bandura, 2004; Martin & Woods, 2012; Reid et al., 2007; Rogerson et al., 2012). An overview of the reliability and internal consistency is provided in Table 1.

Table 1

*Measures for Prehab Study*

Physical Activity Volume	Self-efficacy for Physical Activity
GLTEQ 2-questions: Duration, frequency, and intensity to physical activity Reliability: .62 - .74 Test retest reliability: .81 Physical activity log (recorded in minutes and type of activity)	MOEES Internal consistency .75-.84 12 questions: Outcome expectations for physical activity  SSEE Internal consistency .88 Reliability .38-.70 4 questions: Barriers to physical activity  BARSE Internal consistency .92 13 questions: Barriers to Physical activity Audiotape of discussion at final celebration Field notes collected throughout the study

*Note.* GLTEQ=Godin Leisure-Time Exercise Questionnaire; MOEES=Multidimensional Outcomes for Exercise Expectations Scale; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale

Data Analysis

Baseline data collection included age, gender, relationship status, education level, ethnicity, income range, level of work commitment, level of diagnosed CAD, and time passed since CAD diagnosis received. Descriptive statistics were computed using the continuous and interval variables obtained from the GLTEQ, MOEES, SSEE, and BARSE. All scale level data were examined for standard deviation, mean, and median. Histogram and p-plot data were examined for normal distribution, residual, and skew. Frequencies were performed on all study variables to assess for missing data. Imputation was not necessary as there was not greater than 10% randomly missing data (Cronk, 2008).

Measurements of physical activity volume and self-efficacy scores were the fundamental sources of quantitative data gathered. Physical activity volume was measured using the GLTEQ

and minutes recorded by participants in their physical activity log. Physical activity self-efficacy was measured by examining the scores from the MOESS and the SSEE and BARSE. Repeated measures analysis of variance (ANOVA) was used to compare scores of the GLTEQ, MOEES, SSEE, and BARSE before the self-efficacy intervention, immediately following the intervention and at the study's conclusion as with Mertler & Vannatta (2005). Initially, data were examined for missing data, outliers, and test of assumptions. Dependent variable data were assessed for normal distribution. When data were found to have abnormal distributions, transformation of the data was performed. When significant findings were reported, post hoc analysis was performed using protected dependent t tests. Multiple linear regression was used to predict the effect of self-efficacy for physical activity and self-efficacy barriers on physical activity volume gathered from the GLTEQ and physical activity log. Additionally, the Pearson correlation coefficient was used to calculate the relationship between self-efficacy for physical activity and physical activity volume as well as the relationship between reported barriers to exercise self-efficacy and physical activity volume (Cronk, 2008).

Qualitative research was performed by thematic analysis. Thematic analysis was used to help transition broad data into more detailed themes and patterns in order to generate explanations for quantitative results (Boyatzis, 1998). The thematic analysis process followed the steps outlined by Braun and Clarke (2006). The main purpose of gathering qualitative data was to gain insight about what factors help improve or hinder self-efficacy for physical activity and maintain physical activity habits. The secondary purpose of collecting qualitative data was to evaluate the participants' experience of being in the study and gain insight for future recommendations with such a program.

Qualitative data were gathered throughout the course of the prehab study. During the initial prehab class, participants discussed and wrote anticipated goals and barriers to the prehab program and their activity goals. These were kept for analysis on perceived barriers and facilitators to regular physical activity to be assessed later in the study. Field notes were taken by the PI and the research assistants during weekly phone calls when participants spontaneously discussed their experiences. Participants were specifically asked what, if anything, had influenced their motivation during the study at the 10-week phone call, the phone call that occurred 30-days after the study, and during the celebration luncheon after the study was complete. Recurring themes emerged and often were consistent with promoters of self-efficacy.

During the final phone calls at 10-weeks and 30 days after the study completion, participants were asked for suggestions to improve the prehab program and what could be done to further help increase their motivation for physical activity. The final luncheon was audiotaped in order to retain the collected qualitative data. Discussion topics included individual experiences of being in the study, plan for continued physical activity maintenance, experienced health benefits, and recommendations for group based prehab classes in the future. Small focus groups were used for classes and the luncheon in order to provide opportunities for the group to build upon the opinions of others and gain a deeper understanding the prehab experience (Polit & Beck, 2012).

The audiotape of the celebration luncheon was recorded and transcribed verbatim. The principle investigator and the research assistants reviewed transcription records for accidental alterations of the data and notes were made in regards to emotional details that occurred during the class. General codes were assigned to potential themes related to self-efficacy theory in regard to motivators and barriers to exercise. Data were classified using a category scheme of

themes that emerged during the interview process. Themes were reviewed, and a thematic map of categories was generated. Coding terms and segments of data were refined and combined as appropriate in final categories of themes and subthemes. Finally, quotations and stories were chosen as appropriate to relate back to the research question and literature findings (Braun & Clarke, 2006; Polit & Beck, 2012).

In order to establish trustworthiness of the qualitative work, the principle investigator took steps to establish credibility, dependability, confirmability, transferability, and authenticity (Polit & Beck, 2012; Schwandt, Lincoln, & Guba, 2007). Credibility was enhanced through the use of repeated comparison of audiotape, transcription, and field notes. This was done to ensure that the essence of the interviews was represented in a reliable manner (Thomas & Magilvy, 2011). Dependability was addressed by comparing themes found in the focus groups and follow-up phone calls. This was done in an effort to confirm that the data were repeated under different conditions. Confirmability was achieved by having an expert in qualitative research from the University of Central Florida review field notes and audio transcription records to ensure that the transcripts truly reflect the essence of the interviews and that bias were not reflected in the findings. Transferability was achieved by providing a detailed description of the demographics and the study conditions along with recruitment and inclusion criteria (Thomas & Magilvy, 2011). These data were collected in order to add to the body of research that examines physical activity self-efficacy barriers and facilitators. Additionally, qualitative data were gathered to help make future recommendations for a successful prehab program (Schwandt et al., 2007). Authenticity was addressed by providing examples of stories from research participants' experiences. This was done so that readers can authenticate a range of realities that were discussed by participants (Polit & Beck, 2012).



### Threats to Internal Validity

There were several maneuvers taken to minimize threats to internal validity. All participants were ensured that if they sought care with the PI during future medical interactions that their care would not be affected. This was necessary given that St. Johns County is a small community and that the PI's place of employment is a high volume interventional cardiology practice. Avoidance of enrolling participants from the practice was impractical given that the physicians in the office were well poised to identify appropriate adults who would benefit from the study and were able to provide exercise stress testing when needed to ensure exercise safety prior to enrolling in the study. During the statistical analysis, participants who may have seen the PI outside the study were identified and examined for any differences in outcome measures compared to the rest of the research group.

Although history can be a threat due to media attention regarding healthy diet and exercise, it was believed to be similar for all study participants and was not an evident threat to the study. In order to examine any threat to maturation, date of CAD diagnosis and depth of CAD severity were obtained from participants (Polit & Beck, 2012). This is because time of diagnosis and severity may have an impact on exercise motivation. (Orakzai et al., 2008; Tulloch et al., 2009).

Attrition was a concern to internal validity for this study given that attrition was high in previous studies conducted in this area of research. Efforts made to decrease attrition included limiting the study to 10 weeks, offering cash incentives, and providing follow up phone calls. Statistical analysis was completed to compare baseline measures of individuals who dropped out and individuals who completed the study to determine if the attrition was random (Polit & Beck, 2012).

### Threats to External Validity

Efforts were made to reduce threats to external validity. The sampling technique used offered the study to a wide variety of people. By placing locked boxes near advertisements so that interested parties could drop off their phone number opened the study to anyone who visited their cardiology office. Additionally, the local cardiac rehab informed individuals who were unwilling or unable to attend traditional cardiac rehabilitation of the study. This allowed for referrals beyond individuals that a medical provider selects for enrollment. It was hoped that these recruitment efforts would result in a more diverse population and, thus, more generalizable findings. The majority of researchers in this area had previously gathered samples from cardiac rehabilitation programs which resulted in a disproportionate amount of educated Caucasian men (D'Angelo et al., 2007; Drbošalová et al., 2010; Martin & Woods, 2012; Russell & Bray, 2010; Smith et al., 2011; Sweet et al., 2011; Tulloch et al., 2009; Reid et al., 2011). Threats to external validity were lessened by limiting the detail of the intervention applied. After the group meeting, participants were only required to accept a short weekly phone call. Although reduced contact with participants may increase attrition and threaten internal validity, this was done in order to more clearly ascertain the effect of the intervention and replicate a real life scenario where individuals were not under constant observation (Polit & Beck, 2012).

### Human Subjects

This study was undertaken only after it had received approval by the Institutional Review Board of the University of Central Florida (Appendix I). The risk of injury associated with physical activity to human subjects was a concern for this study. Although rare, and more likely to occur with competitive sports, musculoskeletal injuries are the most commonly reported

injuries with physical activity (Thompson et al., 2003). In order to reduce this risk, recommendations coincided with those outlined from the CDC (2014) that activity should increase gradually and be ceased immediately if pain occurs. Walking was encouraged for participants when applicable as this is considered a low risk activity that may additionally decrease a risk for falls (Thompson, 2003).

Individuals with CAD may be at particular risk for cardiovascular events associated with physical activity. Although rare, it is estimated that there are “1 cardiac arrest per 116,906 patient-hours, 1 myocardial infarction per 219,970 patient-hours, 1 fatality per 752,365 patient-hours, and 1 major complication per 81 670 patient-hours of participation” in cardiac rehabilitation programs (Thompson et al., 2007, p2361). This rate may be higher outside of a hospital-based cardiac rehabilitation program where there is less immediate medical support.

#### Adequacy of Protection Against Risks

In order to decrease any potential risks to participants, all individuals enrolling in the study had a written statement from their cardiologist or medical provider confirming that they were fit for an unsupervised home-based physical activity program. Additionally, all participants were instructed to increase their activity slowly but stop immediately for any sign of increased shortness of breath, pain, chest discomfort, or injury (Franklin et al., n. d.; Thompson et al., 2007). Participants were instructed to call 911 for any symptoms that did not subside quickly. Weekly phone contacts were made by research assistants with cardiology experience; and participants were screened weekly for any unusual shortness of breath, chest discomfort, or physical injuries. Participants were discouraged from continuing regular physical activity until cleared by their medical provider if a significant health issues arose.

### Potential Benefits

Given that 70% of U.S. of adults with known CAD are known to not participate in the minimum amount of recommended physical activity, the benefits of physical activity in this population far outweigh the risk (Beswick et al., 2004). Potential benefits include:

- A potential reduction in secondary cardiovascular events up to 50% (Mohamad et al., 2013; Thompson et al, 2003; WHO, 2011).
- Decrease in health care costs (Chenoweth & Leutzinger, 2006; Pratt et al., 2000).
- An opportunity to slow, reduce, or possibly reverse atherosclerotic disease (Lavie & Milani, 2011; Thompson et al., 2003).
- A decrease in CAD related symptoms (Chenoweth & Leutzinger, 2006; Leon, 2005; Thompson et. al., 2003).
- A decrease in atrial natriuretic peptide and cardiac inflammatory markers (Almeida et al., 2012; Fernandes et al., 2011; Luk et al., 2012; Swardfager et al., 2012; World Heart Federation, 2014).
- A potential for reduced low-density lipoprotein levels, increased high-density lipoprotein levels, improved insulin usage, decreased body weight, decreased depression, improvement in collateral circulation, and lowered blood pressure (Jolly et al., 2009; Tudor-Locke et al., 2004; World Heart Federation, 2014).
- A potential necessary alternative to underutilized, expensive cardiac rehabilitation programs

### Importance of Knowledge to be Gained.

The benefits of regular physical exercise and the difficulty experienced by individuals with CAD to maintain regular physical activity have been highlighted. The potential knowledge to be gained by this study include a potential method to circumvent physical activity barriers experienced by the majority of CAD sufferers who cannot or will not participate in a standardized program. In order to reduce the number of secondary cardiovascular events, it is necessary to explore options beyond traditional hospital-based cardiac rehabilitation programs that are drastically underutilized or inaccessible.

### Minorities and Vulnerable Population

Individuals with severe learning disabilities who were unable to participate in meaningful discussion about the subject matter were excluded from the research study. Individuals with significant cognitive impairment were not included in the study because it was necessary to understand instructions as well as potential risks and benefits associated with regular physical activity in the setting of CAD. Participants under the age of 18, pregnant, imprisoned, or institutionalized were excluded from the study as they are not typically found in the cardiac practice setting. All adults with known CAD, regardless of gender or ethnicity, were encouraged to participate if they met the inclusion and exclusion criteria.

### Summary

This mixed method study recruited a sample of 54 adults with diagnosed CAD who expressed interest in improving their physical activity habits. Results from three separate self-efficacy for physical activity measures were assessed at four time periods during the study to

determine any possible effect of the intervention on participants. Assessments were taken at baseline, immediately after the 90-minute prehab class, and after 10-weeks. The shortest self-efficacy measure was taken again by phone 30 days after the study. Physical activity volume was assessed at baseline, collected over a 10-week period, and reassessed again 30 days after the study was complete. Physical activity measures were compared to baseline to ascertain if any sustained improvement in regular physical activity behavior in this population could be maintained. Descriptive statistics, ANOVA, multiple linear regression, t tests, and correlations were used as analysis tools for the data. Qualitative data were collected throughout the course of the study. Themes found in the qualitative data were linked to quantitative results to further explain the findings. Additionally, qualitative data permitted the examination of perceived and experienced barriers and facilitators to regular physical activity as well as recommendations for a future prehab program. Facilitators were linked back to themes associated with self-efficacy theory. Figure 2 highlights the stages of the intervention associated with the facilitators of self-efficacy

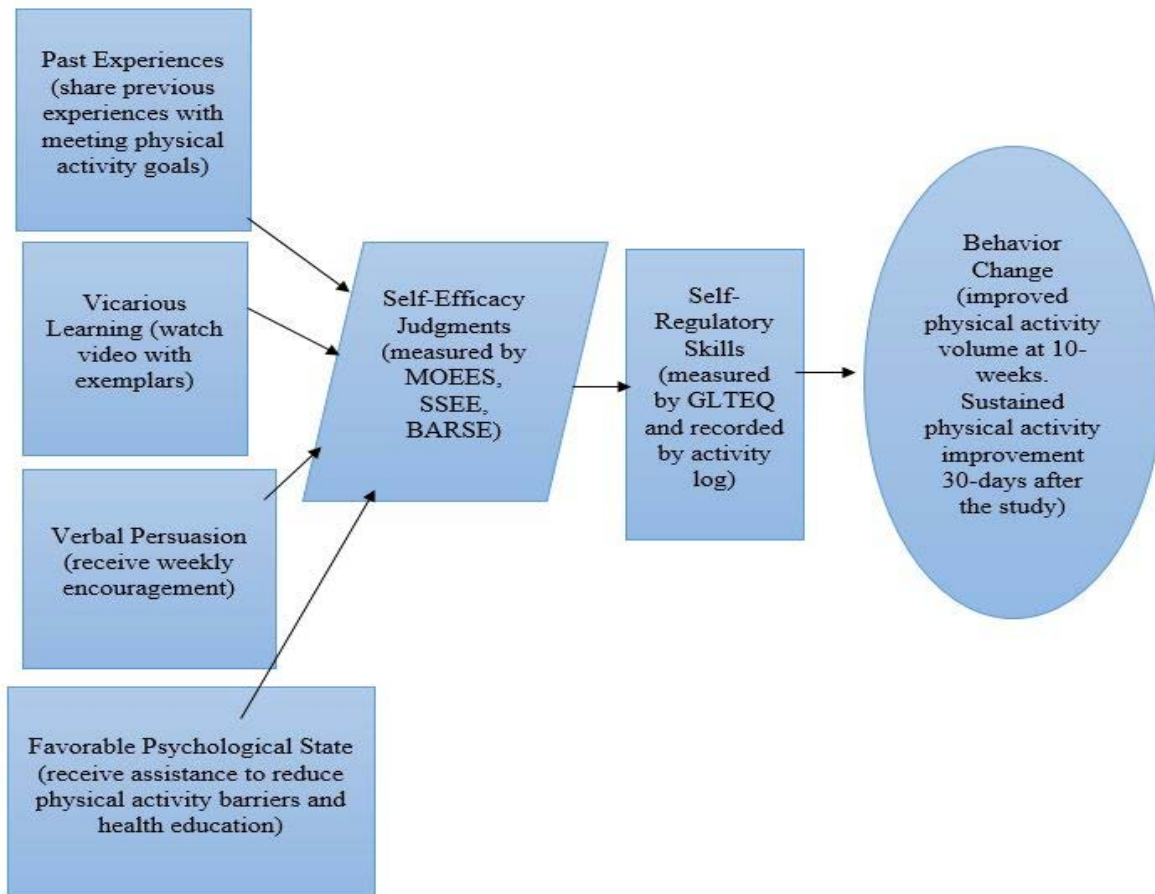


Figure 2. Prehab interventions that coincide with self-efficacy facilitators

## CHAPTER 4 FINDINGS

### Recruitment

Participants were recruited from cardiology practices in St. Johns County. The opportunity to participate in the study was presented to prospective participants by their medical providers and through office advertisements. The PI screened potential participants for inclusion and exclusion criteria. Sixty participants were referred to the study. Of these, 54 attended the prehab class and consented to participate. There were 50 (93%) participants remaining after the 10-week intervention period and 48 (89%) were reached for reassessment 30-days after the prehab study was complete. A consort flow diagram is shown in Figure 3.



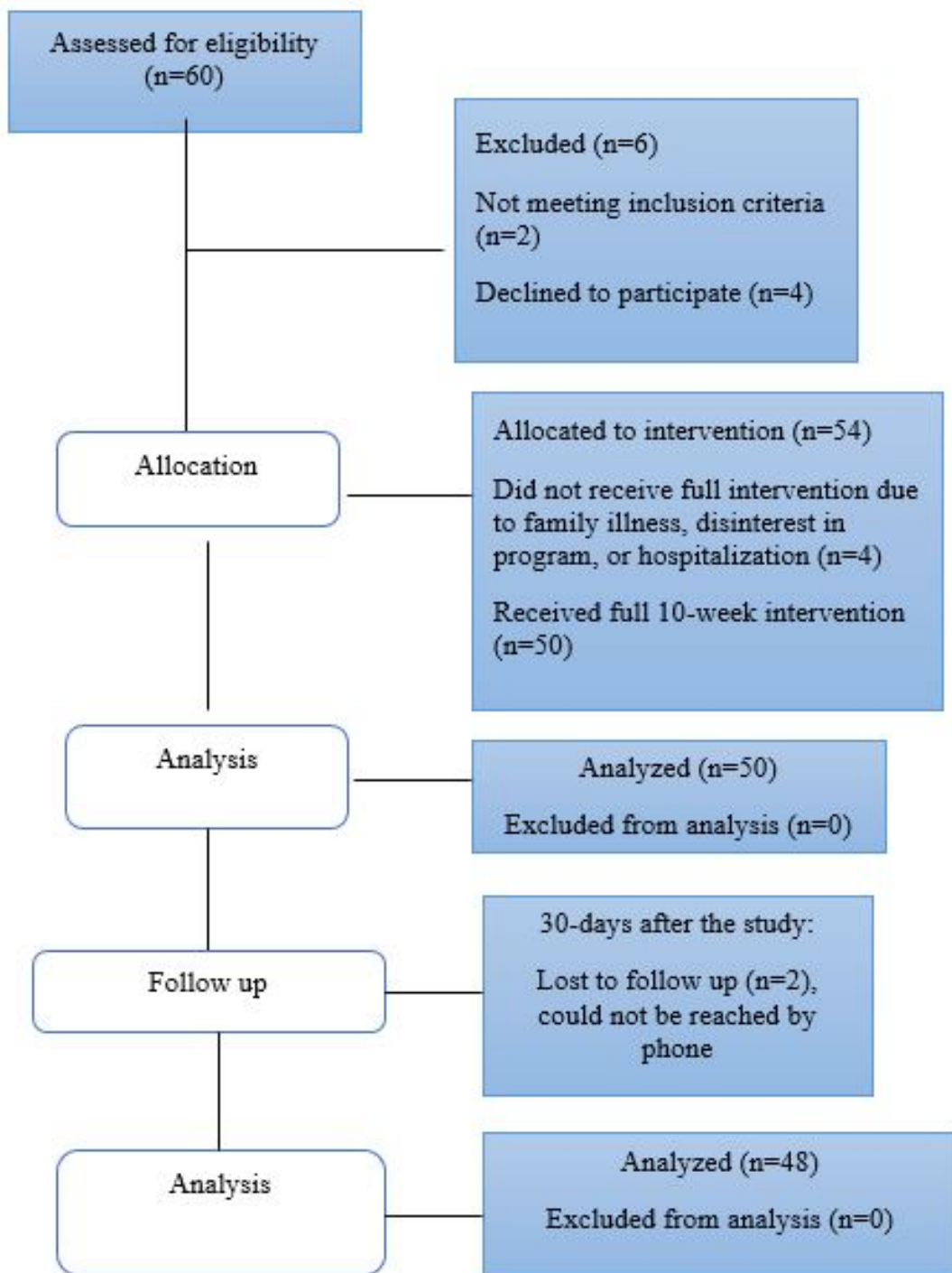


Figure 3. Consort flow diagram for Prehab recruitment and analysis

## Description of Sample

### Baseline Demographic Findings

Demographic information is summarized in Table 2. A total of 54 adults with diagnosed CAD between the ages of 50-80 enrolled in the Prehab study. The majority of the sample was male 68.5% (n=37), Caucasian 88.9% (n=48), and married 74% (n=40). The average age enrolled of participants was 68.5 years (SD 7.13). The majority of enrollees had reached an education level beyond high school: 22.2% (n=12) had some college experience, 14.8% (n=8) attended a vocation program after high school, 20.4% (n=11) graduated college, and 13% (n=7) had post-graduate experience. Most participants reported income greater than \$20,000/year (n=48). Employment status of participants included 70.4% retired (n=38), 22.2% full time (n=12), and 7.4%-part time (n=4).

CAD history included the following: MI 40.7% (n=22), stent placement 38.9% (n=21), medical therapy alone 29.6% (n=16), and coronary artery bypass surgery 27.8% (n=15). Several participants had had more than one type of intervention for their CAD during their life time. In this study population, 70.4% (n=38) received their CAD diagnosis more than five years prior to entering the study. Other participants received their CAD diagnosis within the previous 1- 5 years (n=8), within the past 6-12 months (n=3), or within the past 6 months (n=4).

Table 2

*Baseline Demographic Variables*

Variable	n	Percent	Mean (SD)
Age	54		68.57 (7.13)
men	37	68.50%	69.08 (7.27)
women	17	31.50%	67.47 (6.88)
Race			
Caucasian	48	88.90%	
Hispanic	2	3.70%	
African American	1	1.90%	
Other	3	5.60%	
Income			
More than 20K/year	48	88.90%	
Less than 20K/year	5	9.30%	
Education level			
some college	12	22.20%	
college graduate	11	20.40%	
high school graduate	10	18.50%	
trade/vocation	8	14.80%	
post graduate	7	13%	
some high school	3	5.60%	
some post graduate	3	5.60%	
Employment status			
retired	38	70.40%	
full time	12	22.20%	
part time	4	7.40%	
Marital Status			
married	40	74.10%	
single	5	9.30%	
widowed	4	7.40%	
divorced	3	5.60%	
partnership	2	3.70%	
CAD time of diagnosis			
greater than 5 years	38	70.40%	
1-5 years ago	8	14.80%	
within 6 months	4	7.40%	
6-12 months ago	3	5.60%	
CAD treatment type			
Myocardial infarction	22	40.70%	
Stent placement	21	38.90%	

Variable	n	Percent	Mean (SD)
Medical therapy	16	29.60%	
Coronary artery bypass surgery	15	27.80%	

### Research Question 1

What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of self-efficacy for physical activity after a 10-week intervention, and can it be maintained for 30-days after the study?

Research Aim 1 was to evaluate the effect of a self-efficacy based class on self-efficacy levels in adults with known CAD. In order to accomplish this aim, baseline self-efficacy scores were examined (Table 3), internal consistency reliability of the measures were assessed (Table 4), and baseline measures were compared to post class measures of the MOEES, SSEE, and BARSE (Table 5).

Table 3

#### *Baseline Self-efficacy for Physical Activity*

Measure	N	Mean (SD)	Skewness	Minimum	Maximum
SSEE	52	12.75 (4.02)	-.31	4.00	20.00
Physical outcome expectations (MOEES)	54	21.87 (4.67)	-2.30	5.00	25.00
Social outcome expectations (MOEES)	54	9.04 (3.74)	.09	3.00	15.00
Self-evaluative expectations (MOEES)	54	16.70 (4.15)	-1.92	4.00	20.00
BARSE	54	751.46 (255.12)	-.22	200.00	1250.00

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

Internal consistency reliability of the baseline self-efficacy measures was examined using Cronbach's Alpha and then compared to reliability findings from previous studies in order to assess that the correct construct was being measured. According to Polit (2010), coefficients of .70 to .75 are acceptable although levels greater than .80 are desired. All of the measures demonstrated Cronbach's alpha near 1.00 at baseline except the SSEE measure that had an acceptable Cronbach's alpha of .72. These results are shown in Table 4.

Table 4

*Internal Consistency Reliability of Measure*

Self-efficacy Measure	Cronbach's Alpha	Literature	Cronbach's Alpha (prehab)	N
Physical outcome expectations	0.75	Hall et al., 2012	0.95	5
Social outcome expectations	0.82	Hall et al., 2012	0.92	3
Self-evaluative expectations	0.84	Hall et al., 2012	0.95	4
SSEE	0.88	Resnick et al., 2007	0.72	4
BARSE	0.92	McAuley et al., 2003	0.90	13

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

Post class measures were completed by participants before leaving the prehab class. Paired t-tests were used to compare mean differences in the measures. The self-efficacy measures demonstrated significant improvement immediately following the prehab class ( $p < .04$ ) for all tests) and are reported in Table 5.

Table 5

*Post-class Self-efficacy Levels*

Pair	Measure	N	Mean (SD)	t	df	Sig (2 tailed)	d
1	Physical outcomes baseline	48	22.19 (4.30)	-2.22	47	.031	.32
	Physical outcomes post class	48	23.46 (2.29)				
2	Social outcomes baseline	49	9.18 (3.83)	-3.05	48	.004	.44
	Social outcomes post class	49	9.86 (3.76)				
3	Self-evaluative outcomes baseline	49	16.98 (3.94)	-2.09	48	0.04	.30
	Self-evaluative post class	49	18.22 (2.5)				
4	SSEE baseline	48	12.79 (3.93)	-3.84	47	<.001	.55
	SSEE post class	48	14.77 (3.48)				
5	BARSE baseline	48	758.94	-2.88	47	.006	.41
	BARSE post class	48	859.56 (257.82)				

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

Research Aim 2 was to evaluate the effect of a self-efficacy theory based intervention on levels of self-efficacy for physical activity in adults with CAD after 10 weeks. A one-way repeated-measures analysis of variance (ANOVA) was calculated comparing SSEE, MOEES, and BARSE scores at baseline, after the prehab class, and after 10 weeks in the study. For the SSEE, a significant effect was found ( $F(2,86) = 7.41, p < .01$ ) and is displayed in Table 6.

Protected t test revealed that SSEE scores at 10 weeks were significantly improved from baseline ( $t(47) = -3.49, p < .01$ ) as shown in Table 7. There was no significant improvement when SSEE scores after the prehab class were compared to SSEE scores at 10 weeks ( $t(44) = -19, p > .05$ ).

A one-way repeated-measure ANOVA was calculated to determine if there was any significant difference in physical outcome expectations at baseline, after the prehab class, and after 10 weeks in the study. A significant effect was found ( $F(2,68) = 5.31, p < .05$ ). It is displayed in Table 6. Protected t test revealed a significant increase in physical outcome expectations on the MOEES at baseline compared to scores taken after 10 weeks in the study ( $m=24.37, sd = 1.33$ ) ( $t(40) = -3.24, p < .01$ ). As shown in Table 7, there was also a significant improvement when post class scores were compared to scores for physical outcome expectations at 10-weeks ( $t(34) = -2.09, p < .05$ ).

A one-way repeated measure ANOVA was calculated to determine if there was any significant difference in the three time measures for self-evaluative outcome expectations. A significant effect was found and displayed in Table 6 ( $F(2,70) = 3.22, p < .05$ ). Protected t test revealed that the mean improvement in self-evaluative outcome expectations were significantly improved from baseline to assessment taken at 10-weeks ( $t(40) = -2.51, p < .05$ ) but was not significantly improved from post class to the 10-week assessment ( $t(35) = -.55, p > .05$ ) as shown in Table 7.

One way repeated-measure ANOVA was calculated to determine if there were any significant difference on repeated measures of social outcome expectations at baseline, post-class, and at 10-weeks. No significant effect was found for social outcome expectations ( $F(2,72) = 1.42, p > .05$ ). Scores obtained from the BARSE measure also did not produce a significant equation when evaluated at the three time periods ( $F(2,70) = 1.59, p > .05$ ). Table 6 summarizes

the repeated measures analyses performed for the self-efficacy measures at baseline, post-class, and at the end of the study (10-weeks). Table 7 displays the post-hoc analysis with protected t-test.

Table 6

*Repeated Measures ANOVA for Self-efficacy Measures*

Measure	df	F	<i>p</i>
SSEE	2,86	7.41	<.001
Physical outcome expectations	2,68	5.31	.002
Self-evaluative outcome expectations	2,70	3.22	.046
Social Outcome expectations	2,72	1.42	.238
BARSE	2,70	1.59	.211

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.



Table 7

*Post-Hoc t-Tests for Repeated Measures of Self-Efficacy*

Self-efficacy Measure	N	Mean (SD)	t	df	p
Physical outcome expectations at 10 weeks	42	24.39 (1.26)			
Compared to baseline	41	22.57 (3.86)	-2.98	41	0.002
Compared to post-class	35	23.51 (1.33)	-1.92	36	0.044
Social outcome expectations at 10 weeks	42	10.02 (3.35)			
Compared to baseline	41	9.38 (3.77)	-1.20	40	0.238
Compared to post-class	37	10.02 (3.35)	0.23	36	0.822
Self-evaluative expectations at 10 weeks	42	18.52 (2.17)			
Compared to baseline	41	17.08 (3.90)	-2.51	40	0.016
Compared to post-class	36	18.27 (2.83)	0.55	35	0.583
SSEE at 10 weeks	48	1.86 (3.40)			
Compared to baseline`	48	12.88 (4.07)	-3.49	47	0.001
Compared to post-class	45	14.84 (3.56)	-0.19	44	0.851
BARSE at 10 weeks	42	796.94 (375.43)			
Compared to baseline	42	759.97 (270.37)	-0.70	41	0.489
Compared to post-class	36	860.53 (270.37)	1.03	35	0.311

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

Research Aim 3 proposed to determine if there was a lasting effect on levels of self-efficacy for physical activity 30 days after the study intervention. Only the SSEE measure was used at the 30-day after mark. A one-way repeated-measures ANOVA was calculated to determine if there was any significant change in SSEE scores taken at 4 different time periods

throughout the study: baseline, after the self-efficacy class, at 10-weeks, and 30 days after the study was complete. A significant relationship was found with  $F(3,123) = 7.05, p < .001$ .

Protected t tests were performed and demonstrated that SSEE scores taken at all time periods were significantly improved compared to baseline scores. As shown in Table 8, there was no significant difference noted between the time periods taken after the baseline measurement.

Table 8

*Repeated Measures of SSEE*

SSEE	Mean (SD)	N	df	t	p
Baseline compared to post-class scores	14.88 (3.64)	48	47	-3.84	<.001
Baseline compared to 10-week scores	14.81 (3.47)	48	47	-3.49	.001
Baseline compared to scores taken 30 days after study	15.50 (3.41)	44	45	-3.890	<0.001

*Note.* SSEE=Short Self-Efficacy for Exercise Scale

Research Question 2

What is the effect of a nurse-practitioner-led prehab program for persons with coronary artery disease (CAD) on physical activity volume after a 10-week intervention, and can it be maintained for 30-days after the study?

Research Aim 4 was to evaluate the effect of a self-efficacy theory based intervention on physical activity habits of adults with known CAD over a 10-week period. Baseline mean GLTEQ scores for the prehab group were 18.39 (sd= 16.93). The GLTEQ asks the frequency that a person breaks a sweat during a normal week: 18.5% reported often, 38.9% reported

sometimes, and 42.6% reported rarely. Levels on the GLTEQ above 24 are considered sufficiently active (Amireault, et al., 2015). Baseline GLTEQ reported scores, as shown in Table 9, revealed that 31.5% reported scores above 24, reflecting that 68.5% of the population were considered sedentary at enrollment.

Table 9

*Baseline Activity Levels*

Activity Level	N	Frequency	GLTEQ (SD)	Range
GLTEQ	54	100%	18.39 (16.85)	0-85

*Note.* GLTEQ=Godin Leisure Time Questionnaire

The literature review suggested that many background demographic variables influence activity levels. In order to help determine if there were confounding variables affecting activity status that should be considered for subsequent analyses, mean baseline differences in activity levels among the different demographic groups were compared. Independent t tests were performed to determine if activity levels differed significantly by gender or income level, no significant equation was found ( $p>.05$ ). One-way ANOVA was used to determine if there was any significant difference in baseline activity levels by age group, education level, level of coronary disease, time since CAD diagnosis, ethnicity, or marital status. No significant differences were found ( $p>.05$  for all tests). The results of the comparisons of activities by demographic factors are displayed in Tables 10 and 11.

Table 10

*t-Test Comparisons of Activity Among Demographic Factors*

Factors	n	GLTEQ Mean (SD)	t	df	p
Gender					
Men	37	21.38 (17.92)	1.97	52	.06
Women	17	11.88 (12.70)			
Income					
<20K	5	20.60(18.93)	.31	51	.48
>20K	48	18.10(17.09)			

Note. GLTEQ=Godin Leisure Time Questionnaire

Table 11

*ANOVA Comparisons of Activity Among Demographic Factors*

Factors	n	GLTEQ Mean (SD)	F	df	p
Age Group			.64	2,51	.98
Age 50-60	11	18.27 (14.17)			
Age 61-70	23	17.96 (14.65)			
Age 71-80	20	18.95 (19.89)			
Education Level			.02	2,51	.54
some high school	3	13.67 (23.67)			
high school grad	10	14.40 (15.88)			
some college	12	22.58 (11.00)			
trade/vocation	8	17.63 (17.04)			
college grad	11	20.73 (23.92)			
some post grad	3	10.43 (6.75)			
post grad	7	10.43 (16.93)			
CAD treatment			.71	3,50	.55
Medical treatment	16	19.81 (21.67)			
Myocardial infarction	5	27.20 (10.92)			
Stent Placement	18	15.06 (14.73)			
CABG	15	17.93 (15.49)			
Length of time since diagnosis			.31	3,49	.82
Within 6 months	4	23.00 (13.17)			
6 month-12 months	3	15.67 (13.80)			
1-5 years	8	22.13 (13.04)			
> 5 years ago	38	17.11 (18.56)			
Ethnicity			1.06	3,50	.37
African American	1	31.00 (0.00)			
Caucasian	48	18.58 (17.25)			
Hispanic	2	0.00 (0.00)			
other	3	23.33 (16.93)			
Marital Status			.78	4,49	.55
Single	5	25.60 (10.90)			
Married	40	16.23 (17.72)			
Partnership	2	28.50 (12.02)			
Divorced	3	13.00 (17.58)			
Widowed	4	26.00 (16.35)			

Note. GLTEQ=Godin Leisure Time Questionnaire

Participants' physical activity level was recorded in four ways during the 10-week data collection: mean GLTEQ scores for the 10-week period, mean minutes of physical activity reported by the participant, perceived average GLTEQ score by the participant, and active level with GLTEQ score greater than 24. Wherever applicable, paired sample t-tests were performed to determine if there were any significant differences in activity levels between baseline and 10-week activity levels. Significant improvement occurred when baseline GLTEQ was compared to mean GLTEQ scores for the 10-week period ( $t(49) = -3.66, p = .001$ ) and when baseline scores were compared to retrospective perceived GLTEQ levels reported by participants for the 10-week period ( $t(49) = -6.75, p < .001$ ) as shown in Table 12. Additionally, McNemar testing demonstrated that there was significant ( $p < .001$ ) improvement in the number of participants achieving active status (GLTEQ >24). After 10-weeks in the study, 68% of participants reported GLTEQ scores greater than 24, compared to 31.5% at baseline (Table 14).

Table 12

*10-week Activity Levels*

Activity Measure	N	Mean (SD)	t	p	Range
Mean GLTEQ score for the 10-week period compared to baseline	54	27.05 (11.58)	-3.66	<.001	4.30-65.50
Mean reported GLTEQ score at 10 weeks by participants compared to baseline	50	41.10 (24.11)	-6.75	<.001	3.00-100
Mean minutes recorded over 10 weeks	54	299.30 (188.79)			39.00-755.80

*Note.* GLTEQ=Godin Leisure Time Questionnaire.

Research Aim 5 was to evaluate if there is a lasting effect on physical activity volume 30 days after the study intervention. A one-way repeated measures ANOVA was calculated comparing the reported GLTEQ scores of participants at three different times: baseline, after 10 weeks in the study, and 30 days after the study was complete. A significant effect was found ( $F(2,90) = 21.86, p < .001$ ). Post-hoc protected t test revealed that scores increased significantly from GLTEQ baseline ( $m = 19.15, sd = 17.47$ ) to 10 week scores ( $m = 40.57, sd = 24.74$ ). Additionally, GLTEQ baseline to scores were significantly improved when compared to GLTEQ scores 30 days after the study was complete ( $m = 38.02, sd = 21.87$ ). Scores did not change significantly from the 10-week score to the 30-day score, ( $p > .05$ ). The results of this analysis are displayed in Table 13.

Table 13

*Baseline Activity Level Comparison: 10-week and 30-days After Study*

Activity	Mean (SD)	N	t	df	p
Baseline compared to 10-week GLTEQ	40.57 (24.74)	50	-6.75	49	<0.001
Baseline compared to 30-day after GLTEQ	38.02 (21.87)	47	-4.96	46	<0.001

*Note.* GLTEQ=Godin Leisure Time Questionnaire

McNemar chi-square testing demonstrated that non-sedentary GLTEQ scores remained significantly improved compared to baseline ( $p < .001$ ). At baseline 68.5% scored in the sedentary range whereas sedentary levels declined to 32% after the 10-week intervention period and 30.4% 30-days after the study (Table 14).



Table 14

*Rates of Participant Active Levels with GLTEQ>24*

Measurement Time	N	Percentage
Baseline	17	31.5
10-weeks	34	68.0
30-days after the study	32	69.6

*Note.* GLTEQ=Godin Leisure Time Questionnaire

In considering the criterion-related validity of the self-efficacy measures, the relationships between the different self-efficacy measures were assessed to help support that the effects of self-efficacy were truly being measured. Pearson's correlation was calculated to determine if baseline self-efficacy measures (MOEES, SSEE, BARSE) correlated with each other (Table 15). There was a strong positive correlation between self-evaluative expectations and physical outcome expectations at baseline ( $r(52) = .91, p < .01$ ). Baseline social outcome expectations had a moderate positive correlation with self-evaluative outcome expectations ( $r(52) = .31, p < .05$ ). Baseline BARSE scores had a moderate positive correlation with SSEE scores ( $r(50) = .40, p < .01$ ).

Table 15

*Baseline Measures: Validity of Self-efficacy*

Measures		Baseline Physical Outcomes Expectations	Baseline Social Outcome Expectations	Baseline Self-evaluative Expectations	Baseline SSEE Score	Baseline BARSE
Baseline Physical Outcomes Expectations	Pearson Correlation	--	.22	.91**	-.03	.15
	Sig. (2-tailed)		.11	<.01	.86	.28
	N		54	54	52	54
Baseline Social Outcomes Expectations	Pearson Correlation	.22	--	.31*	.16	.10
	Sig. (2-tailed)	.11		.02	.25	.47
	N	54		54	52	54
Baseline Self-evaluative Expectations	Pearson Correlation	.91**	.31*	--	-.08	.14
	Sig. (2-tailed)	<.01	.02		.57	.30
	N	54	54		52	54
Baseline SSEE score	Pearson Correlation	-.03	.16	-.08	--	.40**
	Sig. (2-tailed)	.86	.25	.57		<.01
	N	52	52	52		52
Baseline BARSE	Pearson Correlation	.15	.10	.14	.40**	--
	Sig. (2-tailed)	.28	.47	.30	<.01	
	N	54	54	54	52	

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale. \*\*Correlation significant at .01 level. \*Correlation significant at .05 level.

Pearson's correlations were examined at the end of the study (10-weeks) for self-efficacy measures (MOEES, SSEE, and BARSE). As shown in Table 16, there was a moderate positive relationship found between SSEE scores and physical outcome expectations ( $r(39) = .38, p < .05$ ). BARSE scores at 10-weeks had a moderate positive correlation with SSEE scores ( $r(40) = .43, p < .01$ ). Social outcome expectations had a moderate positive correlation with self-evaluative outcome expectations ( $r(39) = .48, p < .05$ ). There was a moderate positive relationship found between social outcome expectations and BARSE scores ( $r(40) = .46, p < .01$ ).

Table 16

*Validity of Self-efficacy Measures: 10-week Mark*

Measures		10-week SSEE	10-week Physical Outcome Expectations	10-week Social Outcome Expectations	10-week Self Evaluative Expectations	10-week BARSE
10-week SSEE	Pearson Correlation	--	.38*	.27	.28	.43**
	Sig. (2-tailed)		.01	.09	.08	.01
	N		41	42	41	42
10-week Physical Outcome Expectations	Pearson Correlation	.38*	--	-.01	.18	.02
	Sig. (2-tailed)	<.01		.93	.26	.90
	N	41		41	40	41
10-week Social Outcome Expectations	Pearson Correlation	.27	-.01	--	.48**	.46**
	Sig. (2-tailed)	.09	.93		.00	<.01
	N	42	41		41	42
10-week Self- evaluative Expectations	Pearson Correlation	.28	.18	.48**	--	.43**
	Sig. (2-tailed)	.08	.26	<.01		<.01
	N	41	40	41		41
10-week BARSE	Pearson Correlation	.43**	.02	.46**	.43**	--
	Sig. (2-tailed)	<.01	.90	<.01	<.01	
	N	42	41	42	41	

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale. \*\*Correlation significant at .01 level. \*Correlation significant at .05 level.

Variance of Physical Activity Explained by Self-Efficacy Measures

Multi-dimensional Outcomes for Exercise Expectations (MOEES) Scale

Multiple linear regression analyses were performed to determine if the measures of MOEES self-efficacy explained the increased physical activity status at 10-weeks in the prehab study. During measure development of the MOEES, it was determined that increased functional status correlated with physical outcome expectations ( $r=.37, p<.01$ ) and self-evaluative expectations ( $r=.25, p<.01$ ) but not with social outcome expectations ( $r=.01, p=0.33$ ) (Hallet al., 2012). In the prehab study regression results indicated that baseline (pre-class) factors of the MOEES significantly predicted 10-week activity levels (GLTEQ) ( $F(3,46) = 7.62 = p<.001$ ), with  $R^2 = .33$ . Post class MOEES scores did not significantly predict activity levels at 10-weeks in the study ( $F(3,40) = 2.63, p>.05, R^2=.17$ ). Additionally, 10-week MOEES scores did not explain 10-week activity levels ( $F(3,36) = 1.30, p>.05, R^2=.10$ ). Table 17 depicts the variance of activity explained by MOEES.

Table 17

*Variance of Activity Explained by MOEES*

Measure	Variance
MOEES (Hall et al., 2012)	25-37%
MOEES (prehab)	33%

Note. MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise

### Short Self-Efficacy for Exercise Scale (SSEE)

SSEE reliability measures ranged from  $R^2 = .38$  to  $.70$ . The items were determined to account for 13% of the variance in exercise when the measure was constructed (Resnick et al., 2007). Simple linear regression was used to evaluate the effect of the SSEE on physical activity behavior at 10-weeks. For the prehab study no significant regression equation was found when baseline SSEE scores were compared to 10-week physical activity scores ( $F(1,46) = .17, p > .05, R^2 = .004$ ) and no significant regression equation was found when post-class SSEE scores were compared to 10-week physical activity scores ( $F(1,43) = 1.10, p > .05$ ). However, 10-week SSEE scores and 10-week activity scores did produce a significant equation ( $F(1,48) = 9.94, p < .01, R^2 = .17$ ). As reflected in Table 18, the 10-week SSEE scored accounted for 17% of the variance in exercise at the 10-week point in the prehab study.

Table 18

#### *Variance of Activity Explained by SSEE*

Measure	Variance
SSEE (Resnick et al., 2007)	13%
SSEE (prehab)	17%

### Barriers Self-Efficacy Scale (BARSE)

When the BARSE measure was previously studied over a 20-week period, the measure accounted for 60.54% of the variance for perceived physical exertion (McAuley, 1992). Simple linear regression was used to evaluate the effect of the BARSE on physical activity behavior at 10-weeks. For the prehab study, baseline BARSE scores were not a significant predictor for GLTEQ measured activity after 10 weeks ( $F(1,48) = .20, p > .05, R^2 = .004$ ) or 30 days after the



study completion ( $F(1,44) = .40, P > .05, R^2 = .009$ ). Post-class BARSE scores were significant predictors of physical activity GLTEQ scores at 10-weeks ( $F(1,42) = 5.24, p < .05$ ), with  $R^2 = .11$ . Additionally, as shown in Table 19, 10-week BARSE scores predicted 10-week activity level ( $F(1,40) = 4.24, p < .05$ ) with  $R^2 = .11$ . Table 20 reviews the best found self-efficacy predictors of 10-week activity levels.

Table 19

*Variance of Physical Activity Explained*

Measure	Variance
BARSE (Mcauley et al., 1992)	60.5%
BARSE (prehab)	11.0%

*Note.* BARSE=Barriers Self-efficacy Scale.

Table 20

*Best Found Self-efficacy Predictors of 10-week Activity Levels*

Model (constant)	B	Std. Error	Beta	F	sig	R <sup>2</sup>
Baseline MOEES	-5.26	14.38	1.33	7.62	<.001	.33
10-week SSEE	3.07	.97	.41	9.94	.003	.17
Post-class BARSE	.03	.01	.33	5.24	.027	.11

*Note.* MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

## Quantitative Summary

### Research Question 1

What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of self-efficacy for physical activity after a 10-week intervention, and can it be maintained for 30-days after the study?

Research Question 1 was answered by addressing Research Aims 1-3. Research Aim 1 was to evaluate the immediate effect of a self-efficacy based prehab class on self-efficacy levels in adults with known CAD. Baseline self-efficacy scores of the MOEES, BARSE, and SSEE were described using means and standard deviations. Internal consistency of the measures used was adequate with all Cronbach's Alpha levels above .70 (Polit, 2010). Paired t-tests were used to compare mean differences of each self-efficacy measure before and after the initial prehab class. All of the measures were improved significantly immediately following the class ( $p < .01$ ).

Research Aim 2 was to evaluate the effect of a self-efficacy theory based intervention on levels of self-efficacy for physical activity in adults with CAD after 10 weeks. Repeated measures ANOVA was used to assess changes in levels of self-efficacy at the three time periods: baseline, post-class and at 10 weeks. For post-hoc analyses, protected t test were used when significant equations were found. Baseline physical outcome expectations, self-evaluative outcome expectations, and self-efficacy for exercise (SSEE) remained improved when reexamined at the 10-week mark. The improvement in BARSE and social outcome expectation scores were no longer significant at the 10-week mark.

Research Aim 3 proposed to determine if there was a lasting effect on levels of self-efficacy for physical activity 30 days after the study intervention. Only the SSEE measure was used at the 30-day mark as it is short enough to discuss by phone. A one-way repeated-measures

ANOVA determined that improvements in the SSEE scores remained significant 30-days after the study when compared to baseline.

## Research Question 2

What is the effect of a nurse-practitioner-led prehabilitation (prehab) program for persons with coronary artery disease (CAD) on levels of self-efficacy for physical activity after a 10-week intervention, and can it be maintained for 30-days after the study?

Research Question 2 was answered by addressing Research Aims 4 and 5. Research Aim 4 was to evaluate the self-efficacy based intervention on physical activity habits in this population after a 10-week intervention period. There was a significant improvement in reported activity scores at the 10-week mark, with mean GLTEQ scores at 41.10 (SD=24.11) compared to baseline scores of 18.39 (SD=16.85). Likewise, there was a significant decline in sedentary behavior, with 68.50% of the population reporting sedentary activity levels at baseline and 32.00% reporting sedentary activity level after 10-weeks in the study.

Research Aim 5 was to evaluate if physical activity habits could be maintained 30-days after the study was completed without weekly contact. Phone survey revealed that 29.60% (n=16) believed their activity had continued to improve over the 30-day period, 20.40% (n=11) reported a slight decrease in regular activity over the 30-day period, and 33.30% (n=18) reported that their activity habit had remained the same. The 30-day GLTEQ scores (M=38.02, SD=21.87) remained significantly improved compared to baseline (M=18.39, SD=16.93) for the group as a whole. A small portion of the population (9.3%, n=5) reported that they did not believe that the intervention helped improve their regular physical activity habits. Table 21 presents a summary that outlines activity and self-efficacy scores at the various time periods.

Table 21

*Summary Table of Self-efficacy and Physical Activity*

Measures	Baseline	Post Class	10 Weeks	30 days After Study
	Mean (SD), N	Mean (SD), N	Mean (SD), N	Mean (SD), N
Physical Outcome Expectations	21.87 (4.67), 54	23.46 (2.29), 48	24.39 (1.26), 41	
Social Outcome Expectations	9.04 (3.72), 54	9.86 (3.76), 49	9.81 (3.45), 42	
Self-evaluative Outcome Expectations	16.70 (4.15), 54	18.22 (2.65), 49	18.39 (2.27), 41	
SSEE	12.75 (4.02), 52	14.71 (3.46), 49	15.06 (3.25), 50	15.65 (3.42), 48
BARSE	751.46 (255.12), 54	849.56 (257.82), 48	794.76 (378.47), 42	
GLTEQ	18.39 (16.93), 54		41.10 (24.11), 50	38.02 (21.87), 47

*Note.* GLTEQ=Godin Leisure Time Questionnaire; MOEES=Multidimensional Outcomes for Exercise Expectations Scale that measures physical, social, and self-evaluative outcome expectations for exercise; BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale.

Additional findings. Regression statistics were used to determine if the various self-efficacy measures were predictive of physical activity behaviors at the end of the study (10-week mark). Baseline physical outcome expectations, self-evaluative expectations, and social outcome expectations of the MOEES were significant predictors of GLTEQ scores at 10 weeks. Correlations were calculated to determine relationships between self-efficacy and activity at different time periods during the study. Baseline SSEE correlated with baseline activity on the

GLTEQ. At the 10-week mark, SSEE scores and BARSE scores had significant correlation with activity scores of the GLTEQ as shown in Table 22.

Table 22

*Self-efficacy Correlations at Study Completion (10 weeks)*

Measures		Physical Outcome Expectations	Self-evaluative Outcome Expectations	Social Outcome Expectations	SSEE	BARSE
Physical Outcome Expectations	Pearson Correlation	--	.91**	.23	-.25	.18
	Sig. (2-tailed)		<.001	.100	.100	.205
	N		54	54	54	54
Self-evaluative Outcome Expectations	Pearson Correlation	.91**	--	.31*	-.080	.18
	Sig. (2-tailed)	<.001		.022	.573	.191
	N	54		54	52	54
Social Outcome Expectations	Pearson Correlation	.23	.31*	--	.16	.17
	Sig. (2-tailed)	.100	.022		.248	.215
	N	54	54		52	54
SSEE	Pearson Correlation	.03	.08	.16	--	.39**
	Sig. (2-tailed)	.862	.573	.248		.004
	N	54	52	52		52
BARSE	Pearson Correlation	.18	.18	.17	.39**	--
	Sig. (2-tailed)	.205	.191	.215	.004	
	N	54	54	54	52	

*Note.* BARSE=Barriers Self-Efficacy Scale; SSEE=Short Self-Efficacy for Exercise Scale. \*\*Correlation significant at .01 level. \*Correlation significant at .05 level.

A series of chi-square analyses were calculated to determine if there were any baseline demographic differences existed between individuals who remained in at end of the 10-week intervention and individuals who did not. Gender, age category, education level, race, income, marital, nor being sedentary was significantly associated with leaving the prehab study ( $p > .05$ ). Chi-square analyses were also conducted and determine if the research assistant or medical provider who cared for the participant were associated with attrition at the 10-week mark. No significant equation was found ( $p > .05$ ). As reflected in Table 23, a significant difference was found in work commitment ( $X^2 = 7.00, p < .05$ ) with 25% ( $n=3$ ) of full time workers dropping from the prehab program.

Table 23

*Attrition Rate by Employment Status*

Employment Status	Total Population	
	N	Percentage
Full Time	3	5.6
Part Time	0	0.0
Retired	1	1.9

### Qualitative Data Analysis

The goal of qualitative analysis was to assess the satisfaction with the prehab class, gain insight about experienced barriers and facilitators to physical activity in this population, gather personal experiences from participants in the prehab study, and collect recommendations to guide development and implementation of a future prehab programs:

- Data were collected about satisfaction with the prehab class via anonymous survey taken after the class was completed.
- Perceived barriers and facilitators for establishing a regular physical activity habit were written by participants after the prehab class.
- The PI and research assistants recorded field notes during weekly phone calls when participants spontaneously discussed experienced barriers and facilitators in establishing their regular physical activity plan.
- Participants were specifically asked to discuss their experience in the prehab study during the 10-week phone call, the phone contact 30-days after the study was completed, and during the celebration luncheon. Participants were asked to share what, if any, factors in the prehab study contributed to establishing better physical activity habits. They were also asked to provide suggestions to improve the prehab program.

Thematic analysis was conducted to evaluate the qualitative data collected in the prehab study. In keeping with the thematic analysis technique outlined by Braun and Clarke (2006), data were categorized by themes and subthemes as they materialized during the data collection



process. Where applicable, facilitator themes found in the prehab study were related back to known facilitators of self-efficacy theory.

#### Baseline Qualitative Data.

Perceived facilitators and barriers to establishment of a regular physical activity plan were collected during the initial prehab classes. Perceived facilitators coincided with those noted in self-efficacy theory. Perceived barriers coincided with themes noted in the literature review. This produced broad themes to consider and compare to barriers and facilitators experienced during the intervention.

#### Research Question 3

What barriers and facilitators were described by participants in the prehab study?

#### Perceived Physical Activity Facilitators

Theme: *Vicarious learning* refers to the power of social modeling and the ability of individuals to find motivation to achieve a task when they can identify with others who have succeeded in completing the task without adverse events (Bandura, 1977). For the initial prehab class, participants reported that vicarious learning was beneficial from two sources. First, the film provided interviews with community exemplars who had overcome significant obstacles to achieve a life-long habit of regular activity. Participants remarked that they were motivated by watching the people interviewed who were exercising, despite being older and having significant health issues. The second source of vicarious learning was unexpected by the PI. Participants

gave feedback at the conclusion of the class that they liked hearing the success stories of other class members in regard to achieving previous activity goals.

Theme: *Psychological state* refers to elements that influence one's emotional state connected to learning (Bandura, 1977). Factors that reduce anxiety, such as health education and a plan to improve health, were used in the prehab study. In response to the education participants indicated that they were persuaded to think differently about initiating a physical activity program. Initial feedback for the prehab class included:

- I liked "learning more" about the heart.
- The program "opened my eyes about heart disease and exercise."
- Liked learning more about inflammation.
- The program is a "chance to start again."

Theme: *Perceived physical activity barriers*. Subtheme: *motivation*. Participants most commonly reported that their perceived barrier to a regular physical activity plan was due to a lack of motivation. Participant statements included "having a lack of desire and motivation" and "I'm lazy." Other participant statements included:

- "I just need to get started."
- "I don't have any barriers to exercise."
- "No ability to start a habit."

Subtheme: *Health concerns* were a frequently reported barrier to regular exercise. One participant remarked that increased weight hindered physical activity initiation. Decreased energy, claudication pain, depression, and shortness of breath were additional recorded perceived barriers. A subtheme of a fear of a worsening health problem emerged. One participant

remarked, “If I do something active, I try to make sure my neighbors are around to keep an eye on me.” Another participant stated that he “wanted to walk alone without fear that something would happen.” Participants highlighted how concerns of worsening health can hinder progress to establishing a regular physical activity regimen.

### Intervention Period Qualitative Data Collection

#### Experienced Facilitators

Theme: *Psychological State*. Subtheme: *Perceived Health Benefits*. During weekly phone calls several participants reported notable health improvements that inspired them to continue on with their activity commitment. These included having more energy, feeling an emotional benefit, sleeping better, weight loss, and experiencing satisfaction in meeting weekly set goals. Other health-related influences included realizing that heart disease “was serious” and being concerned because a friend died from complications of a heart problem. A specific individual case included a participant with known peripheral vascular disease who during the study reported:

I looked ridiculous stopping every five minutes when walking around my neighborhood because my legs hurt. I kept going though. It got gradually better each week. After 10 weeks of a walking program, I stop less and I don't think I need the test to check the circulation in my legs any more. I'm going to keep it up.

Another specific case included a husband and wife who were in the study together. The husband had significant chronic obstructive pulmonary disease (COPD) and had become increasingly sedentary over years. His wife reported:

I think this program is exactly what we needed. He has just sat in that chair for years. Since we started in the study, our walks have gotten longer and he now feels so good that he spends time in his workshop again. He has even been helping me in the yard. I have

also been more aware of my activity and am trying to increase how hard I work during my normal chores.

Other experienced health benefits reported by participants included:

- The class taught me how important exercise was for health.
- Blood work came back great. Blood sugar was normal and I still have a desire to lose weight.
- I wanted the benefits of feeling better.
- Knew that exercise was good for health “knew I should do it.”

Subtheme: *Internal Motivation*. Several participants remarked on ways they were keeping themselves motivated for activity during the study. One participant opted to increase the length and frequency he walked his dogs. He noted that he felt that he had to keep up the activity because “now my dog expects these walks all the time!” Another participant chose to find more active endeavors when he had custody of his children on the weekends: “I bought kayaks for us. Now when my son comes over we will have something fun to do and it will keep me more active.” Another participant expressed her internal motivation despite debilitating medical issues:

I still haven't heard about my spinal cord stimulator procedure. I'm staying more active by at least pacing up and down the hall at home. I park my car farther away when I go to the store. I'm just consciously trying to move more and I'm counting my steps on a pedometer.

One research participant had reported being particularly fearful of walking alone. He had reported slowly decreasing his activity since the time of his CAD diagnosis. He experienced particular success at changing his habits through the study:

When I was walking back out to my truck, I was walking and I was not meandering. Meandering is what I used to do. . . now I walk. I mean I have a positive gait. I used to have to move over to let people get by me that were walking and now I have people moving out of my way. It makes me feel good about that plus I feel physically better too with walking. I don't know if you went to the beach yesterday, but I did.

Participants were asked after 10 weeks in the study and 30-days after the study what they thought was helping them stay motivated for regular physical activity. Many believed motivation needed to be completely internally driven. Statements included:

- Just need to have goals and take pride in meeting the goals.
- It's just a matter of doing it--just get out and do it!
- Being goal driven.
- Just be more aware of activity level.
- You have to want it for yourself.
- Had to keep a promise to myself to complete the study.
- Ultimately it is an individuals' decision to stay motivated.
- Just make up your mind to do it.
- I just keep reminding myself that it's "for the heart."

Theme: *Self-regulation*. A commonly reported physical activity facilitator that participants noted during the study was self-regulation. Keeping an activity log, tracking steps on a pedometer, seeing the amount of calories burned on electronic measures, and writing activities down were frequently cited as motivators to maintain the physical activity habit. When participants were asked what would help keep people motivated beyond the study, continuing to keep an activity log was frequently cited as a method they would continue to use. In fact, although participants were not asked to keep a log after the 10-week mark in the study, several did so and gave their activity time and duration when contacted 30 days after the study was completed.

Subtheme: *Accountability*. Weekly phone calls were the most frequently reported external motivator for regular physical activity by participants. Participants reported that positive encouragement to maintain and improve activity goals from the caller were particularly useful. When participants were asked what factors about receiving a weekly phone call were influential, they reported:

- Being accountable to someone;
- Having a watch dog;
- I didn't want to let anyone down [during weekly phone calls];
- I didn't want to disappoint you or look bad in the study.

Theme: *Verbal Persuasion*. Verbal persuasion proved to be a valuable source of motivation for participants. When asked what kept people motivated during the study, receiving a phone call every week was the most powerful motivator to set goals and complete the study. Specifically, getting encouragement during phone calls and receiving positive reinforcement for meeting goals was noted as a facilitator to keep activity goals. Most participants reported looking forward to the phone call to discuss their progress.

Theme: *Vicarious Learning*. Vicarious learning was achieved by having participants watch the prehab video and hear the success stories of others in the prehab group. Even after 10-weeks in the study, participants still remarked that these were motivating factors. One participant reported that, "The people in the video keep me motivated." Group discussion allowed for perspective that "there were people with worse health problems."

Theme: *Previous Experience*. Self-efficacy theory and research conducted in this area purports that previous physical activity behavior was one of the most powerful predictors of

future physical activity habits among individuals with CAD (Reid et al., 2006; Tulloch et al. 2009). Likewise, in the prehab study, as participants completed weekly physical activity goals, they reported increased confidence and established routine. Example statements from participants included:

- Once I was in the study for a few weeks I missed my activity if I couldn't get to it.
- I just don't feel right now if I don't exercise.

Theme: *Experienced Barriers*. Experienced barriers that coincided with perceived barriers included lack of motivation and depression. Other experienced barriers were not predicted by participants such as musculoskeletal pain, scheduling conflicts, and unexpected illness. Scheduling conflicts were produced by work commitment, vacations, taking care of ill family members, and holidays. Although these were recorded reasons for missing a physical activity goal, participants were encouraged to start the next week anew. Throughout the study most participants were able to resume their activity goals once the barrier had been circumvented or an accomplishable goal was set.

#### Prehab Study Anomalies

During the course of the study there were a few participants who demonstrated activity patterns outside the norm. For example, when participants were contacted during their 10-week phone call, 9.3% (n=5) reported that being in the study did not sufficiently change their activity habit. Two of the participants reported that they were active before the study and remained similarly active throughout the study. However, the three remaining participants reported that the prehab intervention did not improve their sedentary habits. This particular subset of participants

reported that: (a) having a partner to exercise with, (b) finding a group activity that interested the individual, and (c) seeing weight loss could have improved their motivation for physical activity.

When participants were contacted 30-days after the study, without weekly phone contact, most participants reported activity habit maintenance or a slight decrease in their activity routine. However, there was a small subset of participants who reported an increase in their activity level during this time period. Two participants who had previously reported no improvement in their physical activity habits during the intervention suddenly reported a development of an improved physical activity regimen. One participant reported that he was not feeling well through the holiday period and began to increase his activity in order to feel better. The other participant reported that having two friends die from heart disease inspired him to improve his physical activity habits. Other reported reasons for continued improvement in physical activity after the intervention period included positive blood work results, keeping personal goals, and desire for continued health benefits.

### Recommendations for Future Programs

After the study completion, final phone calls and the celebration luncheon were used to collect recommendations to make a prehab program better or more motivating.

Recommendations included more frequent group meetings, group exercise opportunities, help with finding an exercise partner, webinars, weight loss incentive, and continued phone calls.

When asked how often participants could reasonably meet for group sessions, responses ranged from once a week to once a month with the most frequent response being every other week.

When asked what content they would like to see in a group session, most participants responded that a balance of learning and talking to others with the same struggle would be of benefit.



Several of the prehab participants desired an exercise partner and thought that they could establish relationships with others in the area through regular group meetings. Other participants already had a spouse or exercise partner or preferred to exercise alone. Many of the prehab participants reported that continued weekly phone calls were motivational for keeping activity goals and thought this could be performed by a peer in the group. For individuals who could not attend meetings, the ideas of webinars were suggested. There was a substantial number of participants who reported a desire for weight loss and thought that if that was included in the study it would be beneficial. Having a good place to walk, access to exercise equipment, and a place to walk away from the elements were additional recommendations to make a regular exercise plan more successful.

### Qualitative Summary

Qualitative data were collected in order to better understand barriers and facilitators for regular physical activity in this population. Qualitative information was additionally necessary in order to evaluate the effectiveness of a novel prehab program and support quantitative findings. Perceived and experienced barriers to regular physical activity habits were recorded and found to be similar to those noted in the literature review. Themes of perceived and experienced facilitators to regular physical activity were consistent with facilitators of self-efficacy.

Perceived barriers of participants prior to the intervention period included lack of motivation, health concerns, depression, and fear of injury. Experienced barriers to physical activity likewise included lack of motivation and depression. Experienced barriers that were not predicted by participants included: scheduling conflicts, musculoskeletal discomfort, and illness. Encouraging methods to circumvent these barriers was a major goal of callers in the study.

Participants noted several facilitators during the weekly phone calls. Facilitator themes were linked to self-efficacy theory. Participants reported benefits of vicarious learning by gathering with others with CAD to hear their previous struggles and successes in meeting physical activity goals. Benefits of vicarious learning were additionally reported by watching the interview exemplars who had overcome significant obstacles in order to maintain a regular physical activity. Benefits of verbal persuasion were reported by participants; weekly phone calls reportedly provided positive reinforcement and encouragement to continue with setting and reaching physical activity goals. When participants were asked what kept them motivated throughout the study, psychological state was important. Most participants reported a desire for good health and avoidance of poor health. Previous experience was noted as a sustaining factor for regular physical activity. Participants reported that once they had adopted a habit of engaging in physical activity, they longed for the activity when the opportunity was missed.

Self-regulation was the most frequently cited reason for maintaining a regular physical activity habit. Participants kept weekly activity logs and felt compelled to fulfill individual goals. Subthemes that contributed to one's self-regulation included accountability, self-commitment, and habit formation. Participants reported that receiving weekly phone calls kept them accountable for their weekly goals.

At the conclusion of the study, participants were asked what could improve the study. Increased social support was an overwhelming recommendation. Participants desired a more frequent connection to the group, continued phone calls beyond 10 weeks, continued opportunities for learning in group or by webinar, and assistance with establishing an exercise partner. Access to equipment, an indoor place to walk, and group exercise classes were

additional recommendations to improve physical activity adherence. Table 24 summarizes facilitator themes and subthemes discovered in the qualitative analysis.

Table 24

*Facilitator Themes*

Theme	Subthemes	Participant Statements
Self-Regulation	Accountability	Weekly phone calls kept me on track, I didn't want to disappoint anyone.
	Self-Regulation	Keeping a log of my activity was helpful in keeping me going.
	Self-commitment	It's just a matter of doing it. You have to want it for yourself.
	Habit	Now, when I don't exercise, I miss it.
Psychological State	Health	The class taught me how important exercise was for the heart.
	Fear	I decided to pick up my activity because I had friends who passed away from heart problems.
Verbal Persuasion	Encouragement	Getting encouragement during weekly phone calls helped me keep going.
	Hope	I saw hope that I could improve my activity.
Previous Experience		Once I was in the study for a few weeks I missed my activity if I didn't get a chance to do it.

## CHAPTER 5 DISCUSSION AND SYNTHESIS

### Introduction

This chapter contains a summary and discussion of the quantitative and qualitative findings of the study organized around the Research Aims which guided the study. Major facilitator themes and subthemes, as well as barriers, are also discussed. Implications for practice, strengths and limitations, and recommendations for future research are offered.

### Sample

The sample for this study was comparable to the demographics observed in American adults with diagnosed CAD. Although the prehab population was more likely to be male (68.5%) than female (31.5%), this was not considerably different than the national average of adults over 40 with diagnosed CAD where 58.4% are male and are 34.1% female (Florida Charts, 2012; Mozaffarian et al., 2015). Other demographics such as race, poverty rate, and education were reflective of averages noted in the surrounding county (Table 25). Because participants who wanted to improve their activity habits were invited into the study, the prehab population was understandably less active than the general population in the St. Johns County area.

Table 25

*Demographic Comparison: Prehab and St. Johns County*

Characteristics	St. Johns County	Research Population
Caucasian	89.5%	88.9%
Percentage of poverty	8.2%	9.3%
Less than high school education	6.2%	6.5%
Sedentary	18.0%	68.5%

The literature review revealed that socio-economic, physical, personal, and environmental elements contribute to a person’s motivational drive. Factors that were noted to negatively impact activity included female gender, lower education level, advancing age, lower income, and lack of time (Reid et al., 2007; Soni, 2004; Trost et al., 2002; U.S. Department of Health and Human Services, 2013). These trends were not noted in the prehab population; there was no significant difference in activity levels at baseline or after 10-weeks among different demographic groups: gender, education level, age group, income, or work commitment. Sharp and Freeman (2009) similarly determined that gender, age, occupation, medical status and ethnicity were not predictors of non-adherence in a cardiac rehabilitation program. The prehab population was homogenous in nature and were admittedly sedentary which helps explain the marked difference in sedentary levels compared to people in the surrounding county. The homogenous composition of the prehab population may also contribute to the similar trends of activity levels noted among differing demographic groups in the study.

## Self-Efficacy for Physical Activity

### Research Aim 1

Research Aim 1 was to evaluate the effect of a self-efficacy-based, nurse-practitioner-led, prehab class on self-efficacy for physical activity levels. Participants in the prehab study were asked to complete the various self-efficacy measures before and after the prehab class. The improvement was statistically significant for all of the measures post-class. Participants were more likely to report higher self-efficacy for physical activity (SSEE), higher outcome expectations with physical activity (MOEES) and better ability to circumvent barriers to physical activity (BARSE). This supported the notion that levels of self-efficacy can be influenced by outside observers through use of the facilitators of self-efficacy: previous experience, vicarious learning, psychological state, verbal persuasion, and self-regulation techniques (Bandura, 1977, 1991). These findings were consistent with those of other researchers in this area who have demonstrated that self-efficacy based coaching can result in improved self-efficacy for exercise and improvements in barrier perception (Barkley & Fahrenwald, 2013). Improvements in levels of self-efficacy with the prehab class were considered crucial given that self-efficacy mediates exercise initiation, motivation, and long-term behavior change (D'Angelo et al., 2007; Sweet et al., 2011; Tulloch et al., 2009; Woodgate, et al., 2006).

### Research Aim 2

Research Aim 2 evaluated the effect of a self-efficacy theory based intervention on self-efficacy for physical activity levels in adults with known CAD over a 10-week period. Effects of self-efficacy for physical activity were mixed at the 10-week period. The 10-week measures of the SSEE, physical outcome expectations, and self-evaluative outcome expectations, remained

significantly improved from baseline. Social outcome expectations remained improved but was no longer statistically significant at the 10-week mark. BARSE scores declined at the 10-week mark.

The loss of significant improvement in social outcome expectations was not surprising given that persons over the age of 50 are more likely to engage in exercise for fitness and health while younger people are motivated by interpersonal influences (Thompson et al., 2003). When participants of the prehab study were asked about outcome expectations, on a scale of 1-5 (1=strongly disagree, 5= strongly agree), mean physical outcome expectations were 4.70 (sd=.93); mean self-evaluative expectations were 4.20 (sd=1.04); and mean social expectations were 3.02 (sd=1.23). This indicated that participants were more likely to expect that physical activity would help them perform daily activities, improve body function, increase muscle strength, improve their cardiovascular system, manage stress, improve their psychological state, increase their mental alertness, and give them a sense of personal accomplishment. There was a much lower expectation that regular physical activity would impact social factors such as improving social standing, increasing ease with people, and gaining social acceptance that is in accordance with trends noted in the MOEES development (Hall et al., 2012). There are no known studies available that suggest that social outcome expectations correlate with physical activity maintenance over the long term for an older population.

The ability to circumvent barriers is vital to long term establishment of an exercise practice in this population (Reid et al., 2007; Rogerson et al., 2012). The loss of significant improvement on the BARSE after the prehab class was worrisome. It is possible that although the class resulted in a temporary feeling of resilience, once barriers were actually experienced, confidence declined. For example, participants who reported missing their activity goal due to



pain or discomfort during the study, were likely to report an 80% confidence level (0=not confident at all, 100= completely confident) at baseline that they could exercise even if they had discomfort. This suggests that perception of ability to circumvent barriers and actual ability to circumvent barriers may be very different.

This proposition has been suggested by other researchers who have examined BARSE trends decreasing over time (Moore et al., 2006; McAuley et al., 2003). Findings of these studies similarly suggested that barrier self-efficacy decline may stem from people over estimating their capabilities then falling short of their goals thus resulting in a loss of confidence (McAuley et al., 2011). Unlike findings in other studies, prehab physical activity volume did not decrease when there was a reduction in barrier self-efficacy.

### Research Aim 3

Research Aim 3 was to evaluate if there is a lasting effect on levels of self-efficacy for physical activity 30 days after the study. Self-efficacy for physical activity (SSEE) was the single self-efficacy measure assessed 30-days after the study. This was done because the SSEE is a short four-question measure which could be conducted easily during the 30-day follow-up phone call. The improvement in self-efficacy for exercise (SSEE) remained significantly improved from baseline. Establishing that self-efficacy levels were sustained is of particular importance because self-efficacy mediates between motivation and behavior change (D'Angelo et al., 2007; Mildestvedt et al., 2007). Self-efficacy levels correlate with long term maintenance of an exercise program (D'Angelo et al., 2007; Martin & Woods, 2012; Reed et al., 2007; Sweet et al., 2011; Tulloch et al., 2009) and predicts future attendance in a physical activity program (Woodgate et al., 2006). When individuals with CAD who have complied with a long-term

exercise plan were examined, they were consistently found to have high levels of self-efficacy (Martin & Woods, 2012; Mildestvedt et al., 2007; Reid et al., 2007; Sweet et al., 2011; Tulloch et al., 2009).

### Qualitative Self-Efficacy Findings

The qualitative analyses revealed broad themes of both perceived and experienced facilitators and barriers to establishing a regular physical activity habit in adults with diagnosed CAD. Major facilitator themes which participants reported helped establish a regular physical activity habit were consistent with those found in self-efficacy theory: a favorable psychological state, vicarious learning, previous experience, verbal persuasion, and self-regulation (Bandura, 2004). Subthemes that emerged in the analysis coincided with many of the items contained in the self-efficacy measures. For example, experiencing health benefits (physical outcome expectations) and obtaining satisfaction with meeting goals (self-evaluative outcome expectations) were frequently cited reasons to continue with a physical activity habit. Perceived barriers and experienced barriers were likewise consistent with the self-efficacy measures used. Similar to questions on the BARSE and SSEE, experienced barriers included pain, schedule conflicts, depression, and lack of access to a preferable exercise location.

#### Facilitator Themes: Psychological State and Verbal Persuasion.

Psychological state and verbal persuasion themes overlapped in the qualitative analysis. Verbal persuasion that was rendered by the PI and research assistants was provided through health education and weekly encouragement. This was done because support, health knowledge, and self-regulatory skills correlated with higher levels of self-efficacy and increased physical

activity behaviors (Martin & Woods, 2012; Woodgate et al., 2006). The overlap of favorable psychological state and verbal persuasion has been demonstrated in other research. Medical advice, tailored to a person's stage of wellness, is a valuable form of verbal persuasion that can produce a favorable psychological state and result in long-term adherence in a regular physical activity plan in adults with CAD (Barkley & Fahrenwald, 2013; Jolly et al., 2007; Martin & Woods, 2012; Reid 2011; Rogerson et al., 2012; Throw et al., 2008). Higher attendance in cardiac rehabilitation at home or hospital-based is directly linked to support and encouragement received by outside influences (Jolly et al., 2007). Qualitative feedback from participants at the study's conclusion confirmed that this was a vital component to success in the program.

Learning and experiencing health benefits of physical activity was a valuable contributor to verbal persuasion and a favorable psychological state. Participants reported that understanding the importance of physical activity benefit for heart health in the prehab class was an initial instigator for setting physical activity goals. Participants gave feedback indicating that the education had persuaded them to view a new physical activity commitment differently. As the study progressed, participants reported that feeling health improvements were critical to initiation and maintenance of physical activity habits. These positive psychological states were reportedly crucial for continuation of exercise commitment. When Reid et al. (2007) examined this phenomenon, fear of susceptibility of disease initiated behavior change but led to a decline in physical activity volume if a favorable psychological state was not achieved. Similar to findings in prehab, the study by Reid et al. (2007) demonstrated that the factor that led to a favorable psychological state and better exercise adherence was believing that regular exercise is an effective means to prevent secondary coronary events. In summary, prehab trends showed that desire to feel better and avoidance of ill health was an initiator for exercise while actually feeling

better was cited as a motivator to maintain the habit which was a recurring theme found in the literature review (Martin & Woods, 2012; Reid et al., 2007; Rogerson et al., 2012; Throw et al., 2008; Tulloch et al., 2009).

#### Facilitator Themes: Vicarious Learning and Past Experience

Vicarious learning and past experience overlapped in the thematic analysis. Both of these facilitators helped improve participants' psychological state. It was intended that vicarious learning would be achieved in the prehab study by allowing participants to view a video with community exemplars who discussed their motivating factors for regular physical activity and performed some of their activity routine. The video was reportedly influential for participants. However, another form of vicarious learning was achieved in the prehab class. Participants shared their previous successes with meeting health goals; and this in turn, produced another source of vicarious learning for participants. This reportedly offered perspective to others that they could also achieve physical activity goals despite setbacks and barriers. More research is needed to determine if this type of vicarious learning is comparable to the vicarious learning experienced in the hospital based cardiac rehabilitation setting (Barkley & Fahrenwald, 2013)

Previous experience was also reported as a motivational factor because as participants continued to experience success with their physical activity routine, they reported an increased ability to continue on with their commitment. Producing an opportunity for prehab participants to experience vicarious learning and past experience was meaningful given that previous researchers have suggested this to be an important motivator in hospital-based cardiac rehabilitation programs (Barkley & Farenwald, 2013; Martin & Woods, 2012). Additionally,

previous experience with regular physical activity is a powerful predictor of future activity (Reid et al., 2006; Tulloch et al. 2009).

#### Facilitator Theme: Self-regulation

Self-regulation relates to the practice of being able to adopt standards, keep track of behavior, and set incentives for meeting one's goals. These skills are necessary in order to sustain efforts at achieving a habit change (Orakzai et al., 2008; Reid et al., 2007; Sniehotta et al., 2005; Tulloch et al. 2009). In part, this is successful because as people self-evaluate their outcomes, they achieve a sense of well-being when goals are accomplished (Bandura, 1991). Similar to this phenomenon, noted in self-efficacy theory and in previous studies, participants reported satisfaction with goal attainment throughout the prehab study. For this study group, meeting weekly goals and keeping the activity log were purported to be some of the most influential motivating factors in the study.

#### Barrier Themes

The literature in this area of research suggested that sedentary behaviors were often worse among adults with CAD, in part, because persons with CAD have increased concerns about pain, injury, or worsening their cardiovascular condition (Reid et al., 2007; Rogerson et al., 2012). This was reflected in the qualitative data collected in regard to perceived barriers to regular physical activity. Fear of having a cardiac issue while exercising alone proved to be a significant concern. It is notable that although these barriers were reported during weekly phone calls in the prehab study, most participants reported successful ability to circumvent barriers with the weekly encouragement and support of the research staff.

The primary difference in perceived barriers and experienced barriers was that participants predicted that a lack of motivation would be their primary barrier to establishing a regular physical activity plan. Rarely did a participant report lack of motivation as a reason for missed activity goals during the intervention period in the study. Experienced barriers were more consistent with measures of the SSEE and BARSE. Barriers of pain, depression, time constraints, vacation, and having to exercise alone were common reasons to miss activity goals. These results are comparable to other research findings among adults with CAD. Ability to circumvent barriers has been found to be a more important indicator of continued physical activity adherence (Reid et al., 2007; Rogerson et al., 2012) than self-determined motivation (Russell & Bray, 2010).

### Physical Activity Findings

#### Research Aim 4

Research Aim 4 was to evaluate the effect on physical activity volume after a 10-week prehab program. Physical activity levels were significantly improved for the group as a whole at the 10-week mark. Even individuals who did not achieve a score of greater than 24 by GLTEQ, to signify a non-sedentary activity level, still improved their activity level to some degree. Mean reported GLTEQ scores increased from 18.39 (sd=7.13) at baseline to 41.10 (sd=24.11) after 10 weeks. The prehab program undoubtedly resulted in increased physical activity volume over a 10-week period. Tulloch et al. (2009) used the GLTEQ to assess activity levels in adults with CAD and noted comparable trends found in the prehab study. Baseline GLTEQ scores (m=23.4, sd=20.7) improved to 35.8 (sd=21.9) at six months and remained improved at one-year (m=42.4, sd= 30.3). Sedentary levels improved in Tulloch's study with 60% claiming sedentary activity

levels at baseline, 33% after 6-months, and 30 % after one year. Although Jolley et al. (2007) used a different GLTEQ score with a maximum score of 18, increases in activity trends were still seen using a self-efficacy themed intervention for home-based adults with CAD. GLTEQ scores were 6.21(sd= 3.76) at baseline, 6.96 (sd=3.81) at six months, and 7.11 (4.0) at 12-month follow up. Even when the GLTEQ has not been used, a similar effect of improved physical activity habits was demonstrated in other studies that have utilized aspects of self-efficacy theory to help adults with CAD (Barkley & Fahrenwald, 2013; D'Angelo et al., 2007; Martin & Woods, 2012; Mildestvedt et al., 2007; Sniehotta et al., 2005 Sweet et al., 2011; Woodgate et al., 2006).

#### Research Aim 5

Research Aim 5 sought to evaluate if there was a lasting effect on physical activity habits 30 days after the study was assessed by obtaining GLTEQ scores for comparison. Lally & Gardner, (2013) suggested that 66 days was the mean amount of time for most people to form a habit. Participants were kept in the intervention period for 10 weeks in order to ensure that they had weekly support and encouragement to help them maintain their physical activity habits for 66 days. In order to confirm Lally's proposal that habit would occur over this time period, participants were not contacted for one month but were encouraged to maintain their new regimen. GLTEQ scores remained significantly improved compared to baseline, confirming that most participants did form a new habit even without weekly contacts. Although more research would be required to determine if this effect continued beyond 30 days, the finding is promising for a home-based program in the U.S. There appear to be factors beyond those only found in a hospital-based cardiac rehabilitation that can provoke increased physical activity initiation and habit maintenance (Smith et al., 2011).

### Qualitative Physical Activity Findings

Qualitative data indicated that after several weeks in the study, participants felt as though they had formed a habit. It was noted by the research assistants who contacted participants that several had found a routine and would report the same activity from week to week toward the end of the study. Additionally, participants would report they had a sense of “missing the activity” when their routine was disrupted. They also reported feeling better when the activity routine was kept. Although it was not a requirement, a few of the participants continued keeping a written activity log after the 10-week period. During the celebration luncheon, the preponderance of participants reported that they planned to continue with their new physical activity regimen. The quantitative and qualitative data support that the majority of the prehab population achieved improved physical activity volume after 10-weeks in the study that was maintained when reexamined 30 days after the study was completed.

Establishing that habit formation was achieved in the prehab study is critical. Once behavior is habitual it is more likely to be maintained (Lally et al., 2010; Lally & Gardner, 2013). By using self-efficacy theory to guide the prehab intervention, the key facilitators to habit formation were instituted. Lally and Gardner (2013) proposed that when evidenced based techniques are used to break unhealthy habits and form new ones, along with providing social cues to encourage repetitive new healthy behaviors, automaticity of behavior can be achieved. The longer the automatic behavior continues, the more likely it will continue at the individual level even when missed opportunities arise (Lally et al., 2010). Prehab findings support that habit formation can be achieved for most in 66 days (Lally et al., 2010).

In conclusion, quantitative and qualitative findings in the prehab study suggested that a nurse practitioner-led, self-efficacy-based, prehab program can produce improvements in self-



efficacy for physical activity and physical activity volume. The majority of participants in the prehab study reported greatly improved physical activity regimens over the 10-week intervention period. Additionally, GLTEQ scores collected 30-days after the intervention demonstrated maintenance of physical activity habits. All measures of self-efficacy for physical activity improved post-class. Self-efficacy for exercise, physical outcome expectations, and self-evaluative outcome expectations remained improved at the conclusion of the study.

Through qualitative analyses it was determined that past experiences, vicarious learning, and verbal persuasion all contributed to a favorable psychological state. The quantitative analysis demonstrated that self-efficacy judgements improved as a result of the intervention. Self-regulation was the key facilitator for participants that kept their physical activity goals on track. Together, these facilitators resulted in improved physical activity habits and self-efficacy for physical activity during the 10-week intervention period and provided maintenance for at least 30-days after the study. Given the overlapping nature of self-efficacy facilitators, the following revised model for this research intervention is proposed (Figure 4).

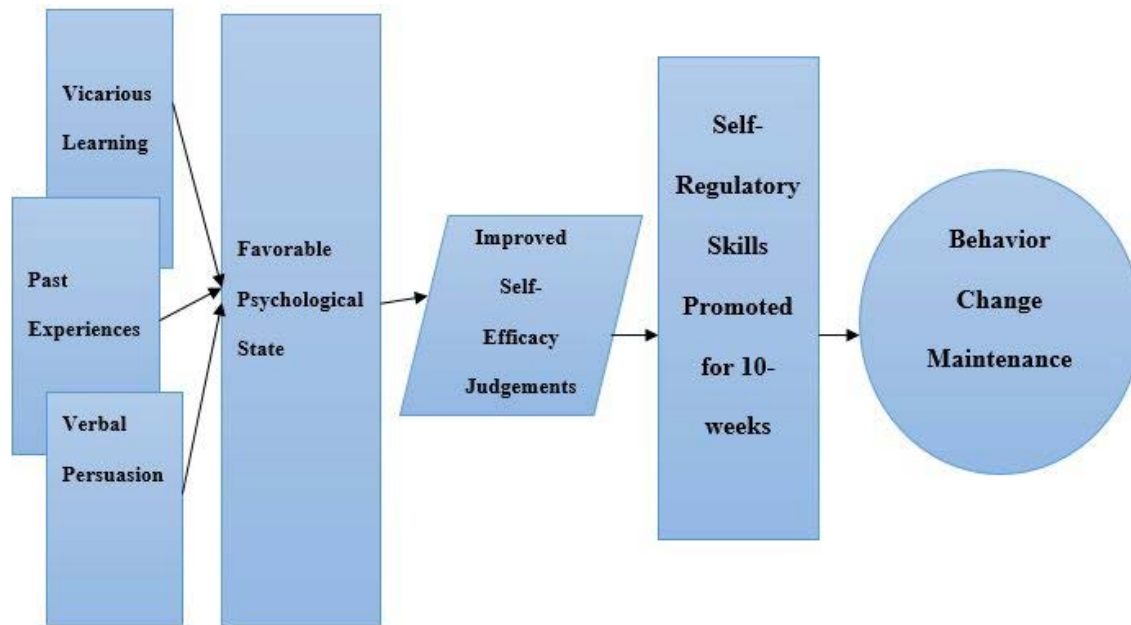


Figure 4. Revised Self-Efficacy Model for Prehab

#### Implications for Practice

In the U.S., sedentary behavior adds more than \$24 billion in annual medical costs and dramatically increases secondary cardiovascular events. Health care costs, morbidity, and mortality could be substantially reduced with even minimal improvements in physical activity behaviors (Chenoweth, & Leutzinger, 2006; Pratt et al., 2000; U.S. Preventive Services Task Force, 2002; WHO, 2007). This highlights the potential economic benefit that a prehab program could offer. In this particular study, active levels improved from 31% to 68%.

Nurse practitioners are in a prime position to lead prevention programs aimed at improving physical activity behaviors in stable adults with CAD. Advanced knowledge is necessary to educate individuals about up to date health issues, screen for health difficulties, communicate with physicians, and oversee data collection. Nurse practitioners can ideally

provide periodic assistance to help adults set goals, prevent relapse, problem solve, and direct safe physical activity options that are known to help increase exercise compliance (Hughes, 2007). Practitioners are positioned to provide motivational counseling which can increase coping and motivation (Plotnikoff & Higginbotham, 2002; Rozanski, 2005; Sniehotta et al., 2005). Periodic contact with a health care provider can decrease the likelihood that motivational interventions can diminish quickly without interaction (Krannich et al., 2008).

In the prehab study, the role of the nurse practitioner was vital. It placed an overseeing medical practitioner in position to identify appropriate candidates for prehab, render expert medical advice, and intervene when medical issues arose. Making a personal connection in order to facilitate realistic physical activity goal setting and offer appropriate encouragement to meet those goals was a key factor in the success of the program. A nurse-practitioner-led self-efficacy-based prehab program could offer a needed prevention program for the vast majority of stable adults with diagnosed CAD who do not fit criteria to attend a standard cardiac rehabilitation program (Centers for Medicare and Medicaid Services, 2014). Furthermore, a home-based program can offer a method for adults with CAD to circumvent schedule and cost barriers associated with a standard cardiac rehabilitation program.

The economic benefit of a nurse practitioner-led prehab program should be considered. For the prehab study alone there were reported benefits of improved sleep, better breathing, and improved feeling of wellness. Although suspected, there is no objective way to determine if these benefits could lead to health cost savings in the future. However, it is known that even a 10% increase in physical activity among sedentary adults would save more than \$5 billion annually in health care costs (Chenoweth & Leutzinger, 2006; Pratt et al., 2000). There was one participant

in the study who diverted, at minimum, a CT angiography of the aorta and lower extremities to assess his peripheral artery disease. Average U.S. prices for that procedure can be as high as \$13,600 (New Health Choice, 2016). This overshadows the cost of a potential prehab program dramatically. If such a program did not need to advertise at medical offices for recruitment, incentivize participants, or make a video for the class, the only remaining cost would be nursing hours. The two research assistants who assisted in the study spent approximately two hours each week for 10-weeks calling participants: average pay for a registered nurse is \$32/ hour (Bureau of Labor Statistics, 2014). The PI of the study spent approximately two hours a week calling participants for 10-weeks, and it is estimated that it would take four hours to research new medical information and form a new learning opportunity for participants each month. Average pay for a nurse practitioner is \$49/hour (Bureau of Labor Statistics, 2014). Therefore, man hours for a 10-week program would cost approximately \$2,552 for 54 participants. Per person, cardiac rehabilitation costs at least \$683 (Lee& Shepard, 2009) where as a prehab program would cost approximately \$50-60 per person.

There were several recommendations gathered from the qualitative analysis to help guide a future prehab program.

- Encouragement was important to psychological state. Research assistants who called participants were careful to avoid negative feedback when activity goals were not met by the participant. Each week was a new opportunity to improve. Prehab participants reported that weekly encouragement was key to continued motivation.
- Keeping an activity journal or finding a method for self-regulation was valuable. Participants in the prehab study reported a positive effect of counting steps on a pedometer, seeing the calories burned on exercise equipment, and keeping the activity

log. More than just self-regulation alone, it was reportedly paramount that each participant had to report this weekly activity to a person who was holding them accountable.

- Being reminded of the health benefit of physical activity was important. During phone calls, research staff reminded participants that getting more than 150 minutes of moderately vigorous activity has substantial health benefits. When health benefits such as better sleep or more energy were realized by participants, they were reinforced by the research staff.
- Knowing the participant was crucial. Research staff met participants and assisted them in setting realistic goals in the prehab class before making weekly phone calls. This was done, because self-efficacy is known to deteriorate when set goals are unrealistic (Bandura, 1988). For example, it was helpful to know when chair yoga was a more appropriate task than a 30-minute walk.
- A future program should consider bi-weekly classes with a mix of learning opportunities and group discussion. Participants of the prehab study overwhelmingly reported that this was a necessary component to a future successful prehab program. More group contact and opportunity for group discussion was requested by nearly every participant.
- Find a way to assist participants in meeting others within the group. The prehab population wanted to establish relationships others for support and exercise.
- Keep groups small enough to share stories. This was a valuable form of vicarious learning and gave people a better perspective of their own health and illness.

- Continue weekly phone calls as necessary to help participants form a habit. Several prehab participants desired continued phone calls, and others did not report a habit until after the 10-week mark.
- Include an option for diet and weight loss. Participants wanted to focus on weight loss in the program and believed that would be positive reinforcement to continue with exercise.

An alternative to traditional hospital-based cardiac rehabilitation is needed for the vast majority of adults with CAD who are stable and do not qualify for a hospital-based program. A prehab program would offer an alternative to learn about the effects of CAD while still allowing a flexible physical activity schedule. This type of program holds the possibility of helping adults improve physical activity behaviors and reducing secondary cardiovascular events.

#### Strengths and Limitations

Several limitations were noted in the prehab study. It was predetermined that increasing the study population size, formulating a wait list control group, and using full randomization of participants to either group would have increased the study's strength (Polit & Beck, 2012). This was not possible for the prehab study but could be accomplished for a larger funded study in the future. For the prehab study, a convenience sample allowed the researcher to identify appropriate participants and ensure that they had medical clearance to participate.

The study sample presented certain limitations. Although the sample was representative of the St. Johns County area in terms of education, race, education, and income, it did not allow for a diverse population. It was hoped that by placing drop boxes in doctors' offices that any CAD patient regardless of race or gender would be invited to attend the study, thereby resulting

in a more diverse population. Unfortunately, this did not occur. Although some participants did enter the study by dropping their contact information in the lock boxes, the majority of individuals who entered the study did so at the encouragement of their physician. Similar to other research, Caucasian males demonstrated more interest in participating in an exercise program than did other populations (Soni, 2004). For the future, targeted recruitment of minorities and females would be helpful in determining that this type of program can work for a wider variety of populations.

The study population was primarily recruited from the same cardiology office where the PI was employed. There was concern that this might result in some degree of social desirability, but there were no significant differences in outcomes noted among the participants of different cardiology practices. In fact, the only attrition that occurred was among participants who belonged to the same practice as the PI. This can be perceived as a strength in that participants did not appear to be influenced by the PI to remain in the study or increase their reported physical activity.

It was predetermined that measures of self-efficacy for physical activity in this study could have had higher reliability and validity. However, there were several strengths noted for using these measures in the prehab study. These were some of the few available measures that directly measure self-efficacy for physical activity. Baseline measures of the SSEE, MOEES, and BARSE explained 37% of the variance observed in perceived activity levels at 10-weeks in the prehab study. Criterion related validity of these measures demonstrated moderate correlations with each other indicating that the phenomenon of self-efficacy for physical activity was truly being measured. Internal consistency of the MOEES and BARSE were near 1.0. Only the SSEE fell short, but it was still at an acceptable .72 level (Polit, 2010). Using these measures was also

supported by the fact that exercise self-efficacy and barrier self-efficacy have been shown to predict long-term exercise adherence in this population (Barkley & Fahrenwald, 2013; D'Angelo et al., 2007; Martin & Woods, 2012; Rogerson et al., 2012; Sweet et al., 2011; Tulloch et al., 2009; Woodgate et al., 2006). These factors highlight the strength of using these self-efficacy measures for such a project.

It was hoped that the BARSE measure would have produced comparable results given that it has been studied in similar populations of the same age range (McAuley et al., 2003). For prehab, the measure did not remain significantly improved throughout the study although physical activity did. The BARSE measure additionally has similar questions to those found on the SSEE and were somewhat repetitive with both asking how likely a person is to sustain an exercise habit despite pain or exercising alone. The BARSE is a long measure which made it cumbersome for some participants. Finally, the BARSE only explained 11% of the variance in activity at 10-weeks compared to 60.54% in measure development (McAuley et al., 1992). This measure could have arguably been eliminated from the measures used in the study.

One identified weakness of the measures used was that social outcome expectations of the MOEES did not maintain significant improvement after the prehab class. This portion of the MOEES asks if one can expect that physical activity will improve social standing, increase ease with people, and help gain acceptance of others. These were not mentioned as anticipated or experienced facilitators to a regular physical activity plan by this population. Additionally, mean scores for social outcome expectations were markedly lower compared to physical outcome and self-evaluative outcome expectations. Consistent with previous studies using this measure, in older adults, social outcome expectations did not correlate with increased functional status (Hall



et al., 2012). The social outcome expectation measure may perform differently in a more diverse population of adults but did not predict activity in this homogenous group.

Conversely, other social factors were reportedly important for this population and could be considered for future programs. Feeling a connection to the group, finding a friend to exercise with, needing more group classes, and wanting weekly phone calls to continue were frequently reported social needs for this group. This is consistent with previous research in the area which highlighted the importance of social support and structured class as important facilitators for establishing a new physical activity practice (Barkley & Fahrenwald, 2013; Martin & Woods, 2012; Woodgate et al., 2006). Previous research and findings of the prehab study indicate that social interaction and support was far more meaningful than social status for a population of adults with diagnosed CAD.

Using the GLTEQ had certain strengths for the prehab study. This measure is short, easy to use, and had been used in other research that made outcomes comparable (Jolly et al., 2007; Reid et al., 2011; Reid et al., 2006; Sweet et al., 2011; Tulloch et al, 2009). The GLTEQ has also demonstrated acceptable reliability and validity. Validity of the measure has been compared to oxygen uptake, calories burned, and body fat reduction with adequate results (Godin & Shephard, 1985, 1997). Qualitative data collected strengthened the findings of the GLTEQ self-report measure. Qualitative data highlighted the reported health benefit, exercise habit formation, and psychological improvements reported by individuals. It is unlikely that such an experience would be reported by unrelated groups of people without actually engaging in the said activity.

There are weaknesses to consider when using the measures for this study. One weakness is that the GLTEQ is a self-report instrument and may not provide a precise measurement of true exercise expenditure. There was a significant difference between mean weekly reported GLTEQ

results for the 10-week period ( $m=27.05$ ,  $sd=11.58$ ) and perceived GLTEQ results after the 10-week intervention period ( $41.10$ ,  $sd=24.11$ ). There are possible explanations for the large difference. One is that participants were encouraged to meet their specific goals of increased activity beyond their normal routine. This may have resulted in participant's reporting activity pertaining more to their weekly goals and not consistently including their routine activity behaviors. For example, if individuals normally cleaned their own homes or had active jobs, they did not always report this in the weekly phone calls. Conversely, when participants were surveyed at the end of the 10-week period, they were asked to give the total number of mild, moderate, and strenuous activity sessions they engaged in, on average, each week during the month that they were not contacted. The retrospective opinion of average activity may have included a more comprehensive assessment of average activity compared to weekly reported improvements in physical activity regimen.

An additional strength of the prehab study was a low 7.4% ( $n=4$ ) attrition rate at the 10-week mark. This was substantially better than other research in this area which ranged from 21% to 83% in longitudinal studies (Drbošalová et al., 2010; Reid et al., 2011; Russell & Bray 2010; Sweet et al., 2011). The low attrition rate was likely partially due to the ease of the study intervention. Allowing participants to choose their own activity and expecting only a short phone call each week allowed more people to complete the study, plan activity to fit their schedule, and find non-traditional forms of exercise. However, attrition was still a problem, and individuals who worked full time were more likely to leave the program.

### Recommendations for Future Research

Home-based programs have resulted in favorable outcomes when utilized in Europe and the U.K. Further research is needed in the U.S. to determine if the same effect would be replicated in the U.S. It is proposed that just one metabolic equivalent (MET) of increased activity, that is comparable to one point of the GLTEQ, can produce a 12% reduction in all-cause mortality (Amireault et al., 2015; Mampuya, 2012). More regular exercise may decrease all-cause mortality up to 28% and substantially decrease risk of recurrent myocardial infarction (Mampuya, 2012). For the prehab study, average METS increased by 20 points and were easily increased by assisting adults to explore swimming, gardening, or walking. Often these activities could be achieved even in individuals with significant physical disabilities. This, too, was found in other studies where improved self-efficacy was documented as instrumental in assisting persons with CAD to overcome physical barriers (D'Angelo et. al., 2007; Martin & Woods, 2012; Mildestvedt et al., 2007). There is a need for long-term research to determine to what extent secondary cardiovascular events could be decreased in this population through such a project.

In order to make future research in this area comparable, it is proposed that continued use of the GLTEQ, SSEE, physical outcome expectations, and self-evaluative expectations outcomes would be useful. It is unclear if social outcome expectation measures are meaningful for this population, and BARSE scores may be repetitive of SSEE questions. GLTEQ activity evaluations could potentially be augmented by electronic devices such as pedometers or activity measuring bracelets. This would offer confirmation of improved activity and be an additional source of self-regulation for participants. Ultimately, reporting activity to another person each week was profoundly more important to this population than self-regulation devices. The

participants in this study who already had pedometers or other feedback devices had not been successful in using them in the past but found them to be helpful when they were accountable for their activity to another person.

The following combination of successes of the prehab study and recommendations obtained from qualitative analysis should be considered for a future program. More frequent group learning opportunities, a chance to meet with others having the same struggle, and continued contact with medical professionals beyond 10-weeks were some of the most frequent recommendations. The cost of adding these recommendations would still be negligible compared to the potential health and economic benefits that would likely be experienced by this population who are higher risk for secondary cardiovascular events.

Recommendations include:

- Structured class with opportunity to learn and meet with others to enhance vicarious learning and social support.
- Encouragement from research staff who assist others to establish realistic goals and provide medical support to improve psychological state. Knowing the person was crucial to support a participants' psychological state.
- Self-regulation practices with activity journals or other measurement tools but followed up accountability with weekly phone calls. This was proven to reinforce a participants' sense of task mastery and self-regulation practices.
- Continued health education about health benefits to the cardiovascular system, healthy diet, and weight loss periodically in group format. This was shown to provide a sense that activity was needed to avoid illness and maintain wellness.

- Establish a method for participants to connect with others in the group so that outside the classroom they can establish relationships with others for support and exercise.
- Keep groups small enough to share stories. This was a valuable form of vicarious learning and gave people a better perspective of their own health and illness.
- Continue weekly phone calls as necessary to help participants form a habit since the time it can take to form a habit can be greater than 66 days for some.

In summary, the prehab program was successful at improving physical activity habits and self-efficacy for physical activity in this research population. The fact that these individuals were able to maintain their new physical activity habits with only brief weekly contact from researchers is promising that an effective and economical secondary prevention program can be developed for adults with CAD. Home-based programs may offer a flexible and affordable option to persons with CAD who desire to improve their current health practices and deter future cardiovascular events. It is evident from participant feedback in this study, that over the long-term participants will likely benefit from more frequent group contact and a maintenance option to stay in the program longer than 10-weeks. More research is needed to determine the long-term economic and health benefits that such a program could offer individuals with CAD.

APPENDIX A  
SUMMARY OF LITERATURE REVIEW

## Summary of the Literature Review

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>Author: Barkley &amp; Fahrenwald, 2013</p> <p>Study: Quasi-experimental</p> <p>Setting: U.S. based cardiac rehab</p> <p>Sample: n=65 64% male and 36% female</p> <p>Length: Participants who had attended rehab for more than 6 months were examined from 2-12 weeks. Study end was determined by reaching exercise intensity or end of program due to insurance</p>	<p>Purpose: To measure effects of a self-efficacy coaching intervention versus an action control intervention.</p> <p>Measure: 2 self-efficacy scales and exercise volume measurement</p> <p>Intervention: The efficacy coaching</p> <p>Intervention included staff recording the time exercised, giving verbal persuasion, and assessing participant's psychological state. Participants kept a log of their exercise. The action control group discussed progress with staff and were given healthy eating information</p>	<p>Theory based: Yes, self-efficacy</p> <p>Findings: 87% of participants completed the study. Both groups improved equally for changes in exercise self-efficacy, barriers to self-efficacy, and independent exercise.</p>	<p>Graduation was determined by limit of health insurance or 40 minutes of predetermined exercise intensity. This resulted in a range of adherence from 2 to 12 weeks. Because all participants were enrolled in cardiac rehab it is difficult to assess the true influence of the interventions applied.</p>
<p>Author: D'Angelo, et. al., 2007</p> <p>Study: Retrospective, cross-sectional</p> <p>Setting: Hospital-based cardiac rehab, Canada</p> <p>Sample: 200 participants (81% male) who were long-time exercise adherers</p> <p>Length: one-time survey</p>	<p>Purpose: to examine the psychological processes related to long and short term motivation after CAD diagnosis</p> <p>Measure: Survey instrumentation was used to determine intention to exercise, motivation, self-determination, and barrier</p> <p>Self-efficacy</p> <p>Intervention: None</p>	<p>Theory Based: Yes, self-efficacy theory and Self-determined motivation</p> <p>Findings: Self-efficacy was relevant to exercise intentions. Self-efficacy mediated the relationship between motivation and behavior change.</p> <p>Self-determined motivation was relevant to exercise planning and longer term motivation.</p> <p>There were no statistically significant differences between groups. Non-adherence was reported as a result of fixation on sedentary lifestyle,</p>	<p>This study was actually testing a developed tool for measurement.</p> <p>The population was predominantly male and college educated</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
		psychological, and social issues	
<p>Author: Drbošalová, et al., 2010</p> <p>Study: Randomized control trial</p> <p>Setting: Home-based cardiac rehab in Czech Republic</p> <p>Sample: 4 women and 16 men recruited while inpatient</p> <p>Length: Activity assessments were made at 3, 6, and 12 months.</p>	<p>Purpose: Evaluate physical activity adherence in a home-based exercise program</p> <p>Measure/Intervention: Activity recording by pedometer, heart rate monitor, or both</p>	<p>Theory Based: No</p> <p>Findings: Attrition rate was high. There was no statistically significant difference between groups in terms of exercise adherence improvement</p>	<p>Research group was small. Although it was not statistically significant, there were better results found in the group that used pedometer and heart rate monitor together.</p> <p>Greater than 60% of participants dropped out.</p> <p>Participants were allowed to choose their intervention group.</p>
<p>Author: Jolly, et al., 2007</p> <p>Study: Mixed method</p> <p>Setting: Home and hospital-based cardiac rehab in the United Kingdom</p> <p>Sample: 525 participants who had a myocardial infarction in England</p> <p>Length: Assessments were made at 6, 12, and 24 months</p>	<p>Purpose: Evaluate the effectiveness and cost effectiveness of a home-based cardiac rehab program using the Heart Manual versus a hospital-based program. Qualitative interviews were completed to assess reasons for non-adherence to cardiac rehab by semi-structured interviews</p> <p>Measure: Exercise capacity, self-reported exercise</p> <p>Intervention: Home and hospital programs included, relaxation, exercise, and lifestyle counseling</p>	<p>Theory Based: No</p> <p>Findings: There were not statistically significant differences in exercise adherence between groups after 12 weeks. Dropout rates increased in both groups over time. Home-based and hospital-based programs produced improvements in cholesterol, smoking, anxiety, and exercise habits.</p>	<p>Some participants changed from home care to a hospital program that made over-all dropout rates and adherence hard to interpret. Non-adherence varied by participant. Few general trends were found.</p>
<p>Author: Karjalainen, et al., 2012</p> <p>Study: Randomized control trial</p>	<p>Purpose: To assess if a home-based program can increase physical activity adherence long term</p>	<p>Theory Based: No</p> <p>Findings: 26% of the eligible patients with CAD and 29% of the eligible patients with CAD and</p>	<p>Reasons for attrition were not discussed which are likely important to assessment of long-term motivation to exercise.</p>



Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>Setting: Home-based exercise program in Finland</p> <p>Sample: 44 patients with CAD and 39 patients with CAD and type 2 diabetes</p> <p>Length: 6 months</p>	<p>Measure: Activity was assessed by self-report and accelerometer</p> <p>Intervention: 6-month individually tailored home-based physical activity plans.</p>	<p>type 2 diabetes +T2D were not willing to participate. High intensity activity increased in both groups. Individuals with type 2 diabetes also had higher BMI and engaged in less moderate physical activity</p>	
<p>Author: Martin &amp; Woods, 2012</p> <p>Study: Qualitative</p> <p>Setting: Hospital-based cardiac rehab in Ireland</p> <p>Sample: 15 men, 9 women who were long time exercise adherers</p> <p>Length: one time focus group examined 6-month exercise compliance</p>	<p>Purpose: To evaluate what motivations and supports were deemed necessary to comply with a community-based cardiac rehab program.</p> <p>Measure: Focus group</p> <p>Intervention: No intervention was applied to change exercise behavior</p>	<p>Theory Based: Yes, Social cognitive theory</p> <p>Concept measured: Self-efficacy</p> <p>Findings: Structured class and enhancing self-efficacy were essential to long-term adherence.</p> <p>Task, barrier, and recovery self-efficacy were essential for sustained exercise adherence.</p> <p>Adherence was influenced by receiving a referral, social support, and knowledge of health benefits.</p>	<p>All participants were Caucasian. Because they had complied in rehab long term they were already quite motivated.</p>
<p>Author: Mildestvedt, et al., 2007</p> <p>Study: Randomized control trial</p> <p>Setting: Hospital-based cardiac rehab in Norway</p> <p>Sample: 176 CAD patients (n=38 female)</p> <p>Length: participants were followed from 4 weeks after cardiac rehab for 24 months</p>	<p>Purpose: To examine if individualized therapy and cardiac rehab produce better long term physical activity habits compared to group therapy with cardiac rehab</p> <p>Measure: Self-Regulation Questionnaire</p> <p>Intervention: Group or individualized therapy</p>	<p>Theory Based: Yes, self-efficacy and Self-determination theory</p> <p>Concept measured: Autonomous motivation and self-efficacy</p> <p>Findings: Autonomous motivation and self-efficacy proved to be important predictors of exercise change.</p> <p>Controlled motivation was associated with less</p>	<p>All participants who were interviewed were already considered to be highly motivated (and still participating in exercise after 24 months). Findings may not be generalizable.</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
		<p>beneficial physical capacity change.</p> <p>There were no statistically significant between-group differences 24 months after the intervention.</p>	
<p>Author: Orakzai, et al., 2008</p> <p>Study: Observational</p> <p>Setting: outpatient in the U.S.</p> <p>Sample: 980 (78% men aged 60 +/- 8 years of age) with asymptomatic CAD</p> <p>Length: 3 years.</p>	<p>Purpose: To evaluate if educating patients about their coronary calcium score would influence participation in beneficial lifestyle behaviors</p> <p>Measure: self-report exercise behaviors</p> <p>Intervention: participants were given their CT calcium score. No intervention was given to specifically change exercise behavior</p>	<p>Theory Based: No</p> <p>Findings: Knowledge of greater calcium scores were strongly associated increased exercise</p>	<p>Exercise was measured by self-report. Patients with a previous history of CAD (before CT scan diagnosis) were not included in the study</p>
<p>Author: Reid et al., 2011</p> <p>Study: Randomized control trial</p> <p>Setting: Participants were recruited from the hospital and exercised from home in Canada</p> <p>Sample: 141 individuals who were not planning on attending cardiac rehab after an acute coronary syndrome</p> <p>Length: assessments were made at baseline, 6 months, and 12 months</p>	<p>Purpose: To investigate if motivation to attend cardiac rehab after a CAD diagnosis can be improved</p> <p>Measure: Exercise was measured by logbook, Godin Leisure Time Questionnaire, and pedometer</p> <p>Intervention: 72 participants were randomized to usual care the remainder received 9 contacts from a trained physical therapist for motivational counseling, follow up prompts, encouragement, goals setting. Self-monitoring was encouraged.</p>	<p>Theory Based: Yes, ecological theory</p> <p>Findings: Individuals who received motivational counseling (9 contacts over 52 weeks) were more physically active than the control group. Home-based interventions can increase activity in individuals not participating in cardiac rehab.</p>	<p>The intervention was complex and may not be realistic to implement in real world situations.</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>Author: Reid et al., 2006</p> <p>Study: Prospect cohort study</p> <p>Setting: Participants were recruited from the hospital and followed through hospital-based cardiac rehab in Canada</p> <p>Sample: 782 persons who were discharged after hospitalization with CAD</p> <p>Length: 12 months</p>	<p>Purpose: To examine the effect of time, demographic, medical, and activity factors on physical activity progress.</p> <p>Measure: Leisure-time activity energy expenditure</p> <p>Intervention: No specific intervention was done to change behavior.</p>	<p>Theory Based: no</p> <p>Findings: Physical activity declined 2 months after hospitalization. Factors which coincided with increased activity were: male gender, without congestive heart failure. Individuals who had bypass were more active than individuals who received percutaneous angioplasty.</p>	<p>Activity was self-reported. There was a disproportionate amount of educated persons who had a previous regular physical activity regimen.</p>
<p>Author: Reid et al., 2007</p> <p>Study: Prospect cohort study</p> <p>Setting: Participants were recruited from the hospital and followed through hospital-based cardiac rehab in Canada</p> <p>Sample: 782 adults with CAD were evaluated</p> <p>Length: 6 months</p>	<p>Purpose: To describe a change in stages of exercise over a 6-month period after being hospitalized for a diagnosis of CAD</p> <p>Measure: Exercise motivation was measured by using the constructs of Protection Motivation Theory,</p> <p>Theory of Planned Behavior, Social Cognitive Theory, the Ecological Model, and participation in cardiac rehab.</p> <p>Intervention: No specific intervention was done to change behavior.</p>	<p>Theory Based: Yes, Protection motivation theory</p> <p>Findings: 577 participants completed the survey at 6 months.</p> <p>Increased activity over 6 months was associated with: belief that exercise reduces future risk and less perceived barriers to exercise.</p> <p>Activity regression was associated with perceived disease susceptibility, reduced intention to exercise, lower self-efficacy and increased perceived barriers to exercise.</p>	<p>Exercise was measured by self-report.</p>
<p>Author: Rogerson, et al., 2012</p> <p>Study: Qualitative</p> <p>Setting: Hospital-based cardiac rehab, Australia</p>	<p>Purpose: To examine barriers and facilitators to physical activity in people with CAD</p> <p>Measure: semi-structured interviews.</p> <p>Cardiac depression scale</p>	<p>Theory Based: No</p> <p>Findings: Barriers included having an overall negative perception about how CAD changed their life, having a depressed mood, feeling fearful of exercise, lacking motivation to exercise,</p>	<p>All participants scored high on the cardiac depression scale in order to be included in the study.</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>Sample: 12 males and 3 females after a cardiac event.</p> <p>Length: One-time interview</p>	<p>Intervention: No specific intervention was used to change behavior</p>	<p>lacking knowledge about exercise, and increased perceived barriers to exercise. Facilitators of exercise behavior included social support, understanding the benefit of exercise, and reporting a reason to participate in exercise.</p>	
<p>Author: Russell, &amp; Bray 2010</p> <p>Study: Correlational cross sectional</p> <p>Setting: Hospital-based cardiac rehab in Canada</p> <p>Sample: 53 men</p> <p>Length: Self-determined motivation was measured at 4 weeks and exercise adherence measured at 10 weeks.</p>	<p>Purpose: To examine if self-determination theory can predict a relationship between perceived autonomy support, motivation for exercise, and exercise behavior</p> <p>Measure: Health Care Climate Questionnaire, Exercise Self-Regulation Questionnaire, cardiac attendance records, and 7-day Physical Activity Recall</p> <p>Intervention: No specific intervention was employed. Participants were already enrolled in cardiac rehab.</p>	<p>Theory Based: Yes</p> <p>Findings: Self-determined motivation did not predict cardiac rehab attendance or exercise frequency. Increased perceived autonomy support correlated with exercise session duration</p>	<p>21% of were lost to attrition. The study only examined 8 weeks of cardiac rehab. All participants were male.</p>
<p>Author: Sharp &amp; Freeman., 2009</p> <p>Study: Prospective</p> <p>Setting: Hospital-based cardiac rehab in United Kingdom</p> <p>Sample: 91 patients following a cardiac event</p> <p>Length: participants were gathered over a 3-month period</p>	<p>Purpose: To evaluate variables associated with failure to attend or poor adherence to cardiac rehab</p> <p>Measure: Adherence was measured by cardiac rehab attendance. Hospital anxiety and depression score was also assessed</p> <p>Intervention: No specific intervention to change behavior was implemented. All were</p>	<p>Theory Based: No</p> <p>Findings: 35% of patients chose not to attend cardiac rehab and 35% were non-adherent to cardiac rehab (attended less than half of the classes). No factors (gender, age, occupation, medical status, depression scores or ethnicity) were found to predict non-adherence.</p>	<p>Authors did not study participant's physician endorsement, ease of physical exercise, transportation, or self-efficacy</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
	invited to participate in cardiac rehab		
<p>Author: Smith et al., 2011</p> <p>Study: Randomized control study</p> <p>Setting: 70 hospital-based and 70 home-based cardiac rehab attenders in Canada</p> <p>Sample: 120 men and 24 women</p> <p>Length: 6 years</p>	<p>Purpose: To evaluate commitment to long term exercise 5.5 years after a 6-month cardiac rehab program</p> <p>Measure: Physical Activity Scale in the Elderly and peak oxygen uptake</p> <p>Intervention: Home-based or hospital-based cardiac rehab</p>	<p>Theory Based: No</p> <p>Findings: Home-based exercise program resulted in greater persistent physical activity after 6 years compared to the hospital-based cardiac rehab group.</p>	<p>Participants were disproportionately men; all participants were post bypass surgery</p>
<p>Author: Sniehotta, et al., 2005</p> <p>Study: Randomized control trial</p> <p>Setting: Hospital-based cardiac rehab in Germany</p> <p>Sample: 240 patients with CAD</p> <p>Length: 4 Weeks</p>	<p>Purpose: To improve activity adherence in cardiac rehab participants</p> <p>Measure: Kaiser Physical Activity Survey was used to assess exercise level.</p> <p>Behavioral intentions and self-efficacy were measured by Fuchs scale</p> <p>Intervention: All participants were enrolled in cardiac rehab and received physician instruction to exercise. Group 1 had cardiac rehab alone. Group 2 received instructions to make a detailed action plan and group 3 were asked to make an action plan and keep a diary. Behavioral intentions, self-efficacy, and planning were assessed at three time points during a 4-week period</p>	<p>Theory Based: Yes, self-efficacy</p> <p>theory of planned behavior</p> <p>Findings: At the end of 4 weeks, group 3 had the largest percentage of attenders and the highest scores for self-efficacy, behavioral intention, coping, action control, and recommended strenuous activity while group 1 showed the least amount of benefit. Increased self-regulation (diary keeping, coping planning) were associated with increased physical activity and cardiac rehab attendance.</p>	<p>Study was only 4 weeks in length. One could question if this is long enough to measure sustained exercise motivation. Cardiac rehab structure is much different in Germany and is supervised by a cardiologist.</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>Author: Sweet et al., 2011.</p> <p>Study: Prospective</p> <p>Setting: Hospital-based cardiac rehab in Canada</p> <p>Sample: 251 adults with CAD</p> <p>Length: 24 months</p>	<p>Purpose: Explore patterns of exercise and motivation in cardiac rehab patients</p> <p>Measure: Exercise, self-efficacy, outcome expectations, and physical activity regulation scale</p> <p>Intervention: No specific intervention was employed to change behavior</p>	<p>Theory Based: Yes, self-efficacy theory and self-determination theory</p> <p>Findings: Three exercise patterns emerged: inactive (16%), non-maintainers (67%), and maintainers (17%). Individuals with the highest rates of self-efficacy, outcome expectation, and self-determined motivation were most likely to be maintainers. Cardiac rehab based exercise programs did not help patients sustain exercise long term. Authors promote a realistic outcome expectation.</p>	<p>The population was mostly Caucasian and male.</p> <p>Only 17% of participants completed the study at the 24-month mark</p>
<p>Author: Throw, et al., 2008</p> <p>Study: Two-stage triangulation approach</p> <p>Setting: Hospital-based cardiac rehab in United Kingdom</p> <p>Sample: 30 and 25 Women who were long term (5 years) cardiac rehab participants</p> <p>Length: One-time interview</p>	<p>Purpose: To identify motives among long term cardiac rehab adherers</p> <p>Measure: The Exercise Motivation Inventory based on self-determination Theory was used to determine the key motivations for cardiac rehab compliers to maintain sustained physical activity habits</p> <p>Intervention: Focus group discussions were also conducted.</p>	<p>Theory Based: Self-determination theory</p> <p>Findings: ill health avoidance, health promotion, social support, and enjoyment were found to be the main reason for long term adherence. Other motivating factors were: understanding of the benefits of exercise, desire to stay nimble, improve strength, and experience increased energy.</p>	<p>All participants had been in cardiac rehab for 5 years and were felt to have long term motivation. This group may not represent the average person with CAD.</p>
<p>Author: Tulloch et al. 2009</p> <p>Study: Prospect cohort study</p> <p>Setting: Recruited from the hospital and followed</p>	<p>Purpose: Explore the utility of protection motivation theory on exercise intentions. Examine for coping mechanisms, perceived threat, and exercise behaviors</p>	<p>Theory Based: Yes, Protection motivation theory</p> <p>Findings: Protection motivation theory predicted exercise behavior over the short term but not long term (12</p>	<p>The population was mostly Caucasian and male.</p> <p>Information was extracted from the Reid et al., 2007 study</p>

Author and Study Background	Purpose, Measure, Intervention	Results and Theoretical Findings	Special Notes and Limitations
<p>through hospital-based cardiac rehab in Canada</p> <p>Sample: 801 patients with CAD</p> <p>Length: Theory constructs measured at 2 and 6 months.</p> <p>Exercise behavior measured at baseline, 6 and 12 months</p>	<p>Measure: 8 item self-efficacy survey and Godin leisure-time questionnaire were used for measurement</p> <p>Intervention: No specific intervention used. All participants had enrolled in cardiac rehab upon hospital discharge</p>	<p>months). Perceived vulnerability did not predict exercise behavior. Barrier Self-efficacy and the belief that exercise would result in health benefits predicted exercise intentions and behavior at one year but declined by 2-year mark. Previous exercise behavior was the more powerful predictor of future exercise maintenance</p>	
<p>Author: Woodgate, et al. 2006 .</p> <p>Study: Prospective observational study</p> <p>Setting: Hospital-based cardiac rehab, Canada</p> <p>Sample: N=64 participants in a maintenance cardiac rehab greater than 6 months</p> <p>Length: One- time assessment</p>	<p>Purpose: examine which types of self-efficacy (task or self-regulatory) predicted exercise maintenance</p> <p>Measure: Task and self-regulatory self-efficacy were measured as well as exercise intensity and cardiac rehab attendance.</p> <p>Intervention: No specific intervention was employed to influence exercise behavior</p>	<p>Theory Based: Yes, self-efficacy</p> <p>Findings: Prior cardiac rehab attendance, self-regulatory behaviors, and self-efficacy predicted future attendance.</p>	<p>Population was 92.2% male with a mean cardiac rehab attendance of 3 years</p>

APPENDIX B 10-WEEK PHONE CALL QUESTIONS



Week 10 Final Phone Call Questions:

Prior to entering this study, how many times a week (more than 15 minutes) would you say that you engaged in strenuous activity?

How many times a week do you engage in strenuous activity now?

Prior to entering this study, how many times a week (more than 15 minutes) would you say that you engaged in moderate activity?

How many times a week do you engage in moderate activity now?

Prior to entering this study, how many times a week (more than 15 minutes) would you say that you engaged in mild activity?

How many times a week do you engage in mild activity now?

Examples:

Strenuous	Moderate	Mild
running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling	fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow- mobiling, easy walking)

On a scale of 1 to 5... 1 being NOT confident at all and 5 being very confident how would you rate the following questions?

How confident do you feel that you can exercise when having pain?

How confident do you feel that you can exercise alone?

How confident do you feel that you can exercise when you are tired?

How confident do you feel that you can exercise when you are depressed?

Do you feel like you are more active now that prior to entering the prehab study? (Yes or no)

(If they were more active then ask) ...What kinds of things helped you stay motivated during the study?

(if they were not more active then ask) ... What additional steps do you think could have been taken to help you get more motivated for physical activity?

What do you think would help people stay motivated (or be more motivated) in a similar type of program?

We would like to mail you a gift certificate and a few more surveys to complete and send back, would you mind giving me your address?

May I contact you again in 30 days to see how you are doing with your activity?

APPENDIX C  
30-DAY PHONE CALL FORMAT

### 30-day after: Final Phone Call Questions

How do you feel your activity has been over the past month? Do you feel as though you are doing more, less, or the same amount of activity as you were during the study? What has changed and why?

Do you feel as though you are doing more, less, or the same amount of activity as you were before you entered the study?

How many times on average in a week do you engage in strenuous activity now (over the past 30 days)?

How many times a week do you engage in moderate activity now?

How many times a week do you engage in mild activity now?

Examples:

Strenuous	Moderate	Mild
running, jogging, hockey, football, soccer, squash, basketball, cross country	fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)	yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)
skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling		

On a scale of 1 to 5.... 1 being NOT confident at all and 5 being very confident how would you rate the following questions?

How confident do you feel that you can exercise when having pain?

How confident do you feel that you can exercise alone?

How confident do you feel that you can exercise when you are tired?

How confident do you feel that you can exercise when you are depressed?

Looking back over the past month, what do you think would help you (or others in a similar program) stay motivated for physical activity in the future? (what would make the program more successful for people)

If you have not mailed in your questionnaire, please do so.

APPENDIX D  
QUALITATIVE QUESTION OVERVIEW

## Qualitative Research Questions (Celebration Luncheon)

How was this program different from other activity programs you have tried?

What surprised you the most about being in the prehab study?

What do you think made the biggest impact on you in the study?

What would you tell other people about being in a program similar to this one?

What was the most useful to you about being in the study?

Do you plan on continuing your exercise plan?

What impact do you think being in the study had on your health?

Did it make a difference to you that the phone calls/study were being conducted by medical persons (nurses)?

Would you have participated in the study if you did not receive gift cards?

Would you have participated in a similar program if you had to pay a co-pay?

What impact do you think it would have on you if your medical provider urged you to participate in the study as part of your health care (versus keeping this program completely voluntary)?

Do you think more people would be more likely to participate if medical providers encouraged enrollment in a prehab program?

Would you volunteer to be in a similar program again?

Most people reported that more classes would make the program better.

What types of subjects would you like to see covered if you had attended more classes?

How often do you think you could attend a one-hour class to meet with others and learn more about heart disease?

Many people reported that meeting with others or exercising with a partner would have helped their motivation level.

What do you think the best way to set people up with an exercise partner?

Do you think you would drive to meet someone in your zip code to take a walk or exercise together?



APPENDIX E  
GODIN LEISURE-TIME EXERCISE QUESTIONNAIRE

## Godin Leisure-Time Questionnaire

### INSTRUCTIONS

In this excerpt from the Godin Leisure-Time Exercise Questionnaire, the individual is asked to complete a self-explanatory, brief four-item query of usual leisure-time exercise habits.

### CALCULATIONS

For the first question, weekly frequencies of strenuous, moderate, and light activities are multiplied by nine, five, and three, respectively. Total weekly leisure activity is calculated in arbitrary units by summing the products of the separate components, as shown in the following formula: Weekly leisure activity score =  $(9 \times \text{Strenuous}) + (5 \times \text{Moderate}) + (3 \times \text{Light})$

The second question is used to calculate the frequency of weekly leisure-time activities pursued “long enough to work up a sweat” (see questionnaire).

### EXAMPLE

Strenuous = 3 times/wk.

Moderate = 6 times/wk.

Light = 14 times/wk.

Total leisure activity score =  $(9 \times 3) + (5 \times 6) + (3 \times 14) = 27 + 30 + 42 = 99$

### Godin Leisure-Time Exercise Questionnaire

1. **CURRENTLY** During a typical **7-Day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your free time (write on each line the appropriate number).

#### Times per Week....

##### a) STRENUOUS EXERCISE

(HEART BEATS RAPIDLY) \_\_\_\_\_

(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

##### b) MODERATE EXERCISE

**(NOT EXHAUSTING)** \_\_\_\_\_

(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

**c) MILD EXERCISE**

**(MINIMAL EFFORT)** \_\_\_\_\_

(e.g., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)

2. During a typical **7-Day period** (a week), in your leisure time, how often do you engage in any regular activity **long enough to work up a sweat** (heart beats rapidly)?

OFTEN

SOMETIMES

NEVER/RARELY

1.

2.

3.

APPENDIX F  
MULTIDIMENSIONAL OUTCOME EXPECTATIONS FOR EXERCISE SCALE

## Multidimensional Outcome Expectations for Exercise Scale (MOEES)

How much do you agree with the following statements?

(1 = strongly disagree.... 5 = strongly agree)

Exercise will improve my ability to perform daily activities.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will improve my overall body functioning.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will strengthen my bones.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will increase my muscle strength.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will improve the functioning of my cardiovascular system.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will improve my social standing.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will make me more at ease with people.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will increase my acceptance by others.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will help manage stress.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will improve my psychological state	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will increase my mental alertness.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Exercise will give me a sense of personal accomplishment.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>



APPENDIX G  
SHORT SELF-EFFICACY FOR EXERCISE SCALES

Short Self-Efficacy for Exercise Scale (SSEE)

**You believe that exercise can be performed when... 1 (not confident) to 5 (very confident)**

You felt pain when exercising	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
You had to exercise alone	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
You felt tired	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
You felt depressed	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>



APPENDIX H  
BARRIERS SELF-EFFICACY SCALE (BARSE)

## Barriers Self-Efficacy Scale (BARSE)

The following items reflect situations that are listed as common reasons for preventing individuals from participating in exercise sessions or, in some cases, dropping out. Using the scales below please indicate how confident you are that you could exercise in the event that any of the following circumstances were to occur. Please indicate the degree to which you are confident that you could exercise in the event that any of the following circumstances were to occur by circling the appropriate %. Select the response that most closely matches your own, remembering that there are no right or wrong answers.

### FOR EXAMPLE:

**In question #1 if you have complete confidence that you could exercise even if “the weather was very bad,” you would circle 100%. If, however, you had no confidence at all that you could exercise (that is, confidence you would not exercise), you would circle 0%.**

**0%= not confident at all                      50%= moderately confident                      100%= highly confident**

**Rate your confidence level for each statement below:**

**“I believe that I could exercise 3 times per week for the next 3 months if:”**

**1. The weather was very bad (hot, humid, rainy, cold).**

0      10          20          30          40          50          60          70          80          90          100

**2. I was bored by the program or activity.**

0      10          20          30          40          50          60          70          80          90          100

**3. I was on vacation.**

0      10          20          30          40          50          60          70          80          90          100

**4. I was not interested in the activity.**

0      10          20          30          40          50          60          70          80          90          100

**5. I felt pain or discomfort when exercising.**

0      10          20          30          40          50          60          70          80          90          100

**0%= not confident at all                  50%= moderately confident                  100%= highly confident**

**Rate your confidence level for each statement below:**

**I believe that I could exercise 3 times per week for the next 3 months if:**

**6. I had to exercise alone.**

0      10          20          30          40          50          60          70          80          90          100

**7. It was not fun or enjoyable.**

0      10          20          30          40          50          60          70          80          90          100

**8. It became difficult to get to the exercise location.**

0      10          20          30          40          50          60          70          80          90          100

**9. I didn't like the particular activity program that I was involved in.**

0      10          20          30          40          50          60          70          80          90          100

**10. My schedule conflicted with my exercise session.**

0      10          20          30          40          50          60          70          80          90          100

**11. I felt self-conscious about my appearance when I exercised.**

0      10          20          30          40          50          60          70          80          90          100

**12. An instructor does not offer me any encouragement.**

0      10          20          30          40          50          60          70          80          90          100

**13. I was under personal stress of some kind.**

0      10          20          30          40          50          60          70          80          90          100

APPENDIX I  
UCF INSTITUTIONAL REVIEW BOARD APPROVAL



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

### Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Billie Russell**

Date: **September 28, 2015**

Dear Researcher:

On 09/28/2015 the IRB approved the following minor modification to human participant research until 06/21/2016 inclusive:

Type of Review: IRB Addendum and Modification Request Form  
Expedited Review

Modification Type: Susan Romanelli was added as a research assistant. The Study Application was revised and an Individual Investigator Agreement was uploaded in iRIS.

Project Title: Prehab: Prevention in Motion

Investigator: Billie Russell

IRB Number: SBE-15-11339

Funding Agency:

Grant Title:

Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 06/21/2016, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

*Kanille Chay*

IRB Coordinator

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