SELF-ESTEEM AND MASTERY IN MAINTENANCE CARDIAC REHABILITATION

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ABSTRACT

Background: CVD is the second leading cause of death in Canada. Mastery and self-esteem are psychosocial factors, suggested to be emerging risk factors for CVD.

Purpose: The purpose of the study was two-fold; first to establish whether mastery and self-esteem predicted adherence to maintenance CR; and second, whether mastery and self-esteem improved after a 6-month maintenance CR program.

Methods: Data were collected at the Brock University Heart Institute. The study involved a sample of 98 participants. At intake to the program and 6-month follow-up, participants completed a questionnaire battery which included the Rosenberg Self-Esteem Scale and the Pearlin-Schooler Mastery Scale.

Results: Mastery and self-esteem scores did not alter the likelihood of adherence to the CR program. Mastery and self-esteem did significantly improve after 6-months of CR amongst participants with the lowest exercise capacity.

Conclusion: Maintenance CR does improve mastery and self-esteem amongst those with diminished exercise capacity.

Key Words: Mastery, Self-Esteem, Maintenance Cardiac Rehabilitation, Risk Factors, Cardiovascular Disease

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ABBREVIATED TERMS

AHA- American Heart Association

ACC- American College of Cardiology

ACS- Acute Coronary Syndrome

ACSM- American College of Sports Medicine

BUHI- Brock University Heart Institute

BMI- Body Mass Index

BP- Blood Pressure

CABG – Coronary Artery Bypass Graft

CACR- Canadian Association of Cardiac Rehabilitation

CAD- Coronary Artery Disease

CHD- Coronary Heart Disease

CHF- Congestive Heart Failure

CR- Cardiac Rehabilitation

CVD – Cardiovascular Disease

GXT- Graded Exercise Tolerance Test

HDL- High Density Lipoprotein

HR- Heart Rate

IHD – Ischemic Heart Disease

LDL- Low Density Lipoprotein

MET- Metabolic Equivalent

MI- Myocardial Infarction

PCI – Percutaneous Intervention

THR- Target Heart Rate

CHAPTER 1: INTRODUCTION

In 2008, cardiovascular disease (CVD) accounted for 29.2% of all-cause mortality in Canada.[1] CVD is an umbrella term for several diseases including: coronary artery disease (CAD), stroke, congestive heart failure (CHF), valvular heart disease, rheumatic heart disease, peripheral vascular disease and congenital heart defects.[2] Several decades of research have been completed in order to understand the risk factors for CVD. There are four categories of risk factors for CVD; non-modifiable, modifiable, traditional and emerging.[2] Non-modifiable risk factors are factors an individual cannot change such as: age, ethnicity, family history of CVD, and gender.[2] Modifiable risk factors are factors an individual can change such as: smoking, diet, stress, inactivity, alcohol consumption, and some forms of depression.[2] Traditional factors have long been associated with CVD, including hypertension, obesity, and dyslipidemia.[2] Emerging risk factors are newly researched risk factors such as exercise capacity, the presence and amount of homocysteine and certain psychological factors.[2] Research suggests that self- concepts such as mastery and self-esteem are associated with chronic diseases and may be emerging risk factors for CVD.[3-18] Our self-concept is our mental perception of ourselves. Self-concept involves many dimensions including mastery and self-esteem.[19-21] Mastery is defined as one's perception that they are in control and targets one's impression that they are in control of their own life events and their perceptions of ability to change their life and deal with personal problems.[22] Global self-esteem is defined as one's judgement of their self-worth.[21] Global self-esteem involves one's overall attitude toward themselves as well as their worth and capabilities relative to others. It has been suggested that individuals with greater mastery may demonstrate less of a functional decline from

CVD.[9] Cardiac rehabilitation (CR) is primarily an exercise-based intervention which is often implemented to prevent cardiac events in people who have risk factors for CVD or who have previously had a cardiac event.[2] CR consists of both aerobic and resistance training.[23] There are 4 models of CR; inpatient or Phase I occurs immediately after a CVD event or procedure in the hospital, outpatient or Phase II occurs in the first six months following a CVD event at a hospital or community site, Phase III provides outpatient rehabilitation after the first 6 months, and Phase IV offers maintenance rehabilitation long after a CVD event and focuses on lifestyle management.[2] Currently, Phase IV is now referred to as the maintenance model and will be the focus of this thesis.[2]

Certain factors have been found to be associated with CR participation including age, gender, and socioeconomic status.[24-26] Mastery and self-esteem have been shown to be associated with CVD as well as other chronic diseases and therefore, may play a role in CR.[3, 5, 7, 10, 17, 18, 27-31] Psychosocial factors, such as mastery and self-esteem, explain 3% of the variance towards increases in leisure time physical activity in the elderly, suggesting that it may also be a predictor of exercise-based CR.[24] Studies focusing on the early phases of CR suggest that self-esteem and self-efficacy may affect adherence. Self-efficacy relates to one's perceived ability to perform a specific task.[32] This is a related concept to mastery, and may influence participation in CR.[7, 33, 34] However, studies which specifically focus on mastery with relation to adherence have been inconclusive.[35] More importantly, this research has not focused on maintenance (Phase IV) cardiac rehabilitation. In the literature there is some suggestion that self-esteem and mastery may increase as a result of CR. Self-esteem has been shown to increase as a result of CR in

Phase I and II.[36, 37] Further, self-efficacy has been shown to increase in less monitored CR programs, akin to maintenance programs, compared to more highly structured CR programs, akin to inpatient and outpatient programs.[38] Mastery, a more global concept, was not assessed in this study. To date, two studies completed with Phase III/IV patients have indicated that self-esteem increases as a result of CR.[39, 40] However, these studies involved small samples,[39, 40] focused only on males[39] and did not complete adequate baseline measures.[40] Therefore, there is a need for greater research in this area within Canadian CR patients.

Purpose

The purpose of this study is two-fold. First, to examine and evaluate whether differences in self-esteem and mastery are associated with adherence to maintenance CR. Second, to investigate whether adherence to maintenance CR over 6-months is associated with greater levels of mastery and self-esteem.

Hypotheses

It is predicted, based on the literature, that self-esteem and mastery will be associated with adherence to maintenance CR, in that those with greater mastery and self-esteem will be more likely to adhere to maintenance CR. Furthermore, it is predicted that self-esteem and mastery will increase as a result of 6 months adherence to the CR program.

CHAPTER 2: LITERATURE REVIEW

2.1: Cardiovascular Disease

A chronic disease of great concern in the aging Canadian population is cardiovascular disease (CVD). CVD is the leading cause of death in Canada, with the highest rates in Newfoundland & Labrador and the lowest rates in the Northwest Territories.[41] In 2008, CVD accounted for 29% of mortality in Canada.[42] Between 2005 and 2006, there were 389,577 hospitalizations related to cardiac issues in Canada.[43] Moreover, in terms of cost to the health care system, the cost of cardiac care in Canada was $22.2 billion in 2000.[43] More specifically, the Niagara region was one of the regions[A] with the highest rate of ischemic heart disease (IHD) death in Canada.[41] As well, the Niagara region was among several regions with the second highest rate[B] for CVD mortality.[41] The term CVD encompasses a wide range of diseases including; CAD, IHD, stroke, CHF, valvular heart disease, rheumatic heart disease, peripheral heart disease and congenital heart defects.[2] In fact, CAD, stroke, and CHF are the forms of CVD that most commonly afflict Canadians.[2]

2.1.1: Pathophysiology of Cardiovascular Disease

Atherosclerosis is a primary initiator of CVD. Coronary artery atherosclerosis and IHD are the most common CVDs among CR patients.[2] Atherosclerosis is a chronic inflammatory process that begins in the medium and large sized arteries in utero and early childhood.[2, 44] The first stage of atherosclerosis is known as fatty streaks. Fatty

[A] Alongside Chatham-Kent (ON), Haldimand-Norfolk (ON), Eastern Ontario (ON), Timiskaming (ON), Algoma (ON), Thunder Bay (ON), Northern Lights (AB), Keewintook (AB), and much of Newfoundland and Labrador

[B] Below Chatham- Kent (ON), Northern Lights (AB), Crossroads (AB), Norman (MB), Nunavik (PQ), and the island of Newfoundland

streaks occur when lipids are deposited in the innermost layer of the artery known as the intima.[2] Fatty streaks can begin as early as infancy.[2] During adolescence and young adulthood, the artery wall itself can begin to thicken. There are several theories concerning the development of atherosclerosis, however, the most widely accepted is known as the response to injury hypothesis [also known as Virchow's triad].[2, 45] According to this hypothesis, the innermost endothelial layer of the artery becomes damaged, possibly due to hypertension, diabetes, smoking or dyslipidemia.[2, 44] This damage to the vascular wall allows cholesterol, monocytes and lipids found in the blood to collect and initiate fatty streak and fibrous plaque formation.[2, 44] Once atherosclerosis begins, the artery begins to become larger while maintaining the same internal diameter.[2] Under normal conditions, the endothelial layer of the artery is an anti-inflammatory, antithrombotic environment with tonic vasodilation.[2, 44] However, atherosclerosis disrupts these processes leading to less dilation in the arteries and less blood flow.[2, 44] As the arteries continue to be exposed to cholesterol, lipids and oxidative stress, plaques will continue to grow.[2] In addition, a fibrous cap will form around the plaque. Thicker caps are believed to be more stable and less likely to cause cardiovascular events.[2,44] Plaque composition can play a significant role in whether or not symptomatic disease will develop; positioning of plaques and the stress on the walls also play a part in the pathogenesis of CVD.[44] The most vulnerable plaques involve 50% narrowing of the artery with 40% or more of the plaque being comprised of lipids enclosed by a thin cap.[2,44] Actual symptoms of CVD will occur if a plaque ruptures, the plaque erodes, the plaque intrudes into the artery lumen thereby disrupting blood flow, a thrombus or thromboemboli forms, or the arterial wall weakens.[2, 46] When a plaque ruptures, through

an inflammatory process or erosion leading to the development of mural thrombosis, this process is known as atherothrombosis and may cause MI, angina or stroke.[2, 44, 47] Atherothromboembolism may also occur when fragments of the plaque detach from the lesion and travel to other sites disrupting blood flow and possibly resulting in a stroke.[46] Plaques which disrupt the passage of blood flow also reduce the delivery of oxygen which may result in ischemia.[46] Lastly, these plaques may also compromise the integrity of the vessel wall resulting in an aneurysm.[46] Once these plaques form, it is very difficult to remove them, although studies have found that by decreasing cholesterol consumption plaque size may decrease.[48,49] As well, exercise through CR has been found to improve artery function as well as promote plaque stabilization in the first 6 months.[2]

2.1.2: Treatment of Cardiovascular Disease

Since CVD varies so greatly in each individual, the treatment of the condition is largely variable and depends on the risk factors that an individual has as well as the severity of the disease. Pharmacological therapy is an important component to CVD control and treatment.[50] Antihypertensives, anti-ischemic, antiplatelet, and anticoagulant medications are the most common therapies in use today.[50-52] Moreover, in terms of prevention, lipid-lowering medications, for example statins, can also be prescribed in order to control cholesterol levels.[52, 53] If the situation is more severe, surgical options may be implemented such as coronary artery bypass graft (CABG), or percutaneous coronary interventions (PCI) also known as coronary angioplasty.[51] Exercise interventions can also be prescribed as a method of primary, secondary or tertiary intervention against CVD.[50-54] Primary interventions focus on preventing the development of risk factors. Secondary interventions focus on reducing disease

progression after the risk factors have developed while tertiary interventions act to limit disease progression after an individual has been diagnosed with CVD.

2.1.3: Risk Factors for Cardiovascular Disease

Over past decades, several risk factors for cardiovascular disease have been identified. These risk factors may be grouped into four categories: non-modifiable, modifiable, traditional and emerging.[2] Non-modifiable risk factors are factors the individual cannot change, for example: age, gender, ethnicity and family history of CVD.[2] Being male (RR= 1.52) and being greater than 65 years of age (RR=2.01) have been shown to significantly increase CVD risk among those already with controlled hypertension.[55] Furthermore, native Canadians have been shown to be more at risk of CVD.[42] Therefore, non-modifiable risk factors are important in increasing one's risk and may modify risk for those with other risk factors. Modifiable risk factors primarily relate to behaviours and include factors an individual can change, such as smoking, diet, inactivity, alcohol consumption, social support, depression, and work stress.[2] Traditional risk factors are those which have long been associated with CVD including dyslipidemia, high blood pressure (BP) and diabetes.[2] Obesity is considered to be both a modifiable and traditional risk factor.[2] Emerging risk factors have been identified and are continually being researched with respect to their role in CVD. Some of these risk factors include inflammatory markers, platelet related factors, insulin resistance, exercise capacity, homocysteine levels and some psychosocial factors.[2]

More specifically, the American Heart Association (AHA) and the American College of Cardiology (ACC) have published specific guidelines with regards to many of these risk factors. These recommendations include the complete cessation of cigarette

smoking, as well as control of BP, cholesterol, lipids, weight and diabetes. It is recommended that BP remain below 140/90 mmHg and below 130/80 mmHg for an individual with diabetes.[50] Low density lipoprotein (LDL) cholesterol is recommended to be below 100 mg/dL through reductions in saturated fat and cholesterol intake.[50] Triglycerides are recommended to be below 150 mg/dL. In terms of diabetes management, glycosylated haemoglobin should be below 7%. Body mass index, a measure of obesity, is recommended to be between 18.5 and 25 kg/m^2. Furthermore, it is recommended, in terms of CVD prevention that an individual be active for a minimum of 30 minutes 3-4 days a week.[50]

Predictive formulas for cardiovascular disease have been developed based on these risk factors.[56] This has allowed for an understanding of how much each risk factor may contribute to the development of heart disease. Approximately 29% of CVD events are attributable to high BP.[56] Interestingly, some studies suggest that stage I hypertension has the greatest effect on increasing risk for CVD.[56] High total cholesterol ($\geq$200mg/dL) is attributed to 27% of CVD events in men and 34% in women.[56] CVD risk is also increased if high density lipoprotein (HDL) cholesterol is less than 35 mg/dL, but decreased if the level is above 60 mg/dL.[56] CVD risk is also said to be greatly increased if LDL cholesterol is above 160 mg/dL.[56] It is important to note that obesity, diabetes, high cholesterol and high BP often occur together.[56] Furthermore, family history, and physical activity and many other factors can modify these relationships. Psychosocial factors, such as self-esteem and mastery, have been identified as potential emerging risk factors for CVD and other chronic conditions. Self-esteem is the judgment that one makes of their own self-worth.[21] Those with CVD may feel they are worth less than others due to their

condition and the limitations it may place on their ability to accomplish tasks. Furthermore, those who are less satisfied with themselves and those with negative attitudes towards themselves, suggesting a lower sense of self-esteem, may be at greater risk of developing CVD. Self-esteem has been shown to have a strong influence on the development of chronic conditions. In a longitudinal study (1996 to 2002), those with higher collective self-esteem (defined as one's sense of self-worth within their social circles) developed significantly fewer chronic conditions[C] over a 6 year period compared to those with lower collective self-esteem.[4] Higher collective self-esteem has also been shown to have a stronger influence on chronic conditions, including CVD, when an individual's perception of health control is low compared to when it is high.[5] However, this was observed in a cross-sectional study; therefore, it cannot be determined whether self-esteem and health control precede or succeed the onset of chronic conditions. Furthermore, collective self-esteem is a specific type of self-esteem, and therefore, the same associations may not be seen with global self-esteem. Overall, research has shown that low self-esteem often accompanies myocardial infarction (MI),[7, 17, 18] acute coronary syndrome (ACS) and coronary heart disease (CHD).[13, 14, 16]

Mastery can be defined as the extent to which one feels they are in control of their life.[20] People with a greater sense of mastery feel that they have a more active role in their destiny and are more responsible for their life events and ability to solve situations. Those with a lower sense of mastery, see themselves as having a more passive approach

[C] Chronic conditions included: (a) heart/circulation problems, (b) high blood pressure, (c) heart attack, (d) stroke, (e) anemia/other blood disease, (f) arthritis/rheumatism, (g) palsy/Parkinson's disease, (h) Alzheimer's disease/dementia, (i) eye trouble not relieved by glasses, (j) ear trouble, (k) dental problems, (l) chest/breathing problems, (m) stomach trouble, (n) bladder incontinence, (o) trouble controlling bowels, (p) kidney trouble, (q) diabetes, (r) foot trouble, (s) skin problems, (t) nerve trouble (including all mental illness/emotional problems), (u) any variety of cancer, and (v) other specified problems (including amputations)

to life. They may feel that they have less involvement in what happens in their life and outside forces have a greater impact than themselves. Sudden diagnosis with a chronic condition may alter one's sense of mastery in that they no longer see themselves as having as much control over their condition. In middle-aged and older individuals, mastery has been shown to reduce the risk of all-cause mortality as well as CVD mortality.[10] Penninx, et al. (1996) found that those with chronic illnesses often experience reduced mastery and are more psychologically distressed than people without chronic health problems.[57] However, compared to patients with other chronic conditions including osteoarthritis, rheumatoid arthritis, and stroke, cardiac and diabetic patients were found to be the least psychologically distressed and often report higher levels of mastery compared to the mean level of mastery for all chronic conditions[D] in the study.[57] This could be due to the fact that so much more is known regarding the treatment of CVD and individuals find it less distressing than conditions that are less understood and treatments are less effective. In addition, mastery may be protective in the relationship between life stress and health outcomes.[3, 11, 12]

Mastery has also proven to be beneficial to help cope with many stressors, such as recovery from heart surgery.[15] Acute myocardial infarction (AMI) patients with higher levels of mastery displayed less functional decline, after adjusting for age, sex, chronic medical conditions, and functional disability at baseline and disease severity compared to those with lower levels of mastery.[9] These findings provide support for the claim that CVD and mastery may reduce the effect of CVD on functional decline, in that mastery

[D] Including cardiac diseases, atherosclerosis, stroke, diabetes mellitus, lung disease, cancer, osteoarthritis, rheumatoid arthritis or other serious diseases (gastrointestinal, kidney, serious back or neck problems, endocrine or neurological diseases).

moderates the effect of AMI on functional decline. It has been shown in women that after 6 weeks of recovery from AMI, age, social support and mastery account for 42% of the variation in functional status and 45% in mood disturbances.[8] In CHF, physical function has been shown to be correlated to mastery,[6] however, this relationship was no longer significant after controlling for age and disease severity. Therefore, it is important to examine the role that self-esteem and mastery may play in determining risk for and appropriate management of CVD.

2.2: Cardiac Rehabilitation

Cardiac rehabilitation (CR) can be defined as an individualized program which focuses on enhancing or maintaining cardiovascular health to optimize physical, psychological, social, vocational and emotional status.[2] CR is often prescribed for primary, secondary or tertiary prevention of CVD and often involves exercise as a primary component. The Canadian Association of Cardiac Rehabilitation (CACR) defines a CR program as a hospital or community-based site which incorporates appropriate medical assessment, a multidisciplinary team of health professionals, and a central focus on exercise, exercise testing, and client education.[2] In addition, the program should provide heart hazard identification and behaviour modification.

In previous editions of the Canadian Guidelines for Cardiac Rehabilitation and Cardiovascular Disease Prevention, CR programs were divided into four phases: Phase I- inpatient, Phase II- outpatient, Phase III- long-term outpatient, Phase IV –maintenance.[2] However, this has since been revamped to a model system which divides CR programs into: coordinating sites, inpatient, outpatient and maintenance models. Coordinating sites are often run in conjunction with a hospital and act as the largest service provider in a

specific region.[2] Inpatient sites are found within hospitals and are responsible for initiating the whole CR process through education and coordination with outpatient services. In-patient CR lasts as long as the patient is still in the hospital. Outpatient CR begins upon discharge and may be at a hospital or community site. Outpatient CR focuses on exercise, risk factor education and other services and can last from several weeks to several months.[2] Maintenance sites may also be available at hospitals or in the community and may be for-profit or non-profit. These sites exist for patients who have completed an outpatient CR and wish to continue their CR participation. Inpatient sites were formerly referred to as Phase I. Outpatient services were formerly referred to as Phase II and III. Finally, maintenance sites were formerly referred to as Phase IV. The model based terminology will be used in this thesis, as this terminology is more current.

An overwhelming amount of research has been conducted to understand the cardiovascular benefit of exercise and CR in preventing CVD and subsequent CVD events.[58] Exercise has been found to reduce cardiac risk by approximately 30%.[59] CR and exercise have been shown to reduce LDL cholesterol by 1-5%, BP by 3 mmHg (systolic)/2 mmHg (diastolic) as well as promoting slight improvements in glucose control.[59] Forty percent of this reduction in cardiac risk comes from factors other than the established risk factors, for example, improvements in endothelial function such as the vasodilatory properties and production of NO [nitric oxide], which act to increase the size of the artery through vasodilation.[59] Additionally, exercise promotes beneficial changes in the autonomic regulation of heart rate (HR) through parasympathetic nervous system adaptations, which are thought to be cardioprotective.[59] Greater parasympathetic influence can lead to a lower HR, reducing strain on the cardiac muscle.[58]

Exercise training has been shown to increase event-free survival.[59, 60] A meta-analysis which focused on the effectiveness of CR showed that CR may reduce total mortality by 20% and cardiac mortality by 26% when compared to traditional medical treatment alone.[58, 60] However, follow-ups used in this analysis ranged from 6 months to 6 years and therefore, results are difficult to combine between studies as effectiveness in treatments likely differ over time. CR can also improve exercise capacity by increasing the threshold for the onset of symptoms or ischemia.[60]

CR not only includes aerobic training but may also include resistance training.[2, 23, 60, 61] A study by Marzolini, et al. (2008) found that the combination of aerobic and resistance training in CR promoted greater benefits in terms of muscle function and body composition.[23] The combination of aerobic and resistance training decreased abdominal fat more so than aerobic training alone which is believed to be beneficial in the prevention of heart disease.[23] Resistance training is recommended for both the prevention of CAD and prevention of secondary CAD events.[2, 58]

Although participation with CR has been shown to have numerous health benefits, not all people with or at risk of CVD participate in CR. Studies have shown that in Canada 30% of eligible patients do not participate in CR.[60, 62] Certain modifiable and non-modifiable factors have also been shown to affect CR participation such as age,[26] and socioeconomic status.[24] It has been shown that with increasing age, CR attendance decreases.[26] Low socioeconomic status has also been associated with low participation in leisure time physical activity, and therefore may impact CR participation.[24] Gender has also been suggested to be an important factor. Generally, females are referred to CR less often, while males have been shown to dedicate more time to moderate/vigorous physical

activity during home-based CR.[63] Furthermore, a study by Ng, et al. (2003) showed significant differences in life satisfaction and importance of life events between men and women with CVD.[25] These authors found that men were less likely to participate in health enhancing behaviours and therefore, should be of concern in CR.[25] However, conflicting evidence exists as Conn et al., (1991) found that gender was not a statistically significant factor for predicting CR participation.[26]

2.3: Terminology

There are several psychological factors that have been studied in the CR literature. Although each is different, they are often closely related and difficult to differentiate. The focus of the remainder of this literature review will be mastery and self-esteem, however, the terms self-efficacy and psychological distress must also be introduced. Both mastery and self-esteem are constructs that reflect self-concept or thought about one's self. Mastery is the perception of control in an individual's life.[20] Mastery is closely associated with self-efficacy which relates to one's perception of his/her abilities to perform specific tasks.[32] However, mastery is a more general feeling of overall control in one's life and the ability to use resources to control one's life, whereas self-efficacy is control over specific behaviours.[6, 32] For example, in a CR setting self-efficacy could pertain to accomplishing a specific task, such as walking 5 kilometers, whereas, mastery relates to one's sense that they can control their personal situation. As for self-esteem, it relates to an individual's perception of their own self-worth. Finally, psychological distress relates to the amount of stress and anxiety a person experiences and is felt to be a predictor of depression.[64] Psychological distress is a very broad term

that includes feelings of nervousness, hopelessness, restlessness, depression and worthlessness. [65] These concepts will now be discussed as they pertain to CR.

2.4: Mastery, Self-Esteem and Cardiovascular Rehabilitation

In addition to non-modifiable, modifiable, and traditional factors, it is important to assess the effect that other emerging factors may affect participation and success in CR. Mastery and self-esteem have been shown to be associated with CVD and other chronic diseases and therefore, may play a role in CR.[3, 5, 7, 10, 17, 18, 27-31] To better understand how both self-esteem and mastery may influence CR, it is important to examine these self-views within the stress process model.

The stress process model identifies the effect that stress has on health and how various personal and social characteristics may influence this connection.[20, 66, 67] Originally proposed by Pearlin and colleagues (1981) to examine the effect of social stress on mental health outcomes such as psychological distress and depression, it can also be applied to how CVD and CR may operate to affect future symptoms and difficulties that arise with CVD. Stress is usually presented as a major change or event in an individual's life such as the loss of a job or spouse, a sudden illness or accident, or another life-altering event.[66] CVD often presents itself through an event such as angina, a MI, and the need for surgical procedures such as CABG or PCI. The event itself constitutes a stressor but, as suggested by Pearlin, secondary stressors resulting from the specific event such as difficulties in performing ones' roles (e.g., going to work, contributing to one's household) or resulting financial difficulties can be as or more severe than the primary event.

The stress process model would predict that the extent to which CVD events and the secondary stressors associated with CVD cause subsequent health problems is influenced by the degree to which these stressors reduce one's resources to cope with the stressors.[20, 68] These resources can be both social resources (i.e. social support) but also personal resources (i.e. self-concepts like mastery and self-esteem). Based on this model, exposure to stress would diminish these self-concepts, which would lead to adverse health outcomes (mediation). In addition to this exposure process, the stress process also predicts that those with higher levels of resources prior to an event would be better able to withstand the negative effects of a stressful event such as a CVD (moderation). That is, certain people with higher levels of resources may be more resilient or less vulnerable to experiencing the adverse health consequences of a stressful event. These two process, differential exposure and differential vulnerability are both accounted for within the stress process and could be operating separately or simultaneously. These two processes can be thought of in terms of mediation and moderation.

An exposure to stress may adversely reduce one's self esteem and mastery which, in turn, may adversely influence health and health behaviours. This would be a mediational process sometimes referred to as the "differential exposure hypothesis". In addition, having higher levels of self-esteem and/or mastery may provide one with a better ability to withstand the adverse effects of stress. That is, having a higher level of resources may moderate the negative effect of stress on subsequent health and health behaviour outcomes. This is sometimes referred to as the "differential vulnerability hypothesis" because people would be differentially vulnerable to an exposure based on their existing levels of resources.[69] Figures 1 and 2 provide a visual illustration to better

understand the difference between these two processes. Figure 3 provides a theoretical model illustrating the overall stress process including these two different pathways.

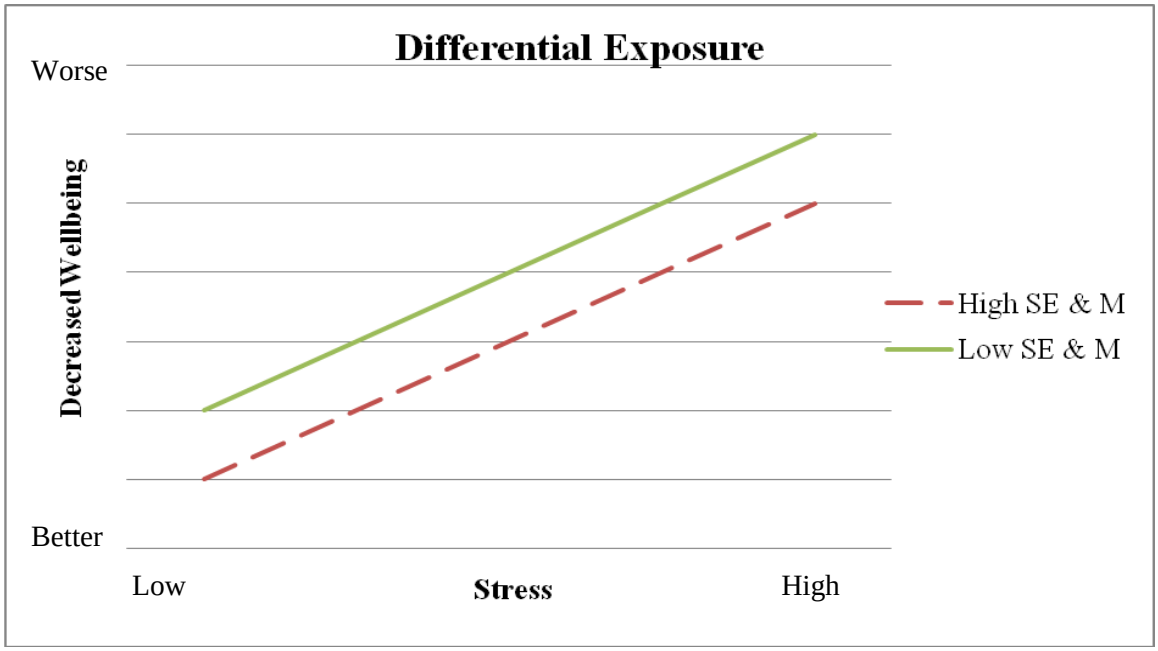

Figure 1. Differential Exposure Hypothesis. SE=Self-Esteem; M=Mastery[20]

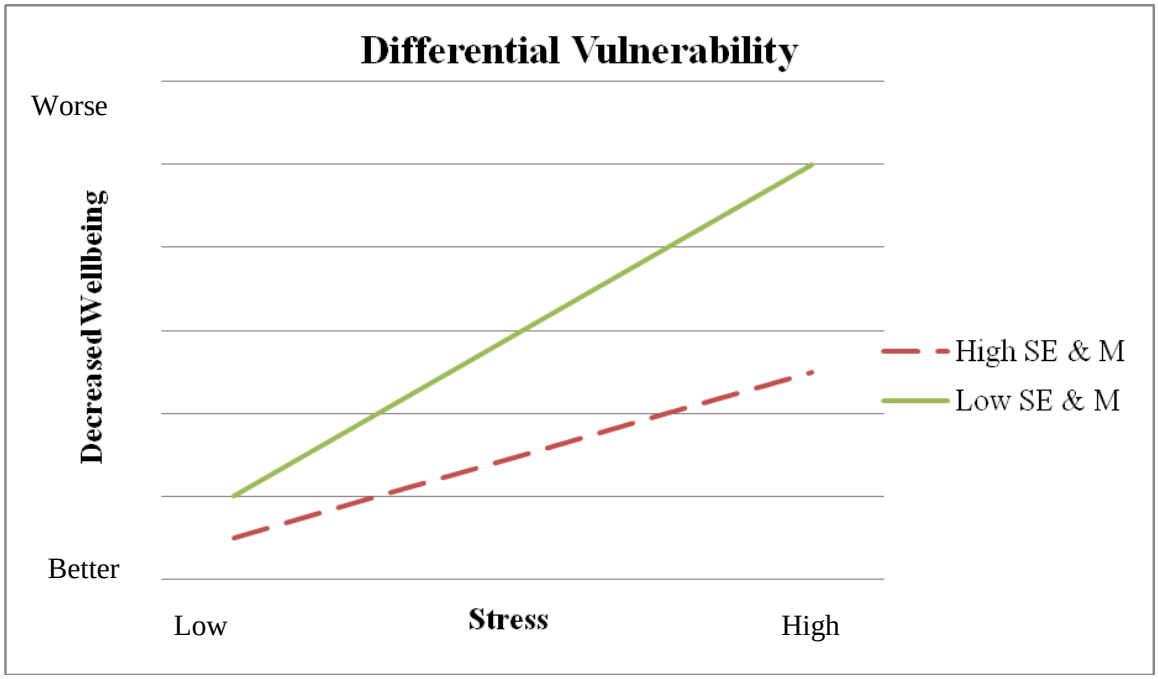

Figure 2. Differential Vulnerability Hypothesis. SE=Self-Esteem; M=Mastery[69]

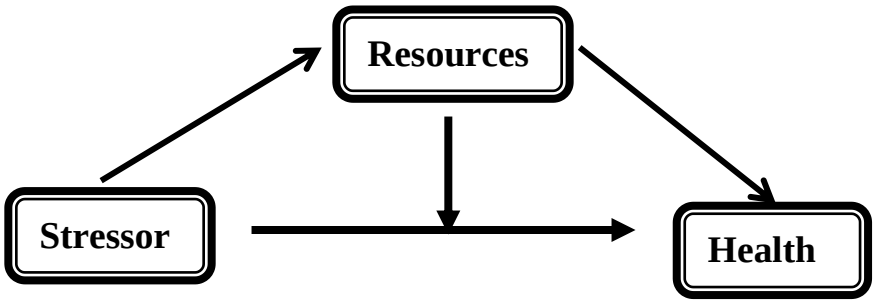

Figure 3. The Stress Process[20]

2.4.1: Self-esteem, Mastery, Participation and Adherence to Cardiac Rehabilitation

Within a moderation framework, both self-esteem and mastery may predict the likelihood of participation and adherence to CR. Psychosocial factors, such as mastery and self-esteem, have been shown to explain 3% of the variance towards increases in leisure time physical activity in the elderly, suggesting that it may also be a predictor of exercise-based CR.[24] Applying the exposure hypothesis, previous work has also shown that physical, emotional, and social functioning as well as pain, vitality and general health are predictive of CR participation.[70] The specific phase of CR in this study was not acknowledged, however based on the description, it was likely Phase I and II. Conversely, in a study focusing on Phase II CR by Younger, et al. (1995), mastery did not significantly differ between participants and non-participants in CR at entry.[35] This phase is much closer to the actual cardiac event than maintenance CR. Hence, those who chose to continue with CR in outpatient services may not be that different in terms of mastery this early on compared to those who did not participate in CR (differences may be seen in later phases of the CR process because earlier phases of CR have more of a mandatory nature whereas, maintenance CR is more of a choice for patients). Furthermore, this study did not measure improvements in mastery as a result of CR participation. The authors of this study noted that the mean mastery score was lower than their previous study by Younger (1993). However, the earlier study involved a larger sample of people who had encountered a larger variety of stressors than solely CVD stress. This finding further justifies the need to research mastery in CVD patients and CR participants.[35]

While mastery has received some attention in the literature regarding CR, self-esteem has received very little. More attention has been placed on self-efficacy, a related concept of involving perceived competence. Self-esteem and self-efficacy have both been shown to influence participation in CR programs.[7,71] Daly, et al. (2002) reviewed barriers to adherence and participation and indicated that both self-esteem and self-efficacy may have roles in adherence to and participation in CR.[7] In a study by Hellman (1997), predictors of exercise adherence were assessed in CVD patients who had recently completed inpatient CR utilizing the STAGE of behaviour change model to assess exercise adherence.[72] It was found that self-efficacy, perceived benefits of exercise, interpersonal support for exercise and perceived barriers accounted for 50% of variance within each stage of behaviour change. With increasing stage of change, the amount of exercise completed increased as did self-efficacy score.[72] Moreover, a study by Vidmar & Robinson (1994) in a post-Phase II CR population some of which were now exercising on their own, some of which were no longer exercising and some of which were attending a Phase III program assessed how self-efficacy related to how well patients complied with American College of Sports Medicine (ACSM) guidelines.[E 33] Self-efficacy was found to be predictive of exercise compliance.[33] With regards to self-esteem, Conn, et al. (1992) studied a population of MI survivors (greater than 1-2 years) to determine influences on participation in CR retrospectively and determined a correlation between CR participation and global self-esteem.[71] Although these findings are preliminary, they do suggest the potential for a relationship between participation and self-esteem.[71]

[E] ACSM guidelines were defined based on frequency, intensity and duration to maintain benefits of Phase II CR. Guidelines set for the study were based on 1990 guidelines. This included exercise for at least 40 minutes, 3-5 times per week at an RPE of 4 or 5.

Therefore, it is plausible that mastery and self-esteem may also be related to participation and adherence to CR programs.

2.4.2: Improvements in Self-Esteem and Mastery as a result of Cardiac Rehabilitation

The mediation model framing the exposure hypothesis indicates that CR may improve self-esteem and mastery. As some previous research has shown that lower levels of resources like mastery and self-esteem are linked with a greater likelihood of future negative health outcomes, improvements resulting from CR could explain part of its success in reducing future coronary issues. While there has been little research in this area, there is some research to suggest that CR adherence may improve self-esteem and mastery. Self-esteem has been shown to increase as a result of CR in Phase I patients, however, several years after CR, complaints of low self-esteem have been shown to increase in those same participants.[37] Since this study utilized Phase I rehabilitation patients, it suggests that continuing CR into further phases may be necessary in order to maintain or improve any self-esteem benefits achieved through Phase I CR.[37] Similarly, Joyce et al. (2010) found CR patients reported an increase in self-esteem and self-confidence after the program was complete, however, the patients also desired program continuity and demonstrated a dependency on the program.[36] The specific phase was not declared in the article, however, based on the description it appeared to be Phase II.

With relation to changes as a result of CR, again, mastery has seen very little attention with a greater focus of CR research being placed on self-efficacy.[73-75] Furthermore, in a literature review regarding self-efficacy it was concluded that greater attention has been placed on earlier phases of CR and that more attention is needed with

regards to adherence, maintenance CR and maintenance to exercise behaviours. [76] Self-efficacy in maintaining functions and controlling symptoms has been shown to increase in low frequency exercise CR compared to high frequency CR.[73] However, there was no control group in this study to establish a significant benefit of CR in this regard. Work by Carlson, et al. (2001) assessed the difference between a highly monitored CR program (similar to a Phase I or II CR) versus a less monitored CR program, similar to a Phase III or IV program.[77] They found that those in the less monitored CR program experienced greater improvements in self-efficacy.[77] Again, no control group of non-CR participants or non-adherers was used in this study and, therefore, the overall benefit of CR was not established. Together, this research suggests that the degree of independence a patient feels and the program's structure influences the degree of improvement in self-efficacy, factors which will likely impact CR's ability to improve overall mastery. Furthermore, this shows that CR can improve one's perception of control and may be more effective in this regard in the later phases of CR.

Most importantly, and significant to this study, very few studies have investigated the relationship between mastery, self-esteem and CR outcomes in maintenance (Phase III/IV) programs which are typically multidimensional programs. Most studies do not acknowledge the specific phase of CR, however, based on their descriptions they appear to be early outpatient or Phase II programs. One study by Hudson, et al. (2001) focused on a Phase III/IV CR program and found that these programs were effective in improving self-esteem.[39] Although this study was only a six week program and only involved 12 men, CVD patients reported feeling several losses as a result of their condition, including self-esteem, which were lessened through their participation in CR. CR provided a

beneficial sense of achievement, purpose and other psychological effects.[39] Similarly, in a quantitative study by Ng & Tam (2000), it was claimed that self-esteem was found to increase as a result of Phase III CR when compared to a control group who did not participate in CR.[40] However, the sample size was quite small (n=37) and there appeared to be no baseline measures to support their finding that the rehab process improved self-esteem. Their findings do suggest however, that self-esteem was significantly higher in those who participate in CR compared to the control group. Furthermore, the program itself was only 2 months; therefore the lasting impact of CR was not assessed.

The literature presented regarding self-esteem, mastery and CR indicates that the relationships between CVD and CR may be understood through a stress process model using both the differential exposure, and differential vulnerability hypotheses. Evidence that differences in self-esteem and self-efficacy predict CR participation and that participation in CR may bolster both self-esteem and self-efficacy suggest that CR may operate as a resource to reduce the effect of CVD stress on subsequent well-being. However, the focus on earlier phases of CR coupled with small sample sizes suggests that more research in this area is warranted especially in later CR phases.

In relation to CR, the stress process, including its stress exposure and differential vulnerability pathways, can provide a tool to understand how self-esteem and mastery may both influence CR participation and how they may be influenced by CR participation (as a mediator) to influence future health outcomes. As can be seen in Figure 4, CVD can act as a stressor due to its potential to make performing ones role in society difficult. The literature does indicate that CVD often affects one's mastery and self-esteem and that mastery and self-esteem subsequently affect one's future health

status. The stress process also tells us that mastery and self-esteem may alter the effect of stress on health (differential vulnerability). CR is a health promoting behaviour which has been shown to improve future health status and therefore, mastery and self-esteem may moderate adherence to CR programs. Higher mastery and self-esteem would be protective against the effect of stress on health and since CR is linked to future health status in this population, would promote adherence. Furthermore, the stress process also assesses mediating effects in that stress can impact one's personal resources and thus affect a number of stress manifestations and one's future health status. Cardiac rehabilitation may also act to mediate the effect of a CVD stressor on one's mastery and self-esteem and subsequently future health status.

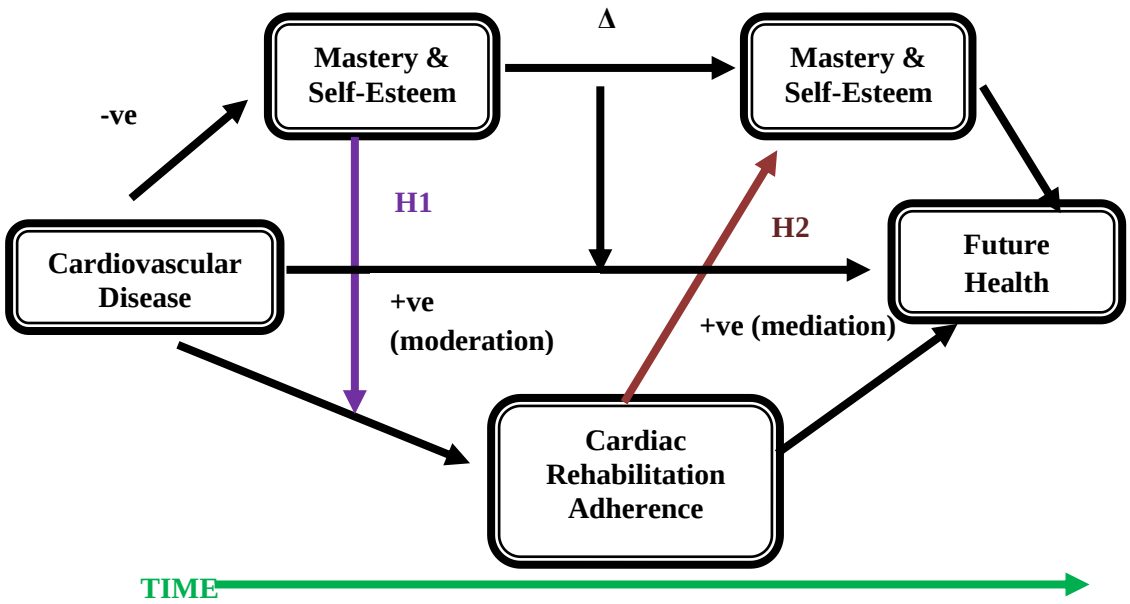

Figure 4. Proposed Model of Cardiovascular Disease, Cardiac Rehabilitation, Mastery, Self-Esteem and Wellbeing operating through the Stress Process. (H1: Hypothesis #1 for study (Mastery and Self-Esteem have a positive association with adherence to CR); H2: Hypothesis #2 for study (CR adherence is associated with change in Mastery and Self-Esteem)

Purpose

The purpose of this study is two-fold. First, to examine and evaluate whether differences in self-esteem and mastery are associated with adherence with maintenance CR. Second, to investigate whether adherence to maintenance CR over 6-months is associated with greater levels of mastery and self-esteem.

Hypotheses

It is predicted, based on the literature, that self-esteem and mastery will be associated with adherence to maintenance CR, in that those with greater mastery and self-esteem will be more likely to adhere to maintenance CR (differential vulnerability hypothesis). Furthermore, it is predicted that self-esteem and mastery will increase as a result of 6 months adherence to the CR program (exposure hypothesis).

CHAPTER 3: METHODS

3.1: Site/Program

Data for this prospective study were collected at the Brock University Heart Institute (BUHI). The BUHI opened in January 2008 and since that time has been collecting data at the beginning of a patient's rehabilitation program and at follow up 6 months later. The BUHI is a maintenance rehabilitation program.

3.2: Participants

The BUHI is available to patients who have CVD, past MI, CHF, cardiac surgeries (i.e. CABG) or PCI as well as those who have physician-identified risk factors for the development of CVD, such as hypertension, obesity, diabetes and high cholesterol. Potential members often hear about the program through television advertisements, word of mouth or through their physician. Referral from a physician is required to initiate the program. Due to the location of the BUHI, our patients primarily come from the Niagara region.

3.3: Procedures and Measurements

Data collection includes performance of a graded exercise tolerance test (GXT) results, and data collected using the BUHI questionnaire battery both at intake and 6 month follow-up. The total assessment time is approximately 2 hours and 10 minutes per person. The specific components of the data collection are discussed below.

3.3.1: Physician Referral

The physician referral form contains patient information including name, date of birth and contact information (Appendix, page 96). Furthermore, the referring physician

is asked to provide the reason for referral; primary prevention, secondary prevention or spousal support. Under secondary prevention, the physician is asked to provide the risk factors the individual has including dyslipidemia, hypertension, obesity or diabetes. Under tertiary prevention, the physician is asked to identify if a MI, cardiac surgery (CABG, valve replacement, or other) or coronary angioplasty has occurred as well as the dates of these events. The physician must sign the referral form indicating that the patient is able to safely participate in stress testing and an exercise program.

3.3.2: Graded Exercise Tolerance Test

A Bruce Protocol graded GXT (operation system) was administered by an exercise technician and interpreted by a cardiologist. The Bruce Protocol involves increases in both speed and incline of the treadmill (Full Vision Inc. Trackmaster Treadmill, Model TMX425, Newton, Kansas) at 3 minute increments. The graded GXT estimated exercise capacity using METs, which was automatically calculated by the Norav Medical System (Stress PC ECG application/PC ECG 1200, 2007, Yokneam, Israel). Participants were asked to complete a consent form prior to completing the GXT (Appendix, page 97). The Bruce Protocol is recommended by the CACR and AHA for use in cardiac patients.[2, 78] There are 3 main purposes to the GXT for the BUHI and the patient. First, the GXT and its evaluation by a cardiologist allows for the assessment of underlying CVD. If the GXT is positive, the patient's physician is notified for a decision as to whether the patient is suitable for the program. Second, the test is used to determine a target heart rate (THR) range to be used during the exercise protocol using the Karvonen formula [$HRR=(HR_{max} - HR_{rest})$*desired % intensity + HR_{rest}]. Third, the GXT

results are used to evaluate changes in exercise capacity and the cardiovascular response to exercise.

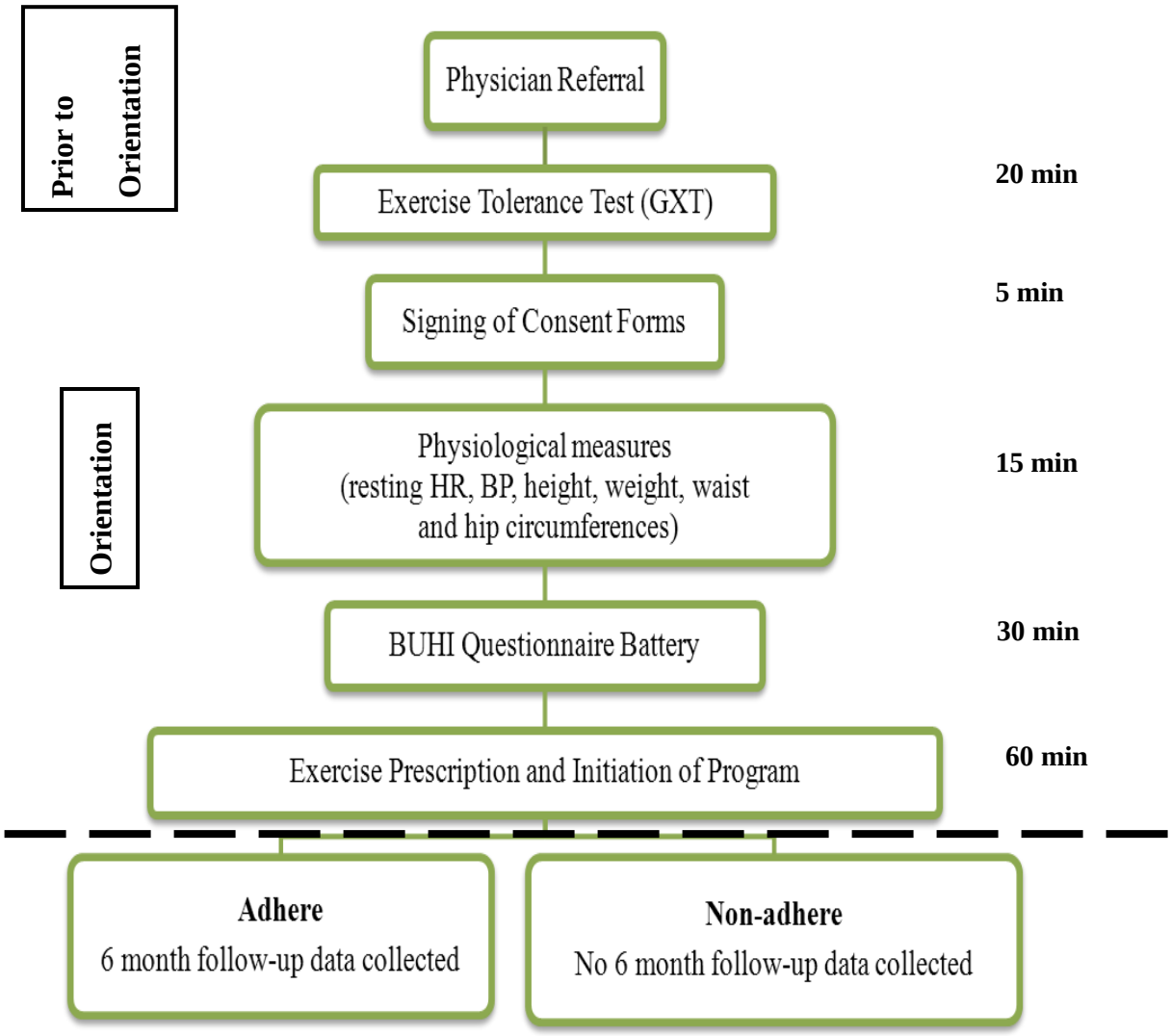

Figure 5. Brock University Heart Institute Intake and Follow-Up Protocol.

Note: Consent Forms included both an Assumption of Risk and Release of Liability agreement and an Informed Consent for research purposes.

3.3.3: Intake

The intake or orientation to the BUHI program occurred after the GXT testing was complete. Figure 5 summarizes the intake and orientation process. First, patients were asked to read and sign two consent forms. The first was an Assumptions of Risk and Release of Liability for participating in an exercise routine consent form (Appendix, page 98-99). The second consent form provided informed consent for participation in the research component of the BUHI (approved by Brock University Research Ethics Board, REB 09-226-O'Leary) (Appendix, page 100-101). This consent form also provided information regarding confidentiality and anonymity of the data. All participants were assigned a unique identifier number which was associated with all collected data. All data were stored separately from the documentation that associates participants with their unique identifier. After the consent forms were completed and patients had changed into their exercise attire, the physiological measures of the BUHI questionnaire were completed. These included four resting HR and BP measures, three taken on the right arm and one on the left arm. HR and BP were measured in accordance with guidelines set forth by the AHA[79] using an Omron automated BP monitor (Model HEM-705CP or HEM-7000-CANCS, Bannockburn, IL). Body mass was measured with shoes removed by a Health-o-meter Professional Scale (Model 400KL, Alspin, IL) and was recorded to the nearest half pound and subsequently converted to kilograms. Height was also measured with shoes removed to the closest tenth of a centimetre using a SECA stadiometer (Model 222, Germany). Body mass index (BMI) was then calculated as body mass in kilograms divided by height in metres squared. Waist circumference was measured at the narrowest point of the waist and hip circumference was measured at the

widest part of the hips.[78, 80] Both hip and waist circumferences were recorded to the nearest tenth of a centimetre.

The BUHI questionnaire battery is a comprehensive survey, collecting information on demographics, medical conditions, physiological measures, body satisfaction, depression, fat intake, leisure time exercise, psychological distress, body image, health-related quality of life, smoking and alcohol consumption, stress, mastery, self-esteem, and social support. Two specific questionnaires will be highlighted for the purposes of this study: Rosenberg Self-esteem Scale and the Pearlin and Schooler Mastery Scale (Appendix, page102-103).

The Pearlin and Schooler Mastery Scale is a seven item scale which asks respondents to indicate how strongly they agree or disagree with statements related to their perceived mastery on a four, five or seven point scale (Appendix, page 102-103). Mastery can be defined as the extent to which one's life chances has been under their own control.[22] This study utilized a 5 point Likert scale, with a score range of 7-35 with higher scores indicating a higher level of perceived mastery. In the present study, for both hypotheses one and two samples, the Pearlin and Schooler Mastery scale was shown to have a Cronbach-alpha score of 0.82, (for hypothesis 2, α=0.81 at baseline and α=0.82 at 6-month follow-up) suggesting that the scale had good internal consistency.

The Rosenberg Self-Esteem measures global self-esteem and can be defined as a person's positive or negative attitude toward him/herselves.[21] This scale is the most widely used measure of self-esteem.[21] The Rosenberg Self-Esteem Scale is a 10 item scale where six of these items measure global self-esteem and will be used for the

purposes of this study.[21] This scale utilized a 5 point Likert scale from 1 to 5 with scores ranging between 6 and 30. Schmitt, et al., (2005) utilized the Rosenberg Self-Esteem Scale in several languages and found the cronbach-alpha score of this scale in Canada was 0.80.[81] Lawton, et al. (1984) found in the elderly the cronbach-alpha was 0.84 with test-retest reliability of 0.79.[82] The reliability of this questionnaire was found to be similar to that seen in previous literature, α=0.85 and α=0.86 for the hypothesis one and two (α=0.85 at baseline and α=0.87 at 6-month follow-up) samples respectively.

After all questionnaires and consent forms were completed; patients were prescribed a program which allowed them to exercise between 40% and 85% of their HRR, as determined by their GXT. On their intake date and at the beginning of their program, patients spent 10 minutes walking on a treadmill, 10 minutes biking on a leg cycle ergometer and three minutes using an arm ergometer at a pre-determined speed of 50 rpm. If the patient was able, they repeated this cycle a second time, if not they worked towards accomplishing two rounds as they progressed throughout the program. During this time, patients were educated about safe exercise, and proper monitoring of their exercise through estimates of exertion (Borg Scale – CR10) and through the use of radial or carotid pulse checks. The importance of exercising within their THR was also emphasized.

After approximately 4 weeks of cardiovascular exercise training, patients were educated about the benefit of resistance training. Patients were then trained on safe and proper use of resistance equipment which aimed at strengthening all of the major muscle groups. Again, these recommendations were consistent with CACR exercise guidelines as

well as the ACSM. All exercise information was recorded in a log book by the patient or by a trainer.

3.3.3.1: Covariates

The BUHI questionnaire also collected information regarding presence of known CVD risk factors. Age was calculated in years based on the difference between the date of intake or follow-up indicated on the questionnaire and the patients' birth date. Patients were asked to indicate whether they were male or female. Patients were also asked to indicate which risk factors they had in response to "do you have any of the following risk factors for heart disease." Options included: smoking, hypertension, hypercholesterolemia, physical inactivity, overweight/obesity, diabetes, excessive stress, family history of CVD. Those who indicated that they did have a family history of CVD were also asked to indicate whether the relative was their mother, maternal grandmother, maternal grandfather, father, paternal grandmother, paternal grandfather, or other. Those who indicated they had hypertension or hypercholesterolemia also specified whether this was controlled or uncontrolled. Ever-smoker status was determined based on a 'yes' response to "have you smoked 100 whole cigarettes in your life?"

Depression is also a risk factor for CVD. Research has shown that depressed moods and self-esteem are correlated.[21, 22] However in CVD patients, it has been shown that depression scores improve up to 6 months after a cardiovascular event. Since the BUHI is a maintenance program, patients begin to participate several months or years after an event and therefore, psychological distress was chosen to be a more appropriate measure.[83, 84] The K-6 (Kessler-6) was used as a measure of psychological distress. The

K-6 addresses a wide-range of indicators of psychological distress including sadness, restlessness, feelings of worthlessness, nervousness, and hopelessness. The K-6 has been shown to be a good predictor of depression and has been shown to have acceptable reliability (α=.79).[64, 85] In the present study, the K-6 was shown again to have acceptable reliability with cronbach alphas of 0.79 and 0.68 for hypothesis one and two samples respectively.

3.3.4: Exercise Program

The patients at the BUHI facility exercised two to three times per week and were encouraged to exercise at home on their days away from the facility. At the BUHI, patients were involved in a 45 minute cardiovascular exercise program consisting of treadmills (Nautilus Model T916, Independence, Virginia), arm ergometers (Monark Rehab Trainer 881E, Sweden) and leg cycle ergometers (Nautilus Model U916 and R916, Independence, Virgina). Volunteer student trainers were available to assist patients at any time during their program with the taking of HR, BP or the set-up of exercise equipment. Patients were asked to record the duration of exercise, speed for treadmill, incline for treadmill, intensity and revolutions per minute (RPM) for the leg cycle ergometer, and watts for the arm ergometer. For each cardiovascular exercise they were asked to record their training HR and rate of perceived exertion. The amount of weight used, number of sets, and repetitions for each resistance exercise was also recorded. In addition, resting HR and BP were measured after 5 minutes of seated rest before and after each exercise session. All of this information was kept in the patient's log book.

Patients were considered to adhere to the program if they were still an active member at their six month follow-up date. Compliance and attendance to the program

itself did not affect an individual's classification of adherence. This method adds external validity to the study as it gives a more 'real world' applicability; as CR programs are not designed to be ideal experimental situations. However, this may reduce the capability to see changes in mastery and self-esteem as those who have greater compliance would likely experience greater changes.

3.3.5: Six Month Follow-Up

This study, and the BUHI program itself, utilized a 6 month follow-up period for all members. This was mostly due to the fact that after 6 months, a plateau in the benefit of exercise has been found to occur. Bocalini, et al. (2008) found significant improvement in quality of life and physical function in CR patients after 6 months in the program.[86] Additionally, 6 months of exercise-based CR have been shown to induce left atrial remodelling and improved left ventricular function and exercise capacity.[87] Moreover, Denis, et al. (1982) assessed the physiological responses of healthy individuals to a prescribed exercise program and measured improvements in exercise capacity every 10 weeks for 40 weeks.[88] It was noted that at 20 weeks (approximately 6 months) improvements in aerobic threshold began to plateau. Since the BUHI program primarily focuses on aerobic exercise, this finding justifies the six month period as an appropriate follow-up time.

After 6 months of program participation passed, a follow-up GXT was scheduled and completed. Both the baseline and follow-up GXT were carried out and observed by an exercise technician and cardiologist. At this time, the BUHI questionnaire battery was administered again. This questionnaire did not change in content from its first administration from baseline measures. Physiological measures including resting HR and

BP were re-assessed, as well as: body mass, height, waist and hip circumference by the same examiners in the same manner.

3.4: Statistical Analysis

This sample includes participants who began the program in January 1, 2008 up until December 8, 2011 providing a sample size of 98 (46 adherers; 52 non-adherers). Student's t-tests were used to compare baseline measures between the two groups. These variables included mastery and self-esteem. In order to determine appropriate covariates, a correlation matrix was created to identify factors that could potentially be associated with mastery, self-esteem and adherence. This correlation matrix included all risk factors for CVD collected by the study (age, sex, family history, hypertension, high cholesterol, diabetes, excessive stress, psychological distress, exercise capacity, obesity status, BMI, waist circumference, smoking status). All covariates were obtained in the intake and follow-up questionnaires. Exercise capacity was obtained from the GTX results. Chi-square tests were used to compare sex and enrolment for secondary or tertiary prevention reasons. In order to address the first hypothesis that self-esteem and mastery predict adherence to CR, logistic regression was used to evaluate mastery and self-esteem (in separate models) between the adherence and non-adherence group. Additional logistic regression models were completed to adjust for the covariates including age, sex, secondary or tertiary prevention, psychological distress, ever smoker, living with spouse, employment status, education and exercise capacity.

To test the second hypothesis regarding changes in self-esteem and mastery as a result of CR, repeated measures, generalized linear models (generalized estimating equations) were used to evaluate changes in self-esteem and mastery after six months of

maintenance rehabilitation. Additional models were tested to adjust for the effect of covariates (age, sex, secondary or tertiary prevention, psychological distress, ever smoker, living with spouse, hypertension status, education and exercise capacity) in the generalized linear models. Self-esteem and mastery were evaluated in separate models.

CHAPTER 4: RESULTS

In this chapter, the results of the study are presented. Cases that were eliminated, as well as the way in which missing cases were dealt with, will first be discussed. Advantages and disadvantages of commonly used techniques dealing with missing values will also be examined. Results of the first study hypothesis related to adherence will then be addressed followed by the results dealing with the second study hypothesis. In these sections, the distribution of data within the sample, preliminary results, and results from advanced statistics will be summarized.

4.1: Eliminated Cases

Cases were eliminated if the individual only attended the BUHI for the purpose of spousal support (n=11), if they had missing intake data (n=8), if they were active at the BUHI beyond 6 months without proper follow-up (n=5). One case was also eliminated because the individual passed away from an unrelated cause during the first 6 months at our facility. Two individuals had multiple intakes at our facility. Their initial intakes were eliminated and the intake completed by the current investigator was used. Another was eliminated from the self-esteem studies as the majority of the Rosenberg Self Esteem Scale was unanswered. After eliminating these cases, baseline analysis had a sample size of 98. The self-esteem studies had a sample size of 97. To address the second hypothesis regarding those who adhered to the maintenance CR program for 6 months, the sample size was 46.

4.2: Missing Cases and Imputation

There are many possible methods that can be used to estimate missing values.[89] Simple deduction in which a logical value based on information known about a participant can be used; however, this is not used very often. Missing values can also be replaced by the mean for the variable or, in the case of a scale, the mean value of responses for that individual across items in the specific questionnaire can be used. The advantage of this technique is that it is straight forward. However, if too many values are missing, using the mean value for the variable can lead to loss of variance in the data and alter the distribution of the data. This can cause the results to be skewed away from the null. Individual-mean substitution has the potential to skew data in either direction. Multiple regression equations can also be used to estimate values using other variables as predictors. This can be assessed using the R^2 value of the equation. If the value is too low, the ability of the equation to predict the missing value is not very good and may alter the findings. On the other hand, the equation may over-predict based on these other factors, causing to increase the correlation among variables when such a strong correlation may not be true. There are some disadvantages to this technique as it relies on the ability to predict the missing values using other variables which may not be true predictors in reality. Further, if there are missing values in the predictor variables, the prediction may be based on a smaller number of cases and therefore be less accurate. Multiple imputations can also be utilized, where multiple estimates of the missing values are computed through repeatedly running the regression equation. The advantage of this technique is that the values allow the variance in the data to remain intact. However, this technique can be more labourious and can be difficult to implement using some statistical

software packages. Finally, in longitudinal studies, last observation carried forward can be used. With this technique, the last observation is used to fill missing values in the follow-up data. This allows for a conservative estimation in the results, as it assumes that there was no change in a particular participant. There are disadvantages with using this technique in drug therapy studies as those with placebos often improve. This technique also assumes that improvement occurs linearly which is not usually the case. Depending on the purpose of the drug, it can result in overestimation of the effectiveness of a treatment. In summary, there are a variety of techniques that can be implemented to deal with missing data values, each with its advantages and disadvantages that must be considered carefully. The techniques used in this study are described below.

4.2.1: Missing Demographic Variables

To address issues of missing values in the BUHI database, several techniques were implemented. First, for individuals who did adhere to the program, missing values for systolic and diastolic BP, height, weight, body mass index, waist or hip circumferences and exercise capacity were dealt with using last observation carried forward between wave 1 and wave 2 and vice versa. One case (adherer) had all body composition data except for height and therefore a regression equation was created to replace height in order to calculate BMI (R^2=0.67). Weight, hip circumference, age and sex were used to predict height. Another case (non-adherer) could not perform a stress test due to the presence of an implantable cardioverter-defibrillator and so a regression equation (R^2=0.58) was created to estimate exercise capacity. Age, type of prevention, education level, sex, and presence of risk factors (including, physical inactivity, smoker, hypertension, high cholesterol, overweight/obesity, and diabetes) were used to predict

exercise capacity. The R^2 values are considered to be acceptable as the predictors explain a sufficient amount of variance in the data (R^2 must be at least 0.10 to be considered useful).[80]

There are, however, a few cases where the physiological measures are completely missing. These cases were eliminated for correlation analyses involving these variables. Since no significant correlations were seen between these variables and the outcome variables (not shown), these cases were not deleted from subsequent analyses. Lastly, a case from the non-adherers had a missing education level and so the value was substituted by the mean education level of the baseline sample.

4.2.2: Missing Scale Variables

Four cases had missing responses on the final Pearlin and Schooler Mastery questionnaire. A regression equation was created using the other responses to mastery questions 1 through 6 as well as other relevant variables including psychological distress and self-esteem to estimate this value. Estimated values were then calculated and inserted. One case had a missing response to the second Rosenberg Self-Esteem scale question. Similarly, a regression equation was created using the other responses to self-esteem questions, 1 and 3 through 6 as well as other relevant variables including mastery and psychological distress. Values were then calculated and replaced. Since the R^2 values for mastery and self-esteem were 0.44 and 0.75 respectively, the regression equations were strong predictors.

4.3: Hypothesis One: Predictors of Adherence in Maintenance CR

Having dealt with the missing values, the results of the first study hypothesis, whether mastery and self-esteem was associated with adherence to maintenance CR, will now be addressed.

4.3.1: Distributions (n=98)

As seen in Table 1 and 2, the mean age of the baseline sample was 62.1 years and was approximately normally distributed. The majority of the sample was male (65.3%) and were referred to our program for tertiary prevention reasons (59.2%). The majority of the sample were non-smokers (92.9%), had hypertension (60.2%), high cholesterol (53.1%), family history of cardiac disease (74.5%) and were physically inactive (31.6%). However, 52% of the baseline sample had smoked at least 100 cigarettes at some point in their life. In terms of other CVD risk factors, 15.3% of the sample claimed to have excessive stress in their life and 21.4% acknowledged that they had a form of diabetes. Only 55.1% of the sample claimed to be overweight or obese, however the mean BMI for the sample was 32.4 kg/m^2. Notably, the sample is highly educated with 77.5% having completed at least a partial college education and 59.2% have an undergraduate degree/diploma or graduate degree. 42.9% of the sample was working at baseline and 79.6% of participants lived with a spouse. In terms of exercise capacity, the sample was found to have a bimodal distribution at 6.9 METs and 10 METs suggesting some had a relatively high exercise capacity while others had a more moderate exercise capability. The K-6 values, which were used to measure psychological distress, indicated a mean score of 9.5 and were heavily skewed to the right indicating that the overall sample experienced low levels of psychological distress. The mean self-esteem score was 25.1

and was skewed toward the left, based on histograms, indicating that the sample had relatively high levels of self-esteem (highest possible score = 30). The mean mastery score was 26.7 (highest possible score =35) and was relatively normally distributed, yet slightly skewed to the left, based on histograms, suggesting that the sample has relatively high sense of mastery. Since, kurtosis values were not greater than ± 1.0 and mean, median, mode remained close, it was decided to proceed with analysis without transformation (*mastery:* mode=28, median=27.1, mean=26.7; *self-esteem*: mode=24, median=25, mean=25.1). Of the baseline sample, only 46.9% adhered to the program for 6-months.

Table 1. Distributions of Continuous Variables (Hypothesis One)						
	Age (years)	**Exercise Capacity (METs)**	**Mastery**	**Self-Esteem**	**Psychological Distress**	**Body Mass Index (kg/m^2)**
Mean	62.1	7.7	26.7	25.1	9.5	32.4
Median	63.0	6.9	27.1	25.0	8.0	30.4
Mode	61.0	6.9	28.0	24.0	7.0	36.4
Standard Deviation	10.5	2.7	5.4	3.7	3.4	7.3

MET=Metabolic Equivalents

Table 2. Distributions of Categorical Variables (Hypothesis One)	
	Percent (%)
Prevention	
Tertiary	59.2
Sex	
Male	65.3
Adhere	
Yes	46.9
Education	
Less Than Grade 6	1.0
Grade 8	2.0
Grade 10	2.0
Grade 11	3.1
Grade 12	7.1
High School	7.1
Partial College	18.3
College/Undergraduate Degree	28.6
Graduate Degree	30.6
Working	42.9
Smoker	7.1
Hypertension	62.2
High Cholesterol	53.1
Physically Inactive	31.6
Overweight/Obesity	55.1
Diabetes	21.4
Excessive Stress	15.3
Family History of CVD	74.5
Living With Spouse	79.6
Ever-Smoker	52.0

4.3.2: Correlations

The correlation matrix described the association between the scale variables, mastery, self-esteem, psychological distress and adherence to maintenance CR (not shown). Mastery and self-esteem were significantly associated with each other ($r=0.49$, $p<0.01$). Both were also significantly associated with psychological distress, $r=-0.59$ ($p<0.01$) and $r=-0.42$ ($p<0.01$), respectively. The relationship between adherence and psychological distress approached significance ($r=-0.16$, $p=0.12$).

4.3.3: Preliminary Analysis

Table 3 illustrates the baseline comparisons between adhere and non-adhere groups at the baseline utilizing factors identified in a correlation matrix to possibly be associated with adherence, mastery and self-esteem (not shown). The percentage of males in the adherence group was significantly higher than the percentage of males in the non-adhere group ($\chi^2 =4.45$, $p=0.04$). The percentage of ever-smokers was also significantly higher in the non-adhere group ($\chi^2 =5.79$, $p=0.02$). No significant differences were found between the adhere and non-adhere groups in terms of age, living with spouse, education, employment, exercise capacity, mastery or self-esteem.

Table 3. Baseline Comparison Between Adhere and Non-Adhere Groups.

	Adhere (n=46)	**Non-Adhere (n=52)**	**Statistics**
N	46 (46.9%)	52 (53.1%)	
Age (Mean, SD)	62.8 (9.2)	61.4 (11.7)	t=-0.67
Sex (% Male)	35 (76.1%)	29 (55.8%)	χ^2 =4.45*
Ever Smoker (% Smoker)	18 (39.1%)	33 (63.5%)	χ^2 =5.79 *
Living With Spouse (% Yes)	36 (78.3%)	42 (80.8%)	χ^2 =0.10
Prevention (% Tertiary)	27 (58.7%)	31 (59.6%)	χ^2 =0.01
Education			
Less Than Grade 6	0 (0%)	1 (1.9%)	χ^2 =7.43
Grade 8	1 (2.2%)	1 (1.9%)	
Grade 10	0 (0%)	2 (3.8%)	
Grade 11	2 (4.3%)	1 (1.9%)	
Grade 12	3 (6.5%)	4 (7.7%)	
High School Graduate	2 (4.3%)	5 (9.6%)	
Partial College	11 (23.9%)	7 (13.4%)	
College/Undergraduate	14 (30.4%)	14 (26.9%)	
Graduate	13 (28.3%)	17 (32.7)	
Employment			
Working	18 (39.1%)	24 (46.2%)	χ^2 =0.49
Exercise Capacity	7.7 (2.7)	7.6 (2.7)	t=-0.12
Psychological Distress	9.0 (2.6)	10.0 (3.9)	t=1.6
Mastery	26.6 (5.3)	26.8 (5.6)	t=0.25
Self-Esteem	25.4 (3.5)	24.9 (3.9)	t=-0.62

*p<0.05

4.3.4: Logistic Regression Analysis

4.3.4.1: Mastery

Utilizing logistic regression models (Table 4), it was found that mastery was not a significant predictor of adherence. However, when adjusting for mastery, being male was associated with a 2.7 times greater likelihood of program adherence (95% CI 1.1-6.5, p=0.03). Ever being a smoker was also associated with a significant 2.7 greater likelihood of not adhering to the program (OR=0.37, 95% CI 0.16-0.84, p=0.02). After adjusting for mastery, higher scores of psychological distress were associated with a decreased likelihood of program adherence (OR=0.85, 95% CI 0.72-0.99, p=0.04).

4.3.4.2: Self-Esteem

Utilizing logistic regression models (Table 5), it was found that self-esteem was not a significant predictor of adherence. Adjusting for self-esteem, ever-smoking status was shown to, again, be a significant predictor of adherence (OR=0.39, 95% CI 0.17-0.88, p=0.02), suggesting that those who had never smoked had a 2.6 greater likelihood of adhering to maintenance CR. The effect of psychological distress approached significance (OR=0.90, 95% CI 0.78-1.0, p=0.13). Age, sex, prevention type, living situation, education, employment and exercise capacity had no significant impact on likelihood of adherence.

Table 4. Logistic Regression Analysis of the Effect of Mastery on Adherence to Maintenance CR (n=98).

	Model 1. O.R. (95% CI)	Model 2. O.R. (95% CI)	Model 3. OR (95% CI)	Model 4. OR (95% CI)	Model 5. OR (95% CI)	Model 6. OR (95% CI)	Model 7. OR (95% CI)	Model 8. OR (95% CI)	Model 9. OR (95% CI)	Model 10. OR (95% CI)
Mastery	0.99 (0.92-1.1)	0.99 (0.92-1.1)	0.97 (0.90-1.1)	1.0 (0.93-1.1)	0.99 (0.92-1.1)	0.99 (0.92-1.1)	0.99 (0.92-1.1)	0.99 (0.92-1.1)	0.99 (0.92-1.1)	0.93 (0.85-1.0)
Age		1.0 (0.98-1.1)								
Male			2.7 (1.1-6.5)*							
Ever Smoker				0.37 (0.16-0.84)*						
Live With Spouse					0.88 (0.32-2.4)					
Prevention						0.97 (0.43-2.2)				
Education							1.1 (0.87-1.3)			
Working								0.74 (0.33-1.7)		
Exercise Capacity									1.0 (0.87-1.2)	
Psychological Distress										0.85 (0.72-0.99)*

***p<0.05**

Table 5. Logistic Regression Analysis of the Effect of Self-Esteem on Adherence to Maintenance CR (n=97).

	Model 1. O.R. (95% CI)	Model 2. O.R. (95% CI)	Model 3. OR (95% CI)	Model 4. OR (95% CI)	Model 5. OR (95% CI)	Model 6. OR (95% CI)	Model 7. OR (95% CI)	Model 8. OR (95% CI)	Model 9. OR (95% CI)	Model 10. OR (95% CI)
Self Esteem	1.0 (0.93-1.2)	1.0 (0.93-1.2)	1.0 (0.91-1.1)	1.0 (0.92-1.2)	1.0 (0.93-1.2)	1.0 (0.93-1.2)	1.0 (0.92-1.2)	1.0 (0.93-1.2)	1.0 (0.93-1.2)	0.99 (0.88-1.1)
Age		1.0 (0.97-1.0)								
Male			2.4 (0.97-5.7)							
Ever Smoker				0.39 (0.17-0.88)*						
Live With Spouse					0.80 (0.29-2.2)					
Prevention						0.93 (0.41-2.1)				
Education							1.1 (0.86-1.3)			
Working								0.75 (0.33-1.7)		
Exercise Capacity									1.0 (0.87-1.2)	
Psychological Distress										0.90 (0.78-1.0)

***p<0.05**

4.4: Hypothesis Two: Changes in Self-Esteem & Mastery in Maintenance CR

The results of the second study hypothesis regarding improvements in self-esteem and mastery as a result of maintenance CR will now be discussed. First, the distribution of data within this sample will be addressed, followed by preliminary statistical results and advanced statistics results.

4.4.1: Distributions

The mean age of those in the adherence group was 62.8 years and was approximately normally distributed (Table 6). The adherence group had an increase in exercise capacity (7.6 METs to 9.0 METS) after 6-month maintenance CR. Similarly, mean scores at follow-up for mastery, self-esteem and psychological distress all increased. Average mastery and self-esteem scores rose from 26.1 and 25.2 to 26.8 and 25.7, respectively. As for mean psychological distress score, it declined from 9.2 to 8.5. These three scale variables had slightly skewed distributions suggesting that the sample experienced relatively little psychological distress and had a greater sense of mastery and relatively high self-esteem.

Table 6. Distributions of Continuous Variables

	Baseline			6-month Follow-Up		
	Mean (SD)	**Median**	**Mode**	**Mean (SD)**	**Median**	**Mode**
Age (years)	62.8 (9.2)	64.0	67.0	62.8 (9.2)	64.0	67.0
Exercise Capacity (METs)	7.7 (2.7)	6.9	10.0	9.0 (2.1)	10.0	10.0
Mastery	26.6 (5.2)	27.1	29.0	26.8 (5.1)	27.5	27
Self-Esteem	25.4 (3.5)	25.0	24.0	25.7 (3.5)	25.0	25.0
Psychological Distress	9.0 (2.6)	8.0	7.0	8.5 (2.5)	8.0	6.0

METs= Metabolic Equivalents ; SD = Standard Deviation

4.4.2: Correlations

A correlation matrix (not shown) was used to assess the relationship between the scale variables over time. Mastery at baseline was significantly correlated with self-esteem ($r=0.43$, $p=0.003$) and psychological distress ($r=-0.63$, $p<0.001$) at baseline. As well mastery ($r=0.73$, $p<0.001$), self-esteem ($r=0.48$, $p<0.001$) and psychological distress ($r=-0.57$, $p<0.001$) at 6-month follow-up were correlated with mastery at baseline. Self-esteem at baseline was significantly correlated with baseline psychological distress ($r=-0.40$, $p=0.01$) and all scale variables at the 6-month follow-up (self-esteem, $r=0.43$, $p=0.003$; mastery, $r=0.49$, $p=0.01$; psychological distress, $r=-0.35$, $p=0.02$). Psychological distress at baseline was negatively associated with mastery ($r=-0.46$, $p=0.001$) and self-esteem ($r=-0.39$, $p=0.01$) at the 6-month follow-up. Mastery at 6-month follow-up was also associated with self-esteem ($r=0.53$, $p<0.001$) and psychological distress ($r=-0.42$, $p=0.004$) at the 6-month follow-up. There was no significant association between self-esteem and psychological distress at 6-month follow-up.

4.4.2: Preliminary Analysis

Table 7 illustrates the comparisons between baseline and 6-month follow-up among the adherence group focusing on differences in risk factors for CVD collected in this study. The only significant differences seen in risk factors for CVD were found in the number of people reporting to be physically inactive at baseline and follow-up, which was found to be significantly decreased ($\chi^2 = 5.97$, $p=0.02$). Mean scores for sense of mastery or self-esteem were not found to be significantly different between baseline and 6-month follow-up. However, mean exercise capacity was found to significantly improve

as a result of 6-months of maintenance CR ($t = -3.8$, $p<0.001$). Change in psychological distress scores at 6-month follow-up approached statistical significance ($t=1.8$, $p=0.08$).

Table 7. Comparison between Baseline and 6-month Follow-Up Characteristics among Adherers. (n=46)

	Baseline	**6-month Follow-up**	**Statistics**
N	46	46	
Age (Mean, SD)	62.8 (9.2)		
Sex (% Male)	35 (76.1%)		
Prevention (% Tertiary)	27 (58.7%)		
Education			χ^2 =2.54
Grade 7	0 (0%)	1 (2.2%)	
Grade 8	1 (2.2%)	0 (0%)	
Grade 11	2 (4.3%)	2 (4.3%)	
Grade 12	3 (6.5%)	3 (6.5%)	
High School Graduate	2 (4.3%)	2 (4.3%)	
Partial College	11 (23.9%)	9 (19.6%)	
College/Undergraduate	14 (30.4%)	13 (28.3%)	
Graduate	13 (28.3%)	16 (34.8%)	
Ever Smoker (% Smoker)	18 (39.1%)	16 (34.8%)	χ^2 =0.19
Living With Spouse (% Yes)	36 (78.2%)	37 (80.4%)	χ^2 =0.07
Hypertension (% Yes)	29 (63.0%)	28 (60.9%)	χ^2 =0.05
Working	18 (39.1%)	18 (39.1%)	χ^2 =0.00
High Cholesterol	23 (50%)	27 (58.7%)	χ^2 =0.70
Physically Inactive	16 (34.8%)	6 (13.0%)	χ^2 =5.97*
Overweight/Obesity	23 (50.0%)	21 (45.7%)	χ^2 =0.17
Diabetes	9 (19.6%)	10 (21.7%)	χ^2 =0.07
Excessive Stress	5 (10.9%)	2 (4.3%)	χ^2 =1.39
Family History of CVD	36 (78.3%)	37 (80.4%)	χ^2 =0.07
Body Mass Index (kg/m^2)	32.2 (7.0)	33.3 (8.6)	t=-1.5
Exercise Capacity (METs)	7.7 (2.7)	9.0 (2.1)	t = -3.8*
Psychological Distress	9.0 (2.6)	8.5 (2.5)	t = 1.8 †
Mastery	26.6 (5.2)	26.8 (5.1)	t= -0.49
Self-Esteem	25.4 (3.5)	25.7 (3.5)	t= -0.56

*p<0.05 ; † p<0.10 ; CVD = Cardiovascular Disease

4.4.3: Generalized Linear Model Analysis

Generalized linear models were used in order to test for changes in both mastery and self-esteem between baseline and 6-month follow-up. Baseline psychological distress was shown to be a significant predictor of change in mastery score (B=-0.75 p=0.002); a relationship which did not interact with time (B=-0.39, p=0.23). No other factors were found to be significant predictors of mastery; however two significant interactions were found (Table 8). The first (Figure 6) indicated that the effect of time on mastery was dependent on the influence of hypertension status (B=2.6, p=0.02). Those with hypertension had improved mastery over time, whereas those without hypertension had a decline in mastery score over time. Second, the change in mastery over time was also dependent on changes in exercise capacity (B=-0.61, p=0.01). Figure 7 displays this interaction in a graphical form. In this representation those with highest exercise capacity had >1 SD above mean for exercise capacity and those with lowest exercise capacity had >1 SD below the mean for exercise capacity. The middle exercise capacity was within one SD of the mean. This was completed for each respective time point. Although all exercise capacity groupings did improve, those with the lowest exercise capacity at both had a greater improvement in mastery after 6-months of CR compared to those with high or moderate exercise capacity.

With respect to self-esteem, there was also a significant exercise capacity – time interaction (B=0.48, p=0.03), suggesting that the change in self-esteem over the 6 month period is dependent on changes in exercise capacity (Table 9). Figure 8 displays this interaction in a graphical representation (highest, moderate and lowest exercise capacities were divided in the same manner as Figure 7). At baseline, the mean self-esteem score

for each exercise capacity group was approximately equal. However, those in the lowest exercise capacity group over the 6-month period experienced the greatest amount of improvement with respect to self-esteem. Those in the highest exercise capacity group experienced greater improvement in self-esteem after 6 months of CR than those in the middle exercise capacity group.

4.5: Attrition Analysis

Two attrition analyses were completed using student's t-tests and chi-square to determine if there were any significant differences between the present baseline sample and those who agreed to participate in the study but did not complete the intake questionnaire and between the present baseline sample and those who adhered to the program for 6-months without completing follow-up questionnaires. Those that did not complete the intake questionnaire were not significantly different from the present baseline sample in terms of age, exercise capacity, sex and presence of hypertension, dyslipidemia, obesity or diabetes. There was a significantly greater proportion of tertiary patients in the baseline sample then those who did not complete the questionnaire (χ^2 =12.4, p=0.002). Those who adhered without proper follow-up had significantly lower psychological distress scores (p=0.02) compared to the present baseline sample.

Table 8. Generalized Linear Model Improvement in Mastery Score over Time with Covariates (n=46).

	Model 1 B(SE)	**Model 2 B (SE)**	**Model 3 B (SE)**	**Model 4 B (SE)**	**Model 5 B (SE)**	**Model 6 B (SE)**	**Model 7 B (SE)**	**Model 8 B (SE)**	**Model 9 B (SE)**	**Model 10 B (SE)**	**Model 11 B (SE)**	**Model 12 B (SE)**	**Model 13 B (SE)**	**Model 14 B (SE)**	**Model 15 B (SE)**	**Model 16 B (SE)**	**Model 17 B (SE)**	**Model 18 B (SE)**	**Model 19 B (SE)**
Baseline	-0.27 (0.56)	-0.27 (0.56)	-0.45 (0.68)	-0.27 (0.56)	-1.1 (3.7)	-0.27 (0.56)	-0.11 (0.76)	-0.25 (0.56)	2.1 (2.3)	-0.29 (0.56)	0.29 (1.0)	-0.21 (0.56)	-0.73 (0.56)	-0.27 (0.56)	-1.3 (0.63) *	-0.55 (0.58)	4.7 (1.9) *	0.12 (0.60)	3.5 (2.4)
Sex (Females)		-0.49 (1.7)	-0.85 (1.8)																
Sex*Time			0.72 (1.1)																
Age				-0.07 (0.07)	-0.08 (0.07)														
Age*Time					0.01 (0.06)														
Prevention						0.54 (1.4)	0.75 (1.5)												
Prevention *Time							-0.41 (1.1)												
Education								0.25 (0.36)	0.34 (0.34)										
Education *Time									-0.22 (0.24)										
Ever Smoker										-0.31 (1.1)	0.24 (1.3)								
Ever Smoker * Time											-0.91 (1.2)								
Living with Spouse												-2.9 (2.2)	-4.2 (2.2)						
Living with Spouse * Time													2.5 (1.7)						
Hypertension														0.32 (1.3)	-.92 (0.50)				
Hypertension * Time															2.6 (1.1)*				
Exercise Capacity																-0.21 (0.18)	0.21 (0.16)		
Exercise Capacity * Time																	-0.61 (0.22)*		
Psychological Distress																		-0.75 (0.25)*	-0.51 (0.32)
Psychological Distress * Time																			-0.39 (0.27)

*p<0.05

Table 9. Generalized Linear Model Improvement in Self-Esteem Score over Time with Covariates (n=46).

	Model 1 B (SE)	**Model 2 B (SE)**	**Model 3 B (SE)**	**Model 4 B (SE)**	**Model 5 B (SE)**	**Model 6 B (SE)**	**Model 7 B (SE)**	**Model 8 B (SE)**	**Model 9 B (SE)**	**Model 10 B (SE)**	**Model 11 (B (SE)**	**Model 12 B (SE)**	**Model 13 B (SE)**	**Model 14 B (SE)**	**Model 15 B (SE)**	**Model 16 B (SE)**	**Model 17 B (SE)**	**Model 18 B (SE)**	**Model 19 B (SE)**
Baseline	-0.30 (0.54)	-0.30 (0.54)	0.06 (0.61)	-0.30 (0.54)	-2.0 (4.3)	-0.30 (0.54)	.11 (0.74)	-0.30 (0.54)	-3.2 (3.5)	-0.30 (0.53)	-0.59 (0.78)	-0.28 (0.55)	-0.39 (0.50)	-0.29 (0.53)	0.12 (0.45)	-0.09 (0.57)	-4.2 (2.0) *	-0.14 (0.55)	1.5 (1.7)
Sex (Females)		0.03 (0.92)	0.79 (1.1)																
Sex*Time Point			-1.5 (1.2)																
Age				-0.01 (0.04)	-0.02 (0.05)														
Age*Time Point					0.03 (0.06)														
Prevention (Secondary)						1.0 (0.84)	1.5 (0.95)												
Prevention* Time Point							-1.0 (1.1)												
Education								0.80 (0.23)	-0.43 (0.18)										
Education* Time Point									0.28 (0.33)										
Ever Smoker										0.06 (0.90)	-0.18 (0.99)								
Ever Smoker * Time Point											0.46 (1.0)								
Living with Spouse												-1.1 (1.2)	-1.4 (1.9)						
Living with Spouse * Time Point													0.51 (1.9)						
Hypertension														0.54 (0.74)	1.1 (1.0)				
Hypertension * Time Point															-1.1 (1.3)				
Exercise Capacity																0.16 (0.13)	-0.17 (0.16)		
Exercise Capacity * Time Point																	0.48 (0.22)*		
Psychological Distress																		-0.31 (0.20)	-0.21 (0.22)
Psychological Distress * Time Point																			-0.19 (0.17)

*p<0.05;

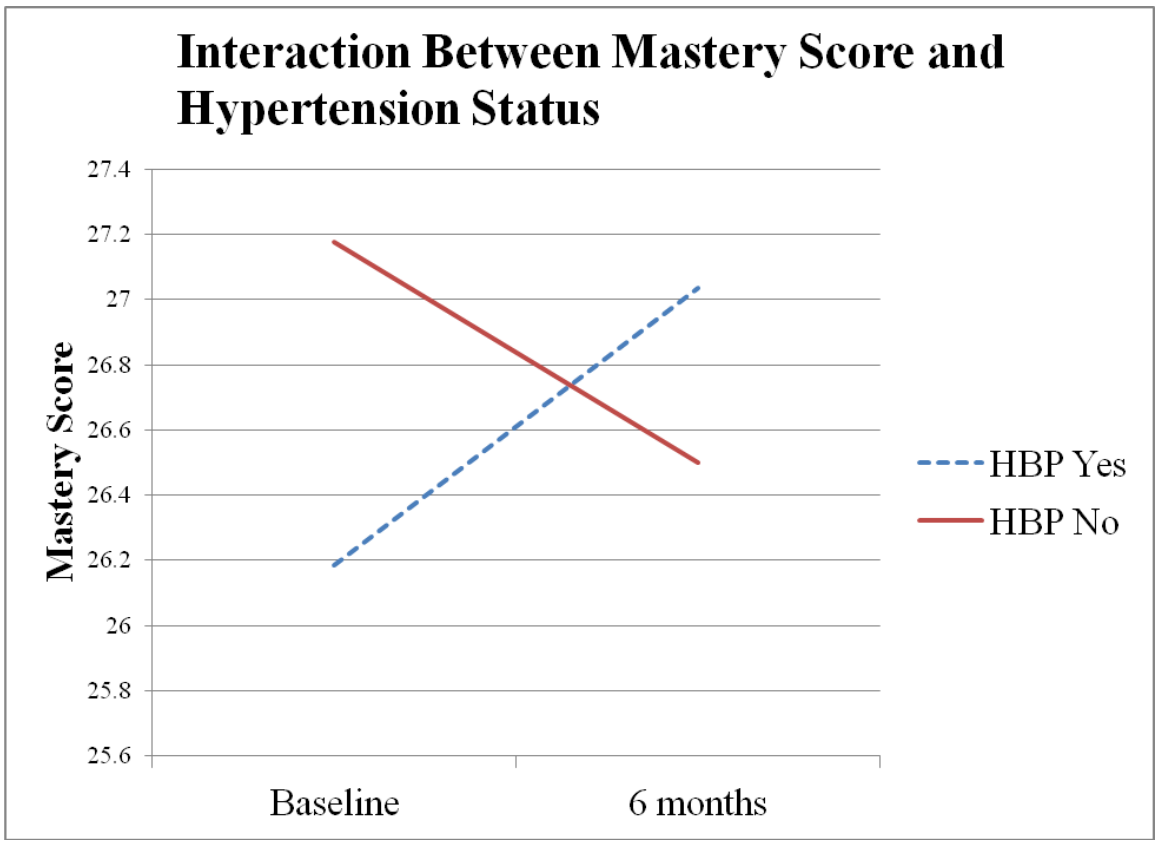

Figure 6. Interaction between Mastery Score and Hypertension Status over Time. HBP=Self-Reported Hypertension Status.

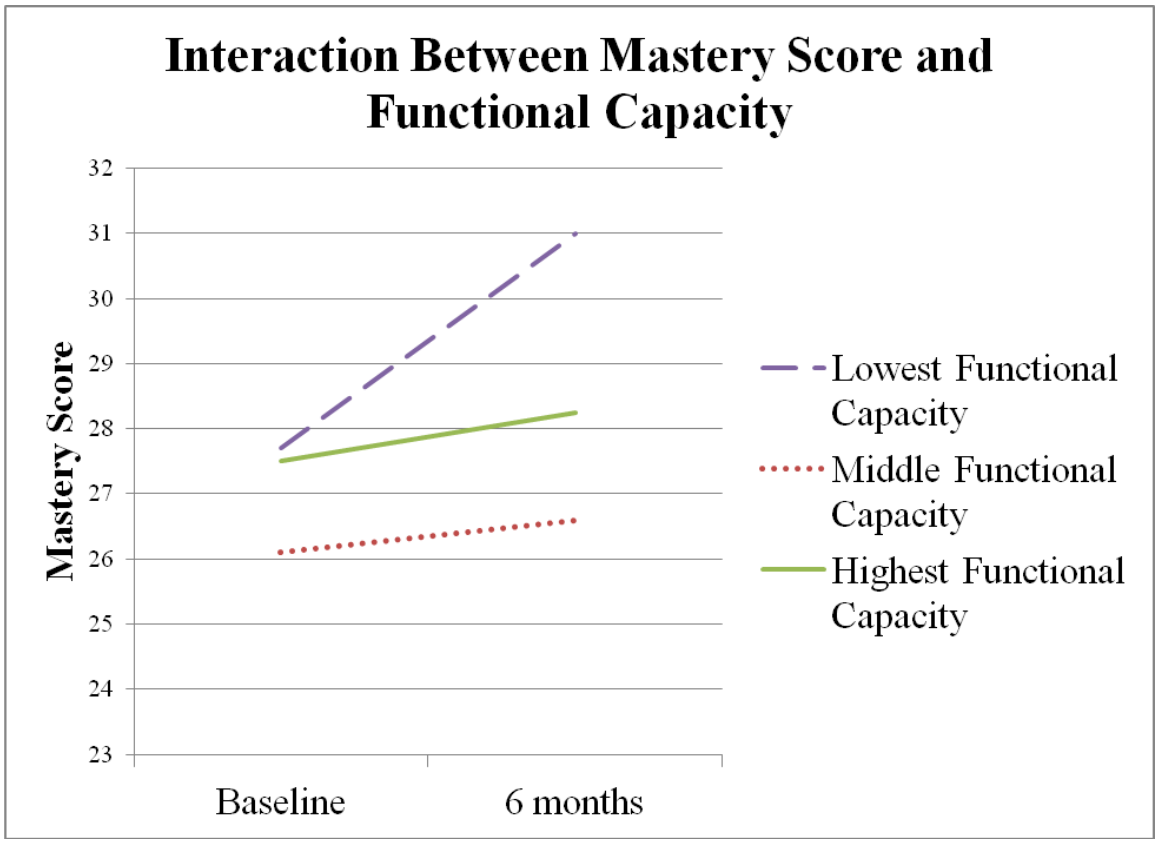

Figure 7. Interaction between Mastery and Exercise Capacity over Time.

Highest Exercise Capacity = +1 SD above mean exercise capacity. Middle Exercise Capacity = within 1 SD of mean exercise capacity. Lowest Exercise Capacity = -1 SD below mean exercise capacity. Means and SD were calculated for each time point. Mastery Score was measured using the Pearlin & Schooler Mastery scale.

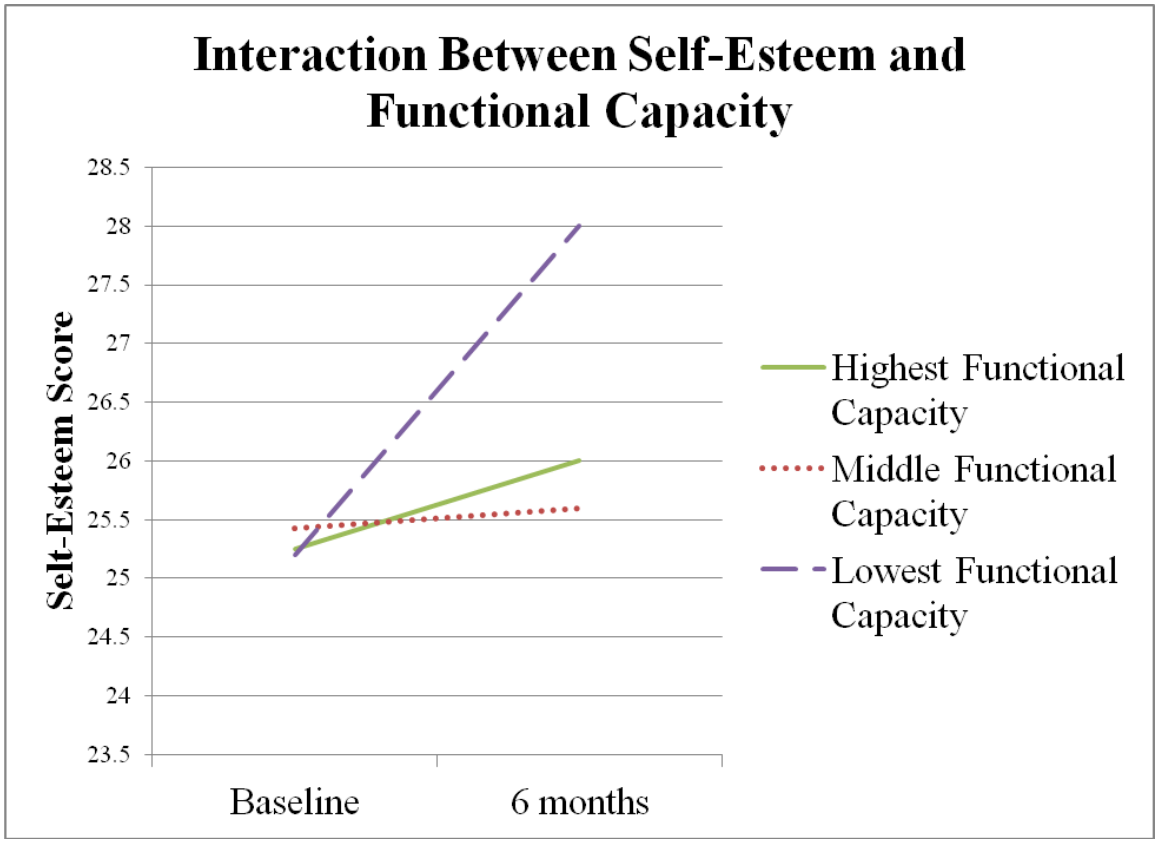

Figure 8. Interaction between Self-Esteem and Exercise Capacity over Time.

Highest Exercise Capacity = +1 SD above mean exercise capacity. Middle Exercise Capacity = within 1 SD of mean exercise capacity. Lowest Exercise Capacity = -1 SD below mean exercise capacity. Means and SD were calculated for each time point. Self-Esteem Score was measured using the Rosenberg Self- Esteem Scale.

CHAPTER 5: DISCUSSION

This chapter will review the study results in the context of stated research objectives and relevant current literature. Conclusions, limitations and recommendations for future research will also be discussed.

5.1: Review of Research Objectives

The objective of this study was two-fold. The first objective was to evaluate whether mastery and self-esteem predict adherence to maintenance CR. The second objective was to evaluate whether mastery and self-esteem improve after 6-months of maintenance CR.

The first objective was based on research suggesting that self-esteem and mastery predict participation in exercise in the elderly[24] and that both self-esteem and self-efficacy predict adherence in early phases of CR.[7, 71] However, very few studies have been done to address these concepts in the later maintenance phase of CR.

Past research dealing with the second objective has focused mainly on early phases of CR.[36, 37] However, it has been shown that CR programs that are less structured and monitored, similar to a maintenance model, increase self-efficacy and self-esteem more so than programs which are highly structured and monitored.[73, 77] To date, two studies have found that self-esteem did increase during maintenance CR.[39, 40] However, the first study did not include baseline measures to support this claim, while the second study focused only on 12 men in a 6-week program.[39, 40] Furthermore, although a community-based study has shown that older adults with a diagnosis of[F] CVD and other chronic conditions report reduced mastery after diagnosis compared to older adults

[F] Period of diagnosis ranged from less than two years to greater than ten years

without these conditions, a review of the literature showed a lack of studies on mastery in maintenance CR. Thus, the current investigation has acted to address gaps in previous research.

5.2: Hypothesis One: Mastery, Self-Esteem and Adherence to Maintenance CR

The first study hypothesis was that that those who adhered to maintenance CR would have greater self-esteem and sense of mastery than those who did not adhere to CR at baseline. This moderating effect is predicted by differential vulnerability hypothesis.[69] In Chapter 2, it was presented that mastery and self-esteem may be considered emerging risk factors for CVD. Modifiable, traditional, and non-modifiable risk factors were all included as covariates during statistical analysis. A correlation matrix (not shown) revealed that age, sex, living with a spouse, education, employment type, prevention type, exercise capacity and psychological distress were associated with mastery, self-esteem or adherence and therefore were included in the remainder of the analysis. As well, correlation analysis revealed that adherence was not correlated with self-esteem or mastery, however, its association with psychological distress did approach significance. Notably mastery, self-esteem and psychological distress appeared to be highly related. Mastery was positively correlated with self-esteem. Psychological distress was associated with a decreased sense of mastery and self-esteem.

Preliminary analyses revealed that self-esteem, mastery and psychological distress scores did not significantly differ between adhere and non-adhere groups. A significantly higher proportion of males compared to females was seen in the in the adhere group. This finding is somewhat surprising as men are traditionally less likely to participate in health-promoting behaviours.[90] The presence of a support person at home or in

attendance to the program may have explained the higher proportion of male adherence. Alternatively, it could be explained by a higher drop-out rate in females in CR. Ever-smoker status (having smoked at least 100 cigarettes in a life time) was significantly associated with adherence. A significantly higher proportion of 'ever-smokers' was found in the non-adherence group, suggesting that they were less likely to adhere to maintenance CR, a health promoting activity.

Logistic regression analysis revealed that mastery and self-esteem were not significant predictors of adherence. Adjusting for mastery, absence of previous smoking, being male and lower psychological distress scores were all associated with greater likelihood of adherence. After adjusting for self-esteem, absence of smoking history increased likelihood of adherence. Having greater psychological distress scores was associated with decreased likelihood of adherence in mastery models. Thus, it appears that in this sample mastery and self-esteem do not play a role in adherence to maintenance CR; however, history of smoking, being of male sex and level of psychological distress may have played a role.

5.2.1: In the Context of Current Literature

The study findings contradicted our initial hypothesis that self-esteem and mastery would predict adherence to maintenance CR. Contrary to present results, similar studies in earlier phases of CR have found that self-efficacy, a related concept to mastery and self-esteem, predicted adherence to CR.[7, 33] The present study also contradicts the work of Yates, et al. (2003) and Dergance et al. (2005) which showed self-esteem and mastery to contribute to leisure time physical activity in the elderly.[24, 91] Dohnke, et al. (2010) also showed that dropouts had decreased self-efficacy compared to adherers

amongst CVD patients participating in a phase III program.[92] Therefore, it is plausible that the more global concept of mastery does not affect adherence, however the more task-specific self-efficacy does affect adherence. Furthermore, researchers found that self-efficacy differed among people with different degrees of intention toward participation in CR, suggesting that motivation likely plays a significant role in this relationship.[92]

Studies have also shown that self-esteem and self-efficacy influence whether individuals participate in CR.[7, 71]Therefore, it is plausible that the acts of choosing to seek out a referral and participate in a maintenance CR program may be influenced by self-esteem and mastery. This could explain why no differences were seen in adherence to maintenance CR; because people with lower self-esteem and mastery may have chosen not to participate at all. However, Younger et al., (1995) did find that in a phase II CR study, mastery did not differ between participants and non-participants.[35] In this instance, data was collected after completion of a phase I CR program to determine differences in those who chose to participate in phase II CR. It is possible that differences in mastery between participants and non-participants may increase in later phases of CR.

In keeping with the stress process framework, there does not appear to be differential vulnerability in that those with a low sense of mastery and self-esteem are not at risk of non-adherence to a maintenance CR program. However, it is possible that differences in self-esteem may only be seen in earlier phases of CR. Participants in maintenance CR have usually completed an initial CR program post-event or diagnosis. These earlier phases may have dealt with threats to mastery and self-esteem encountered at disease onset by promoting positive changes in mastery and self-esteem. Therefore,

adherers and non-adherers to maintenance CR would have equally high mastery and self-esteem. Furthermore, the present maintenance program also deals with individuals at risk for CVD, who have not experienced diminished mastery and would be unlikely to have improvements in these areas. It is also plausible that differences may only be seen in those who participate and do not participate in maintenance CR.

With regards to our findings suggesting that ever-smoker status, being male and being more psychologically distressed affect adherence to CR align with previous research in this field. McGrady, et al. (2009) in a phase II CR program found that drop outs had higher depression and anxiety scores.[93] Depression and anxiety are related to our psychological distress score, and therefore justify our findings. Furthermore, similar to the present study, McGrady, et al. (2009) also found that exercise capacity was not a predictor of adherence to CR.[93] The literature regarding the effect of sex on adherence to maintenance CR is mixed. A maintenance CR study by Dohnke et al. (2010) suggested that there was no difference between the sexes.[92] Similar findings have been reported by other CR sites.[71] In contrast, a large study including 1,115 patients in CR by Sarrafzadegan, et al. (2007) found that women were more likely to complete CR programs, however, this study was completed in Iran and therefore, cultural differences may play a role.[94] The total sample of this study from the BUHI was 76.7% males and males were more likely to adhere than females. This finding is supported by a literature review by Brezinka & Kittel (1996) who identified eight studies which found that women had higher drop-out rates and lower participation and attendance then men.[95] Our sample size, being predominately male may have also played a role, suggesting that women may be less inclined to participate in CR entirely.[95, 96] Previous studies have also suggested

that current smokers are less likely to adhere to CR programs.[94, 96] Interestingly, the present study indicated that even having a history of smoking at least 100 cigarettes significantly reduces the likelihood of adherence, a finding supported by Worcester, et al. (2004).[96]

5.3: Hypothesis Two: Improvements in Self-Esteem and Mastery due to Maintenance CR.

The second hypothesis of this study was that self-esteem and mastery would improve as a result of maintenance CR. This relates to the exposure hypothesis which suggests that exposure to CR mediates the effect of CVD on well-being through improvements in mastery and self-esteem.

As mentioned in the previous section, correlations between self-esteem, psychological distress and mastery were examined in order to assess what may affect mastery and self-esteem (not shown). Mastery, self-esteem and psychological distress were closely associated concepts and were, for the most part, significantly correlated over time. However, at follow-up, self-esteem and psychological distress were not significantly associated.

Preliminary analyses indicated that exercise capacity improved after 6-months of CR as did psychological distress scores. The fact that exercise capacity improved suggests that the exercise based maintenance CR program in this study met its objectives in improving physical fitness. While improvement in physical fitness may have had positive psychological effects, there were no changes in mastery or self-esteem seen through paired t-tests. Generalized linear modeling revealed significant interactions between exercise capacity and time in both mastery and self-esteem models. Graphical

representations of these interactions revealed that greater improvements in mastery and self-esteem after 6-months of maintenance CR occurred in those with the lowest exercise capacities at both time points. A significant interaction was also found between hypertension status and time, where those with hypertension showed improvement in mastery as a result of maintenance CR, however, those without hypertension, showed declines in mastery.

5.3.1: In the Context of Current Literature

The initial study hypothesis that 6 months of maintenance CR would improve mastery and self-esteem scores amongst participants was partially supported by study results. However, the improvement was dependent on exercise capacity and was found only among those with the lowest exercise capacities. This is perhaps not surprising in that those with the lowest exercise capacities have the most to gain from joining the BUHI program. Furthermore, it is likely easier to improve one's exercise capacity when it was initially very low in comparison to someone who began the program with a high exercise capacity. This ability to improve exercise capacity would likely improve global self-esteem through this sense of accomplishment. These results are supported by previous investigations in phase I and II rehabilitation which indicate that self-esteem improves as a result of CR.[36, 37] These studies did not find that this relationship was dependent on exercise capacity, however, since these studies were done during the early phases of CR, it is likely that the exercise capacity of these individuals may be similar to those of in the lowest exercise capacity of the present sample which were below 4.9 METs at baseline and below 6.8 METs at 6-month follow-up.

Previous studies in maintenance CR have also indicated that self-esteem may improve; however, one of these studies only utilized a 6-week program and only focused on a small sample of men.[39] Another study did not provide baseline measures to support their findings.[40] The present study indicates that improvements in global self-esteem can be seen in both men and women after 6-months in a larger sample, dependent on exercise capacity. This may indicate that improvements in exercise capacity may facilitate increases in physical self-esteem which relates to one's physical condition, physical strength and body attractiveness. These increases in physical self-esteem may then increase one's perception of global self-esteem.[97, 98]

Our study results regarding the ability of a CR program to improve mastery in those with the lowest exercise capacity align with the work of Oka et al. (2000) who found that an at-home CR program among heart failure patients with severe activity limitations reported significantly improved levels of mastery after 3-months.[99] Since the patients in their study had severe activity limitations, it is likely that their exercise capacity was compromised. The present study's findings are also supported by several studies which have found improvements in self-efficacy, a related concept to mastery, as a result of CR or related exercise program.[74,75, 99] Self-efficacy relates to the confidence in one's ability to perform a specific task and therefore, may be more likely to see significant changes then in mastery, a much more global concept. Nevertheless, the present study did not find improvements in self-esteem and mastery for all participants, as improvements were only seen in those with the lowest exercise capacity. Studies which have shown a relationship between CR and self-efficacy are in earlier phase programs and in patients with more severe limitations. Patients in these studies likely

have exercise capacities similar to those with the lowest exercise capacity in the present study. Therefore, the fact that we were able to see improvements in mastery, a factor that has been suggested to be relatively constant over time, in a maintenance CR population (that have less severe limitations then seen in the study by Oka et al. (2000)) suggests that the BUHI's CR program is not only being effective from a physiological standpoint but also a psychological standpoint for those who have the greatest limitations who attend our facility.[99]

Our finding that the changes in mastery and self-esteem were dependent on changes in exercise capacity are perhaps not surprising considering the vast amount of research on the psychological benefits of exercise and the fact that the program at the BUHI is primarily exercise focused. Research by Oka, et al. (2005) showed that those with greater self-efficacy scores performed better on an exercise stress test than those with lower self-efficacy scores; thereby supporting the link between such psychosocial factors as self-efficacy, and possibly mastery and self-esteem, and exercise capacity.[38] Oka et al. (2005) also performed measures of self-efficacy at baseline, immediately after an exercise treadmill test and at the end of a 3-month exercise program.[38] They found that improvements of self-efficacy were not seen immediately after a single exercise stress test, but were seen after 3-months of exercise, suggesting that these improvements take time, as indicated by our study. Contrary to the present study, significant changes in exercise capacity were not seen, however, this may be attributable to the fact the follow-up was 3-months instead of 6-months. Shephard et al. (1998) found trends toward significant improvements in psychological domains of quality of life during a 16 week progressive walking program for those with stable CHF.[100] They also found a relationship

trending towards significant between initial peak power output (p=0.07), oxygen uptake (p=0.11) and change in mastery. This study had a very small sample of only 17 participants, which authors of the study believe may have contributed to non- significant findings. The present study, with a much larger sample size, was able to detect a relationship between improvements in mastery and self-esteem and improvements in those with the lowest exercise capacity. This relationship is further supported by the work of Cairney, et al. (2009). Their study found that improvements in physical activity levels are beneficial in reducing overall psychological distress, an association which is mediated by self-esteem and mastery.[101] These authors suggested that changes in physical activity may promote changes in self-esteem and mastery which consequently reduces overall psychological distress.[101] Their findings support the associations between physical activity capability, self-esteem and mastery.[101] It is also interesting that this study found changes over a 6-year period, and hypothesized that these changes would not be seen in short-term physical activity interventions as self-esteem and mastery are considered to be stable constructs.[101] However, the present study differs in that those with CVD or its risk factors were investigated and it is well documented that this population has low mastery and self-esteem scores.[7, 17, 28, 57, 102, 103]

The interaction which was found with hypertension status was surprising in that it was not expected for mean mastery score to decline for those without hypertension. Although this finding may be related to the self-report nature of the hypertension measure used in this study (see **5.4 Limitations**), it may also indicate that 6-months of maintenance CR improved sense of mastery in the BUHI patients. The majority (63%) of patients in the adherence group reported being hypertensive at baseline. These patients

may have been at the BUHI for either secondary or tertiary prevention. Often with CVD, patients do not necessarily know the health issues that they have until the sudden onset of a myocardial infarction, angina and/or the need for cardiac surgery. This sudden onset can alter one's perception of mastery in that they may no longer see themselves as being in control of their personal situation. The same may be true with the diagnosis of hypertension, often noted as a "silent killer", patients are completely unaware that they have hypertension until they receive a physician's diagnosis. This interaction finding indicates that maintenance CR may be helping patients regain their sense of control after such diagnoses.

5.4: Limitations

There are several limitations to this study which may influence the results. First, although the sample size of this study is larger than the sample size of many previous studies, our sample size for the second hypothesis was still quite small and may not have provided enough statistical power to detect results. However, to be able to have enough power to detect these results, an unrealistically large sample size would have been required.

Second, there is also an issue as to how adherence was measured in this study. Adherence was measured simply by whether or not an individual was still attending the program at 6-month follow-up and completed a follow-up assessment. Although this does give a sense of real-world applicability to the results of the study, it does present the issue of whether someone who came to the program 4 times per week for 3 months should be considered to adhere less to the program than someone who attended once a week or less for 6 months. This definition may also potentially explain why no significant effects were

seen with respect to adherence, mastery, and self-esteem at 6-month follow-up. For example, people who have a more routine attendance would likely experience greater improvements in mastery and self-esteem than those who did not attend as frequently. Those who exercise more frequently would likely see increases in their perception of physical self-esteem, through improvements in physical condition, which in turn would increase their global self-esteem more so than those who attend less frequently.[97] With respect to mastery, those who attend more frequently would likely see more changes in themselves, therefore, increasing their perception of control over their condition, thereby increasing their sense of mastery. This study did not differentiate between these individuals within the adherence group, which may conceal a relationship between adherence, mastery and self-esteem as people who did not adhere adequately remain in that group.

Third, there were many issues within the BUHI database. When the program was first initiated, many individuals did not receive a proper intake (n=63) and had missing questionnaire data. The majority of these individuals (n=55) did not complete consent for inclusion in the research aspect of BUHI. Comparisons between those who provided consent but did not complete the questionnaire (n=8) and the baseline sample (n=98), revealed no significant difference. Furthermore, there were some individuals (n=5) who did not receive proper follow-up and were subsequently removed from analysis. At baseline these individuals were found to have significantly lower psychological distress scores compared to the baseline sample that received proper follow-up. After these exclusions, there were still missing values in the data set. Although appropriate

techniques were used to estimate the missing values, these were only approximations and may have posed some limitations to the ability to complete analyses.

The self-reporting nature of some measures in this study also lends itself to limitations. Based on results regarding demographics, there appears to be errors in reporting of education levels between baseline and follow-up. Furthermore, the interaction seen with hypertension status suggests that there may have been errors in reporting. Initial results indicated a gain in the amount of people reporting hypertension between baseline and 6-month follow up. After investigating such cases, errors that were found were corrected in the database. Although it is logical that those with hypertension improved in mastery as a result of CR, it is interesting that those without hypertension indicated a decline in mean mastery score over time. This may be attributable to further errors in reporting in that those with hypertension controlled by medication would simply no longer acknowledge hypertension as a risk factor as their BP values are normal. Thus, there may be individuals in the no hypertension group who may actually have hypertension, affecting the interaction seen in the results of the study. Lastly, a study has also shown that the exercise stress test does not always allow for an accurate estimation of exercise capacity and may over-estimate METs and underestimate THR, possibly overestimating the exercise capacities of the participants in this study.[104] However, since the Bruce protocol was utilized for all study participants it is likely that any error in measurement would be consistent across participants and time.

Finally, the analysis for this study would have been strengthened had additional measures been collected. More specifically, a measure of motivation may have also alleviated some of the issues with the measure of adherence used in this study. The

definition of adherence used in this study did not allow the differentiation between individuals who attended the facility more, hence may have had a greater motivation to adhere and improve their health. Our facility did not have an adequate measure of attendance in operation since 2008. Therefore, assuming that those who attended more regularly were more motivated, controlling for motivation could have alleviated the issue with the measure of adherence. Furthermore, since self-efficacy is so closely related to the concepts of mastery and self-esteem, a measure of self-efficacy may have also been helpful in terms of program evaluation and to more closely examine the relationship between global mastery and physical activity-based efficacy.

In terms of study design, the study did not include a control group of people who chose not to participate in maintenance CR, which would have allowed us to see if self-esteem and mastery affect program enrollment and not just adherence. Incorporating a control group would have been a very difficult task to accomplish as it would have required collaboration with other rehabilitation facilities at completion of their program to allow us to see differences among people who chose not to continue with rehabilitation. Another way this could have been accomplished would have been to collaborate with a large number of physicians in order to determine those patients who were referred, but chose not participate in our program. Nevertheless, both these options would likely have resulted in a low response rate as these methods would not capture the full scope of "non-participants." Therefore, the resources and logistics required to form a control group made it too difficult to accomplish within the present study.

5.5: Strengths

Despite the limitations in this study, the study did have several strengths. Although the sample size is still small, it is much larger than that of previous studies examining the effects of CR. Furthermore, the scales used in this study performed well in reliability analyses and are widely used and well validated. The greatest strength of this study is its focus on maintenance CR as very little research has been carried out on this model of CR. This study also looked at mastery and self-esteem as predictors of adherence as well as mastery and self-esteem being improved as a result of maintenance CR. While these have been examined in Phase I and II CR, albeit only to a small extent, these research questions have not previously been evaluated in maintenance CR. Furthermore, because mastery and self-esteem were assessed as potential emerging risk factors for CVD, we evaluated them in relation to several other known risk factors for CVD.

5.6: Implications and Future Research Recommendations

Psychological distress and history of smoking were shown in this study to impact adherence in participants at the BUHI program. Therefore, the BUHI may want to consider screening these individuals at entry into the program in order to identify and target them to better ensure they reach their fitness goals. Furthermore, since mastery and self-esteem were found to improve among those with the lowest exercise capacity, it may be worthwhile to add a mental health component to the program. This may foster further gains in mastery and self-esteem irrespective of an individual's physical capacity and allow for greater improvements in individuals with moderate and high exercise capacity. Furthermore, adherence to the program may be improved with more of a consultation

with the BUHI staff at intake and follow-up regarding patients' physiological measures (ie, BP, exercise capacity), their psychological measures, including mastery and self-esteem, as well as a goal setting process. This may foster greater gains in both domains if patients see where they are improving and whether they are meeting their initial goals. Research in cardiac care in general should also focus more on self-esteem and mastery as emerging factors in CVD and CR. Furthermore, future research should evaluate differences in participants and non-participants in maintenance CR to see if self-esteem and mastery have an effect.

5.7: Concluding Remarks

In conclusion, mastery and self-esteem do not appear to affect adherence to maintenance CR. However, mastery and self-esteem do appear to improve among those with lower exercise capacity following 6 months of physical activity in maintenance CR. These findings add to the current research on maintenance CR. Furthermore, the results of the present study justify the need to study mastery and self-esteem as potential emerging risk factors for CVD, as well as CR being a mechanism that improves such risk factors. CVD remains the second leading cause of death in Canada. Therefore, continuing to understand other potential risk factors from a psychosocial standpoint is important to further reduce morbidity and mortality from this chronic condition.

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APPENDIX

Physician Referral Form
Fax: (905) 378-5724

For completion by Referring Physician
Name of referring physician:
I wish to refer my patient to the Brock University Heart Institute for the purpose of cardiac rehabilitation, which includes exercise stress testing and aerobic and resistance training.
Certification Statement: I have received authorization from this patient to release the information below and to permit the staff of the Brock University Heart Institute to contact him/her directly for follow-up. *(Physician signature required below)*
Physician Signature: _____ **Date:** _____

Patient Information	
Name:	Date of Birth:
	Telephone:

Reason for Referral – Primary Prevention/Spousal Support ☐

Reason for Referral - Secondary Prevention ☐			
☐ Dyslipidemia	☐ Hypertension	☐ Obesity	☐ Diabetes

Reason for Referral – Tertiary Prevention ☐						
☐ **Post MI:** Date:			☐ Q Wave	☐ Non Q		
	Location:	☐ Anterior	☐ Inferior	☐ Lateral	☐ Posterior	☐ Rt. Vent
☐ **Cardiac Surgery:** Date:			☐ CABG	☐ Valve	☐ Other _____	
☐ **Coronary Angioplasty:** Date:			Vessel (s):		☐ Stent	

Brock University Heart Institute
130 Lockhart Drive
St. Catharines, ON
L2S 3A1

CONSENT TO EXERCISE TEST

Your Doctor has referred you to the Brock University Heart Institute with the knowledge that an *Exercise Stress Test* is included in the program. Most people have this examination without any complications.

However, ***risks are involved*** with this procedure. The risks of this test ***may include:***

1. ***Disorders of heart beats.***
2. ***Abnormal blood pressure response***
3. ***Feeling faint***
4. ***And, very rarely, a heart attack.***

The Medical Staff in charge of your examination are aware of the risks and possible complications and are trained and prepared to react to any emergency.

In their opinion, the information to be gained from the examination will be beneficial in your diagnosis and treatment.

Please direct any questions regarding your test to the supervising physician.

I HAVE READ AND UNDERSTOOD THIS AGREEMENT. I AM AWARE THAT BY SIGNING THIS AGREEMENT I AM AGREEING TO VOLUNTARILY PARTIPCATE IN AN EXERCISE STRESS TEST AND AM WAIVING CERTAIN LEGAL RIGHTS WHICH I, OR MY NEXT OF KIN, MAY HAVE AGAINST THE BROCK PARTIES OR MEDICAL STAFF PERFORMING AND SUPERVISING THIS TEST.

_____ _____

Participant Name – Please print Signature of Participant

_____ _____

Witness Name – Please print Signature of Witness

_____

Date

ASSUMPTION OF RISK AND RELEASE OF LIABILITY AGREEMENT

WARNING: By signing this agreement you indicate that you understand all the risks associated with participating in the Brock University Heart Institute cardiac rehabilitation program (the "Program") and that you hold Brock University harmless from any personal injury that you may suffer arising out of your participation in the Program. This agreement also gives Brock University the authority, if necessary, to secure medical assistance for which you agree to be financially responsible.

PLEASE NOTE: THERE WILL BE NO PHYSICIAN PRESENT DURING THE PROGRAM!

PLEASE READ THIS FORM CAREFULLY!

NAME OF PARTICIPANT: _____

ADDRESS OF PARTICIPANT: _____

Description of Risks

I am aware that by participating in the Brock University Heart Institute cardiac rehabilitation program (the "Program"), I will be exposed to the following inherent risks, including but not limited to:

- injuries from physical exertion and cardiovascular output;
- injuries from exerting and/or stretching various muscle groups;
- injuries from tripping and/or falling and impacting against the floor or equipment;
- abnormal blood pressure, lightheadedness or fainting, and irregular heart beat; and
- in rare cases, HEART ATTACK, CARDIAC ARREST AND EVEN DEATH.

For your information, the research literature on cardiac rehabilitation programs (based in the United States) suggests that the risk of a cardiac event during supervised exercise in patients with coronary artery disease is approximately the following:

- for a myocardial infarction (or heart attack) - 1 per 294,000 patient hours (meaning that one patient could exercise for 294,000 hours and have a heart attack, or 294,000 patients could exercise for an hour each and one of them may have a heart attack);
- for cardiac arrest (cessation of the heart beat) - 1 per 112,000 patient hours; and
- for a fatality - 1 per 784,000 patient hours.

Every effort will be made to minimize the risks during your participation in the Program. Staff will be trained in basic cardiopulmonary resuscitation (CPR) and will have access to a semi-automated external defibrillator.

Assumption of Risk

I hereby agree to assume all risks arising out of, associated with or relating to my participation in the Program. I acknowledge that there will be no physician in attendance during my participation in the Program and as such, I agree to be solely responsible for any injury, loss or damage that may occur or be sustained during my participation in the Program. Further, I agree that if Brock University, in its sole discretion and on my behalf, should secure any medical advice or services as it may deem necessary for my health and safety, that I shall be financially responsible for such medical advice or services.

Release of Liability

I hereby agree to WAIVE any and all claims that I have or may have against Brock University, its Board of Trustees, officers, employees, students, agents, volunteers, and independent contractors (the "Brock Parties").

I further agree to release the Brock Parties from any and all liability for any loss, damage, injury or expense that I may suffer, or that my next of kin may suffer as a result of my participation in the Program, due to any cause whatsoever INCLUDING NEGLIGENCE, BREACH OF CONTRACT OR BREACH OF ANY DUTY OF CARE owed on the part of the Brock Parties.

I further agree to INDEMNIFY AND HOLD HARMLESS the Brock Parties from any and all liability for any damage to the property of, or personal injury to, any third party, resulting from my participation in the Program.

Acknowledgement

I HAVE READ AND UNDERSTOOD THIS AGREEMENT. I AM AWARE THAT BY SIGNING THIS AGREEMENT I AM AGREEING TO VOLUNTARILY PARTIPCATE IN THE PROGRAM AND AM WAIVING CERTAIN LEGAL RIGHTS WHICH I, OR MY NEXT OF KIN, MAY HAVE AGAINST THE BROCK PARTIES.

_____ _____

Participant Name – Please print Signature of Participant

_____ _____

Witness Name – Please print Signature of Witness

_____

Date

Informed Consent

Project Title: **Brock University Heart Institute**

Principal Investigator:
Deborah O'Leary, Director of the Brock University Heart Institute /
Department of **Heart Institute**
Brock University
905.688.5550 x4339 doleary@brocku.ca
905.688.5550.x5585 Heartinstitute@brocku.ca

INTRODUCTION

As a part of the normal procedures for all members of the Brock University Heart Institute, you will be asked to periodically complete questionnaires and have your weight, height, blood pressure, and waist and hip measurements recorded. These questionnaires and measurements are used to provide the staff of the Heart Institute with your cardiovascular risk profile. We are seeking permission to use this information, which we are already collecting, for research purposes.

PURPOSE

The purpose of the research is to evaluate the effectiveness of the Brock University Heart Institute cardiac rehabilitation program and to capture an understanding of the characteristics of the individuals who take part in cardiac rehabilitation. You are also invited to allow your data to be available for future research endeavours surrounding cardiac rehabilitation.

POTENTIAL BENEFITS AND RISKS

Possible benefits of participation include receiving knowledge on the overall benefits and effectiveness of the Brock University Heart Institute; results may lead to improvement in areas of the program which are shown to be ineffective; results will support and expand on existing knowledge about cardiac rehabilitation and those involved in these programs; and published research will add to the sustainability of the program and establish the Brock University Heart Institute within the scientific community. As an individual, you could also receive reports identifying progress made during your membership at the Brock University Heart Institute. There are no known or anticipated risks associated with participation in this study.

CONFIDENTIALITY

Because our interest is in the average responses of the entire group of participants, you will not be identified individually in any way in written reports of this research.
In regards to the data, each individual will be provided with a unique identifier. This number will be matched to each individual in a separate database that will be kept in a secure room to which only the principal investigators will have access. The data itself will only contain the unique identifier. Only the principal investigators will have access to identifiable data collected.
Any secondary research endeavours will only be conducted on the de-identified data and the researcher(s) will not have access to the identifiable data. Researchers external to the Institute would need to seek permission from the Institute and have Research Ethics Board clearance for their particular project before accessing de-identified data for research purposes.

All data will be stored in a secure room requiring a master key or swipe access to enter. The paper form of the data will be preserved for ten years and will be stored in a secure location for the entire length of time. At the end of the 10 years all the data will be destroyed.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study. Further, you may decide to withdraw from this study at any time and may do so without any penalty or loss of benefits to which you are entitled. Your decision to either participate in this study or decline this invitation will have no bearing on the services which you receive at the Brock University Heart Institute.

PUBLICATION OF RESULTS

Results of this study may be published in professional journals and presented at conferences. Feedback about this study will be available at an ongoing basis through the principal investigators Dr. Deborah O'Leary, doleary@brocku.ca or heartinstitute@brocku.ca

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please contact the Principal Investigators using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at Brock University (REB # 07-313). If you have any comments or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 Ext. 3035, reb@brocku.ca.

Thank you for your assistance in this project. Please keep a copy of this form for your records.

CONSENT FORM

☐ **I agree to participate in the program evaluation portion of the study described above**.

I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

☐ **I agree to allow my data to be available for future research studies.**

I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

☐ **I would like to receive personalized reports regarding my individual progress at the Brock University Heart Institute**.

I understand that these reports would be created by analyzing my identifiable data and, as such, these reports would only be created by the principal investigators. I also understand that these reports would be kept in a secure location to which only the principal investigators have access. I understand that I may withdraw this consent at any time.

Name: _____

Signature: _____ Date: _____

Mastery and Self Esteem

Everyone has strengths and things about themselves they wish to improve. The following questions are about you and how you feel about yourself. Read each statement below and say whether you:

strongly agree / agree / neither agree nor disagree / disagree / or strongly disagree.

	strongly agree	**agree**	**neither agree nor disagree**	**disagree**	**strongly disagree**
Mastery					
1. You have little control over the things that happen to you.	☐	☐	☐	☐	☐
2. There is really no way you can solve some of the problems you have.	☐	☐	☐	☐	☐
3. There is little you can do to change many of the important things in your life.	☐	☐	☐	☐	☐
4. Sometimes you feel that you are being pushed around in life.	☐	☐	☐	☐	☐
5. What happens to you in the future mostly depends upon you.	☐	☐	☐	☐	☐
6. You can do just about anything you really set your mind to.	☐	☐	☐	☐	☐
7. You often feel helpless in dealing with the problems of life.					
	strongly agree	**agree**	**neither agree nor disagree**	**disagree**	**strongly disagree**
Self Esteem					
1. You feel that you have a number of good qualities.	☐	☐	☐	☐	☐

2. You feel that you're a person of worth at least equal to others.	□	□	□	□	□
3. You are able to do things as well as most other people.	□	□	□	□	□
4. You take a positive attitude toward yourself.	□	□	□	□	□
5. On the whole, you are satisfied with yourself.	□	□	□	□	□
6. All in all, your inclined to feel you're a failure	□	□	□	□	□