EXPLORING GENDER DIFFERENCES IN THE OUTCOME OF A SELF-CARE INTERVENTION TO REDUCE CARDIOVASCULAR DISEASE RISK

by

Alanna Larsen
B.A. (Psychology), Simon Fraser University, 2002
A.A., Capilano College, 1999

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

In the
Department of Gerontology

SIMON FRASER UNIVERSITY

Spring 2010

APPROVAL

Name:	**Alanna Larsen**
Degree:	**Master of Arts (Gerontology)**
Title of Thesis:	**Exploring gender differences in the outcome of a self-care intervention to reduce cardiovascular disease risk.**

Examining Committee:

Chair: **Dr. Atiya Mahmood**
Assistant Professor, Gerontology, SFU

Dr. Andrew Wister
Senior Supervisor
Professor and Chair, Gerontology, SFU

Dr. Barbara Mitchell
Supervisor
Associate Professor, Gerontology, SFU

Dr. Andrew Sixsmith
Supervisor
Professor, Gerontology, SFU

Dr. Lynne Young
External Examiner
Associate Professor, School of Nursing, UVic

Date Defended/Approved: **April 26, 2010**

SFU SIMON FRASER UNIVERSITY
LIBRARY

Declaration of Partial Copyright Licence

SIMON FRASER UNIVERSITY
THINKING OF THE WORLD

STATEMENT OF ETHICS APPROVAL

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

(a) Human research ethics approval from the Simon Fraser University Office of Research Ethics,

or

(b) Advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University;

or has conducted the research

(c) as a co-investigator, collaborator or research assistant in a research project approved in advance,

or

(d) as a member of a course approved in advance for minimal risk human research, by the Office of Research Ethics.

A copy of the approval letter has been filed at the Theses Office of the University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the relevant offices. Inquiries may be directed to those authorities.

Simon Fraser University Library
Simon Fraser University
Burnaby, BC, Canada

ABSTRACT

A multitude of gender differences exist in relation to primary prevention of cardiovascular disease. Thus, a gender-based approach to interventions for cardiovascular risk has been identified as the ideal. However, there is a research gap as to what strategies such interventions should include. This investigation explored gender differences in the effectiveness of a cardiovascular risk reduction intervention, the Cardiovascular Health Best Practices Project. The intervention was successful for females but not for males. Gender differences in self-care patterns for physical activity, weight loss, and stress, as well as health care utilization, did not contribute to these findings. Future research should identify which strategies were effective for females as well as explore strategies for risk reduction among males, and future intervention analyses should assess outcome by gender.

Keywords: cardiovascular disease; gender differences; self-care; physical activity; health care utilization; stress

I dedicate this work to my mother, Deanna Larsen, my biggest supporter. Mom, I admire you so incredibly much and the value of the love and encouragement you provide is beyond measure. You should earn an honorary degree for the commitment you have made to my education. Your support was there from the early years, for everything from encouraging me to take classes with the so-called "mean" teachers who turned out to be my favourites, to contesting Spelling grades. Through college and university, your help has been immeasurable. I hugely appreciate you for providing so many interesting ideas for paper topics, reading and editing every paper I have submitted, calming me down during many anxious phone calls after I wrote exams and just "knew" I had failed (never the real case, so always followed by, "this time it's for real, Mom!"), and so much more.

You're the best – thank you for everything!

ACKNOWLEDGEMENTS

Thank you to Dr. Andrew Wister, for providing support and encouragement throughout my graduate studies, sharing your scholarly insights into my topic area, and providing the opportunity to use your data to explore my research interests. Thank you also to Dr. Barbara Mitchell for expanding my consideration of socio-cultural issues, Dr. Andrew Sixsmith for helping to increase my perspectives for critical analysis, and Dr. Lynne Young for her insightful questions and comments.

Thank you to my parents, family members, and friends for their ongoing support. Thank you also to my wonderful friends who are the staff members, volunteers, and members of the South Granville Seniors Centre – you have provided me with encouragement, bestowed knowledge, and shared experiences with me that have enriched my understanding of life and aging. Additionally, I am so appreciative towards the fellow students who have accompanied me in this process – there is no doubt that the friendships gained and experiences we have shared are going to remain with me forever.

TABLE OF CONTENTS

FIGURES

TABLES

1: INTRODUCTION

Cardiovascular disease (CD) is a comprehensive term that encompasses heart disease and diseases of the vascular system (Health Canada, 2000; Health Canada, 2003; Health Canada, 2009). Heart disease affects the heart and the heart's blood vessels, while diseases of the vascular system are found in the body's blood vessels, including in the brain, legs, and lungs (Health Canada, 2000; Health Canada 2003). Implications of CD are severe at the micro-level for an individual who has this condition; at the meso-level for their community; and at the macro-level for the health care system and society as a whole. For example, CD can lead to extended illness and disability that often has a substantial impact on quality of life; CD is the most frequent health problem that leads to hospitalization in Canada; and CD is the primary cause of death in Canada (Health Canada, 2000; Health Canada, 2003; Health Canada, 2009).

Risk factors for CD mainly consist of lifestyle factors, but also include genetic factors and features of the health care system (Health Canada, 2000). Modifiable risk factors that are related to lifestyle choices include: smoking, physical inactivity, being overweight or obese, high intake of saturated fat, excessive alcohol use, insufficient intake of fruits and vegetables, hypertension, high blood glucose, stress, and exertion in the cold (Health Canada, 2000; Health Canada, 2003; Health Canada, 2009). Socio-demographic risk factors for CD include the following: age, as risk increases with age; sex, as men are more prone to CD at younger ages than women; and ethnicity, as certain ethnic groups are at higher risk for CD (Health Canada, 2000; Health Canada, 2003; Health Canada, 2009). Other risk factors for CD include genetic predisposition; cholesterol levels, which are influenced by diet and genetic characteristics; infections and inflammatory agents; atrial fibrillation; and various social and economic factors (Health Canada, 2000; Health Canada, 2003).

Self-care is a concept that describes an individual's own health behaviour, not only in response to poor health but as a preventative measure (Dean, 1992). This health behaviour ranges by individual and encompasses personal decisions and interactions with health care providers, which are influenced, "by the perceptions, decisions, and options available to that individual" (Dean, 1992, p. 34). Despite the high costs of CD and the ability to use self-care as a tool to mitigate many of the risk factors for this disease, CD is highly prevalent in Canada (Health Canada, 2000). CD is primarily a disease of old age, and in 2007, the number of people who reported having heart disease in Canada were: 1.3% of adults ages 35 and older (1.0%females; 1.6% males); 3.2% of those ages 45-54 (2.8% females; 3.5% males); 7.9% of those ages 55-64 (6.6% females, 9.3% males); 14.8% of those 65-74 (11.8% females; 18.1% males); 21.8% of those 75-84 (19.4% females; 25.1% males); and 27.5% of those ages 85 and older (22.8% females; 35.3% males) (Health Canada, 2009). An estimated 32.1% of deaths in Canada are due primarily to CD, and about 30% of deaths worldwide (Health Canada, 2009). Furthermore, mortality rates due to CD may rise with the growth in the proportion of elderly people in the population and as the incidence of both obesity and diabetes increase in Canada (Health Canada, 2009). These estimates suggest that improvements are required in the area of CD prevention.

Chronic disease prevention is divisible into three different areas: primary prevention aims to prevent health conditions through controlling risk factors; secondary prevention aims to provide early detection and treatment; and tertiary prevention includes interventions targeted at slowing or restricting the progression of health conditions (Health Canada, 2000). Various primary prevention measures are directed towards CD and mitigating risk of this condition, and these are often used in some combination with one another. Primary prevention measures for CD that involve self-care include: limiting or ceasing tobacco and alcohol use, increasing physical activity, losing weight, increasing intake of fruits and vegetables, and decreasing intake of foods high in sodium and saturated fat (Health Canada, 2000).

According to the Canadian Institute of Humanities Research (Spitzer, 2007), “implementing gender and sex-based analysis (GSBA) in health research is fundamental to achieving research excellence” (para. 5). A multitude of gender differences have been identified in relation to CD, including but not limited to risk factors, symptomology, progression, response by healthcare providers, outcome of treatment, and prognosis. Many researchers have indicated a need to identify the roles of sex and gender in CD in order to better prevent and respond to it (e.g. Abbey & Stewart, 2000). A review of literature in this area is provided in **Chapter 2**. This review demonstrates that there is evidence that gender differences exist in relation to CD, but further investigation is required. For example, there is a need to identify which factors mediate or moderate the relationship between sex and gender and CD prevention, in which ways they influence this relationship, and how interventions can best address gender-specific characteristics of primary prevention of CD.

The aims of this investigation are to determine whether there are sex and gender differences in the efficacy of a CD risk reduction intervention and, if so, to determine what factors account for these differences. The proposed investigation will include statistical analyses to determine whether specific self-care factors contribute to the relationship between gender and CD. These factors, discussed in **Chapter 3**, include self-care behaviours (**Section 3.1**), specifically physical activity and weight loss (**Section 3.1.1**), the use of stress management techniques (**Section 3.1.2**), as well as health care utilization (**Section 3.2**).

CD encompasses many different disorders of the cardiovascular system and various terminologies describe these conditions. Health Canada has identified six types of CD: ischemic heart disease, cerebrovascular disease (stroke), peripheral vascular disease, heart failure, rheumatic heart disease, and congenital heart disease. However, various other types of CD have been described, including coronary artery disease, congestive heart disease, arrhythmia, and other conditions. For the purposes of this investigation, studies that address any of the conditions that fit into the definition of CD are reviewed, but when individual studies are described, the specific cardiovascular condition addressed in each body of work are identified. It is important to retain the nature of the original cited work because gender differences relevant to CD may emerge only when examining specific conditions.

Additionally, defining and distinguishing between the terms "sex" and "gender" is relevant for the current investigation. In the publication *Gender and Sex-Based Analysis in Health Research: A Guide for CIHR Researchers and Reviewers*, it is noted that sex consists of 'biological characteristics such as anatomy (e.g., body size and shape) and physiology (e.g., hormonal activity or functioning of organs) that distinguish males and females' (Preves, 2003, p.8 cited in Spitzer, 2007, para. 8). "Sex differences may occur at the genetic/molecular, cellular, organ or organism level and result from complex interactions between genetic, hormonal and environmental factors that commence in the genetic and intrauterine environment and continue throughout the lifespan of an individual" (Spitzer, 2007, para. 8). In contrast:

> Gender refers to the array of socially constructed roles and relationships, personality traits, attitudes, behaviours, values, relative power and influence that society ascribes to two sexes based on a differential basis . . . [G]ender roles and characteristics do not exist in isolation, but are defined in relation to one another'
> (Greenberger 2001, p. 14 cited in Spitzer, 2007, para. 9)

Especially given the interaction between genetics and the environment, these terms are often used interchangeably and incorrectly and the term "gender" in particular is currently over-used (Spitzer, 2007).

In literature reviewed in **Chapter 2**, there is much evidence for sex differences when looking at the etiology, symptomology, response to medication, and prognosis for men and women at risk of or with CD. However, within literature summarized in **Chapter 3**, there is evidence of gender differences for the more complex self-care behaviours related to physical activity and weight loss, stress management, and health care utilization. Due to the limited ability to tease out the influence of one or another of the biological, psychological, and socio-cultural factors that influence health behaviours (Spitzer, 2007), it is beyond the scope of this investigation to identify the contribution of gender versus sex. Additionally, although sex differences are more important for patterns of CD itself, the behaviours that contribute to risk of this condition have multiple determinants and thus gender is deemed the more appropriate term for the purposes of this investigation.

2: THE RELATIONSHIP BETWEEN GENDER AND CARDIOVASCULAR DISEASE

This Chapter (**Chapter 2**) reviews literature on gender differences in relation to CD. This is important because differences of this type may contribute to gender differences in the outcome of interventions aimed at reducing cardiovascular risk. The review includes an investigation of the relationships between gender and the following aspects of CD: etiology and risk (**Section 2.1**); symptomology and detection (**Section 2.2**); as well as, treatment and prognosis (**Section 2.3**).

2.1 Gender and Cardiovascular Disease: Etiology and Risk

Literature highlights a differential risk of CD between males and females and gender differences for the etiology of this condition. In Canada (Health Canada, 2003), CD is more prevalent among men. Female sex hormones play a role in CD risk among women, such that with the onset of menopause and with increasing age thereafter the gender gap in the prevalence of CD decreases. Although long-standing in North America, this gap appears to be closing at all ages due to decreases in the prevalence of CD among men coinciding with increases in the prevalence among women; conversely, the gap appears to be increasing in developing countries. Furthermore, incidence of heart failure among individuals with CD is increasing (Rabi & Cox, 2007), and tends to occur among women at an older age and in the presence of more comorbid conditions.

Research also highlights that the severity of cardiovascular conditions is greater for men (Gold, Malmberg, McClearn, Pederson, & Berg, 2002; Daly et al., 2006).

As previously mentioned, stress is a risk factor for CD, but little research investigates whether stress mediates the risk of CD based on gender (Consedine, Magai & Chin, 2004). Consedine, Magai, and Chin (2004) found support that having the personality trait towards anger increases the risk of CD among males, while anxiety increases the risk among females. This suggests that hostility is a risk factor for men, while anxiety is a risk factor for women. Additionally, the results of this study indicate that when assessing the impact of psychological factors on the etiology of CD, it is important that researchers conduct separate analyses on men and women (Consedine et al., 2004).

2.2 Gender and Cardiovascular Disease: Symptomology and Detection

Gender differences are apparent in the symptoms of and likelihood of detecting risk of CD and the condition itself. In the past, the majority of information on cardiovascular health that was used to direct health care practices was based on research conducted on males (Chiaramonte & Friend, 2006). This led to a gender-biased approach to CD with an understanding of "typical" symptoms based on male symptomology (Chiaramonte & Friend, 2006), with chest pain (angina) as the primary symptom and arm pain as another common symptom (Halm & Penque, 1999). However, later research identified that women often have differing or "atypical" symptomology (Halm & Penque, 1999). Although angina remains the most common symptom (Halm & Penque, 1999), women with CD are more likely than men to experience dizziness, difficulty breathing during the night, and decreases in appetite (Halm & Penque, 1999). Furthermore, when experiencing myocardial infarction, men often experience heavy and stabbing chest pressure, while women experience pain in other areas of the body, including the back, neck, arm, shoulder, jaw, and stomach (Halm & Penque, 1999). The above findings suggest that diagnostic tools should be designed which are sensitive to the symptoms that females experience.

Additionally, there is international evidence that women receive less screening for CD. For example, there is support that women receive less lipid assessment for diagnosis and management of CD (Hahn et al., 2006) and less screening using exercise echocardiogram and coronary angiography (Daly et al., 2006), although there is evidence that women are equally likely to receive screening using stress echocardiogram and stress perfusion imaging (Daly et al., 2006). Contrary to these findings, Yawn, Wollen, Yawn, Jacobsen, and Rogers (2007) found that prior to a cardiovascular event, women were more likely to be assessed for risk factors of coronary heart disease and diagnosed with this condition. However, there are problems with this latter study, including participation by more males than females (150 vs. 50) and more current and past smoking behaviour among males (Yawn et al., 2007). Hence, in recognizing these methodological issues of this study in conjunction with findings of other studies, an overall conclusion can still be drawn that screening and diagnosis are less common for women than men.

As well, there is evidence that the sensitivity of some screening techniques is gender-specific. For example, for women compared to men with diagnoses of coronary disease, research findings support that results for exercise electrocardiography are more often negative or inconclusive, for perfusion scintigraphy are more often negative, and for inducible ischemia are more frequently positive (Daly et al., 2006). In addition, some tests (e.g. electrocardiography) may increase the possibility of false positive diagnoses among young females. Chiaramonte and Friend (2006) also discovered gender differences in diagnoses and referrals for CD. This evidence corroborates the need for gender-specific screening of CD.

Screening discrepancies are likely due to lower incidence of CD among younger females compared to males of the same age, and may be contributed to because physicians and other health care providers may better recognize the "typical" symptoms of CD (Chiaramonte & Friend, 2006). Chiaramonte and Friend (2006) investigated two models to explain the gender discrepancy in cardiovascular care. First, "The Heuristic or Stereotype Model" (p. 255), posed by Martin, Gordon, and Lounsbury (1998, cited in Chiaramonte & Friend, 2006) predicts that due to a stereotype that CD affects men: medical professionals do not react appropriately to symptoms of CD amongst women; women are not encouraged to seek health care; and women do not recognize the importance of seeking health care when experiencing chest pain and other symptoms (Chiaramonte & Friend, 2006). Secondly, Chiaramonte and Friend (2006) assessed their model, "The Contextual or Shift-in-Meaning Model (p. 256), which predicts that health care providers base treatment on an impression of a patient that is based on many factors (e.g. age, gender, symptoms), not singular characteristics (e.g. gender). Results support the Contextual Model, suggesting that psychological factors mediate the relationship between gender and provision of cardiovascular health care (Chiaramonte & Friend, 2006).

Chiaramonte and Friend (2006) hypothesized that male gender with “cardiac symptoms” (p. 156) is a strong predictor of assessment and diagnoses of men while female gender with stress and “psychological symptoms” (p. 156) influences whether assessment and diagnosis of women is made when cardiac symptoms are present. Participants rated chest pain, shortness of breath, and irregular heart rate as the most important symptoms of CD for both genders. However, when stress was present in combination with any of these symptoms or with overall symptoms, the symptoms were identified as being physical or organic in origin only among men. Thus, rather than a direct gender bias, there is evidence of a bias towards women who meet criteria for CD and experience stress; they are less likely to be diagnosed or referred (Chiaramonte & Friend, 2006), and their symptoms are less likely to be considered physical than psychogenic, even with symptoms highly linked to CD, such as chest pain.

The researchers (Chiaramonte & Friend, 2006) note that the response of health care providers may have been impacted by the use of typical CD symptoms (e.g. chest pain) to describe the patients’ conditions, rather than the atypical symptoms (e.g. back pain) women often exhibit. However, despite that classic symptoms are more common in men, they still indicate CD in women, and a lack of an appropriate response to their presence is dangerous. Moreover, the health risk to women is increasingly apparent when considering that many people who present with cardiovascular symptoms also report that they are experiencing stress (Chiaramonte & Friend, 2006). The role of anxiety on gender differences related to CD is an important one addressed throughout this review. The implications of these findings are important because they support that interventions directed at primary prevention of CD should ensure that women's legitimate cardiovascular symptoms are not overlooked because they exhibit signs of stress.

2.3 Gender and Cardiovascular Disease: Treatment and Prognosis

Gender differences in the treatment and prognosis of CD are abundant. As with screening provided for CD, there is evidence that treatment provided to women is not equal to that provided to men. Many research examples illustrate this finding. For example, Chou and co-researchers (2007) investigated the cardiovascular care received by both Medicare and private health insurance users and found that for both types of health plans, care was provided less often to women (Chou et al., 2007). Additionally, there is evidence that aspirin use is less common among women with secondary CD (Opotowsky, McWilliams, & Cannon, 2007), and that women are less likely to receive antiplatelet and statin (lipid-lowering) medications both individually and in combination for primary prevention of CD (Daly et al., 2006).

In contrast, some research on treatment of CD does not find gender differences. Hahn and co-researchers (2006) did not find a gender difference in the use of cholesterol lowering medications. Furthermore, contrary to the findings of Chou and co-researchers (2007), there was no gender difference found for the use of beta-blockers in the study by Daly and co-researchers (2006). Moreover, some research has supported that men receive less adequate treatment for CD. For example, in a study by Yawn and co-researchers (2007), described in the previous section, women with hypertension were more likely to be treated for it than men, though there are concerns about the ability to generalize the results of this study. Regardless of inconsistencies in these findings, overall there is more evidence that gender differences exist in the treatment of CD, with women receiving less treatment even when exhibiting the same indicators of poor cardiovascular health. This suggests that interventions designed at reducing cardiovascular risk need to take account of gender differences in response to treatment and ensure that women do not receive poorer quality of treatment.

3: GENDER DIFFERENCES IN SELF-CARE AND HEALTH CARE UTILIZATION AS METHODS OF CARDIOVASCULAR RISK REDUCTION

The role of self-care in contributing to gender differences in the primary prevention of CD is the focus for the current investigation. As described in **Chapter 1**, modifiable risk factors for CD exist, which are controllable through self-care. These include smoking, physical inactivity, being overweight or obese, high intake of saturated fat, excessive alcohol use, insufficient intake of fruits and vegetables, hypertension, high blood glucose, and exertion in the cold (Health Canada, 2000; Health Canada, 2003). This Chapter (**Chapter 3**) begins with a general exploration of the relationship between self-care and gender with CD, particularly for primary prevention of CD, and is followed by specific reviews of research on gender, CD, and each of the self-care behaviours examined in this investigation (**Section 3.1)**. Self-care behaviours of interest include physical activity and weight loss (**Section 3.1.1**), as well as the use of stress management techniques (**Section 3.1.2**). Next, the review focuses on the role of gender in health care utilization for cardiovascular health (**Section 3.2**). The current investigation will assess whether gender differences in the usage of these types of self-care contribute to a relationship between gender and the outcome of an intervention to mitigate cardiovascular risk. Therefore, the review also covers literature on gender differences in the outcome of studies targeted at cardiovascular risk reduction, particularly those addressing these self-care behaviours and health care utilization (**Section 3.3**).

3.1 Gender Differences in Cardiovascular Self-Care

As the current investigation is concerned with gender differences among individuals at risk of rather than those diagnosed with CD, it is pertinent to review literature of self-care practices in the general population. Liang, Shediac-Rizkallah, Celentano, and Rohde (1999) conducted an investigation directed at identifying age and gender differences for health behaviours among a community-dwelling population in the U.S. The results of this investigation suggest that patterns of self-care behaviours that mitigate cardiovascular risk differ by gender. For instance, females were more likely than males to: have medical and cholesterol checkups, except in the oldest age group; smoke fewer cigarettes per day, except in the youngest age group; drink fewer drinks per month; and eat more servings of fruits and vegetables per day. In all age groups, males exercised for more minutes per month than females.

Similarly, Dean (1989) conducted a Danish study of self-care patterns and found that significantly more women than men had never smoked, did not drink, or drank a small amount of alcohol, while more men participated in heavy alcohol use. Furthermore, there was a trend towards more men than women reporting that they did not regularly partake in health maintaining behaviours, and only women reported using self-care behaviours targeted at controlling stress. In light of the combination of these self-care patterns in conjunction with the awareness of how highly these behaviours are related to the risk of CD, it seems inherent that gender would play a role in the incidence of CD.

The lack of diagnostic and treatment care provided, particularly for women, suggests that seeking information about CD may be important in order for individuals to evaluate and address their own health care needs. Seeking information about CD could help individuals gain knowledge of how to reduce cardiovascular risk. There is a dearth of research on how information seeking mediates the relationship between gender and primary prevention of CD. However, investigations on the relationship between gender and seeking information for general health and other health conditions indicate that males are less likely to seek health information (e.g. Lorence & Park, 2007; Rahmqvist & Bara, 2007).

Liang and co-researchers (1999) extended this line of research on the linkages between age, gender, and self-care by investigating to what extent participation in health behaviours is related to participation in other health behaviours. They found that healthy behaviours were associated with females, while unhealthy behaviours (e.g. smoking, drinking, inadequate consumption of fruits and vegetables) were associated with males. These findings suggest that females engaging in some healthy self-care behaviours may be more likely to participate in other similarly healthy behaviours, thus decreasing their risk of CD, while males with unhealthy self-care behaviours may be more likely to participate in other unhealthy self-care behaviours, thereby increasing their risk of CD.

The specific correlations that were found are important, because as Liang and co-researchers (1999) suggest, knowledge of the relationships between specific self-care behaviours may make it easier to design successful interventions aimed at improving multiple self-care behaviours simultaneously. For both sexes, correlations were high between medical and cholesterol checkups. For females in the middle and older age group there was a correlation between exercise levels and the amount of fruits and vegetables they consumed, but this was not present for males. Lastly, the researchers (Liang et al.,1999) note that these findings highlight the potential benefit of offering age and gender appropriate interventions to improve health behaviours, and as mentioned, suggest that behaviours that are highly associated could be targeted concurrently (e.g. target both smoking and drinking behaviours in the youngest age group) (Liang et al., 1999).

3.1.1 Gender and Physical Activity or Weight Loss as Forms of Cardiovascular Risk Reduction

The relationship between CD and both physical activity and weight loss is well established and substantially mediated through the influence of physical activity on blood pressure, Body Mass Index (BMI), and cholesterol levels. Blood pressure is a measure of the amount of pressure that blood exerts on artery walls as it travels through the circulatory system, while BMI is a ratio of a person's weight to their height. Cholesterol levels indicate the amounts and types of fats (lipids) carried in the blood stream, and include low-density lipoproteins (LDLs) and high-density lipoproteins (HDLs). These measures have known parameters that indicate cardiovascular risk: high blood pressure (or hypertension); a high BMI; as well as low levels of HDLs and high levels of LDLs. Research in this area has indicated gender differences for some of these measures, including gendered responses to treatment and impact on quality of life. Weight distribution on the body also predicts cardiovascular risk and can be measured using the waist-to-hip-ratio, the ratio between the circumference of the waist to that of the hips. The tendency for weight distribution across the middle is typical in men, while women tend to carry weight around the buttocks, hips, and thighs. The former results in a higher waist-to-hip ratio and is associated with greater risk of CD.

There are many examples of research that support the relationship between physical activity and weight to physical/biological markers of CD. Research (Fang, Wylie-Rosett & Alderman, 2005) supports that the relationship between physical activity and CD is primarily mediated through hypertension. Also, there is evidence that other factors mediate the relationships between risk of CD and mortality due to CD with hypertensive status (Fang et al., 2005). For example, male gender increased risk of CD among pre-hypertensive and hypertensive participants but not among those with normal blood pressure (Fang et al., 2005). Furthermore, there is evidence that both cardio-respiratory fitness and weight each contribute to cardiovascular health, indicating that being overweight or obese increases risk of CD regardless of fitness levels (Diaz, Player, Mainous, Carek & Geesey, 2006). Additionally, both being overweight or obese and having low cardio-respiratory fitness are associated with physiological markers of cardiovascular risk and being overweight or obese is related to unhealthy ratios of cholesterol and lipids that increase the risk of CD (Diaz et al., 2006).

Individuals' patterns of physical activity tend to remain consistent for the long-term (Apullan et al., 2008, Panagiotakos et al., 2008). Physical activity contributes to risk of CD (Apullan et al., 2008) and is associated with participation in other cardiovascular self-care behaviours (Panagiotakos et al., 2008). There is evidence that most individuals are physically inactive over time and that participation in physical activity decreases over time, especially among women (Panagiotakos et al., 2008). Men are more likely to maintain physical activity while women are more likely to maintain physical inactivity (Panagiotakos et al., 2008). Research supports that participating in physical activity is related to less anxiety and depression, while maintaining physical activity is related to less smoking, eating more fruits and fish, and lower incidence of hypertension, unhealthy cholesterol levels, and CD (Panagiotakos et al., 2008).

Furthermore, there is evidence that physical activity predicts long-term mortality and cardiovascular mortality among men and women (Apullan et al., 2008). These results imply that risk of CD and related mortality are higher among physically inactive individuals, and that these risks increase over time, especially for women, as participation in physical activity decreases or physical inactivity remains consistent. Thus, it is important to increase participation in physical activity, particularly among women, which should help to avoid these negative health implications and also increase participation in other forms of self-care that lower the risk of CD.

Of importance to the current investigation is whether there are gender differences in the relationship between physical activity and weight loss or gain with CD. In 2007, of the general Canadian population ages 12 and older, 27.3% of females and 40.8% of males were overweight, 15.5% and 18% respectively were obese, and 52.5% and 46.5% were physically inactive during their leisure time (Health Canada, 2009). Gallant and Dorn (2001) discovered multiple relationships between race and gender with the health behaviours of weight control and physical activity, but gender alone was not linked to these self-care behaviours. Gallant and Dorn (2001) note that the relationships discovered in their investigation highlight the importance to not only study these health behaviours at the individual level, but also across gender and racial groups. Moreover, results support that gender plays a role in the relationship between both physical activity and weight control with CD but suggest that this relationship is complex and likely contributed to by race, social support, and other factors. Despite these findings, Conn, Hafdahl, Moore, Nielsen, and Brown (2009) found that neither age nor gender predicted the effectiveness of an intervention directed at increasing physical activity among adults with CD. It is possible that because relationships between gender, physical activity and CD are contributed to by so many other factors that when these factors are controlled for while conducting statistical analyses, the gender differences become very difficult to identify.

3.1.2 Gender, Stress, and the Use of Stress Management Techniques as a Form of Cardiovascular Risk Reduction

Stress increases the risk of CD by increasing heart rate, blood pressure, cortisol levels, and other physiological traits that escalate cardiovascular risk. There is evidence that with age, the relationship between stress and CD increases, with a more pronounced physical reaction to stress (e.g. Uchino et al., 2005). In 2007, of the Canadian population ages 12 and older, 23.6% of females and 22.3% of males reported feeling quite a bit to an extreme amount of stress (Health Canada, 2009). There is also a wealth of evidence for gender differences in physiological reactions to stressors, where males tend to have more physiological indicators of stress throughout the day (Hassan et al., 2008) and a greater physiological stress response (e.g. O'Donnell et al., 2008). Researchers (e.g. Hassan et al., 2008) suggest biological causation that makes males more prone to adverse cardiac events due to stress. Additionally, a variety of evidence supports that males and females evaluate stressful situations differently, which further contributes to gender differences in this area. For example, Kivimaki, Leino-Arjas, Luukkonen, Riihimaki, Vahtera, and Kirjonen (2002) found support that workplace stress increases the risk of CD, with the highest risk of death due to CD among males.

Decreasing stress is an effective means of mitigating cardiovascular risk. These above findings on gender differences in the relationship between stress and CD suggest that interventions directed at decreasing cardiovascular risk should target stress reduction, particularly among males. There is little research on the role of decreasing stress as a technique for primary prevention of CD.

However, overall, stress is considered a huge risk factor for CD (Health Canada, 2003; Health Canada, 2009) and control of stress is recommended.

Despite the linkage between stress and CD, research demonstrates that when stress is present with markers of CD there is a treatment bias where women are less likely to receive appropriate intervention. For example, Martin, Gordon, and Lounsbury (1998) found that when provided health scenarios of females who had recently experienced a stressful event and displayed symptoms typical for CD, participants, including physicians, were less likely to attribute symptoms to cardiac health than for females who had not experienced a stressful event. The same finding was not supported for males. This suggests that when stressful events occur for females, it is less likely their risk of CD will be recognized than for males in the same situation. Furthermore, Martin and co-researchers (1998) found evidence that cardiac symptoms were less likely to be attributed to cardiac health among females due to a stereotype that associates coronary heart disease (a form of CD) with males, as predicted by social cognitive theory. While, as discussed, Chiaramonte and Friend (2006) found that other factors (e.g. age, symptomology) in combination with gender are also predictors of whether cardiovascular risk will be recognized among females experiencing stress.

In regards to the effectiveness of interventions at lowering cardiovascular risk through decreasing stress, there is evidence that gender plays a role in the effectiveness of treatment styles. While there is a lack of research on this type for primary prevention of CD, Cossette, Frasure-Smith, and Lesperance (2002) investigated the impact of home-based nursing approaches used to lower psychological stress among patients who had experienced myocardial infarction. Nurses (Cossette et al., 2002) used the following approaches: (1) Cognitive, to decrease negative thoughts and beliefs, while increasing information-processing and problem-solving; (2) Educational, to increase knowledge and feelings of self-control; (3) Managerial, to increase awareness of and ease of use of health care services, including community resources and visits to health care professionals; and (4) Emotionally Supportive, to promote the belief in being cared about and valued.

The nursing approaches used differed by gender even when the patient concerns were the same (Cossette et al., 2002). Most approaches were related to a decrease or no change in stress among men, while women were more likely to experience an increase or no change in stress. As an example of this trend, cognitive approaches lowered stress due to fear among men, but had no impact on fear among women. In contrast, when cognitive approaches were used in response to stress due to financial concerns, men experienced an increase in stress while women experienced no change. These findings suggest that the source of stress is important when designing interventions and overall imply that men can benefit from interventions targeted at lowering stress. However, women appear to be hindered by these approaches and may be better aided by intervention with risk factors other than stress.

3.2 Gender and Health Care Utilization as a Form of Cardiovascular Risk Reduction

Interaction with health care providers is a component of self-care (Dean, 1992). This interaction is measured in many investigations in the form of health care utilization. Physicians are able to play crucial roles in the primary prevention of CD. These roles include providing patients with information about risk factors and symptoms for CD as well as about self-care to ameliorate risk; conducting assessments to determine risk; and making treatment recommendations in response to cardiovascular risk. Research suggests that while physicians play a notable role in secondary prevention of CD, there is room for improvement for primary prevention (e.g. van Wyk, Boom, van Wijk, Sturkenboom, Moormen, & Lei, 2005). There is little research on the impact of physician visits on cardiovascular risk. In one study (Wang et al., 1999), no differences were found at follow-up among participants who were identified at CHD risk and then visited a physician compared to those who did not visit a physician. Furthermore, there is evidence that recommendations of lifestyle changes made by physicians have little effect on the general population (Fleming & Godwin, 2008), and thus may be better suited to a population at risk. To reconcile these results, it may be that the quality of care is more important to primary prevention of CD than the quantity but there is a need for more research in this area.

Investigating the relationships between gender and CD in regards to the potential mediation of health care utilization is an area where there is little available research. However, there is research available on gender and health care utilization in general. While some studies have failed to find gender differences in health care utilization (e.g. Adamson, Ben-Schlomo, Chaturvedi & Donovan, 2003), overall there is support that females use more health care services than males (e.g. Parslow, Jorm, Christensen, Jacomb & Rogers, 2004), including taking part in more frequent medical and cholesterol checkups (Liang et al., 1999). Gender differences in health care utilization appear to be due to specific psychological, physical, medication-related, and socio-demographic factors. However, one should take care in extrapolating these results, since most of the research in this area is not specific to individuals who have either been determined at risk of or diagnosed with CD.

3.3 Gender Differences in the Outcome of Interventions to Reduce Cardiovascular Risk

Little research exists on gender differences in the effectiveness of interventions at reducing the risk of CD but results suggest that positive results in such interventions are more likely among women. For example, among community-dwelling men and women who had experienced heart failure, Chung and colleagues (2006) found that despite no gender differences in barriers to following a sodium-restricted diet, when compared to men, women were more adherent to the diet. Women were also more aware of the signs of excess sodium and had a better understanding of how to follow the diet (Chung et al., 2006).

Additionally, Winkleby, Feldman, and Murray (1997) conducted analysis of three interventions provided to adults between the ages of 25 and 64 to reduce cardiovascular risk. The results were in support of greater success of the interventions among women. In one intervention, smoking steadily declined among women, in another systolic and diastolic blood pressure improved over time among women, serum cholesterol decreased among women in one intervention but in another among men, and no gender differences were found in risk of mortality due to coronary heart disease. It is important to highlight that in regards to the overall effect of each of the interventions, only four tests were statistically significant and these all support greater improvement in cardiovascular risk among women. There was statistical significance in improvement among women only for smoking in the treatment group in one trial, for cholesterol in the control group of the same trial, as well as for both systolic and diastolic blood pressure in the treatment group of another trial.

Some research has found contrary evidence that supports better adoption of self-care behaviours and health impacts for cardiovascular risk reduction trials among men. Findings from a meta-analysis of cardiovascular risk reduction interventions found that the effect sizes of interventions were smaller for smoking and cholesterol among women than for men (Sellers, Crawford, Bullock, & McKinlay, 1997). However, this investigation also highlighted that the outcomes of such interventions mainly differ due to evaluation methods much more than intervention and population characteristics, such as gender. These results suggest that research is needed to extend our understanding of gender differences in cardiovascular risk reduction.

4: SUMMARY OF THE LITERATURE

Risk of CD increases with age and men are more susceptible to this condition than women at younger ages. Despite that cardiovascular risk is greatly impacted by self-care habits, there is a high prevalence of CD in the Canadian population, suggesting that there is a need to increase the use of self-care behaviours targeted to reduce cardiovascular risk. While women are less likely to develop CD, women who are at risk receive fewer diagnoses and treatments and are more likely to die because of the condition when compared to men with the same level of risk. Thus, not only are improvements in self-care to prevent CD necessary overall, approaches should be designed that take account of gender differences.

Findings that emerged from a review of the literature provide evidence for how interventions to reduce cardiovascular risk may best address gender differences. Males tend to exercise more than females, thus increasing physical activity among females may be key to decreasing risk factors, CD incidence, and cardiovascular mortality among females. Conversely, the evidence on gender differences in regards to stress highlights that males are more physiologically reactive to stress in ways that increase cardiovascular risk but that females with a combination of cardiovascular risk and stress are less likely than males in the same position to receive appropriate cardiovascular treatment. This implies that interventions that lower stress will be more beneficial for males, while interventions that close the care gap so that women who are experiencing stress and cardiovascular risk receive appropriate treatment, rather than have their cardiovascular symptoms overlooked due to their stress symptoms, will be more successful in lowering cardiovascular risk among women. Lastly, while females tend to use more health care services than males, there is no evidence to support that more frequent visits to health care providers lowers cardiovascular risk. It therefore remains unknown whether an intervention to reduce cardiovascular risk that increases the frequency of contact with health care providers will be more effective for males or females. Overall, women tend to be more responsive than males to interventions that are designed to reduce cardiovascular risk although there is a need for more consistency in the methods used to evaluate such interventions in order to provide rigorous comparisons.

5: THEORETICAL FRAMEWORK

In this chapter, a theoretical framework is presented, outlining the ways in which gender roles are developed and maintained and thereby influence self-care through the interaction between the person, environment, and behaviour (**Section 3.1**). A multitude of theories exist that focus on how gender roles develop and persist throughout the life-course. Most of these theories fall into the areas of psychology and feminism but provide little insight into how gender affects behaviour change. Concurrently, a number of theories of behaviour change take account of gender as a moderating factor in such change but fail to outline the particular ways in which gender influences contribute to this change. Bussey and Bandura's (1999) *Social Cognitive Theory of Gender Development and Differentiation* combines one of the most established theories of behaviour change, Bandura's *Social Cognitive Theory*, with theory and literature on gender to create a model of the development of gender roles and the influence of motivations and self-regulation on gender-associated behaviour throughout life.

Social Cognitive Theory poses that reciprocal relationships between personal factors, behaviour, and the environment influence the development and maintenance of behaviour (Bandura, 1989). Personal factors include biological traits, affect, and cognition, which include thoughts, expectations, beliefs, self-perceptions, and goals. These factors contribute to behaviour and likewise behaviour affects these factors. This theory also poses that the interaction between personal factors and behaviour are such that people are not only products of their environments but create their environments based on the choices they make (Bandura, 1989).

Additionally, *Social Cognitive Theory* posits that in order to change behaviour a person will not only have to believe that this change is likely to bring positive benefits that outweigh any negative aspects of the change, but they must also have self-efficacy, or the belief that they have the skills and abilities required to change the behaviour (Bandura, 1989). Self-efficacy is influenced by the triadic relationship between behaviour, personal factors, and environment, with specific factors varying in importance throughout the life course (e.g. from family to peers) (Bandura, 1989). In the *Social Cognitive Theory of Gender Development and Differentiation*:

> The personal contribution includes gender-linked conceptions, behavio[u]ral and judgmental standards, and self-regulatory influences; behavio[u]r refers to activity patterns that tend to be linked to gender; and the environmental factor refers to the broad network of social influences that are encountered in everyday life.
> (Bussey & Bandura, 1999, p. 685).

This theory coupled with previous research indicates the role of barriers in preventing self-care as well as the importance of knowledge as a facilitator to self-care. Thus, it is of interest to examine the role of gender when addressing barriers to self-care as a primary prevention method for CD. Research conducted by Gabhainn and co-researchers (1999) highlights gender differences in the barriers and motivation to perform self-care. Despite good levels of knowledge about CD for both genders, men were less motivated than women to change their self-care behaviours. Older men expressed the most intention to change and exhibited knowledge about the benefits of change in lowering cardiovascular risk but belied the least confidence in changing their behaviour, tended to feel behaviour was too engrained to change at their age, and did not feel “capable or able” to make such change. The researchers (Gabhainn et al., 1999) suggest that more knowledge about the benefits of change might be useful for this group, but it might also be valuable to design interventions that increase their health confidence. Additionally, younger men did not initiate behaviour change to decrease risk of CD because they believed they would make this change at a later age. Among men in this age group, it would likely be beneficial to increase knowledge of the benefits of developing cardiovascular self-care habits at an early age.

Overall, these results imply that interventions to address cardiovascular self-care may be more successful among women, because women will be more motivated to change and have more confidence in their ability to do so. However, Gabhainn and co-researchers (1999) also identified that women are more likely to perceive barriers to change. This suggests that women might benefit most by both the removal of barriers to change and by interventions that lower their perceptions of barriers (Gabhainn et al, 1999). This research provides a clear example of the complexity of the relationship between gender and cardiovascular self-care, as well as the importance of age to this relationship. Again, the results of this research corroborate the need for a gendered approach to primary prevention of CD.

According to the *Social Cognitive Theory of Gender Development and Differentiation*, the social environment plays a large role in the development and maintenance of gender roles (Bussey & Bandura, 1999). Gender roles develop through modeling of gendered behaviours, are socially reinforced through positive reactions to acting in accordance with the prescribed roles and negative reactions to acting contrarily, and consequently males and females develop expectations to the outcomes of gendered behaviours that leads to self-regulation of their own behaviour based on gender roles. Gender roles have an influence on self-efficacy by causing people of one gender to feel as if they have less skills or ability to behave in ways that are associated with the other gender. Furthermore, the lack of self-efficacy to perform a gendered behaviour causes further perpetuation of gender roles when individuals instead perform behaviours more consistent with their gender (Bussey & Bandura, 1999). This theory predicts that we can expect gender differences to exist for any behaviours for which there are prescribed gender roles.

CD has traditionally been associated with males, despite the fact that almost as many women die because of it, only at a later age. The belief that CD is not a concern for women has pervaded the medical system and society. Currently the lack of awareness of the risks of this condition for females persists. Mosca and co-researchers (2010) completed a research investigation that compared results to surveys completed in 1997 and every three years afterwards, to results of their own survey performed in 2009. The research goal was to measure changes in awareness of risk of heart disease among women to determine whether public programs are successfully increasing awareness of this condition (Mosca et al., 2010). Between 1997 and 2009, reports by participants of their awareness of heart disease as the number one condition leading to death among women increased from 30% to 54% (Mosca et al., 2010). However, this level of awareness has remained the same since 2006, which suggests that awareness is no longer increasing (Mosca et al., 2010). Over the course of the study, there was an increase from 30% to 48% of the amount of participants discussing heart disease with their physicians (Mosca et al., 2010). While knowledge of the warning signs of heart attack did not improve throughout the study, with less than one-third of participants recognizing the atypical signs more common among women, knowledge of the effectiveness of self-care to prevent heart disease was high (Mosca et al., 2010). These findings suggest that despite increasing awareness of the threat of heart disease and increased discussions with physicians about this condition, almost half of women are still unaware of the threat of heart disease faced by women.

According to the *Social Cognitive Theory of Gender Development and Differentiation*, this association of CD with maleness should have repercussions on the behaviour of both genders. For example, one would anticipate more efforts towards CD risk reduction among males and more stringent screening and treatment offered by their health care providers. Given this belief, males would be more aware of their risk of CD throughout their lifetimes, and have knowledge that they are more at risk when approaching middle age, and thus one would expect their self-care habits directed towards mitigating this risk to be quite steady with possibly more self-care as they enter middle age. In line with this prediction, there is evidence that males participate in more physical activity than women, although they also use more alcohol and tobacco. In accordance with this theory, it is expected that women will make less efforts to reduce cardiovascular risk and will receive less screening and treatment from health care providers due to the belief that CD is not as great of a risk among females. However, this does not imply that females will participate in these self-care behaviours less than men, as physical activity, a healthy diet, limited alcohol and tobacco intake and other behaviours that reduce cardiovascular risk are also associated with other health conditions and with physical appearance. Self-care to influence these other conditions and physical appearance may be more strongly ascribed to gender roles that favour participation among women.

Additionally, based on this theory it can be predicted that interventions targeted at primary prevention may be more successful among women. Firstly, because men's behaviour may not change as a result of interventions targeted at primary prevention of CD. Interventions designed to lower cardiovascular risk do so through many means, including by identifying specific risk among participants, providing self-care recommendations to mitigate this risk, and informing health care providers of risk. *Social Cognitive Theory of Gender Development and Differentiation* suggests that male behaviour may not change because interventions will not challenge existing understanding of the relations between maleness and the risk of CD, among males and their physicians. In contrast, these interventions would provide information to women and their physicians that contradicts their gendered expectations. Also, reinforcements for cardiovascular risk reduction for females may increase through the interventions themselves and through physicians who are informed of cardiovascular risk as a result of the interventions. Overall, this would contribute to a change in their understanding of the gendered nature of CD that would be expected to lead to behaviour change in the form of increased participation in those behaviours that reduce cardiovascular risk.

6: RESEARCH QUESTIONS

The primary purpose of this investigation is to determine the role of gender in the effectiveness of an intervention to lower cardiovascular risk among middle-aged adults with primary cardiovascular disease. The intervention of interest is described in detail below. Findings support that the intervention was effective at lowering cardiovascular risk (Wister et al., 2007). *Social Cognitive Theory of Gender Development and Differentiation* supports that the intervention will be more effective for women. Research evidence suggests that there will be gender differences in the outcome of the intervention and tends somewhat more to supporting the effectiveness of such interventions among women. However, there are inconsistencies for the influence of gender overall and the influence of gender also varies based on the specific types of self-care targeted by an intervention. Additionally, there is a lack of research in this area. Therefore, this investigation is exploratory and will address research questions rather than test hypotheses. These research questions are as follows:

1) Are there gender differences in the efficacy of the Cardiovascular Health Best Practices Project (see **Chapter 7** for description) at lowering cardiovascular risk?
2) If gender differences are found, are they contributed to by: (a) change in physical activity or weight; (b) change in stress; and/or (c) change in health care utilization?

3) Given that affirmative support is found for the first and/or second research question, what are the implications for improving the design of cardiovascular risk reduction interventions?

7: METHODOLOGY

7.1 Sample

Data for this study were collected through the Cardiovascular Health Best Practices Project (CHBPP), an intervention study aimed at lowering cardiovascular risk among middle-aged adults, conducted and described by Wister and co-researchers (2007). Participants, who ranged in age from 45 to 65, were assessed at two periods, with baseline measures collected in 2002/3 and followed-up a year later. Data for the current investigation is limited to the participants who were labelled as having primary cardiovascular disease as a result of scoring a 10% of risk or higher on the Framingham assessment, which is described below, or had pre-diabetes which is indicated by a fasting blood glucose of greater than 6.1-6.9mmol/L. In total, the responses of 315 participants who met these criteria are included in the baseline data, with 277 participants at follow-up. Thus, data are not available for 38 participants, who were omitted from the analysis. For the randomized controlled trial, assignment of participants to the control and intervention groups resulted in 136 and 141 participants respectively per group.

For purposes of generalizability, it is important to compare this sample to the population that participants reside in, the Fraser Valley, as well as to the provincial, British Columbian, population. Data for comparison come from the 2006 census, and represent the 15 and older age group (BC Stats, 2007).

Altogether, 20% of the Fraser Valley's population immigrated to Canada compared to 27% of British Columbians (BC Stats, 2009), and 27% of study participants. Residents of British Columbia and the Fraser Valley region primarily identify as English, Canadian, Irish, and French (BC Stats, 2009), while study participants identify as British, German, French Canadian, and Chinese, although at smaller percentages. The average household income in 2005 was $61,934 in the Fraser Valley, below the average British Columbian income of $65,787 (BC Stats, 2007), while the responses from participants in the study mostly (21%) fell within the $40,000 to $59,999 category with the next most (19%) in the $60,000 to $79,999 category. In regards to education, 59% of Fraser Valley residents and 63% of British Columbian residents have completed high school as their highest level of education (BC Stats, 2009), compared to 18% of the sample. While the percentages of those who had completed a Bachelor's Degree as their highest level of education are 2.4% for Fraser Valley residents and 5.7% for British Columbians (BC Stats, 2009), compared to 19% from the study. These statistics suggest: the sample is equal to British Columbia in terms of immigrant inclusion, with a similar ethnic makeup despite some differences in ethnic background and proportions; the income range of participants is similar to that found in the Fraser Valley but lower than that in British Columbia; and education is higher among the sample than in either the Fraser Valley region or provincially.

7.2 Recruitment

Participants were recruited between April 15, 2002 and November 10, 2004 from among community dwelling residents living in the Fraser Health Region of

British Columbia, Canada (Wister et al., 2007). Recruitment was carried out mainly through community newspaper advertisements, but also through letters that were sent to all physician offices in this region, radio interviews, and advertisements sent via email (Wister et al., 2007).

7.3 Intervention

Participants who took part in the CHBBP were initially measured for a number of parameters related to cardiovascular risk using the Framingham risk assessment. After completing this assessment, participants were separated into two groups, those with primary CD and those with secondary CD. Next, random assignment was made to the intervention and control groups. The control group received typical physician care for the duration of the study. All of the information provided in regards to intervention characteristics is obtained from the work of Wister and co-researchers (2007).

The intervention was designed to be low-intensity, requiring low frequency and duration of professional support and few resources to implement. In the intervention group, participants were assigned report card grades (A, B, C, D, F) and specific goals to improve these grades within the next year, respectively for (1) body mass index; (2) waist circumference; (3) health confidence; (4) nutrition status; (5) physical activity; (6) stress; and (7) smoking. For example, someone who scored a 7/10 on the stress component (a higher score indicates a higher stress level), would receive a “C” grade and be provided with the goal to lower their stress to 3.5/10 to receive a higher “B” grade by next year. See **Appendix** for an example of the report card. The report cards were sent to participants and their physicians at the beginning of the study and after follow-up (Wister et al., 2007). Both the grading system and goals were based on a large body of cardiovascular research.

Upon receipt of the report cards and every six months thereafter, the intervention group received individual counselling from counsellors via telephone. The counsellors, kinesiologists, were certified as exercise clinicians through the *American College of Sports Medicine* and were trained to provide motivational coaching for the purposes of the intervention. There was both a male and female counsellor. Counselling sessions lasted up to thirty minutes, were targeted at addressing individuals' specific cardiovascular risks, and were prioritized based on the respective levels of importance of these risks as determined by past research and participant responses. The most emphasis was placed on changing smoking behaviour and smokers attempting to quit received more frequent counselling sessions. Emphasis on smoking was followed in order of importance by physical activity, diet, weight control, and stress. Following a counselling session, participants were sent a summary of what was discussed along with relevant printed educational materials. When counsellors followed up with participants, they assessed their progress as determined by their current and past letter grades, and provided participants with new goals (Wister et al., 2007).

7.4 Instruments & Measures

The data of interest for this investigation are described below. Data were collected at baseline and during a one-year follow-up of participants. As discussed above, the data for the 38 participants who did not complete follow-up were removed prior to analyses. Any other missing cases were recoded to the mean for interval variables and to the mode for categorical or nominal variables.

7.4.1 Dependent Variable

The primary outcome measure for the CHPBB was the change in score using the Framingham assessment (Wister et al., 2007). For the current investigation, whether the impact of the intervention on cardiovascular risk differed by gender was also assessed using the Framingham assessment. This tool is based on evidence from a large longitudinal study and provides a global measure of cardiovascular risk based on age, smoking behaviour, blood pressure, cholesterol, and whether diabetes is present (Sheridan, Pignone, & Mulrow, 2003). There is evidence that the Framingham score is one of the best measures of cardiovascular risk for people who do not have CD (Sheridan et al., 2003), and this method has been determined valid and reliable at predicting coronary heart disease (e.g. D'Agostino, Grundy, Sullivan, & Wilson, 2001). However, it has been found to overestimate future risk of CD (e.g. van der Heijden, Ortegon, Niessen, Nijpels, & Dekker, 2009), and thus is best considered a global risk score, useful in intervention studies to determine whether risk has decreased but not an ideal predictor of individual outcome.

The specific method of scoring the Framingham assessment was used from a modification of the Grundy and Wilson methods (Wister et al, 2007). This tool provides a measure of the percentage of risk for developing CD within the next 10 years. To be classified as having primary CD and included in this intervention study, participants' risk of developing CD over the next ten years was moderate to high at 10% or greater and/or they had a fasting blood glucose level indicative of pre-diabetes (6.1-6.9mmol/L). The presence of pre-diabetes has been established as a primary risk factor for CD (Sheridan et al, 2003). The mean score at baseline was 10.66, while the mean for males was 12.23 compared to 9.56 for females. At follow-up, the mean score was 8.8, with a mean of 9.46 for males and of 8.34 for females. Higher scores indicate a higher level of cardiovascular risk. The change in Framingham score is the outcome measure to determine success of the cardiovascular risk reduction intervention. It was calculated by subtracting the follow-up score from the baseline score (Time 1-Time 2). For the change in Framingham score, the mean was 1.87 (2.77 for males; 1.25 for females). Owing to the direction of the subtraction, a higher change score indicates greater decreases in global cardiovascular risk.

7.4.2 Group

There were 141 (51%) participants in the control group [54 (47%) males; 87 (53%) females] and 136 (49%) in the intervention group [60 (47%) males; 76 (47%) females].

7.4.3 Key Independent Variable

For gender, there were 114 (47%) males and 163 (53%) females.

Table 1: Coding for Group & Gender

Independent Variables	Original Coding, Frequencies, %	Recoding, Frequencies, %
Group (Time 1)	Control: 141 (50.9%) Treatment: 136 (49.1%)	Control: 141 (50.9%)* Treatment: 136 (49.1%)
Gender (Time 1)	Males: 114 (41.2%) Females: 163 (58.8%)	Males: 114 (41.2%) Females: 163 (58.8%)

*Reference Category

7.4.4 Variables of Interest

The first key independent variable that was statistically analyzed for whether it has an impact on the relationship between gender and the outcome of the intervention is a computed measure of the change in the frequency of seeing or talking to a family physician within the last three months. The next independent variables of interest are those related to physical activity and weight. Change variables were created to determine the influence of change in frequency and duration of moderate intensity activity and change in frequency and duration of intense activity as well as the change in waist size measured in centimetres. The next independent variable of interest measures stress and is the change in scores for stress as calculated for the report cards. The stress report card score was calculated by the original researchers (Wister et al, 2007) based on the self-reported level of stress from zero to ten, with ten being the highest level possible and zero being an absence of stress.

For the type of statistical analyses used (see below), variables must have linear relationships with the dependent variable. Crosstabular analysis of the independent variables with the change in Framingham score determined that the physical activity variables for change in days of moderate and intense activity, and change in waist, as well as the variable for change in stress, do not have linear relationships with the change in Framingham score. Also, these variables have a large percentage of zeros because many individuals do not change behaviour over time, and non-change may be either good or bad depending on whether individuals remain at a high level, low level, or between them. For instance, one person may remain at a low stress level over time and receive a change score of zero, whereas another might remain at a high stress level with the identical outcome. Thus, these variables were recoded to dichotomous dummy variables, with no-change as the reference category, producing positive and negative change dichotomies. Descriptive statistics for the independent variables, including the frequencies of variables that are categorical and the mean and range of variables that are intervals, as well as the recoding are displayed in **Table 2**.

All of the independent variables for which change scores were calculated, were created by subtracting baseline scores from follow-up scores (Time 2-Time1). For example, for days of moderate activity, an original frequency of 3 days per week that at follow-up had changed to 6 days a week would be calculated as 6-3, equalling 3, which would be coded to an increase of 3 days per week. As another example, for stress, if a participant had an original score of 4 and then at follow-up received a score of 6, this would be calculated as 6-4, equalling 2, which would be coded to an increase of 2 in stress. As a final example, for change in waist, if an original waist size was 83cm and at follow-up had become 79cm, or 79-83, equalling -4, this would be coded to a decrease of

4cm in waist size. For dichotomous variables, these values are included in categories of no change versus increases and decreases.

Table 2: Coding for Independent Variables of Interest

Independent Variable	Original Coding, Frequency, %	Recoding, Frequency, %
Change Physician Visits (Time 2-Time1)	*Interval* Range: -8 to 12 Visits; Mean: -0.7	*Interval* Range: -8 to 12 Visits; Mean: -0.7
Change in Days Moderate Activity (Time2-Time1)	*Interval* Range: -7 to 7 Days; Mean: .27	*Dichotomies/Dummy Variables* **Change Days Moderate Activity 1** No change or decrease: 164 (59.2%)* Increase: 113 (40.8%) **Change Days Moderate Activity 2** No change or increase: 189 (68.2%) Decrease: 88 (31.8%)
Change in Days Intense Activity (Time 2-Time1)	*Interval* Range: -4 to 6 Days; Mean: 0	*Dichotomies/Dummy Variables* **Change Days Intense Activity 1** No change or decrease: 234 (84.5%) Increase: 43 (15.4%) **Change Days Intense Activity 2** No change or increase: 231 (83.4%) Decrease: 46 (16.6%)
Change in Duration Moderate Activity (Time 2-Time1)	*Nominal* Time 1 Mode: More than 1 hr/day Time 2 Mode: More than 1 hr/day	*Dichotomies/Dummy Variables* **Change Duration Moderate Activity 1** No change or decrease: 175 (63.2%) Increase: 102 (36.8%) **Change Duration Moderate Activity 2** No change or increase: 183 (66.1%) Decrease: 94 (33.9%)
Change in Duration Intense Activity (Time 2-Time1)	*Nominal* Time 1 Mode: None Time 2 Mode: None	*Dichotomies/Dummy Variables* **Change Duration Intense Activity 1** No change or decrease: 234 (84.5%) Increase: 43 (15.5%) **Change Duration Intense Activity 2** No change or increase: 235 (84.8%) Decrease: 42 (15.2%)
Change in Waist (Time 2-Time 1)	*Interval* Range: -38.18 to 27.94; Mean: -2.36 Missing: 38	*Dichotomies/Dummy Variables* **Change in Waist 1** No change or other value: 212 (76.5%) Decrease greater than 7cm: 65 (23.5%) **Change in Waist 2** No change or other value: 180 (65%) Decrease up to 7cm: 97 (35%) **Change in Waist 3** No change or other value: 213 (76.9%) Increase up to 7cm: 64 (23.1%) **Change in Waist 4** No change or other value: 255 (92.1%) Increase greater than 7cm: 22 (7.9%)

Independent Variable	Original Coding, Frequency, %	Recoding, Frequency, %
Change in Stress (Time 2-Time 1)	*Interval* Range -9 to 9; Mean: -.26	*Dichotomies/Dummy Variables* **Change in Stress 1** No change or other value: 234 (84.5%) Decrease greater than 2: 43 (15.5%) **Change in Stress 2** No change or other value: 190 (68.6%) Decrease up to 2: 87 (31.4%) **Change in Stress 3** No change or other value: 220 (79.4%) Increase up to 2: 57 (20.6%) **Change in Stress 4** No change or other value: 240 (86.6%) Increase greater than 2: 37 (13.4%)

* Reference Category

7.4.5 Socio-Demographic Variables

Age, education level, household income, and marital status were controlled for during the analyses. The importance of taking account of these variables is key in studies of gender because these characteristics differ by gender. As described above, there are gender differences in the age of onset of health conditions. According to British Columbia's census in 2006, males ages 15 and over compared to females were more likely to be single or never-married (29% females; 36% males) and less likely to be married (49% females; 35% males) (Statistics Canada, 2010). Additionally, for the population aged 35 to 64 in 2006: 29% of females compared to 24% males had completed high school or equivalent; 9% of females compared to 17% of males had completed an apprenticeship, diploma, or certificate in trades; and 22% of females compared to 24% of males had completed an university certificate, diploma, or degree (Statistics Canada, 2010). In regards to income for those ages 15 and over, the median income in 2005 was $18,930 for females and $28,251 for males (Statistics Canada, 2010).

Table 3: Coding for Socio-Demographic Variables

Independent Variable	Original Coding, Frequency, %	Recoding, Frequency, %
Age (Time 1)	*Interval* Range: 45 to 65 Years; Mean: 56	*Interval* Range: 44 to 65 Years; Mean: 56
Marital Status (Time 1)	*Categorical* Married: 174 (62.8%) Common Law: 11 (4%) Single: 18 (6.5%) Widowed: 17 (6.1%) Separated: 8 (2.9%) Divorced: 49 (17.7%)	*Dichotomy* Married & Common Law: 185 (66.8%)* Single, Separated, Divorced, or Widowed: 92 (33.2%)
Education (Highest Level of Education) (Time 1)	*Ordinal* Elementary: 1 (.4%) Some secondary: 23 (8.3%) HS graduation: 51 (18.4%) Some trade/technical/vocational/ business: 7 (2.5%) Some community college/CEGEP/nursing/ university: 58 (20.9%) Trade/technical/vocational/ Business, Diploma/Certification: 24 (8.7%) College/CEGEP/nursing/university, Diploma/Certification: 38 (13.7%) University or Teacher's College Certification: 2 (.7%) Baccalaureate: 54 (19.5%) Graduate/Professional Degree: 19 (6.9%)	*Dichotomies/Dummy Variables* **Education 1** High School or Less or other education level: 150 (54.2%) Some trade, some college, trade or college diploma or certification: 127 (45.8%) **Education 2** High School or Less or other education level: 202 (72.9%) University or Teacher's College Certificate/Baccalaureate/Graduate/ Professional Degree: 75 (27.1%)
Income (Household Income) (Time 1)	*Ordinal* < $20,000: 32 (11.6%) $20,000-$39,999: 61 (22%) $40,000-$59,999: 50 (18.1%) $60,000-$79,999: 50 (18.1%) $80,000-$99,999: 26 (9.4%) $100,000-$119,999: 28 (8.9%) $120,000+: 21 (7.6%) Missing: 17 (5.4%)	*Dichotomies/Dummy Variables* **Income 1** Less than $40,000 or $80,000 and up: 151 (54.5%) $40,000-$79,999: 126 (45.5%) **Income 2** Less than $40,000 or $40,000-$79,999: 206 (74.4%) $80,000 and up: 71 (25.6%)

* Reference Category

7.4.6 Health Status

Perceived health compared to others and whether or not health limits moderate activity were each controlled for as indicators of health status. This is essential because, as described above, there are numerous gender differences in regards to health among individuals who have the same chronic condition (e.g. cardiovascular disease).

Table 4: Coding for Health Status Variables

Independent Variable	Original Coding, Frequency, %	Recoding, Frequency, %
Perceived Health (Compared to Others) (Time 1)	*Ordinal* Excellent: 5 (1.8%) Very Good: 60 (21.7%) Good: 119 (43%) Fair: 69 (24.9%) Poor: 24 (8.7%)	*Dichotomies/Dummy Variables* **Perceived Health 1** Fair to Poor or Good: 212 (76.5%)* Very Good to Excellent: 65 (23.5%) **Perceived Health 2** Fair to Poor or Very Good to Excellent: 158 (57%) Good: 119 (43%)
Health Limits Activity (Does Health Limit Moderate Activities?) (Time 1)	*Ordinal* Yes, limited: 22 (7.9%) Yes, a little limited: 49 (17.7%) No, not limited at all: 206 (74.4%)	*Dichotomy* Yes, limited or a little limited: 71 (25.6%) No, not limited at all: 206 (74.4%)

* Reference Category

7.4.7 Social Support

Social support was measured by how much support participants felt they received from family and friends as well as their reported number of confidantes. This variable is important because women tend to have stronger social support networks than men, which might influence their self-care behaviours or health care utilization.

Table 5: Coding for Social Support Variables

Independent Variable	Original Coding, Frequency, %	Recoding, Frequency, %
Support from Family & Friends	*Ordinal* None at all: 5 (1.8%) Slight: 32 (11.6%) Moderate amount: 56 (20.2%) Quite a bit: 127 (45.8%) Extreme amount: 54 (19.5%) Missing: 3 (1%)	*Dichotomies* **Support Received 1** Not help to a bit: 221 (79.8%)* Moderate Amount: 56 (20.2%) **Support Received 2** No help to a bit: 93 (33.6%) Quite a bit to Extreme Amount: 184 (66.4%)
Number or Confidantes	*Interval* Range: 0 to 10; Mean: 2.71	*Interval* Range: 0 to 10; Mean: 2.71

*Reference Category

7.5 Procedures for Data Collection

Data were collected through a variety of sources, including by Research Assistants during telephone interviews, from health records, and through laboratory tests arranged by family physicians (Wister et al., 2007). Annual reminders were sent to physicians and participants to collect blood work and perform the other medical tests required for the study and then submit the results. These tests were then performed within physician offices and at laboratories. Laboratory data and health records were assessed or sent to the Research Coordinator (Wister et al., 2007).

7.6 Data Handling

Both the researchers responsible for assessing outcome and the participants themselves were blinded to which group participants belonged to (Wister et al., 2007). A Research Assistant entered the data from the primary investigation conducted by Wister and co-researchers (2007) into SPSS (Statistical Package for the Social Sciences). The current researcher coded the data as depicted in the tables above.

7.7 Statistical Analyses

Multivariate linear regression was performed, as this method is useful for identifying whether particular variables (e.g. gender) have an impact on an outcome (e.g. cardiovascular health as measured by the Framingham score). This type of regression is used to predict the value of an interval measure given levels of other variables by producing beta coefficients that estimate the linear relationships among variables. The formula for multivariate linear regression is $\gamma = a + b1x1 + b2x2 + \cdots + bpxp + \epsilon$, where: γ represents the dependent variable; x represents the independent variables; p represents the number of explanatory variables; a represents the intercept, which is a constant; b represents the slope, also known as the regression or beta coefficient, an estimate of the change in y associated with a unit increase in x when the other variables in the model are held constant; and ϵ represents the residual or error term. The line of the linear regression provides the best estimate of y given the observed values of x, providing both the R squared (R^2) value that estimates how much of the variance in the Framingham score is due to the independent variables, as well as beta values that estimate the change in y (the Framingham score) given an increase in particular independent variables (e.g. days of participation in moderate physical activity). For the purposes of this investigation, the Adjusted R^2 will be reported rather than R^2 because it takes account of the number of independent variables in the model and only increases if the variables in the block significantly contribute change to R^2.

Linear regression is based on several assumptions that are required for using this method of analysis. The first is that in the absence of random sampling, there is a large sample, with 300 or more participants, which the current sample is approximately in size. Although participants were not randomly selected, they were randomized into homogeneous treatment and control groups. It is acceptable to analyze experimental data using OLS techniques. Another assumption is that the dependent variable is an interval, which is the case with the change in Framingham score. There also must be a linear relationship between the dependent and independent variables. The next assumption is that the measures for the independent variables have relatively low measurement error, which was addressed above. Another assumption is that there is a bivariate normal distribution, which is supported by the size of the sample. A further assumption is that there are a minimum of 20 cases for each model, which is true for all models except for change in stress and change in waist when the analysis is split by gender. The use of linear regression also involves assumptions that the variables have homoscedasticity or equal variances, also supported by the sample size. Another assumption is that specification error is avoided, meaning that all of the important variables have been included in the model, which R^2 will assess. The last assumption is that the variables are independent and thus do not have collinearity or a high correlation with other variables in the same model. A test of multicollinearity is provided in the next chapter.

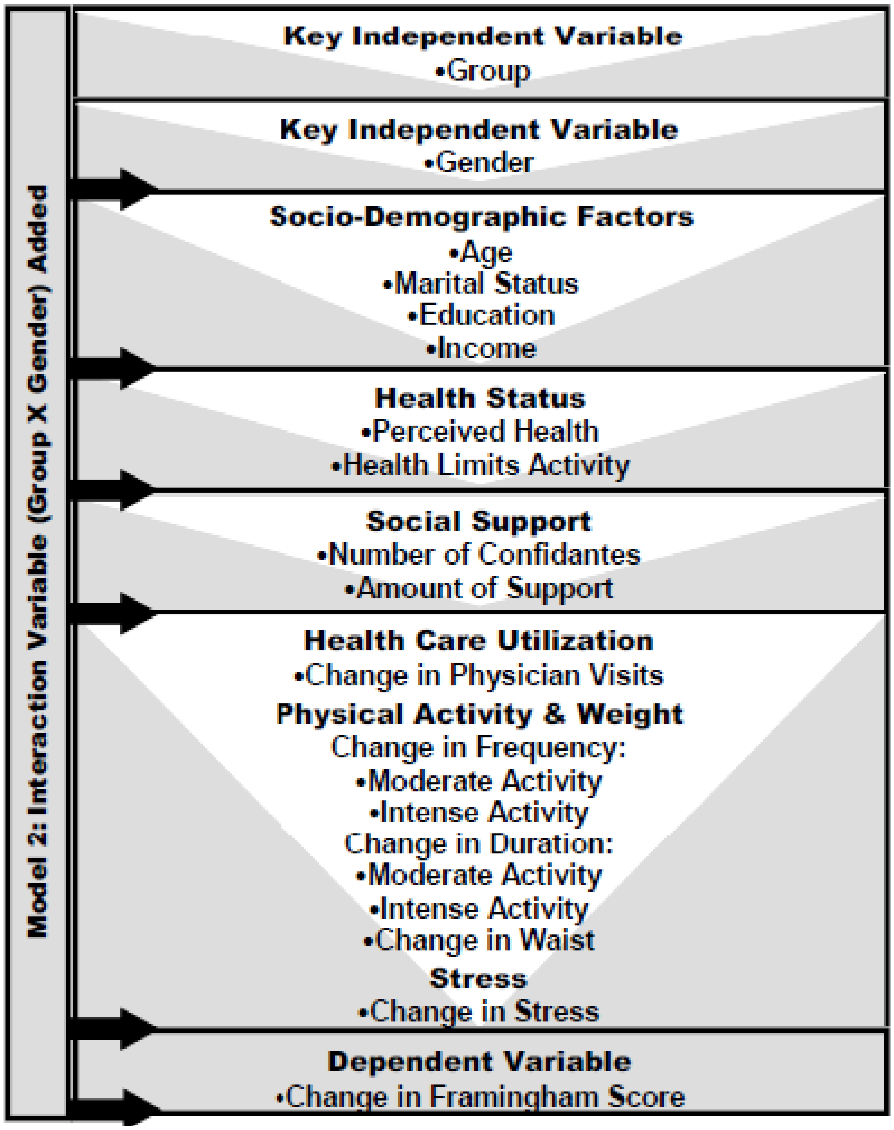
7.7.1 Hierarchical Model for Linear Regression

To test the relationship between gender and the outcome of the intervention to reduce cardiovascular risk (including the inclusion of other variables to be controlled), it is necessary to employ a hierarchical model. This model depicts the order in which these variables exert their effects on the change in Framingham score. The measures as described above and the sequence in which they theoretically influence one another are depicted in **Figure 1**. This hierarchy was created based on theoretical/logical rationale. As outlined earlier, gender is a concept that distinguishes males and females based on socially and culturally prescribed norms. While gender norms and expectations may change over long periods, they are well entrenched and not easily susceptible to change. Thus, gender can be thought of as antecedent to the other variables of interest. Next, other socio-demographic variables that are not very easily influenced by other factors but have significant influence on cardiovascular risk are age, education level, household income, and marital status. These factors, particularly age, income, and marital status, have an impact on health status. Also, social support will be affected by each of these characteristics. In turn, all of the previously described characteristics contribute to self-care behaviour. For example, how much a person participates in physical activity is first influenced by income (e.g. affordability of gym memberships, running shoes, etc.), health status (e.g. impact of health conditions on ease of physical activity, pain involved, etc.), and social support levels (e.g. motivations and barriers provided by friends and family). Finally, all of these variables are considered to influence self-care and cardiovascular risk as measured by the Framingham score.

There are two models for analysis. The first model is designed to determine the main effects of the intervention, gender, and the self-care variables on the change in Framingham score. The second model is designed to test whether the effect of the intervention at reducing cardiovascular risk differs by gender. The second model is also depicted in **Figure 1**. Within this model, there is the addition of an interaction of group multiplied by gender. The interaction effect is tested at every level or block of the model to determine whether it has a significant impact on the change in Framingham score.

In addition to examining a multiplicative interaction term between group and gender, the sample was also split into males and females and the same main effect Ordinary Least Squares (OLS) regression model was applied. Gender was removed from the model prior to running these analyses. This is a more sensitive methodology for identifying interactions, if there is an adequate size within the subsamples to result in significant findings.

Figure 1: Hierarchical Model of Linear Regression Analyses



7.8 Ethical Issues and Procedures

Ethical consent to undertake this research was provided by Simon Fraser University's Office of Research Ethics on March 14, 2010. This research was conducted under the supervision of Dr. Andrew Wister of the Department of Gerontology at Simon Fraser University. The original research was carried out with ethical consent from Simon Fraser University's Office of Research Ethics as well as the Fraser Health Authority (Wister, 2007). Informed consent was received by the Research Coordinator from all participants before assignment to control and intervention groups (Wister, 2007). The current research involves minimal risk to human participants as it does not involve interaction with study participants and the information in the dataset does not contain any particulars that identify the participants, nor is such information required or made accessible to the current researcher.

8: RESULTS

8.1 Correlation Matrix and Collinearity Diagnostics

Independence is the extent to which one set of scores is independent of another set or scores while collinearity is the extent to which the effects of a variable could be explained by another variable. To use OLS Regression it is necessary that the variables be independent and hence not collinear. Therefore, in order to determine that all of the variables described above measure separate constructs and therefore can be included in the same model, a correlation matrix was created that calculated the correlations (Pearson's R) among all of the independent variables. The measure of change in days of intense activity had a correlation of higher than .7 with the measure of change in duration of intense activity, suggesting that they are collinear or measure the same factor, thus the latter variable was removed from the model. None of the other variables had a correlation of .7 or higher, supporting that they are independent and allowing them to remain within the final model. Assessment of the tolerance values in the Regression Collinearity Diagnostics verified this assessment (none were below .10).

8.2 Results of Linear Regression Analyses

In this section, results are provided of the linear regression analyses used to test the hierarchical model, which was designed to investigate the effects of the independent variables on the change in Framingham score. To clarify the direction of interpretation, the change in Framingham score was calculated by subtracting the follow-up score from the baseline score, where a negative score represents an increase in Framingham score with increased cardiovascular risk and a positive score represents a decreased Framingham score with decreased cardiovascular risk. Examples of how the change score is calculated are included in the following table (**Table 6**). Thus, when interpreting the model, a positive association between a particular variable and the change in Framingham score supports that the variable decreases cardiovascular risk (desired change), while an inverse association between a variable and the change in Framingham supports that the variable increases cardiovascular risk (undesired change).

Table 6: Change in Framingham Score

Baseline Score (Time 1)	Follow-Up Score (Time 2)	Change Score (Time1-Time2)
7	3	4 = Lower Cardiovascular Risk
6	-4	10 = Lower Cardiovascular Risk
12	14	-2 = Higher Cardiovascular Risk
-8	-10	2 = Lower Cardiovascular Risk

The results of the linear regression analysis for main effects are provided in **Table 7** (see **Appendix**). Addressing the findings for the individual blocks that make up the model and using $p<.05$ statistical significance as the criteria for accepting an Adjusted R^2, all blocks were supported to have variables that explain some of the variance in the change in Framingham score. In Block 1, containing the group dichotomy, 2% of the variance in change in Framingham score is explained (Adjusted R^2=.02; R^2 Change=.00; S.E.=5.48; $p<.01$). When gender is added in Block 2, the model explains 3% of the variance in the outcome (Adjusted R^2=.03; R^2 Change=.01; S.E.=5.44; p<.01). With the addition of the socio-demographic variables in Block 3, 5% (Adjusted R^2=.05; R^2 Change=.02; S.E.=5.40; p<.01) of the variance in the change in Framingham score is explained by the model. When the health status variables are added in Block 4, the model is significant and the variance explained by the model is 4% (Adjusted R^2=.04; R^2 Change=-.01; S.E.=5.43; p<.05). Although R^2 does not decrease in a hierarchical approach, the smaller proportion of variance explained in this block is due to the use of the Adjusted R^2, which accounts for the number of independent variables. In Block 5, with addition of the social support variables the model is significant but remains with 4% of variance explained (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05). The same variance, 4% (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05), is found when physician utilization variables are added in Block 6. Lastly, in Block 7, when the self-care variables of interest are added to the model, 6% (Adjusted R^2=.06; R^2 Change=.02; S.E.=5.37; p<.05) of the variance is explained overall. Note that since this is an experimental design, it is not necessary to have a large explained variance.

Addressing the statistical results throughout these blocks identifies which specific variables in the model influence the change in Framingham score. Considering that this research is exploratory and the sample size is close but not at the minimum of participants (300) required for linear regression analyses, p<.10 will be the criterion by which findings will be accepted as statistically significant for individual variables and interactions. Within Block 1, 2% of the variance in change in Framingham score is explained (Adjusted R^2=.02; R^2 Change=.00; S.E.=5.48; $p<.01$), and being in the intervention compared to the control group has a weak association with change in Framingham score (B=.16; S.E.=.66; $p<.001$). This suggests that the intervention was effective at lowering cardiovascular risk. Block 2, with gender and group, explains 3% of the variance in the change in Framingham (Adjusted R^2=.03; R^2 Change=.01; S.E.=5.44; $p<.01$). There is a weak negative relationship between being female compared to male with change in Framingham score (B=-.12; S.E.=.69; $p<.01$). Also, the weak positive relationship between group and change in Framingham decreases but remains significant (B=.15; S.E.=.65; $p<.01$). These results suggest that gender partially mediates the relationship between the intervention and the outcome but that each variable also had significant effects of their own on Framingham change.

In Block 3, which contains group, gender, and the socio-demographic variables for age, education, and income, the variables together explain 5% (Adjusted R^2=.05; R^2 Change=.02; S.E.=5.40) of the variance in the change in Framingham Score. In this block, there is a weak inverse association found between having a household income of $80,000 and up compared to earning less than $40,000 with the change in Framingham score (B=-.14; S.E.=1.02; $p<.10$). This supports that individuals who earned the lower amount of income are more likely to experience decreases in their Framingham score, with decreased cardiovascular risk. Also, there remains a weak positive association between taking part in the intervention and the change in Framingham score

(B=.1e; S.E.=.66; $p<0.01$) as well as a weak negative association between gender and the change in Framingham score (B=-.15; S.E.=.69; $p<0.01$) once socio-demographic variables are added to the model. A decrease in the association between the intervention and outcome suggests that socio-demographics partially mediate this relationship, while an increase in the association between gender and the outcome and in the overall variance of this model suggest that socio-demographic factors increase the relationship between these variables. The significance of these two variables continues to support that both being in the intervention group and being male were linked to a decrease in cardiovascular risk as measured by the change in Framingham score.

With the addition of the health status variables in Block 4, the amount of variance explained is 4% (Adjusted R^2=.04; R^2 Change=-.01; S.E.=5.43; $p<.05$), and there are no new associations, which together suggest these variables do not have a relationship with the outcome. However, the relationship between gender and the change in Framingham score increased (B=-.16, S.E.=.72, $p<.01$), supporting a suppressor effect where health status increases the relationship between gender and the outcome. The associations of both group (B=.13, S.E.=.66, $p<.05$) and income (B=-.14; S.E.=1.03; $p<.10$) remain significant and of the same size as in the prior block.

When the social support variables are added in Block 5, there is no appreciable change in the variance explained by the model (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; $p<.05$), although the model remains statistically significant. There is a weak positive relationship between receiving quite a bit to a lot of help compared to none to a little with change in Framingham score (B=.15, S.E.=1.06; p<.10). This finding suggests that a higher amount of social support is related to decreases in cardiovascular risk. There is also evidence that social support partially mediates the relationships between both group (B=.12; S.E.=.67; p<.05) and gender (B=-.14; S.E.=.75; p<.05) with change in the Framingham score, as both of these relationships decrease. The relationship between income and change in the Framingham score (B=-.14; S.E.=1.04; p<.10) remains the same.

In Block 6, the change in health care utilization is added with no difference in variance explained by the model (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05), although the model remains significant. The relationship between receiving quite a bit to a lot of help compared to a little to none with change in Framingham score is no longer significant, suggesting that change in physician visits mediates the relationship between social support and the outcome. There is also a suppressor effect, where the relationship between group and Framingham change increases (B=.13; S.E.=.67; p<.05), suggesting that health care utilization increases the relationship between these variables. The relationships between both gender (B=-.14; S.E.=.75; p<.05) and income (B=-.14; S.E.=1.04; p<.05) with change in Framingham score remain the same.

With the self-care variables of interest for change in physical activity, change in weight, and change in stress that are added in Block 7, the final block of the model , 6% (Adjusted R^2=.06; R^2 Change=.02; S.E.=5.35) of the variance for change in Framingham score is explained overall. In regards to the self-care variables, and particularly for change in physical activity, there is a weak positive relationship between an increase in days of intense activity compared to no change or a decrease with the Framingham score (B=.18; S.E.=1.00; p<.05). This suggests that an increase in days of intense activity is related to decreased cardiovascular risk. At this level, there is a weak positive relationship between receiving a moderate amount of help compared to a little to none (B=.15; S.E.=1.23; p<0.10) and the reappearance of the weak positive relationship between receiving quite a bit to an extreme amount of help compared to a little to none (B=.17; S.E.=1.08; p<0.10). Thus, having any amount of support greater than a little to none is linked with decreased cardiovascular risk, and self-care has a suppressor effect where it increases this relationship. The relationship between group and change in Framingham score persists (B=.12; S.E.=.67; p<.05), and only decreases slightly. This suggests that the intervention was effective at decreasing cardiovascular risk but that there is also partial mediation of self-care in this relationship. Furthermore, the weak negative association persists for gender (B=-.12; S.E.=.76; p<.10) but also decreases slightly, suggesting that self-care partially mediates the relationship between gender and the change in Framingham score and that gender alone also has an impact on outcome, where males are more likely to experience decreased cardiovascular risk. In this block, there is not an association between household income with the change in Framingham score. This suggests that the self-care variables of interest mediate the relationship between income and cardiovascular risk.

8.2.1 Adding an Interaction Effect to the Linear Regression Model

The model as described above tests for the main effects of the independent variables on the Framingham score. The results suggest that among other findings, participation in the intervention, male gender, and increased participation in intense physical activity are related to decreased cardiovascular risk, with evidence that self-care partially mediates the relationship between both group and gender with the outcome. However, the first research question seeks to determine whether the impact of the intervention as measured by change in Framingham score differs by gender rather than whether gender and intervention independently have effects on change in cardiovascular risk. Thus, analysis was completed to address the interaction of the intervention with gender, using the same model as in the previous section, with the addition of extra blocks at each level of the model to test whether the level of intervention (treatment or control) interacts with gender to influence cardiovascular risk.

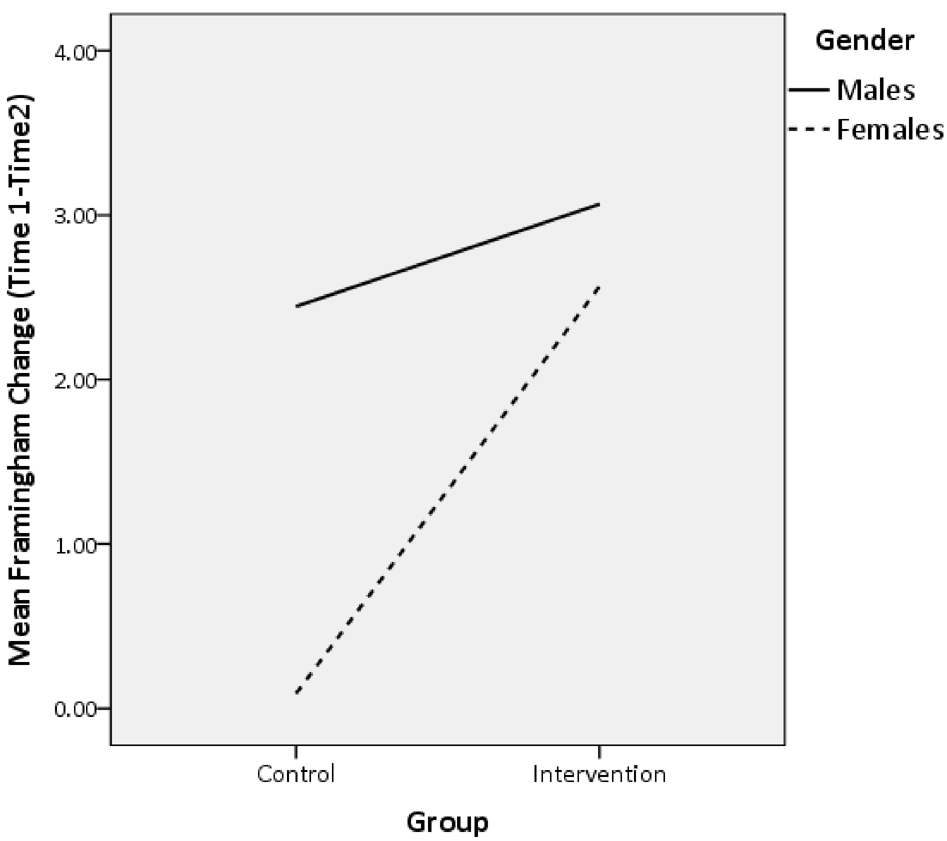
A multiplicative interactive term was created by multiplying group by gender. This interaction variable was added to every level of the model to determine whether it influences findings at each level. The results of this analysis are presented in **Table 7** (see **Appendix).** The proportion of variance explained by the interaction effect is significant at every level of the hierarchical models. In Block 1, the interaction increased the proportion of variance explained to 2% (Adjusted R^2=.03; R^2 Change=.01; S.E.=5.44; $p<.01$), a 1% increase from the influence of group alone. In Block 2, there was again a 1%

increase in explained variance from the amount explained by group and gender (Adjusted R^2=.04; R^2 Change=.01; S.E.=5.30; p<.01) alone. In Block 3, where socio-demographic variables are added to the model, 5% (Adjusted R^2=.05; R^2 Change=.00; S.E.=5.39; p<.01), of the variance is explained but the interaction effect does not increase the proportion of variance explained beyond that already found for the variables at this level. Although the amount of variance explained is significant, there are also no changes to the amount of variance explained when the interaction is added within: Block4 (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05), Block 5, (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05), or Block 6 (Adjusted R^2=.04; R^2 Change=.00; S.E.=5.43; p<.05). Although the proportion of variance explained by each block changes in Blocks 1 through 3 with the addition of the interaction effect, there was not a significant relationship found between the interaction and the change in Framingham score in any of the blocks discussed thus far.

Only in Block 7, with the addition of the self-care variables, is there a statistically significant interaction effect. The variables in this block predict 7% of the explained variance in the change in Framingham score (Adjusted R^2=.07; R^2 Change=.01; S.E.=5.35, p<.05) and there is a moderate positive association between the interaction variable and the change in Framingham score with a borderline level of statistical significance (B=.45; S.E.=1.37; p<.10). This finding supports that the interaction between group and gender has an impact on the Framingham score.

Additionally, interpretation of the direction of interaction effects is aided by graphical modelling. Referring to **Figure 2**, which shows the improvement in cardiovascular risk by gender and participation in the control or intervention group, it is apparent that while both females and males improved in their levels of cardiovascular risk as a result of the intervention, females improved to a greater extent. This chart was created by graphing the mean change in Framingham score for males vs. females when comparing the control and treatment groups. Note that a positive score is indicative of lower global cardiovascular risk.

Figure 2: Mean Change in Framingham Score by Group & Gender



There is support in regards to the second research question, which seeks to determine whether changes in health care utilization and self-care for physical activity, weight, and stress contribute to gender differences in the success of the intervention. When conducting the primary analysis before adding interaction effects, the size of the association between both group and gender with the Framingham score decreased slightly when the self-care variables were added to the model in Block 7. This supports that these self-care variables partially mediate the relationships of these variables with cardiovascular risk. Further elucidation of the influence of self-care factors on gender differences in the outcome is provided with the finding that the interaction between gender and the intervention does not have a significant relationship with the change in Framingham score until the self-care variables are added to the model. This is an example of a suppressor effect, in which inclusion of self-care increases the strength of relationship between the interaction of intervention group and gender with the change in Framingham score. It should be noted, however, that an association of the interaction of gender and group with change in Framingham score is only statistically significant at the $p<.10$ level and is therefore borderline.

8.2.2 Results of Linear Regression Analyses by Gender

The research thus far provides evidence that gender and the intervention interact with one another, and that there is a small amount of support that self-care behaviours have a differential impact on the outcome (change in Framingham score) by gender. However, there is a need for more investigation to address the research question of whether health care utilization and self-care influence gender differences in cardiovascular risk. One way to analyze this is to return to the linear regression model and run separate analyses by gender to determine whether the main effects differ between males and females. The results of such analyses are summarized in this section and presented in **Table 8** (see **Appendix**). The variance explained by the variables was significant at every block of the hierarchical model for females, and was insignificant at every block for males. These findings are discussed below.

Using $p<.05$ as the statistical significance level for accepting the Adjusted R^2, in Block 1 with just group alone, 6% (Adjusted $R^2=.06$; S.E.=4.80; $p<.001$) of the variance in the change in Framingham score is explained for females while there is no significant relationship between the intervention and the change in Framingham score for males. For females, there is a weak positive association between group and the change in Framingham score (B=.25; S.E.=.76; $p<.001$). These findings suggest that the intervention was effective at reducing cardiovascular risk among females only.

When the socio-demographic variables are added in Block 2, the explained variance in the change in Framingham score increases to 8% (Adjusted $R^2=.08$; R^2 Change=.02; S.E.=4.71; $p<.01$) among females and remains non-significant for males. Within this block, there is a weak negative association with earning an income of $80,000 and up compared to earning less than $40,000 with change in Framingham score (B=-.17; S.E.=1.28; $p<.10$), which suggests that among females, earning the lower amount is linked to decreases in cardiovascular risk. The weak positive relationship between group and change in Framingham score persists among females (B=.21; S.E.=.76;

p<.01), but decreases, suggesting that socio-demographic factors partially mediate the relationship between group and change in Framingham score.

As health status variables are added within the next block, these gender differences persist, with no significant findings for males. In Block 3, 8% (Adjusted R^2=.08; R^2 Change=.00; S.E.=4.71; p<.01) of the variance in the change in Framingham score is explained for females. In this block, there is a weak negative association between being single, separated, divorced, or widowed compared to being married or common law with change in Framingham score (B=-.17; S.E.=.87; p<.10). Replicated associations include: a weak positive association between group and change in Framingham score (B=.21; S.E.=.76; p<.01); and a weak negative association with earning an income of $80,000 and up compared to earning less than $40,000 with change in Framingham score (B=-.17; S.E.=1.29; p<.10). These results suggest that for females, participation in the intervention compared to the control group, being married or common law compared to single, separated, divorced, or widowed, and earning an household income of less than $40,000 compared to more than $80,000 are linked with decreased cardiovascular risk among females. The finding that marital status first had a relationship with the change in Framingham score in this block implies a suppressor effect whereby health status increases the relationship between these factors.

At the next level of the model, with the addition of the social support variables in Block 4, the proportion of the variance explained for females increases to 9% (Adjusted R^2=.09; R^2 Change=.02; S.E.=4.68; p<.01) and remains non-significant for males. For females, there are weak positive relationships found between receiving a moderate amount of help compared to a little or none (B=.21, S.E.=1.21; p<.05) and receiving quite a bit to a lot of help compared to a little or none (B=.25; S.E.=1.11; p<.05). The weak positive association between group and change in Framingham score remains (B=.20; S.E.=.76; p<.01), but decreases slightly, suggesting that social support partially mediates this relationship. At this level, other associations for females include: a persistant weak negative relationship between being single, separated, divorced or widowed compared to married or common law with change in Framingham score (B=-.15; S.E.=.87; p<.10); and a persisting weak negative relationship between earning an income of $80,000 or up compared to less than $40,000 with change in Framingham score (B=-.19; S.E.=1.29; p<.10). The former association decreases while the latter increases. This suggests that social support partially mediates the relationship between marital status and cardiovascular risk and has a suppressor effect where it increases the relationship between income and cardiovascular risk.

In Block 5, with the addition of the change in physician visits variable, there were no appreciable changes in the findings and no new findings. For females, the proportion of variance in Framingham score explained is 8% (Adjusted R^2=.09; R^2 Change=.01; S.E.=4.69; p<.001) and the association between group and the outcome is weak and positive (B=.20; S.E.=.77; p<.01). Relationships also remain among females for: being single, separated, divorced, or widowed compared to married or common law with change in Framingham score (B=-.15; S.E.=.87; p<.10); and both moderate social support compared to a little or none (B=.21; S.E.=1.21; p<.05), and receiving quite a bit to a lot of social support compared to a little or none with change in Framingham score (B=.26; S.E.=1.11; p<.05). For males, there were no significant findings within this block.

In Block 6, where the self-care variables for change in physical activity, change in weight, and change in stress were added to the model, there remains no significant findings for males. For females, the proportion of variance explained within this last block is 9% (Adjusted R^2=.09; R^2 Change=.00; S.E.=4.69; p<.001). Findings for females in regards to self-care include a weak negative relationship between a decrease compared to no change or an increase in the duration of moderate physical activity with change in Framingham score (B=-.24; S.E.=1.09; p<.05). Additionally, there is a weak positive relationship between a decrease up to 2 in the stress score compared to no change or another value of change for the stress score with change in Framingham score (B=.19; S.E.=1.18; p<.10). There is also a weak negative relationship between whether health does not restrict moderate activity (no activity restriction) compared to health does restrict moderate activity (activity restriction) with change in Framingham score (B=-.15; S.E.=.90; p<.10). This suggests that when health limits activities compared to not, there is decreased risk of CD. This finding is evidence of another weak suppressor effect, with self-care increasing the relationship between whether health limits moderate activity and the change in Framingham score. The relationships persist between: group with change in Framingham score (B=.19; S.E.=.80; p<.05); and whether a moderate amount of support (B=.27; S.E.=1.29, p<.05) or quite a bit to a lot of support (B=.26; S.E.=1.17; p<.05) is received compared to none to a little with change in Framingham score. The group and change in Framingham association decreases only a small amount, suggesting that self-care partially mediates this relationship but not an appreciable amount. Also, the social support relationships increased, particularly that for moderate support, suggesting that self-care increases the relationship between social support and cardiovascular risk. The findings in regards to both marital status and income in relation to change in Framingham were no longer significant, suggesting these relationships are mediated by self-care.

Overall, these findings suggest that the intervention is important for females, as the relationships between group and the change in Framingham score persist with almost the same beta value throughout the whole model. However, because the beta value decreased only a small amount when self-care variables were added to the model, this does not support that these factors mediate the relationship between the intervention and outcome for females. The findings among females of relationships between both an increase in intense physical activity and decreased stress with the change in Framingham score are examples of main effects of these types of self-care on cardiovascular risk among females, controlling for the interaction effect. Findings do not provide evidence for the effects of these factors on the relationship between the interaction of gender and the intervention and its relationship with the global risk score.

9: DISCUSSION

This research aims to answer two main research questions, for which the findings will be assessed in the context of theory and literature. The study seeks to determine: (1) whether there are gender differences in the effectiveness of the Cardiovascular Health Best Practices Project at lowering cardiovascular risk; and (2) if so, whether these gender differences are the result of change in physical activity or weight, change in stress, and/or change in health care utilization. There is also a third research goal to use the findings to create recommendations for designing future cardiovascular risk reduction interventions. Also, within this section, the limitations of the current research are discussed and recommendations are made for future research.

A brief summary of the intervention is relevant to discussing the results of these analyses. The intervention was directed towards reducing risk of CD among individuals with primary CD. After random assignment to groups, the control group received typical physical care for the following year, while intervention group participants received annual report cards with grades and goals to improve their health, and telephone counselling every six months (Wister et al., 2007). During counselling, emphasis was placed on decreasing risks of CD in a prioritized order from smoking, physical activity, diet, and weight control, to stress (Wister et al., 2007). When counsellors followed up with participants, they assessed their progress as determined by their current and past letter grades, and provided participants with new goals (Wister et al., 2007).

9.1 Summary of the Findings

There were differences in the findings of the two approaches to analyzing the interaction of the intervention with gender. The first analysis of main effects and a multiplicative interaction term supports gender differences in the outcome of the intervention as well as the mediation of self-care in the relationship between an interaction of group and gender with the global risk score. The second analysis of the interaction effect of the intervention and gender ran the model for males and females separately. These findings further support gender differences in the outcome of the intervention but do not support an appreciable effect of self-care on this relationship. The use of $p<.10$ as the level of statistical significance was justified in this investigation to increase the statistical power to detect relationships given the relatively small sample size. However, the second analysis supports the effect of gender differences on the outcome of the intervention at the accepted scientific level of statistical significance ($p<.05$). The evidence for mediation of self-care (suppressor effect) in the first analysis is only statistically significant at the $p<.10$ level. In the interest of limiting the probability of Type I error, or limiting the probability of accepting results that are due to chance rather than actual statistical relationships, the results of the second analysis are more compelling than the first and will be given greater weight.

9.2 Gender Differences in the CHBPP Outcome

Results of the statistical analyses support gender differences in the CHPBB outcome – global cardiovascular risk. First, initial analyses support that being male and participating in the intervention group each independently decrease cardiovascular risk as measured by the change in Framingham score over a one-year period. Interestingly, analyses using an interaction of gender and group supported that the interaction influenced cardiovascular risk and that the intervention was more effective at decreasing cardiovascular risk among females. Additionally, analyses run separately for males and females support that the intervention was not effective at decreasing cardiovascular risk for males but was effective for females, after controlling for the socio-demographic, health status, social support, physician utilization, and self-care variables included in the model.

The finding from the main effects analysis that supports decreases in cardiovascular risk among males compared to females is interesting in the context that there was no significant effect of the intervention on males. This finding is contrary to the literature, which demonstrates that cardiovascular risk is higher both with increasing age and for males compared to females. Given the lack of a literature or theory-based explanation for this finding, this suggests research error may exist. In particular, this likely demonstrates a selection bias as a result of the small sample size (114 males) and recruitment strategies, whereby the males who participated in the study do not represent the general population. Future research should include larger sample sizes and randomly select participants.

The support for the effectiveness of the intervention for females and not males fits with theory and past research. For example, findings support the predictions made by the *Social Cognitive Theory of Gender Development* in combination with literature that suggest women benefit more from cardiovascular risk reduction interventions. Women may be more motivated and confident to change behaviour than men and might benefit more from an intervention that challenges their awareness of their level of cardiovascular risk while helping to remove perceived barriers to change. Theory and literature also led to predictions that men are more aware of their level of cardiovascular risk than women and thus their self-care behaviour may not change much when they take part in a cardiovascular risk reduction intervention. Whether the gendered findings in this investigation were caused by changes in awareness and barriers is beyond the scope of this investigation but gender differences in the outcome of the intervention support this application of the theory. As discussed above, few studies have examined the role of gender in the outcome of interventions targeted at reducing cardiovascular risk. Current findings support the conclusions of the meta-analysis by Winkleby, Feldman, and Murray (1997) discussed above, who found that following intervention, improvements in cardiovascular risk were only significant for females.

9.3 What Contributes to Gender Differences?

The literature reviewed provides a case for the influence of health care utilization and self-care on cardiovascular risk reduction. While there is evidence that patterns of health care utilization and self-care differ by gender, there is a lack of literature to support how gender might influence levels of self-care when participating in risk reduction strategies or how it might contribute to differential outcomes of self-care targeted at reducing cardiovascular risk (e.g. biologically mediated). It is important to note that the intervention worked for females irrespective of changes in the self-care variables of interest. The findings in regards to physical activity and weight (**Section 9.3.1)**, stress (**Section 9.3.2)**, and health care utilization (**Section 9.3.3)** will be discussed, as will possible explanations for the gendered relationship between the intervention and cardiovascular risk.

9.3.1 Physical Activity & Weight

There were significant findings in regards to the influence of changes in physical activity and weight on global cardiovascular risk, but there was a lack of evidence that changes in activity levels or weight have an effect on the relationship between gender and the effectiveness of the cardiovascular risk reduction intervention. In the analyses of main effects, an increase in days of intense activity was associated with decreased cardiovascular risk but only 43 participants (15.4%) increased their level of intense activity. Results from the analyses run with separate gender support that for females a decreased duration of moderate physical activity increases the level of cardiovascular risk as measured by the change in Framingham score. However, there is no evidence from this investigation that increases in moderate physical activity were also linked to lower cardiovascular risk, at least over the period of this study. Also, there is only a very small suppressor effect in the second analyses, where the relationship between group and change in Framingham score among females decreases slightly when self-care variables are added to the model. This effect is so small that it cannot be concluded that physical activity appreciably contributes to the relationship between gender and the outcome of the intervention. This fits with the findings of Conn and co-researchers (2009), who found that neither age nor gender predicted the effectiveness of an intervention directed at increasing physical activity among adults with CD.

There are a few possible explanations that the mediating relationship was not found. First, the intervention was intended to be both low-intensity and cost efficient. The use of a report card and telephone counselling may have not been very effective at changing physical activity levels, or the duration of one year for the intervention may not have been adequate in length to contribute to appreciable change in self-care. Second, it may be that self-care does not mediate gender differences in the efficacy of the CHBPP risk reduction intervention. Additionally, the lack of findings in regards to main effects for physical activity and weight loss on change in Framingham score despite research evidence that both physical activity levels and weight are significant risk factors for CD, suggest that there were problems with the measurement of variables. For example, information on physical activity levels was collected by self-report and is thus subject to reporting biases. Additionally, the sample size may have been too small given patterns of physical activity. As discussed earlier, for most people, physical activity decreases over time and men are more likely to maintain physical activity while women are more likely to maintain physical inactivity (Panagiotakas et al., 2008). When you are accounting for the possibilities of participants experiencing either decreases, increases, or no change in physical activity, when also considering that some participants are initially active, while others are initially inactive, there are many different patterns of self-care possible. This makes analyses of change more challenging. Future research is needed to examine other ways to capture change.

Moreover, in research that addresses gender differences in the relationship between physical activity and weight loss or gain with CD, there is evidence that many factors contribute to this relationship. First, there is evidence that gender plays a role in the relationship between both physical activity and weight control with CD but supports that this relationship is complex and likely contributed to by race, social support, and other factors (Gallant & Dorn, 2001). Also, physical activity is associated with participation in other self-care behaviours (Panagiotakas et al., 2008). Thus, a much larger sample may be necessary to identify gender differences in the effects of self-care on cardiovascular risk reduction and to determine whether changes in self-care contribute to gender differences in the outcome of cardiovascular risk reductions.

Despite problems with the current research, it does provide evidence for gender differences in the outcome of the CHBPP even though it does not support that physical activity or weight loss mediate this relationship. While the lack of support for the latter may be related to research problems, particularly concerning the length of the study, measurement, and sample size, the results in conjunction with the research literature suggest that if self-care does mediate the relationship between gender and change in cardiovascular risk, this effect is quite small and likely mediated by many other factors.

9.3.2 Stress

From this investigation, there is no evidence that changes in stress have an effect on gender differences in the reduction of the global risk score as a result of the CHBPP. In the gender analysis, there is support that decreased stress is related to decreased risk of CD among females, but there is no support that this relationship mediates gender differences in the outcome. Also, as the presence of this relationship did not appreciably reduce the strength of association for the effectiveness of the intervention on change in Framingham score, there is no support that the intervention itself caused the decrease in stress among females. This fits with past research that has found that strategies to lower stress among females who had experienced myocardial infarction were more likely to lead to an increase or no change in stress rather than to decreased stress.

The lack of findings in regards to males and stress is contrary to what is expected based on the literature, which provides evidence that males are more responsive to interventions aimed at lowering stress than females. However, the literature also provides an abundance of support that males are more physiologically reactive to stress in ways that increase cardiovascular risk. Additionally, the physiological reaction to stress includes elevated blood pressure, which is one of the measures used to determine the global risk score using the Framingham Risk Assessment. The males in the CHBPP may be experiencing lower stress as a result of the intervention, but not enough of a change in stress that their physiological reaction to stress becomes low enough to change their Framingham score. Also, the intervention did not specifically target stress reduction. More complex analyses are clearly required to discover whether this type of effect is occurring, preferably completed by comparing groups by gender and using change in stress as the dependent variable.

9.3.3 Health Care Utilization

There is no evidence from this investigation that health care utilization has an effect on gender differences in the change in cardiovascular risk due to the intervention. Evidence from the literature supports that females tend to use more health care services than males, which incited research interest in determining whether changes in health care utilization contribute to gender differences in the outcome of the CHBPP. However, this area has a dearth of research. Additionally, the research that exists suggests that aspects of health care utilization other than physician visits may be more influential to cardiovascular risk, and consequently might cause gender differences in the outcome of the CHBPP. First, there is as lack of evidence to support that more frequent visits to health care providers lowers cardiovascular risk, and even evidence to the contrary (e.g. van Wyk et al., 2005). There is also a lack of evidence, and again contradictory evidence (e.g. Wang et al., 1999), that increased physician visits as a means or primary prevention are related to decreased cardiovascular risk. Finally, there is a lack of evidence for whether interventions to reduce cardiovascular risk that increase the frequency of contact with health care providers will be more effective for males or females. To reconcile these results, it may be that the quality of care is important to primary prevention of CD rather than the quantity but there is a need for more research in this area.

Furthermore, aspects of health care utilization that may be very important were not addressed in the analyses, and these are related more to quality of care than quantity. These include the role of the physician in cardiovascular risk reduction and the prescription of medication to ameliorate cardiovascular risk. For every participant who qualified as a primary prevention participant for the CHBPP, a letter was sent to their physician indicating that the participant was at risk, as well as a report card that identified both their level of risk and annual goals for decreasing risk. Physicians may not have previously identified these risks among their patients, and as the research evidence discussed above highlights repeatedly, women in particular are at risk of not having their level of cardiovascular risk recognized by their physicians. Thus, by identifying risk to health care providers, the CHBPP may have been effective in closing the care gap that women face with respect to circumventing the lack of screening and diagnosis. It is likely that on future visits with these patients, the physicians responded to this risk, both by advocating self-care practices and prescribing medications to lower risk. Since there is little evidence of reduced cardiovascular risk due to self-care improvements in this investigation, this suggests the importance of changes to medications, discussed in the next section.

Medications

Medications are effective at decreasing risk for primary and secondary CD. The most common medications prescribed to control cardiovascular risk factors in Canada (Health Canada, 2009), include: ACE inhibitors and other antihypertensive medications that lower blood pressure; beta-blockers that decrease the heart rate and strength of heart muscle contractions; calcium blockers that combine the effects of the first two medications; and diuretics that help to lower blood pressure. Also, some physicians prescribe statins to improve lipids and cholesterol (Petretta, Costanzo, Perrone-Filardi, & Chiariello, 2008). There are a wealth of gender differences related to medications used for primary prevention of CD, including differences in prescriptions provided and differential effects of medication. These were described in **Chapter 2**, but will be briefly summarized here. There are mixed results in the research literature on gender differences in medication use but there is overall support that females are prescribed medications for primary prevention of CD less often than men are prescribed them. For example, there is evidence that: aspirin use is less common among women with secondary CD (Opotowsky et al., 2007); women are less likely to receive antiplatelet and statin (lipid-lowering) medications as primary prevention for CD (Daly et al., 2006), with contrasting evidence that there are not gender differences in the use of these medications (Hahn et al., 2006); and women are less likely to be prescribed beta-blockers (Chou et al., 2007), with contradictory evidence of no gender differences for the use of beta-blockers (Daly et al., 2006). Additionally, an example of differential outcome from medication use is provided in the results of a meta-analysis (Petretta et al., 2008), where the use of statin therapy was shown to be effective at decreasing the incidence of coronary heart disease events among men but not for women, although the effect on mortality was the same for men and women. There is also mixed evidence of gender differences in medication compliance, which may also contribute to gender differences in the outcome of the intervention. Despite inconsistencies in this research, an abundance of evidence supports that gender differences exist for medication use. Given these findings and the effectiveness of medication at lowering cardiovascular risk, one would expect medication use to have an effect on gender differences in changes in the global risk score.

Gender differences in medication use and compliance are considered by the current researcher to be highly likely to influence gender difference in the CHBPP outcome and therefore medication use and medication compliance were originally intended for inclusion with the main variables analyzed. However, self-reported medication noncompliance was very small in the sample. Of the 277 participants: 216 (78%) reported taking their medications exactly as prescribed more than 90% of the time; 21 (7.6%) reported taking their medications exactly as prescribed 75-90% of the time; 10 (3.6%) reported taking their medications exactly as prescribed 50-75% of the time; 3 (1.1%) reported taking their medication exactly as prescribed 25-50% of the time; 3 (1.1%) reported taking their medication exactly as prescribed less than 25% of the time, and 24 (8.7%)

did not respond. Therefore, reported noncompliance was infrequent in this sample and the numbers were too small to retain meaningful categories of this variable and use them in the linear regression analysis, owing to the need to maintain a minimum number of cases 20 per group. Additionally, medication use was also self-reported but not used for this analysis. The types of medication used were recorded for the original study, but the names of the medication were self-reported and include an inconsistent mixture of brand names, generic names, and pharmaceutical names for the medications.   Due to this, the task of sorting through this list will require a comprehensive understanding of pharmaceuticals used in primary prevention of CD as well as encompass a time commitment and undertaking beyond the scope of the current investigation. Future research is recommended on the influence of medication use and compliance on gender differences in the outcome of cardiovascular risk reduction programs using administrative medication databases such as Pharmacare.

9.3.4 Other Explanations for Gender Differences in CHBPP Outcome

Despite that changes in quality of health care seem very likely to have contributed to gender difference in the effectiveness of the CHBPP in improving the Framingham global risk score, it is important to explore other explanations as well. Two to be discussed here build on the findings (or lack thereof) from the current investigation. First, the role of socio-demographic factors will be considered and secondly, the possibility of overarching but unmeasured behaviour change will be explored. Next, other factors that were not addressed in this investigation but may affect the relationship between gender and the outcome of the CHBPP will be considered.

Socio-Demographic Factors

When the socio-demographic variables were added to the model in the main effects and gender analyses, both the levels of variance explained increased by 2% (for females only in the gender analysis), a higher increase than any other level of the model. This suggests that socio-demographic variables are important to the change in Framingham score. Income was associated with change in Framingham score in both models, but only at the $p<.10$ level of statistical significance. The direction of the relationship was interesting because in both cases having an household income of less than $40,000 compared to that of more than $80,000 was associated with decreased risk of CD. It may be that higher income earners have higher levels of stress, are less likely to see their physicians, or have less time for self-care practices than lower income earners. Although there is widespread evidence that low-income and stress due to low-income affects health (e.g. Steptoe et al., 2002), particularly for women, this was not found in this study. There is also evidence in the literature of gender differences in the relationship between high income and stress. For example, cortisol levels in response to workplace stress were found to be higher among female professionals compared to clerical workers, with the opposite finding for males (Steptoe et al., 2003).

Furthermore, in both analyses there was a small but consistent decrease in the relationship between the intervention and the change in Framingham score when socio-demographic variables were added to the model, suggesting that these factors partially mediate the relationship between the intervention and the outcome. Additionally, the relationship between income and change in Framingham score disappeared when the self-care variables were added to the model. This suggests that self-care mediates the relationship between income and cardiovascular risk. This is especially interesting given that the lower income group improved more in cardiovascular risk, while logic might suggest that higher income earners can afford to participate in more self-care, maybe instead they have a lack of time to do so compared to lower income earners. This area merits more research. However, despite an influence of socio-demographics on differences in the outcome of the CHBPP, these differences are nowhere near large enough to account for the gender differences observed.

Global Risk Reduction

The beta score for the relationship between the intervention and the change in Framingham score remained stable regardless of which other factors were added to the model. This suggests that something intrinsic to the intervention itself may be beneficial for females. For instance, females may have improved incrementally in all of the areas that the report card targeted: smoking, physical activity, nutrition, stress, body mass index, waist circumference, and health confidence. It may be that the changes in any one of these areas were not large enough to show an influence on cardiovascular risk, especially when analyzed using a relatively small sample of 277 individuals inclusive of 163 females, but that the holistic change brought about as a result of the intervention did affect cardiovascular risk. The factors used to calculate the Framingham score include: age, total cholesterol, HDL cholesterol, blood pressure, presence of diabetes mellitus, and smoking behaviour. As discussed above, self-care behaviours that influence cholesterol include changes in physical activity and diet, while blood pressure is influenced by changes in physical activity, diet, weight, stress, medication use, and smoking. A change in all or most of these types of self-care could contribute to decreased cardiovascular risk by influencing cholesterol and/or blood pressure while the change for any one of these types of self-care (e.g. change in stress alone) might not be large enough to detect in this investigation. This explanation remains plausible pending research on larger samples. However, it is unlikely given the number of covariates controlled for in the linear regression analyses and the lack of related findings.

Other Factors

Another explanation for the results between intervention and gender with the change in Framingham score is the possibility of specification error (where all variables that are important to a relationship are not included in analyses). The likelihood that health care improved as a result of the CHBPP, leading to gender differences in the outcome, has already been discussed but there are other factors that might also be related. An important one is nutrition, as risk factors for CD include inadequate consumption of fruits, vegetables, and whole grains, as well as excess consumption of sodium (Health Canada, 2009).

The data from the CHBPP provided limited ability to study the effect of nutrition on cardiovascular risk. For example, the recommended amounts of fruits and vegetables to prevent CD are 7-10 servings per day (Health Canada, 2009), and the highest category to capture this measure within the CHPBB included 5-10 servings lumped together. Furthermore, the sodium measure was "how often do you use salt?", which does not capture the salt already included in meals that are eaten outside of the home or found in prepared or packaged foods. Additionally, there was not a measure of whole grain consumption. Also, the nutrition report card score was not a robust measure of nutrition, but instead was a number indicating whether foods were eaten from each of the four food groups. For these reasons, nutrition was not included in these analyses. However, considering the importance of nutrition as a risk factor for CD, future analyses directed at identifying gender differences in the outcome of cardiovascular risk reduction interventions should include nutrition variables, preferably that measure intake of fruits and vegetables, sodium, and whole grains.

9.4 Limitations of the Research

Many limitations of the current research have been identified above and further limitations will be discussed in this section.

9.4.1 Sample

While the sample size was large enough to have the statistical power to detect significant effects of the intervention (Wister et al., 2007), had the size been larger more findings might have been apparent when statistical analyses were run separately by gender. For example, among males and/or females it is possible that with a larger sample there might be evidence of the mediation of a self-care variable in the relationship between the intervention and the change in Framingham score.

The sampling also leads to problems with generalizability. The data reflect responses from one geographical area over a one-year time span, whereas evidence cited for the theoretical framework demonstrates that concepts such as gender are highly influenced by societal norms and ideals within a particular culture and timeframe. This leads to cohort effects, making the investigation relevant for middle-aged adults living in today's British Columbian society but these results are not necessarily generalizable to those living in other areas and may not hold true in the future.

Furthermore, the sample was more educated than Fraser Valley residents or British Columbians in general. It may be that more educated people are unique in ways that influence gender differences in the outcome of a cardiovascular risk reduction trial. For instance, more educated people may be more or less likely to follow the advice of counsellours of physicians.

In addition, recruiting a more culturally diverse sample would be useful. First, this would allow generalizeability to a wider population. More importantly, literature supports that ethnicity acts both independently and interacts with gender and other factors (e.g. age) to influence cardiovascular risk (e.g. Gallant & Dorn, 2001). It is likely that it is as important as gender to consider for cardiovascular risk reduction. Future research should be conducted to determine the ways in which ethnicity influences cardiovascular self-care and the efficacy of interventions targeted at improving self-care as a form of cardiovascular risk reduction.

9.4.2 Measures

The current investigation is limited in the use of secondary data analysis in that the measures used to answer the research questions are those available in the existing dataset. Thus, the measures are not the best possible measures available. However, the purpose of the analysis is to examine gender differences in the outcome of an intervention study, and such research requires that an intervention study has already been completed. Future researchers may benefit from planning gender-based analyses prior to implementation of an intervention, in order that appropriate data can be collected. Furthermore, the data that represent physical activity levels, stress, and health care utilization as well as the control variables were collected via self-report and may be subject to reporting biases. Also, there were a number of variables that required recoding that resulted in the loss of information. Another recommendation in regards to measurement is the collection of qualitative data in the future, which may uncover a more in depth understanding of the responses of males and females to interventions and help to better determine what factors influence this relationship.

9.4.3 Statistical Analyses

While OLS Regression is a widely used means of analyzing relationships between variables, it has its own set of limitations. Mainly, as is always the case with statistical analyses, a relationship identified between a variable and an outcome may be spurious, meaning the variable may not have caused the outcome. However, the main effects and interactions found in the current investigation are supported by research literature and theory, and thus spurious associations are unlikely.

9.5 Implications for Risk Reduction Interventions & Future Research

From this investigation, there is evidence that the CHBPP was effective for females and not for males, but there is insufficient evidence to explain this finding. In absence of understanding how the intervention improved cardiovascular risk more for females it would be premature to make recommendations for future risk reduction interventions. This investigation does add to a growing body of research that supports that such interventions should be targeted specifically by gender. In order to do so, much more research is necessary. Relevant recommendations for future research related to the findings have already been provided and more are provided in this section.

First, given the complex nature of CD, gender differences related to risk factors for CD, and difficulty identifying the roots of gender differences in the outcome of cardiovascular interventions (given the very large number of factors that independently and in interaction contribute to cardiovascular risk), intervention studies on very large samples or populations are needed to identify how best to create gender-specific interventions. Until more evidence is gathered, it is recommended that interventions such as the CHBPP be employed, as it: (1) targets the most prevalent risk factors for CD; (2) uses relatively little resources and is very unobtrusive compared to many interventions; (3) has been supported to be efficacious at decreasing the Framingham risk score, a global cardiovascular risk score (Wister et al., 2007); and (4) there is now evidence that supports efficacy for females. Researchers should also try to have consistency in their use of evaluation methods, as Sellers and co-researchers (1997) identified the lack of this practice as the largest contributor to contradictory results in this type of research.

Second, research should address why interventions such as this one and those discussed in the literature do not support decreased cardiovascular risk among males. Strategies that are effective for males should be identified, especially because males face cardiovascular risk over a larger age span than females. Successful components can either be combined with the components that are successful for females to design interventions that will be successful for either gender or used separately for primary prevention of CD among males. Males may be more responsive to more intensive interventions than the CHBPP.

Additionally, inclusion of covariates that measure socio-demographics factors and social support is important in studies of this nature. The socio-demographic variables accounted for 2% of the variance explained by the change in Framingham score, while moderate to high levels of social support compared to none to a little were consistently associated with decreased cardiovascular risk.

It would also be useful to investigate other methods of providing low-intensity cardiovascular risk reduction interventions. For example, using the same targets and principles for risk reduction, counselling support and educational resources could be provided via the internet. Use of the internet could further facilitate additional low-intensity strategies for risk reduction. For example, discussion and support groups could easily be created (e.g. chat rooms, discussion forums), and even hosted or monitored if desired. Individual online coaches could also be made available. Furthermore, the internet also provides a low-cost opportunity for live video communication that would require the same amount of time as a telephone call. Not only might such strategies be found to have the same efficacy as the original intervention by Wister and co-researchers (2007), but also there is potential that some of these techniques might have greater efficacy.

Another recommendation that echoes those of other researchers is that investigations of health behaviours and particularly intervention studies should statistically analyze results by gender. The results of the initial main effect analyses and those that were separated by gender are quite different, and much richer for the gender analyses. There are very important relationships that researchers may miss when they fail to consider gender differences in the success of interventions. In some cases with failure to separate gender, the absence of an effect on one gender (e.g. lack of decreasing cardiovascular risk among males) at the same time as that effect exists for the other (e.g. decreased cardiovascular risk among females) could lead to non-significant results.

10: CONCLUSION

This exploratory research into gender differences in the outcome of a cardiovascular risk reduction intervention is one of very few of its type. While research has recognized gender differences related to CD for more than a decade, and numerous recommendations have been made for a gendered approach to CD prevention, there is a dearth of research on how interventions can best be targeted towards reducing cardiovascular risk. This study provides some evidence that the CHBPP, an unobtrusive and low-resource, low-intensity intervention, is effective at lowering cardiovascular risk among middle-aged women. We need to identify why this is the case so we can direct the effective strategies specifically towards primary prevention of CD among women, who comprise the bulk of the baby boomers. We also need more research on older men and women. Additionally, we need to identify why it was not effective for middle-aged men, or more importantly, identify what is effective for this group so that we can improve cardiovascular risk reduction strategies for them too. Additionally, in all intervention studies related to CD, we should recognize the multitude of gender differences related to this condition and compare the effects of the interventions by gender.

APPENDIX

Table 7: Coefficients from Linear Regression Analysis

Block		Std. Error	Standardized Coefficients Beta	R^2
1	(Constant)	1.03		.02**
	Group	.66	0.16**	
2	(Constant)	1.52		.03**
	Group	.65	0.15**	
	Gender	.67	-0.12*	
2+	Block 2 + Group X Gender Interaction[+]		.36	.04**
3	(Constant)	3.82		.05**
	Group	.66	0.13*	
	Gender	.69	-0.15**	
	Age	.06	.07	
	Marital Status	.80	-.04	
	Education 1	.81	.02	
	Education 2	.93	-.07	
	Income 1	.82	.00	
	Income 2	1.02	-0.14^	
3+	Block 3 + Group X Gender Interaction		.30	.05**
4	(Constant)	3.91		.04*
	Group	.66	0.13*	
	Gender	.72	-0.16**	
	Age	.06	.07	
	Marital Status	.81	-.04	
	Education 1	.82	.03	
	Education 2	.95	-.07	
	Income 1	.82	.00	
	Income 2	1.03	-0.14^	
	Perceived Health 1	.93	.00	
	Perceived Health 2	.78	.00	
	Health Limits Activity	.80	-.03	
4+	Block 4+ Group X Gender Interaction		.30	.04*
5	(Constant)	3.92		.04*
	Group	.67	0.12*	
	Gender	.75	-0.14*	

Block		Std. Std. Error	Standardized Coefficients Beta	R^2
	Age	.06	.06	
	Marital Status	.81	-.03	
	Education 1	.83	.03	
	Education 2	.95	-.07	
	Income 1	.83	.00	
	Income 2	1.04	-0.14^	
	Perceived Health 1	.95	.00	
	Perceived Health 2	.79	.01	
	Health Limits Activity	.80	-.04	
	Support Received 1	1.19	.13	
	Support Received 2	1.06	0.15^	
	Number of Confidantes	.20	-.06	
5+	Block 5 + Group X Gender Interaction		.28	.04*
6	(Constant)	3.94		.04*
	Group	.67	0.13*	
	Gender	.75	-0.14*	
	Age	.06	.06	
	Marital Status	.82	-.02	
	Education 1	.83	.03	
	Education 2	.95	-.07	
	Income 1	.84	.01	
	Income 2	1.04	-0.14^	
	Perceived Health 1	.95	.00	
	Perceived Health 2	.79	.01	
	Health Limits Activity	.81	-.03	
	Support Received 1	1.19	.13	
	Support Received 2	1.06	.15	
	Number of Confidantes	.20	-.06	
	Change Physician Visits	.15	-.04	
6+	Block 6 + Group X Gender Interaction		.29	.04*
7	(Constant)	4.11		.06*
	Group	.67	0.12*	
	Gender	.76	-0.12^	
	Age	.07	.03	
	Marital Status	.82	-.02	
	Education 1	.86	.01	
	Education 2	.97	-.12	
	Income 1	.87	.00	
	Income 2	1.08	-.12	
	Perceived Health 1	.96	-.01	

Block		Std. Std. Error	Standardized Coefficients Beta	R^2
	Perceived Health 2	.80	.00	
	Health Limits Activity	.83	-.09	
	Support Received 1	1.23	0.15^	
	Support Received 2	1.08	0.17^	
	Number of Confidantes	.20	-.07	
	Change Physician Visits	.15	-.05	
	Change Days Moderate Activity 1	.86	.03	
	Change Days Moderate Activity 2	.94	-.03	
	Change Days Intense Activity 1	1.00	0.18*	
	Change Days Intense Activity 2	.94	.10	
	Change Duration Moderate Activity 1	.87	-.03	
	Change Duration Moderate Activity 2	.91	-.11	
	Change in Waist 1	1.26	.02	
	Change in Waist 2	1.20	.16	
	Change in Waist 3	1.27	.04	
	Change in Waist 4	1.64	-.02	
	Change in Stress 1	1.17	-.01	
	Change in Stress 2	.99	.04	
	Change in Stress 3	1.07	-.07	
	Change in Stress 4	1.21	.02	
7+	Block 7 + Group X Gender Interaction	1.37	0.45^	.07*

***p<.001

**p<.01

*p<.05

^p<.10

+Interaction Variables: Only included within Model 2

Table 8: Coefficients from Linear Regression Analyses by Gender

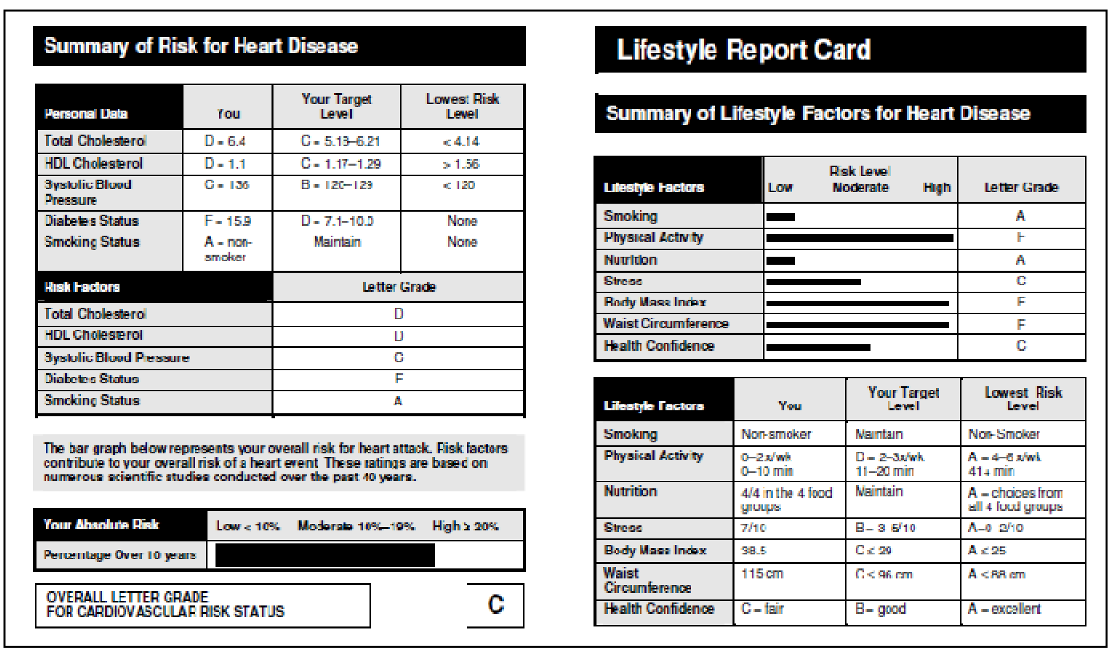
Block		Std. Error	Males Standardized Coefficients Beta	R^2	Std. Error	Females Standardized Coefficients Beta	R^2
1	(Constant)	1.89		-.01	1.16		.06***
	Group	1.18	.05		.75	0.25***	
2	(Constant)	6.43		-.02	4.47		.08**
	Group	1.19	.04		.76	0.21**	
	Age	.11	.03		.07	.13	
	Marital Status	1.68	.09		.85	-.14	
	Education 1	1.50	.10		.93	-.02	
	Education 2	1.67	-.06		1.08	-.06	
	Income 1	1.65	.01		.88	-.01	
	Income 2	1.78	-.09		1.28	-0.17^	
3	(Constant)	6.76		-.03	4.53		.08**
	Group	1.22	.04		.76	0.21**	
	Age	.11	.03		.07	.13	
	Marital Status	1.72	.10		.87	-0.17^	
	Education 1	1.57	.14		.94	-.01	
	Education 2	1.71	-.03		1.10	-.06	
	Income 1	1.73	-.01		.90	-.02	
	Income 2	1.84	-.13		1.29	-0.17^	
	Perceived Health 1	1.66	-.08		1.12	.07	
	Perceived Health 2	1.59	.06		.86	.00	
	Health Limits Activity	1.82	.06		.84	-.12	
4	(Constant)	7.01		-.06	4.51		.09**
	Group	1.24	.03		.76	0.20**	
	Age	.12	.05		.08	.09	
	Marital Status	1.77	.11		.87	-0.15^	
	Education 1	1.60	.15		.95	-.02	
	Education 2	1.74	-.03		1.10	-.07	
	Income 1	1.75	-.01		.90	-.03	
	Income 2	1.88	-.13		1.29	-0.19^	
	Perceived Health 1	1.75	-.06		1.14	.05	
	Perceived Health 2	1.67	.08		.86	.01	
	Health Limits Activity	1.85	.06		.84	-.13	
	Support Received 1	2.76	-.04		1.21	0.21*	
	Support Received 2	2.36	-.06		1.11	0.25*	
	Number of Confidantes	.45	-.06		.20	-.05	
5	(Constant)	7.01		-.06	4.60		.09***
	Group	1.24	.03		.77	0.20**	

Block		Males Std. Error	Males Standardized Coefficients Beta	Males R^2	Females Std. Error	Females Standardized Coefficients Beta	Females R^2
	Age	.12	.05		.08	.09	
	Marital Status	1.77	.10		.87	-0.15^	
	Education 1	1.61	.15		.95		
	Education 2	1.74	-.04		1.11	-.07	
	Income 1	1.75	.00		.93	-.02	
	Income 2	1.89	-.12		1.29	-0.19^	
	Perceived Health 1	1.76	-.07		1.15	.05	
	Perceived Health 2	1.68	.07		.87	.01	
	Health Limits Activity	1.89	.07		.84	-.13	
	Support Received 1	2.76	-.04		1.21	0.21*	
	Support Received 2	2.37	-.07		1.11	0.25*	
	Number of Confidantes	.46	-.03		.20	-.05	
	Change Physician Visits	.30	-.10		.17	-.04	
6	(Constant)	7.23		.06	4.98		.09***
	Group	1.25	-.01		.80	0.19*	
	Age	.12	.02		.08	.07	
	Marital Status	1.75	.13		.89	-.11	
	Education 1	1.61	.13		1.03	-.04	
	Education 2	1.75	-.19		1.18	-.13	
	Income 1	1.74	-.02		1.00	.01	
	Income 2	1.97	-.07		1.41	-.13	
	Perceived Health 1	1.77	-.09		1.20	.07	
	Perceived Health 2	1.62	.00		.90	.03	
	Health Limits Activity	1.95	-.04		.90	-0.15^	
	Support Received 1	3.03	-.25		1.29	0.27*	
	Support Received 2	2.46	-.13		1.17	0.26*	
	Number of Confidantes	.46	-.16		.21	-.08	
	Change Physician Visits	.30	-.06		.18	-.05	
	Change Days Moderate Activity 1	1.71	0.29*		1.06	.01	
	Change Days Moderate Activity 2	1.78	-.12		1.15	.14	
	Change Days Intense Activity 1	1.75	0.29**		1.28	.10	
	Change Days Intense Activity 2	1.71	.17		1.14	.08	

Block	Std. Error	Males Standardized Coefficients Beta	R^2	Std. Error	Females Standardized Coefficients Beta	R^2
Change Duration Moderate Activity 1	1.73	-.13		.99	-.03	
Change Duration Moderate Activity 2	1.73	-.08		1.09	-0.24*	
Change in Waist 1	2.56	-.10		1.46	.03	
Change in Waist 2	2.52	.17		1.37	.13	
Change in Waist 3	2.62	.11		1.43	.00	
Change in Waist 4	3.51	-.05		1.80	-.04	
Change in Stress 1	2.18	-.14		1.38	.11	
Change in Stress 2	1.80	-.17		1.18	0.19^	
Change in Stress 3	2.00	-.10		1.26	.02	
Change in Stress 4	2.55	.09		1.36	.02	

***p<.001
**p<.01
*p<.05
^p<.10

Figure 3: Sample CHBPP Report Card



Summary of Risk for Heart Disease

Personal Data	You	Your Target Level	Lowest Risk Level
Total Cholesterol	D = 6.4	C = 5.13–6.21	< 4.14
HDL Cholesterol	D = 1.1	C = 1.17–1.29	> 1.56
Systolic Blood Pressure	C = 136	B = 120–129	< 120
Diabetes Status	F = 15.9	D = 7.1–10.0	None
Smoking Status	A = non-smoker	Maintain	None

Risk Factors	Letter Grade
Total Cholesterol	D
HDL Cholesterol	D
Systolic Blood Pressure	C
Diabetes Status	F
Smoking Status	A

The bar graph below represents your overall risk for heart attack. Risk factors contribute to your overall risk of a heart event. These ratings are based on numerous scientific studies conducted over the past 40 years.

Your Absolute Risk	Low < 10% Moderate 10%–19% High ≥ 20%
Percentage Over 10 years	

OVERALL LETTER GRADE FOR CARDIOVASCULAR RISK STATUS: C

Lifestyle Report Card

Summary of Lifestyle Factors for Heart Disease

Lifestyle Factors	Risk Level (Low / Moderate / High)	Letter Grade
Smoking		A
Physical Activity		F
Nutrition		A
Stress		C
Body Mass Index		F
Waist Circumference		F
Health Confidence		C

Lifestyle Factors	You	Your Target Level	Lowest Risk Level
Smoking	Non-smoker	Maintain	Non-Smoker
Physical Activity	0–2 x/wk 0–10 min	D = 2–3x/wk 11–20 min	A = 4–6 x/wk 41+ min
Nutrition	4/4 in the 4 food groups	Maintain	A = choices from all 4 food groups
Stress	7/10	B = 3 5/10	A=0 2/10
Body Mass Index	38.5	C ≤ 29	A ≤ 25
Waist Circumference	115 cm	C < 96 cm	A < 88 cm
Health Confidence	C = fair	B = good	A = excellent

REFERENCE LIST

Abbey, S.E. & Stewey, D.E. (2000). Gender and psychosomatic aspects of ischemic heart disease. *Journal of Psychomatic Research, 48*(4-5), 417-423.

Adamson, J., Ben-Shlomo, Y., Chaturvedi, N., & Donovan, J. (2003). Ethnicity, socio-economic position and gender – do they effect reported health-care seeking behaviour? *Social Science & Medicine, 57,* 895-904.

Apullan, F.J., Bourassa, M.G., Tardif, J.C., Fortier, A., Gayda, M. & Nigam, A. (2008). Usefulness of self-reported leisure-time physical activity to predict long-term survival in patients with coronary heart disease. *The American Journal of Cardiology, 102*(4), 375-379.

Bandura, A. (1989). Social cognitive theory. In R. Vasta (Ed.), *Annals of Child Development, 6*. *Six theories of child development* (pp. 1-60). Greenwich, CT: JAI Press.

BC Stats (2007). *2006 Census profile – summary report: Fraser Valley, CD.* Retrieved from http://www.bcstats.gov.bc.ca/data/cen06/profiles/detailed/59009000.pdf

Bussey, K. & Bandura, A. (1999). Social cognitive theory of gender development and differentiation. *Psychological Review, 106*(4), 676-713.

Chiaramonte, G.R. & Friend, R. (2006). Medical students' and residents' gender bias in the diagnosis, treatment, and interpretation of coronary heart disease symptoms. *Health Psychology, 35*(3), 255-266.

Chou, A.F., Wong, L., Weisman, C.S., Chan, S., Bierman, A.S., Correa-de-Aruajo, R. & Scholle, S.H. (2007). Gender disparities in cardiovascular among commercial and Medicare managed care plans. *Women's Health Issues, 17*(3), 139-149.

Chung, M.L., Moser, D.K., Lennie, T.A., Worrall-Carter, L., Bentley, B., Trupp, R., & Armentano, D. (2006). Gender differences in adherence to the sodium-restricted diet in patients with heart failure. *Journal of Cardiac Failure, 12*(8), 628-634.Conn, V.S., Hafdahl, A.R., Moore, S.M., Nielsen, P.J., & Brown, L.M. (2009). Meta-analysis of interventions to increase physical activity among cardiac subjects. *International Journal of Cardiology, 133*(3), 307-320.

Consedine, N.S., Magai, C., & Chin, S. (2004). Hostility and anxiety differentially predict cardiovascular disease in men and women. *Sex Roles, 50*(1/2), 63-75.

Cossette, S., Frasure-Smith, N., and Lesperance, F. (2002). Nursing approaches to reducing psychological distress in men and women recovering from mycocardial infarction. *International Journal of Nursing Studies, 39*(5), 479-494.

Daly, C., Clemens, F., Sendon, J.L.L, Tavazzi, L., Boersma, E., Danchin, N. ...& Fox, K.M. (2006). Gender differences in the management and clinical outcome of stable angina. *Journal of the American Heart Association, 113,* 490-498.

D'Agostino, R.B., Grundy, S., Sullivan, L.M., & Wilson, P. (2001). Validation of the Framingham coronary heart disease prediction scores: Results of a multiple ethnic groups investigation. *Journal of the American Medical Association, 286*(2)*,* 180-187.

Dean, K. (1989). Self-care components of lifestyles: The importance of gender, attitudes, and the social situation. *Social Science and Medicine, 29*(2), 137-152.

Dean, K. (1992). Health-related behaviour: Concepts and methods. In M. Ory et al. (Eds.). *Aging, Health, and Behavior* (pp. 27-56). Newbury Park, CA: Sage.

Diaz, V.A., Player, M.S., Mainous, A.G., Carek, P.J., & Geesey, M.E. (2006). Competing impact of excess weight versus cardiorespiratory fitness on cardiovascular risk. *The American Journal of Cardiology, 98*(11), 1468-1471.

Fang, J., Wylie-Rosett, J. & Alderman, M.H. (2005). Exercise and cardiovascular outcomes by hypertensive status: NHANES I epidemiological follow-up study, 1971-1992. *American Journal of Hypertension, 18*(6)*,* 751-758.

Fleming, P. & Godwin, M. (2008). Lifestyle interventions in primary care: Systematic review of randomized controlled trials. *Canadian Family Physician, 54*(12)*,* 1706-13.

Gabhainn, S.N., Kelleher, C.C., Naughton, A.M., Carter, F., Flanagan, M., & McGrath, M.J. (1999). Socio-demographic variations in perspectives on CD and associated risk factors. *Health Education Research, 14*(5), 619-628.

Gallant, M.P. & Dorn, G.P. (2001). Gender and race differences in the predictors of daily health practices among older adults. *Health Education Research: Theory and Practice, 16*(1), 21-31.

Gold, C.H., Malmberg, B., McClearn, G.E., Pedersen, N.L. & Berg, S. (2002). Gender and health: A study of older unlike-sex twins. *Journal of Gerontology: Social Services, 57*(3), S168-S176.

Hahn, K.A., Strickland, P.A., Hamilton, J.L., Scott, J.G., Nazareth, T.A., & Crabtree, B.F. (2006). Hyperlipidemia guideline adherence and association with patient gender. *Journal of Women's Health, 15*(9), 1009-1013.

Halm, M.A. & Penque, S. (1999). Heart disease in women. *The American Journal of Nursing, 99*(4), 26-32.

Hassan, M., Li, Q., Brumback, B., Lucey, D.G., Bestland, M., Eubanks, G., et al. (2008). Comparison of peripheral arterial response to mental stress in men versus women with coronary artery disease. *American Journal of Cardiology,102*(8), 970-974.

Health Canada (2000). The changing faces of heart disease and stroke in Canada 2000. Retrieved February 1, 2008, from http://www.phac-aspc.gc.ca.ccdpc-cpcmc/cvd-mcv/pub_e.html

Health Canada (2003). The growing burden of heart disease and stroke in Canada 2003. Retrieved February 1, 2008, from http://www.phac-aspc.gc.ca.ccdpc-cpcmc/cvd-mcv/pub_e.html

Health Canda (2009). Tracing heart disease and stroke in Canada 2009. Retrieved March 15, 2010 from http://www.phac-aspc.gc.ca/publicat/2009/cvd-avc/pdf/cvd-avs-2009-eng.pdf

Liang, W., Shediac-Rizkallah, M.C., Celentano, D.D., & Rohde, C. (1999). A population-based study of age and gender differences in patterns of health-related behaviors. *American Journal of Preventive Medicine, 17*(1), 8-17.

Lorence, D. & Park, H. (2007). Gender and online health information: A partitioned technology assessment. *Health Information and Libraries Journal, 24*(3)*,* 204-209.

Martin, R., Gordon, E.E., & Lounsbury, P. (1998). Gender disparities in the attribution of cardiac-related symptoms: Contribution of common sense models of illness. *Health Psychology, 17*(4), 346-357.

Mosca, L., Mochari-Greenberger, H., Newby, L.K., & Robb, K.J. (2010). Twelve-year follow-up of American women's awareness of cardiovascular disease risk and barriers to heart health. *Circulation: Cardiovascular Quality and Outcomes, 3,* 120-127.

Opotowsky, A.R., McWilliams, J.M., & Cannon, C.P. (2007). Gender differences in aspirin use among adults with coronary heart disease in the United States. *Society of General Internal Medicine, 22*(1), 55-61.

Panagiotakos, D.B., Pitsavos, C., Lentzas, Y., Skoumas, Y., Papadimitriou, L., Zeimbekis, A., & Stefanadis, C. (2008). Determinants of physical activity among men and women from Greece: A 5-year follow-up of the ATTICA study. *Annals of Epidemiology, 18*(5), 387-394.

Parslow, R. Jorm, A. Christensen, H., Jacomb, P., & Rodgers, B. (2004). Gender differences in factors affecting use of health services: An analysis of a community study of middle-aged and older Australians, *Social Science and Medicine, 59*(10), 2121-2129.

Petretta, M., Costanzo, P., Perrone-Filardi, P., & Chiarello, M. (2010). Impact of gender in primary prevention of coronary heart disease with statin therapy: a meta-analysis. *International Journal of Cardiology, 138*(1): 25-31.

Rahmqvist, M. & Bara, A.C. (2007). Patients retrieving additional information via the Internet: A trend analysis in a Swedish population, 2000-05. *Scandinavian Journal of Public Health, 33*(5), 533-539.

Sellers, D.E., Crawford, S.L., Bullock, K., & Mckinlay, J.B.(1997). Understanding the variability in the effectiveness of community heart health programs: A meta-analysis. *Soc.Sci.Med (look it up), 44*(9), 1325-1339.

Sheridan, S., Pignone, M., & Mulrow, C. (2003). Framingham based tools to calculate the global risk of coronary heart disease. *Journal of General Internal Medicine, 18*(12), 1039-1052.

Spitzer, D.L. (2007). Gender and Sex-Based Analysis in Health Research: A Guide for CIHR Researchers and Reviewers. Retrieved from http://www.cihr-irsc.gc.ca/e/32019.html

Statistics Canda (2010). *2006 Community Profiles for British Columbia*. Retrieved from http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E

Steptoe, A., Feldman, P.J., Kunz, S., Owen, N., Willemsen, G., & Marmot, M. (2002). Stress responsivity and socioeconomic status: A mechanism for increased cardiovascular disease risk. *European Heart Journal, 23*(22), 1757-1763.

Steptoe, A., Kunz-Ebrecht, S., Owen, N., Feldman, P.J., Willemsen, G., Kirschbaum, C., & Marmot, M. (2003). Socioeconomic status and stress-related biological responses over the working day. *Pyschomatic Medicine, 65*(3), 461-470.

Uchino, B.N., Holt-Lunstad, J., Bloor, L.E., & Campo, R.A. (2005). Aging and cardiovascular reactivity to stress: Longitudinal evidence for changes in stress reactivity. *Psychology and Aging, 20*(1), 134-143.

van Heijden, A.A.; Ortegon, M.M., Niessen, L.,W., & Dekker, J.M. (2009). Prediction of coronary heart disease risk in a general, pre-diabetic, and diabetic population during 10 years of follow-up: Accuracy of the Framingham, SCORE, and UKPDS risk functions: The Hoorn Study. *Diabetes Care, 32*(11), 2094-2098.

van Jaarsveld, C.H., Ranchor, A.V., Kempen, G.I., Coyne, J.C., van Velduisen, D.J., Ormel, & Sanderman, R. Gender-specific risk factors for mortality associated with incident coronary heart disease – A prospective community-based study (2006). *Preventive Medicine, 43*(5), 361-367.

van Wyk, J.T., van Wijk, M.A., Sturkenboom, M.C., Moorman, P.W. & van der Lei, J. (2005). Identification of the four conventional cardiovascular disease risk factors by Dutch general practioners. *Chest, 128*(4), 2521-27.

Wang, J.S., Carson, E.C., Lapane, K.L., Eaton, C.B., Gans, K.M. & Lasater, T.M. (1999). The effect on physician office visits on CHD risk factor modification as part of a worksite cholesterol screening program. *Preventive Medicine, 28*(3), 221-228.

Winkleby, M.A., Feldman, H.A., & Murray, D.M. (1997). Joint analysis of three U.S. community intervention trials for reduction of cardiovascular risk. *Journal of Clinical Epidemiology, 50*(6) 645-658.

Wister, A., Loewen, N., Kennedy-Symons, H., McGowan, B., McCoy, B., & Singer, J. (2007). One-year follow-up of a therapeutic lifestyle intervention targeting cardiovascular disease risk. *Canadian Medical Association Journal, 177*(8), 859-865.

Yawn, B.P., Wollan, P.C., Yawn, R.A., Jacobsen, S.J., & Roger, V. (2007). The gender specific frequency of risk factor and CHD diagnoses prior to incident MI: A community study. BioMed Central Family Practice, 8(18), doi: 10.1186/1471-2296-8-18.