NUTRITION AND CARDIOVASCULAR RISK AMONG MID-LIFE ADULTS: THE ROLE OF SELF-EFFICACY

by

Adrienne L. Wedding
B.A., Simon Fraser University, 2005

THESIS submitted in partial fulfillment of
the requirements for the degree of

MASTER OF ARTS

In the
Department
of
Gerontology

SIMON FRASER UNIVERSITY

Summer 2008

Approval

Abstract

The process of aging can bring forth health-related challenges, specifically an increased risk of cardiovascular disease. This thesis examines the effect of self-efficacy on changes in nutrition behaviour in an intervention aimed at reducing cardiovascular risk in mid-life persons (aged 45-64). The construct of self-efficacy refers to beliefs in our capabilities to undertake the actions necessary to produce a given goal. This psychological construct has shown to be a mediator between various determinants of health and subsequent health behaviour. Social Cognitive Theory lays the groundwork for examining self-efficacy. Undertaking a secondary data analysis of the Cardiovascular Health Best Practice Project, this study examines self-efficacy in both a general health and nutrition health context. Results show that nutrition self-efficacy, income, mutual aid, and family physician visits play a role in changing nutrition behaviour over time, contributing to our understanding and the future development of research and nutrition health promotion programs for this population.

Dedication

For my Gramps.

Acknowledgements

I would like to thank Dr. Andrew Wister for sparking my interest in the field of Gerontology and providing me with continuous encouragement over the course of my graduate studies. I owe particular thanks to Dr. Loren Lovegreen and Dr. Andrew Sixsmith for the many insightful comments that challenged me to consider my topic from different perspectives. Also, a special thanks to Dr. Susan Crawford for offering her expertise with such enthusiasm.

To my amazingly strong family - Mom, Dad, Ryan, and Saskia, thank you for your love and unconditional support.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

Health Canada (2000) states that cardiovascular disease (CVD), encompassing both heart disease and stroke, is the principal cause of death of more than one third of Canadians over the age of 45. The baby boomer generation, including individuals born between 1946 and 1964, is the fastest growing proportion of the population. Thus, Canada can expect a sharp increase in the number of deaths owing to CVD in the coming years. Currently, 8 out of 10 Canadians experience at least one of the major risk factors for CVD, including obesity, diabetes, smoking, physical inactivity, and hypertension (Health Canada, 2003). Given the impact of poor cardiovascular health on chronic pain, disability, activity limitations, quality of life, mortality, and health services cost, it is important to develop prevention strategies focusing specifically on the aging population. Such strategies could suppress the economic burden of CVD that was estimated to be over eighteen million dollars in 1998, comprising 11.6% of the total cost of all illnesses (Health Canada, 2003).

The prevalence of CVD risk factors within the population is astounding. With respect to obesity, 30% of adults between the ages of 45 and 64, 25% of adults 65-74 and 24% of adults 75+ are obese as measured by the Canadian Community Health Survey (CCHS, 2004). Further, middle-aged adults (aged 45-64) experience the highest overall levels of excess body fat relative to all other age groups (Statistics Canada, 2005). Targeting individuals at this stage of the life course consequently offers an opportunity for significant CVD prevention, maximizing longevity and quality of life for a large proportion of the population.

The most successful health-related interventions to date are those that teach individuals the skills necessary to maintain motivation to execute behavioural control after the intervention has ceased (Bandura, 1997). The research world has yet to fully unearth the characteristics of an intervention and of an individual that influence the maintenance of adaptive behaviours (Carrels, Darby, Cacciapaglia, & Douglass, 2004). The mid-life adult is capable of modifying risk factors for disease and can benefit from promotion of factors that contribute to successful aging (Bandura, 1997). Decreasing the major risk factors of CVD is necessary and likely given that 80% of the Canadian population has a minimum of one contributing factor that is modifiable (e.g., diet) (Health Canada, 2003). Research links nutrition habits that follow recommended dietary behaviours suggested in the literature with better health outcomes as well as minimal disability in later life (Gaudreau, Morais, Shatenstein, Gray-Donald, Khalil, Dionne, Ferland, Fülöp, Jacques, Kergoat, Tessier, Wagner, & Payette, 2007).

Thus, the objective of this thesis is to examine the relationship between self-efficacy, nutrition behaviour, and CVD risk over time in mid-life adults in order to add to our understanding of the effectiveness of health promotion strategies aimed at healthy aging. In the chapter to follow, the theoretical foundation for this thesis (Social Cognitive Theory) is outlined, informing us that the personal influence of self-efficacy, or confidence in our abilities, plays a vital role in undertaking behavioural action (Bandura, 1997). Subsequent chapters use a review of the literature to understand the relationship between the construct of self-efficacy and CVD risk and to form hypotheses surrounding this relationship in the context of nutrition in mid-life persons. The methodological strategy for this research is the secondary data analysis of a lifestyle intervention targeting CVD risk in mid-life adults (Wister, Loewen, Kennedy-Symonds, McGowan, McCoy, & Singer, 2007).

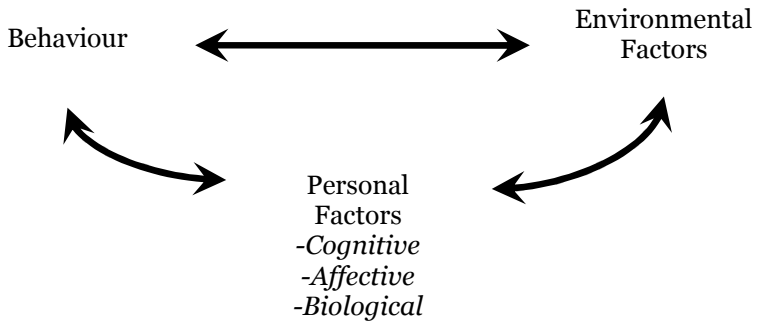
Chapter 2:
Theoretical Framework and Background

The following chapter discusses the Social Cognitive Theory as the groundwork for this research and links the concept of self-efficacy to healthy aging and nutrition research.

Social Cognitive Theory

Developed by Bandura (1977), Social Cognitive Theory (SCT) is based upon the notion that individuals have the power to exercise influence over their behavioural actions. SCT acknowledges that multiple factors interact to produce a given action and individuals contribute to, but cannot fully determine, behaviour. SCT therefore acknowledges the interaction of the environment, behaviour, and the individual, while the relative impact of each concept within the model is context dependent. Consider the following conceptual model:

Figure 2.1: Social Cognitive Theory.



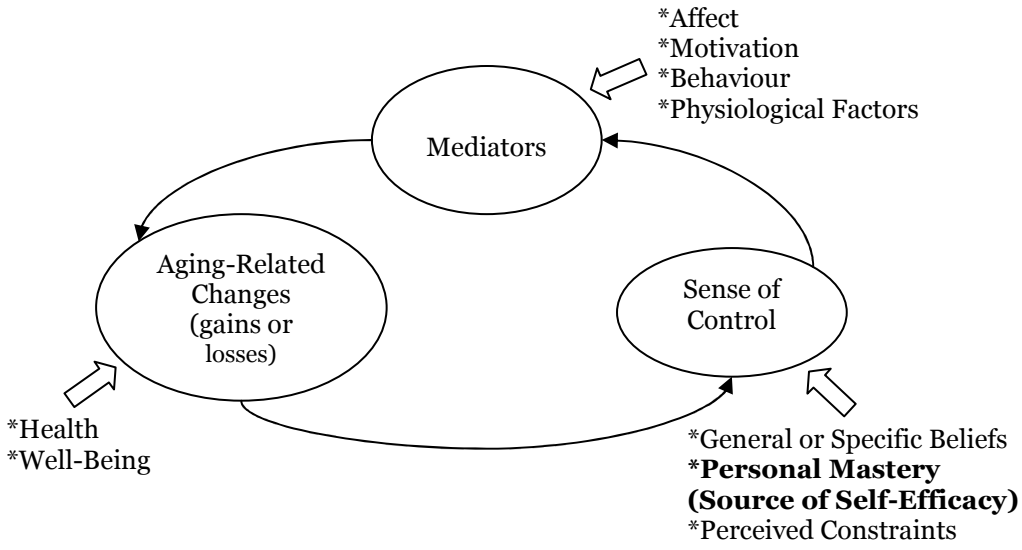
Source: Reproduced from Bandura (1977).

SCT is particularly relevant to health practices because it includes personal factors, including cognitive, affective, and biological components that contribute to behaviour change (Bandura, 1997). The dynamic interplay of these three personal factors is referred to as reciprocal determinism. The unique role of individual cognition is a dimension that encompasses how we translate reality and information into behaviour. From a SCT perspective, the most influential mechanism within a given action is personal or 'self' efficacy, defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). This important construct within SCT provides an individual with the confidence to undertake difficult tasks using personal capabilities to their fullest extent. Having low self-efficacy or experiencing self-doubt can often overshadow the most refined of personal skills. Further, because self-efficacy is not considered a personality trait, it is not universal across contexts and behaviours and requires assessment in a specific situation (Bandura, 1997), for example, dietary behaviour. Examination of self-efficacy in a context-specific manner yields the strongest behavioural predictions (Bandura, 1997; Gaughan, 2003). Thus, interventions may be aimed at modifying (i.e., increasing) self-efficacy in the specific health context of CVD risk. The explicit focus of SCT on the construct of self-efficacy therefore provides the impetus for using this framework as the foundation for this research.

According to Bandura (1997), there are four fundamental sources of self-efficacy, including enactive vicarious experience, verbal persuasion, physiological and affective states, and mastery experience. Vicarious experience builds self-efficacy in relative terms whereby accurately assessing one's capabilities involves a comparison with others' capabilities. Further, it is easier to maintain a sense of self-efficacy when others verbally express their faith in you to achieve a goal. Physiological and affective states are

particularly important in the realm of health functioning; an individual is likely to construe a high quantity of somatic indications in a negative way. For example, an individual who experiences high levels of arousal when making dietary choices may engage in poorer than normal decision-making. Finally, Bandura (1997) characterizes mastery experience as the most authentic source of self-efficacy; successes provide reinforcement while failures convey the value of maintenance to reach that success. This concept represents the most powerful and overarching of the sources of self-efficacy. Figure 2.2 links this important source of self-efficacy and beliefs to healthy adulthood and aging.

Figure 2.2: The Relationship between Beliefs and Health.



Source: Adapted from Lachman & Prenda-Firth (2004).

The above illustration shows that in order for an individual to predict and potentially alter future health events, whether negative or positive, the exercise of control must be present. Beliefs, personal mastery (a source of self-efficacy) and perceived

constraints are three contributing elements to feeling in control. Sense of control is defined by Lachman and Prenda Firth (2004, p. 321) as "the perception that one can influence what happens in one's life, includ[ing] beliefs or expectations about the extent to which one's actions can bring about desired outcomes." In other words, how well an individual perceives they can perform a given action creates outcome expectations. Similar to self-efficacy beliefs, the impact of control is context-dependent; individuals can often consciously decide whether to exercise or relinquish control in a given situation. Thus, control is not linked to innate responses but requires an element of motivation.

Research providing support for the association between beliefs in mid-life and gender, socio-economic status, well-being, general health, physical health, and social relationships has contributed to the above model (Lachman & Prenda-Firth, 2004). According to these researchers, the relationship between self-efficacy and health is mediated by affect, motivation, behaviour, and physiological factors. The current research explores the relationship between self-efficacy and healthy dietary behaviour in the context of age-related change (CVD risk). The following section will discuss current literature pertaining to self-efficacy and healthy aging.

Self-Efficacy, General Health, & Aging Research

Both objective factors (e.g., gender, education) and subjective factors (e.g., health beliefs, perceived control over one's health) have shown to play a significant role in the decision to engage in self-care (Morrongiello & Gottlieb, 2000). Research links self-perceptions of health to mortality rates, suggesting that perceptual beliefs provide a different insight into individual health often overlooked when focusing solely on objective health factors (Menec, Chipperfield, & Perry, 1999). Despite the importance of subjective factors, research focusing on self-efficacy for specific health behaviours or

health outcomes specifically for mid-life individuals is limited (Hendy & Nelson, 1998; Lachman & Prenda-Firth, 2004). Past research has highlighted two relevant issues when studying the aging process: how to maintain high levels of self-efficacy and how to successfully enhance lower levels of self-efficacy in this unique population (Bandura, 1997).

In the realm of CVD risk reduction via behavioural lifestyle intervention, women have cited lack of self-efficacy or confidence in their abilities as the greatest barrier to implementing behaviour change (Carrels et al., 2004). At the level of primary prevention, research demonstrates that an adult with high confidence in health behaviours is more likely to take advantage of existing resources (e.g., educational material) than an adult with low confidence (Grembowski, Patrick, Diehr, Durham, Beresford, Kay, & Hecht, 1993). Similarly, low perceived health has been associated with lower participation in cardiac rehabilitation programs (DiPietro, 2001). In one study predicting nutritional status in community-dwelling elderly, half of the participants reported fair or poor health status relative to other individuals of the same age, showing an inverse relationship between perceived health status and presence of disease as well as the impact of disease on daily life (Payette, Gray-Donald, Cyr, & Boutier, 1995).

Self-efficacy has shown to be a mediator between various determinants of health and subsequent health behaviour (Carrels et al., 2004; McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003; Rimal, 2000). The concept of self-efficacy as it relates to health and health behaviours is particularly important for the aging population given that health issues can lead to loss of desired autonomy (Bandura, 1997). A study by Ferrini, Edelstein and Barrett-Connor (1994) examined the relationship between health beliefs and health behaviour change in the older adult. These researchers aimed to quell the assumption that we cannot “teach an old dog new tricks” (p. 1). The five health beliefs

assessed include the perceived value of diet and physical activity, readiness to spend money on being healthy, motivation to be healthy, confusion as to what foods are healthy, and how to stay healthy. The five behaviour changes assessed include dietary fat intake, salt intake, dietary change, self-help reading, and frequency of physical activity in the past 15 years. Results show that the younger group (aged 50-69 years) were more likely to be motivated to change health behaviours and less likely to be confused about how to be healthy than the older group (aged 70-89 years). The older group tended to agree that staying healthy and engaging in health behaviours is important and were willing to spend money doing so (Ferrini et al., 1994). These findings demonstrate that the mid-life population can be a productive target when studied in the context of nutrition behaviour change.

Self-Efficacy, Nutrition, & Aging Research

Hendy and Nelson (1998) characterize the majority of studies on nutrition and aging as lacking a relevant theoretical basis. These researchers utilized SCT as the groundwork for examining nutritional risk in rural adults. Their work sought to influence future interventions where the goal is to maximize confidence in nutrition behaviours. Study results show that learning by example at mealtime, number of confidants and quality of interaction with them (as opposed to quantity), body mass index (BMI), and number of foods eaten per day were predictors of nutritional scores. These researchers concluded that the four sources of confidence in dietary behaviours as depicted in SCT (enactive vicarious experience, verbal persuasion, physiological and affective states, and mastery experience) provide a useful foundation for examining and explaining nutritional risk in rural older adults. Hendy and Nelson (1998) suggest exploring gender differences in nutritional risk which is undertaken as part of the current research in addition to exploring self-efficacy in an urban population.

Keller and colleagues (2006) developed the Action Nutrition initiative to improve nutritional status of adults attending a seniors' recreation centre. One goal of this initiative was to promote positive attitudes and beliefs towards eating, nutrition, and health for adult members. Participants of the Action Nutrition initiative were more likely to believe that food variety was important for adequate nutrition and that their own eating habits contribute to their health than non-participants. Whether participants entered the program with those beliefs or formed them as a result of the program, results demonstrate that beliefs play a role and should therefore be considered when developing nutrition health promotion programs (Keller, Hedley, Wong, Vanderkooy, Tindale, & Norris, 2006).

Researchers have used dietary self-efficacy scales to measure this construct in the context of chronic illness. Wamsteker and colleagues (2005) implemented an eight-week low calorie diet and nutrition education program in a sample of adults (aged 23-73 years with a mean age of 45.9). The nutrition self-efficacy portion of the obesity psychosocial state questionnaire contains the following three items: being able to control eating habits, feeling helpless about eating behaviour, and being able to master eating behaviour (Wamsteker, Geenen, Iestra, Larsen, Zelissen, & Van Staveren, 2005). It was expected that obesity-related beliefs, including nutrition self-efficacy among other constructs, would predict the amount of weight loss over the intervention period. The predictions of these researchers were supported; participants with a high perception of control over weight and a greater sense of nutrition self-efficacy lost significantly more weight over the intervention period (Wamsteker et al., 2005).

Research has also examined both SCT constructs of self-efficacy and outcome expectations with respect to health behaviour. Conn (1997) examined the relationship between these constructs as predictors of dietary behaviour, exercise, and stress

management in a low-income female population over 65 years of age. Participants with established CVD were excluded from this sample; however, participants with other chronic illnesses were included. Results from self-reports on dietary behaviour demonstrated that self-efficacy was the strongest predictor of the three health behaviours, while outcome expectancy was not a predictor of dietary behaviour. This finding supports the use of self-efficacy as an independent construct in predicting nutrition behaviour (Conn, 1997).

Anderson, Winett, and Wojcik (2000) used social cognitive theory to examine determinants of nutrition behaviour in sample of supermarket food shoppers participating in a nutrition promotion program. These researchers looked at both self-efficacy and outcome expectations components of SCT, food choices at the supermarket, and food intake. Looking at these constructs in the context of nutrition behaviour change, Anderson and colleagues (2000) found that of all factors included in the analysis (socioeconomic status, age, number of children, self-efficacy, and outcome expectations), self-efficacy had the strongest total effect on nutrition behaviour. Further, this relationship was mediated by outcome expectations that the food they purchased would be affordable and enjoyable to eat (Anderson et al., 2000).

Other studies that have looked at multiple psychological and social correlates of fruit and vegetable intake, including dietary self-efficacy, knowledge of recommendations concerning intake, perceived benefits and barriers, and social support. For example, one study analysed data collected on promoting greater intake of fruits and vegetables in low-income women over an eight-month period, finding that change in self-efficacy was positively associated with change in fruit and vegetable intake (Langenberg, Ballesteros, Feldman, Damron, Anliker, & Havas, 2000). In addition, increased consumption of fruits and vegetables was positively associated with self-efficacy change over time. Glanz and

colleagues (1998) pursued this area of interest in a population of males at a higher risk for colorectal cancer, finding that psychological factors (e.g., attitude, knowledge, motivation) contribute more to dietary behaviours than social support, social norms, and access to healthy foods. Causal relationships are not determined here because changes in these variables were measured at the same time points. Langenberg and colleagues (2000) suggest that changes in psychological and social factors may therefore be consequences of behavioural change. A longitudinal perspective on psychological and social factors and nutrition behaviour change is an under-researched area (Glanz, Kristal, Tilley, & Hirst, 1998, Langenberg et al., 2000) and has never been studied in the context of CVD risk among middle-aged adults (Clark & Dodge, 1999).

On the surface, it appears that the relationship between self-efficacy and nutrition behaviour is rather straightforward. However, it is important to acknowledge a conflicting body of research in this area and recognize that differing findings have also emerged. For example, Meland, Gunnar Maeland, and Laerum (1999) examined specific self-efficacy measures in participants at risk for CVD, measuring change in smoking, exercise, and eating behaviours in 110 middle-aged men (aged 30-59 years). Participants in the intervention group underwent a behavioural counselling program over a one-year span that included videotaped demonstrations and feedback from physicians in three-month increments. Although self-efficacy at baseline was found to be a significant predictor of smoking cessation and increased exercise at follow-up, it was not predictive of change in eating habits. Some research has suggested a link between lower self-efficacy and fat intake in adults with high blood cholesterol at baseline measures; however self-efficacy did not predict change in fat intake over a four-month period (Steptoe, Doherty, Kerry, Rink, & Hilton, 2000).

Burke, Dunbar-Jacob, Sereika, & Ewart (2003) discuss the measurement of self-efficacy, stressing the importance of specificity in measuring psychological constructs. They suggest that an intervention targeting nutrition behaviour should measure self-efficacy by placing this perception into a context in which a person may be challenged (e.g., following a specific meal plan in a work-related event, in a social or isolated setting, when under time-pressure, stressed, or depressed). According to these researchers, the tendency to over-estimate this construct requires that questions or scale items present challenging contexts in which to measure self-efficacy and provide an appropriate range of responses. Further, over-estimated or falsely high self-efficacy levels at baseline measures also limit the range of improvement possible in a given intervention process. Results of the study conducted by Burke and colleagues (2003) showed no relationship between self-efficacy and the demographic variables of age, sex, and education level. However, being married and being Caucasian was associated with higher overall levels of self-efficacy (Burke et al., 2003).

Despite the suggested need to examine self-efficacy over time, the most significant limitation of the nutrition research reviewed for this thesis is the use of cross-sectional data (Chima et al., 1997; Conn, 1997; Davis et al., 2000; Denton et al., 2004; Ford et al., 2000; Grundy & Sloggett, 2003; Hendy & Nelson, 1998; Johansson et al., 1999; Keller et al., 1997; Keller & Hedley, 2002; Martikainen et al., 2003; Murphy et al., 1990; Roos et al., 1998; Roos et al., 1996; Wandel, 1995). Cross-sectional design is implemented to examine individuals at one point in time or compare individuals of different ages (Passer & Smith, 2001). It is therefore limited by an inability to determine causal pathways of relationships between variables. In contrast, longitudinal design repeatedly examines the same cohort over time, allowing the researcher to look at patterns and changes in nutrition behaviours (Passer & Smith, 2001). A unique strength

of the current research is therefore the use of longitudinal data where nutrition self-efficacy and behaviour can be evaluated over time.

The relationship between nutrition and cardiovascular risk will be outlined in the chapter to follow, specifically in the context of major physical and physiological CVD risk factors. The review then shifts focus onto the social determinants of nutrition and cardiovascular health to inform the introduction of co-variates to the relationship between self-efficacy and behaviour[1].

[1] Databases consulted in this review include Ageline, Academic Search Elite, CINAHL, Global Health, Health Source, Medline, PsycARTICLES, PsycBOOKS, PsycINFO, and Sociological Index

Chapter 3: Literature Review

Prevention of Cardiovascular Disease

Secondary prevention or early diagnosis and treatment of established CVD has been the focus of the majority of health-related interventions to date. During the 1950s, the United States Public Health Service began to address CVD in addition to providing treatment, offering preventive measures to the population at low or no cost (Rosenstock, 1974). Thus, prevention of CVD is a task definable on multiple levels. At the primary level, the goal is to control risk factors in order to decrease the incidence of disease (Health Canada, 2000). Despite the effort to promote preventative health actions, individuals often fail to make use of available resources. Success of a health-related intervention at this level of prevention is contingent upon creating initiatives that decrease susceptibility to CVD. This is most effective when pursued indirectly through contributing factors that are open to change (Health Canada, 2003). Studies often consider modifiable risk factors in conjunction with immutable characteristics (e.g., age, gender, education) because of their theorized interaction to produce a given health outcome (German & Shapiro, 1997). Examples of such factors include health-promoting and health-risk behaviours, psychosocial elements (e.g., beliefs and attitudes), and use of healthcare services (including access, quality, and type) (German & Shapiro, 1997). For example, a prospective cohort study compared low CVD risk middle-aged men and women to their high CVD risk counterparts with respect to smoking behaviours, serum cholesterol and hypertension levels (Stamler, Stamler, Neaton, Wentworth, Daviglus, Garside, Dyer, Liu, & Greenland, 1999). Following these individuals over a 22 year period led to the researchers to conclude that the lifespan of individuals at low risk for CVD was

5.8 years longer than those at high risk. This research highlights the importance of minimizing risk to decrease mortality rates and increase longevity (Stamler et al., 1999).

The current research explores findings from the Cardiovascular Health Best Practice Project (CHBPP), an initiative that measured physical activity, body mass index, waist circumference, stress level, nutrition status, and health confidence as fundamental lifestyle factors in mid-life adults who were either at risk of or had been diagnosed with CVD (Wister, Loewen, Kennedy-Symonds, McGowan, McCoy, & Singer, 2007). Self-efficacy was conceptualized as 'health confidence' or control over health at both a general level and in the specific context of each of the lifestyle factors, including 'nutrition health confidence'. One-year follow-up of this lifestyle report card and telephone counselling intervention (see Chapter 5 for a full description) demonstrated a statistically significant increase in both nutrition level and health confidence for those at risk for CVD. As suggested by the expert patient model, both the individual and the physician likely play a role in patient health and thus the ideal intervention should involve a combination of self-management skills with professional support to ensure health-related behaviour change (Expert Patients Task Force, 2000 as cited in Wister et al., 2007). Wister and colleagues (2007) point out that we cannot specifically link the study results to either individual behavioural change through self-care or better medical treatment. Change in the subjective measure of health confidence, however, suggests that behavioural and/or psychosocial change did occur at the individual level. Self-efficacy in the specific context of nutrition is the central construct in this thesis, aiming to illuminate what factors, including the intervention, might contribute to nutrition behaviour change for participants in the primary prevention group of the CHBPP. This thesis therefore focuses entirely on behaviours that increase the risk of CVD in mid-life.

Nutrition and Risk Factors of Cardiovascular Disease

Why Focus on Nutrition?

On an individual level, nutrition has been linked to quality of life in the community-living aging population (Amarantos, Martinez, & Dwyer, 2001; Chernoff, 2001; Drewnowski & Evans, 2001; Keller, Ostbye, & Goy, 2004; Payette, 2005). Self-efficacy for health and dietary behaviour have been studied in the context of children, university students, families, individuals with established CVD, and individuals involved in cardiac rehabilitation programs (Gaughan, 2003). Thus, a focus on mid-life adults at risk for CVD provides a unique contribution to research in the area of nutrition. Further, viewing dietary behaviour as a modifiable factor in the prevention of CVD has the potential to suppress the frequent transition from autonomy to functional decline with age and in turn could decrease healthcare expenditures in this population (Payette, 2005).

Nutrition and Obesity

Obesity is often measured in research using the body mass index (BMI), a calculation that divides the weight of an individual in kilograms by their height in metres squared. The BMI is designed to compare relative weights of individuals while standardizing for different heights to determine health risk associated with body fat. While cost-effective and easily administered with minimal patient information, BMI scores can be interpreted differently in research and further assessments are often required to accurately determine health risk. Examples of such assessments include waist girth measurements and dietary evaluation executed by a healthcare professional. However, the vast majority of studies in this area use BMI as a measurement tool.

An abundance of research tells us that diet and exercise are important contributors to the likelihood of being obese. For example, an individual who consumes fruit and vegetables fewer than 3 times per day is more likely to be obese than someone who consumes these foods 5 or more times per day (CCHS, 2004). Using BMI scores over 30 kg/m^2 as an indicator of obesity, the CCHS (2004) found associations between excess weight and chronic conditions, including high blood pressure, diabetes and CVD. This relationship remained when controlling for age and socio-economic factors (e.g., education, income, marital status). Other initiatives using comparable measurement tools have also identified obesity in mid-life as a major risk factor for diabetes (Public Health Agency of Canada, 2006) and a 74% increased risk for future dementia (Whitmer, Gunderson, Barrett-Connor, Quesenberry, & Yaffe, 2005). As previously mentioned, recent national findings show that one third of middle-aged adults are obese (CCHS, 2004), demonstrating the need for nutrition research targeting this particular segment of the population.

Nutrition and Diabetes

Diabetes is a serious chronic disease that is the seventh leading cause of death in this country (Public Health Agency of Canada, 2006). In 2005, almost 120,000 Canadian males and 100,000 females aged 45-54 years were diagnosed by a healthcare professional as having diabetes (Statistics Canada, 2005). Ninety percent of Canadians with diabetes suffer from Type 2 or late-onset diabetes (Canadian Diabetes Association, 2000). The Framingham Heart Study collected longitudinal data for individuals aged 40-50 years, including diagnosis of diabetes, to determine the probability of morbidity free survival to age 85 (Terry, Pencina, Vasan, Murabito, Wolf, Hayes, Levy, D'Agostino, & Benjamin, 2005). Within a sample of 2531 men and women, none of those diagnosed with diabetes in mid-life survived to age 85. This shocking finding emphasizes the

importance of controlling weight and reducing the prevalence of obesity as a contributing factor in the diagnosis of diabetes.

Diabetic individuals can experience a wealth of long-term health complications; 19.8% will simultaneously suffer from CVD, and 60.3% will suffer from hypertension (Statistics Canada: Health Statistics Division, 2006). Most importantly, cases of Type 2 diabetes can be prevented and managed via good nutrition and regular physical activity. Poor diet has been linked to an increase in the incidence of Type 2 diabetes in younger adult men and women aged 35-55 (Kumari, Hea, & Marmot, 2004). Management of established diabetes requires controlling weight and blood sugar levels, both of which can be achieved by consuming a nutritious diet (CCHS, 2004).

Nutrition and Hypertension

There is a well-known direct relationship between all levels of blood pressure and CVD with the exception of the lowest levels. One in five adult Canadians suffer from hypertension, 42% of which do not know that they have it (Heart and Stroke Foundation, 2008). An initiative called Dietary Approaches to Stop Hypertension (DASH) is an example of a large-scale program to reduce risk of hypertension via dietary intake. Created by Vogt and colleagues (1999), DASH implemented a two month initiative involving feeding centres providing hypertensive participants with their meals and snacks. This design allowed researchers to control and measure the exact amount of nutrients ingested. This unique feature resulted in less measurement error than more traditional studies that rely on telephone interviews or questionnaires for dietary recall. Further, the meal plan designed in DASH was not unique to decreasing blood pressure; there was due consideration for what nutrients are best for prevention of other chronic diseases and therefore reflects overall adult nutritional needs. An implementation of the DASH intervention over an eight-week period was conducted on individuals aged 33-56

with a wide range of blood pressures (Appel, Moore, Obarzanek, Vollmer, Svetkey, Sacks, Bray, Vogt, Cutler, Windhauser, Lin, & Karanja, 1997). The study compared a diet that enhanced fruit and vegetable consumption and a combination diet (including high amounts of fruits and vegetables, low-fat dairy, low saturated fat, total fat and cholesterol) to a control group consuming the average American diet. Results found support for the hypothesis that the greatest decrease in blood pressure occurred for participants consuming the combination diet, followed by a smaller decrease for participants consuming mostly fruits and vegetables. Interestingly, decreases in blood pressure began within two weeks of the intervention and were maintained for the remaining weeks. Further, decreases in blood pressure levels were similar among men and women across different ethnic groups. Following a recommended diet therefore has implications for preventing and treating hypertension and subsequent CVD (Appel et al., 1997).

Social Determinants of Nutrition for Cardiovascular Health

Introduction to the Social Determinants of Health Model

Raphael (2004) defines the social determinants of health as "the economic and social conditions that influence the health of individuals, communities, and jurisdictions as a whole" that play a role in remaining healthy or becoming ill (p. 1). The physical, social, and personal resources of an individual that are needed to pursue personal goals and cope with life are a function of social determinants of health. Recent work by Marmot and Wilkinson (2006) highlights the need for public health initiatives to consider behaviours as potential causes for disease as opposed to biological markers. For example, this model focuses on diet (behaviour) as the cause of obesity as opposed to identifying the biological effect of a poor diet (e.g., high cholesterol) as the cause (Marmot, 2006). Going a step further, we can begin to identify causes of that behaviour.

As Marmot and Wilkinson (2006) point out, poor diets do not occur at random or by chance, they are a product of food supply, culture, affordability, availability, and other influences that must be identified to gain a full understanding of poor dietary habits. Food and diet-related lifestyle is therefore an important social determinant of health that is modifiable (Robertson, Brunner, & Sheiham, 2006).

Literature in the area of social determinants is most salient in Europe, particularly in the United Kingdom (e.g., Martikainen, Brunner, & Marmot, 2003). Despite our current understanding of this conceptual model, Canada lags behind in translating knowledge from social determinants to economic and public policy (Raphael, 2004). Offering a Canadian perspective, Raphael (2004) outlines the 11 social determinants of health in this country as per the York University *Social Determinants of Health across the Life Span* conference. These determinants comprise: aboriginal status, early life, education, employment and working conditions, health care services, housing, income and its distribution, social safety net, social exclusion, unemployment and employment security, and food security. Food insecurity as defined by McIntyre (2004) refers to "the inability to acquire or consume an adequate diet quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so" (p. 174). All of these determinants met certain criteria for inclusion, including importance to the health of Canadians, comprehensibility to Canadians, relevance to Canadian policy, and suitability to current active or inactive, yet scrutinized, Canadian policy (Raphael, 2004).

According to Bandura (1997; 2004), self-efficacy is a product of personal (e.g., age, gender, socio-economic status) and environmental influences (e.g., social support). In theory, self-efficacy is the greatest social cognitive determinant of healthy nutrition behaviour. The Social Determinants of Health Model provides the framework by which

the co-variates of self-efficacy and nutrition behaviour are organized in this research. Nutrition research typically focuses on women and children, though it is well known that many mid-life and older adults are at risk for poor nutrition. This thesis suggests mid-life as a gateway through which nutrition self-efficacy and subsequent positive nutrition behaviours can be carried into later life. Many individuals believe that mid-life brings halted development (e.g., one likely already has children and an established career); however, there is ample opportunity for growth and development at this stage of the life course (Bandura, 1997). Bandura (1997) assures that stabilization of family and career life only brings forth new ventures to pursue with resources accumulated thus far. We can view mid-life as an important phase where the social determinants of health remain influential and have the potential to alter health or illness in later life stages (Raphael, 2004). Despite the lack of focus on mid-life populations, researchers acknowledge the complexity of the nutrition-aging relationship and suggest that interventions target individuals as early as possible in adulthood (Bates, Benton, Biesalski, Staehelin, Van Staveren, Stehle, Suter, & Wolfram, 2002). The next section highlights key variables related to socio-demographics, general health status, social support, and healthcare utilization that are identified within recent literature as determinants of nutrition in mid-life and general adulthood.

Socio-Demographic Predictors of Nutrition Behaviour

Socio-demographic variables of interest in this thesis include age, gender, education, income, ethnicity, and marital status. Age is shown to be a more important predictor of nutritional status; the younger the individual, the less likely they are to be at risk (Murphy, Davis, Neuhaus, & Lein, 1990; Nickols-Richardson, Johnson, Poon & Martin, 1996). Opposite findings are identified in a small sample (n=247) of senior centre members aged 55-91 years where the youngest participants were at greater

nutritional risk (Keller & Hedley, 2002). Research looking at supermarket shopping habits found that the older the shopper, the more likely they were to purchase healthier foods and report having healthier diets (Anderson, Winett, & Wojcik, 2000). Younger adult women are more likely to have significantly compromised nutrition than men as indicated by lower nutrition scores (Keller & Hedley, 2002) and self-reported poor quality diets (Murphy et al., 1990). In contrast, more recent reports have shown adult women to self-report healthier diets than men (Johansson et al., 1999). A large-scale study of over 6,000 Finnish adults aged 25-64 found that 28% of women and only 16% of men adhere to healthy dietary guidelines (Roos, Lahelma, Virtanen, Prättälä, & Pietinen, 1998). With respect to age-related nutrition change, fibre and overall energy intakes tend to decrease with age in men and increase in women (Wakimoto & Block, 2001).

A positive relationship between education level and overall diet quality (e.g., consuming fruits, vegetables, and fibre) is demonstrated in adult men (Kant et al., 2000; Lynch, Kaplan & Salonen, 1997), as well as for both adult sexes (Anderson et al., 2000; Johansson, Thelle, Solvoll, Bjorneboe, & Drevon, 1999; Roos et al., 1998; Shatenstein et al., 2004; Wandel, 1995) and adults over age 65 (Keller, Ostbye, & Bright-See, 1997). Individuals with a higher education are also more likely to exert effort to eat well. Education levels can serve as a pathway to certain lifestyles or environments that affect nutritional status (Kant et al., 2000; Lynch, et al., 1997; Martikainen et al., 2003). Higher income levels have been associated with better nutrition scores (Keller et al., 1997) and greater adherence to recommended dietary guidelines in men (Roos et al., 1998). Other research has suggested that adults of higher socioeconomic status, while generally consuming healthier, more modern foods (fruits, vegetables, cheeses, candies) than those of lower status, do not necessarily comply with national dietary guidelines (Roos, Prättälä, Lahelma, Kleemola & Pietinen, 1996). Heart disease and stroke are the

two chronic illnesses that are the most affected by income differences in the Canadian population (Raphael, 2004).

Martikainen, Brunner, and Marmot (2003) identified six different clusters of dietary activities to examine socioeconomic nutrition patterns in middle-aged men and women living in the United Kingdom. In general, women were most likely to be characterized as 'very healthy eaters', consuming low quantities of less nutritious foods (e.g., cream, butter, sugar, pastries, and beer), moderate quantities of wine, and high quantities of fish and whole wheat bread. Women were least likely to be characterized as 'sweet unhealthy eaters' (consuming high quantities of less nutritious foods and low quantities of fruits and vegetables). Ethnic minorities (i.e., non-white and non-European) were more likely to consume the 'unhealthy' and 'very unhealthy' diets. Participants with low education and low income levels were more likely to consume 'unhealthy' and very 'unhealthy diets'. Participants with higher education and income levels were more likely to consume the 'French diet', a relatively healthy choice involving average consumption of moderately and less nutritious foods (e.g., white bread, wine, and pastries) and high consumption of nutritious foods. Among unmarried participants, men were more likely to consume the unhealthy diets and women were more likely to consume a moderately healthy diet. Martikainen and colleagues (2003) suggest that unhealthy behaviours are collective in nature. For example, individuals with lower education were more likely to smoke and to be physically inactive in addition to making poor dietary choices. Moreover, lower income groups have limited financial access to nutritious foods and are more likely to purchase cheaper, less nutritious foods (James, Nelson, Ralph, & Leather, 1997; Martikainen et al., 2003; McIntyre, 2004; Murphy et al., 1990; Wandel, 1995) and characterize their households as having food insecurity (Vozoris & Tarasuk, 2003).

Further research shows a positive relationship between having and living with a spouse and dietary quality for individuals aged 50-64 (Davis, Murphy, Neuhaus, Gee, & Quiroga, 2000) and for all adults aged 25-64 (Roos et al., 1998). Associations of this type are typically stronger for men (Roos et al., 1998). This relationship was demonstrated for individuals across all ethnic groups, but was most significant among non-Hispanic Caucasians. Women had the lowest nutrient intake if they were living with someone (not their spouse) or living alone, while men had the lowest intake if living in any type of arrangement other than with their spouse (Davis et al., 2000). Researchers have speculated that healthier individuals are more desirable and therefore more likely to marry, stay married, or re-marry, and thus benefit from the care and support of their spouse needed to remain healthy (Grundy & Sloggett, 2003). The least nutritious dietary habits have been shown for individuals who were previously married (Roos et al., 1998). Interestingly, one study discovered that the healthiest adult women had never married, suggesting the importance of outside sources of support and health (Grundy & Sloggett, 2003).

General Health Status and Nutrition Behaviour

A relationship between low socio-economic status and poor general health as well as lower perceived control has been documented (Grembowski et al., 1993; Rodin, 1986). Some research suggests that adult women are more likely to self-report lower levels of overall perceived health than their male counterparts (Denton et al., 2004), while others report positive associations between perceived health and diet quality for both genders aged 65+ (Keller et al., 1997). Women living with a spouse are more likely to report higher levels of perceived health compared to those living with others (e.g., friends, other family members) or living alone (Davis et al., 2000). Further, belief that health status is a function of food choice has been positively associated with diet quality in women

(Shatenstein et al., 2004). Individuals who feel they have little or no control over their health are more likely to consume sweet, unhealthy, and very unhealthy diets (Martikainen et al., 2003). In a sample of adults over 20 with a mean age of 44 (men) and 45 (women), a positive relationship was found between age of the participant and self-reported functional health (Denton et al., 2004). Research has also demonstrated a significant relationship between risk of food insecurity and low perceived health (Vozoris & Tarasuk, 2003).

Social Support and Nutrition Behaviour

Social support is a term often defined as "encompass[ing] emotional, instrumental, and informational aid received by individuals from the members of their networks" (Ford, Ahluwalia, & Galuska, 2000, p. 89). Social support has been linked to functional health (e.g., cognition, mobility, vision) in adult women (Denton et al., 2004). Examining all adults over the age of 18, Ford and colleagues (2000) concluded that there is a positive relationship between adequate consumption of fruits and vegetables and quantity of organizational and individual relationships. Individuals living in households with insufficient food or food quality are more likely to report poor levels of social support (Vozoris & Tarasuk, 2003). In a Canadian study of adults aged 55-74, greater social support was associated with superior diet quality (Shatenstein et al., 2004). A similar Canadian study identified the same relationship in adults over 65 years of age (Keller et al., 1997). Interestingly, this study also reported an association between diet quality and the belief that changing diet behaviours affects health outcomes in males only (Keller et al., 1997). Social support from family, friends, and co-workers measured at baseline in a sample of adults aged 18-70 was found to be a predictor of fruit and vegetable intake over one year when controlling for socio-economic factors and baseline food intake (Steptoe, Perkins-Porras, Rink, Hilton, & Cappuccio, 2004). This important

relationship was present independently for participants in a nutrition behaviour counselling group and those in a nutrition education group (Steptoe et al., 2004).

Similar to the concept of self-efficacy, it is important to examine social support in the context of specific domains (Janevic, Janz, Dodge, Wang, Lin, & Clark, 2004). Kummell and colleagues (2002) identified support from others as the most helpful factor in making dietary changes in women aged 20-55, particularly when individuals can relate to one another over a common interest: the goal of being heart-healthy. Relating over a common interest is a type of social support often referred to as mutual aid, whereby individuals are involved in a reciprocal exchange of support, typically in the context of a support group (Gottlieb, 2000). According to Gottlieb (2000), there are three components of mutual aid: social learning, social comparison, and supportive social exchanges. The nature of a support group is to facilitate the exchange of problem-solving strategies and self-help techniques, promoting engagement in pro-active behaviours related to health. In theory, the concept of mutual aid could have a positive effect on an individual by providing an opportunity for disclosure and validation of CVD risk-related experiences and how others have exerted control over their risk factors, in turn enabling processes of self-care (Gottlieb, 2000).

Healthcare Utilization and Nutrition Behaviour

Research considering all age groups has demonstrated that patients at risk for malnutrition upon hospital admission experienced a 50% longer hospital stay (in days) and 36% higher hospitalization costs than patients who were not at risk (Chima, Barco, Dewitt, Maeda, Teran, & Mullen, 1997). Interestingly, comparing at-risk and not-at-risk groups did not show a difference in the amount of hospitalizations up to one year after initial admission. At-risk patients were more likely to undergo interventions during their hospital stay (including provision of dietary supplements, nourishment between meals,

and changing dietary habits); however this group was still more likely to be discharged as needing home care than those who were not-at-risk (Chima et al., 1997). Another study found similar results within the 65+ population, whereby over 40% of the 108 participants were assessed as at-risk for malnutrition upon admission and presence of malnutrition was associated with significantly longer hospital stay (Chung & Sohn, 2005). Examining national data, researchers have found a positive association between BMI and length of hospital stay for individuals over 25 years of age with a BMI over 25 kg/m^2, with the highest number of days for individuals in the over 35 kg/m^2 BMI grouping ('normal' BMI levels range between 18.5 and 24.5 kg/m^2) (Zizza, Herring, Stevens, & Popkin, 2004). Overall, there is currently a lack of information regarding nutrition behaviour and healthcare use in the mid-life population (e.g., hospitalization, doctor visits).

Summary of Literature Review

Many studies have focused on the concept of self-efficacy generally as it relates to overall well-being. Progression of this research has led to the consideration of self-efficacy in a more specific context as suggested by the SCT (Bandura, 1997), yet a review of the literature suggests that the application to the mid-life population at risk for CVD is limited. The need to focus on domain-specific aspects of control is also present to a greater degree when studying aging (Bandura, 1997). The process of aging may lead to a diversification of self-efficacy across many domains, for example, physical activity, occupational status, social support, and health status. The heterogeneity of the adult population suggests that research should study self-efficacy in more specific domains given the potential for variability across contexts (Bandura, 1997). The link between nutrition and CVD risk is pertinent in the literature and self-efficacy for dietary behaviour is therefore an appropriate avenue for domain-specific examination of this

construct. This understanding is used to formulate hypotheses surrounding the relationship between self-efficacy and dietary behaviour in the next chapter.

Further, using the social determinants of health model, we can approach mid-life as a gateway through which positive self-efficacy and behaviours can be promoted in a nutrition context to reduce the presence of CVD risk factors. Thus, the key social determinants reviewed here are examined as co-variates of self-efficacy and nutrition behaviour.

Chapter 4: Hypotheses

There are two components to this thesis. The first component tests hypotheses based upon research that advocates the need for a domain-specific focus on health-related constructs in the mid-life population at risk for CVD. This study therefore compares the construct of self-efficacy in a general health context and specifically in the context of nutrition. Analysing longitudinal intervention data, one-year changes in general and nutrition self-efficacy as well as nutrition as a form of dietary behaviour (referred to as nutrition behaviour) will be examined. Thus, for the mid-life sample at risk for CVD, the following hypotheses will be tested:

1. *General health* self-efficacy change is hypothesized to have a positive relationship with nutrition behaviour change over time when controlling for other factors.
2. Similarly, *nutrition* self-efficacy change is hypothesized to have a positive relationship with nutrition behaviour change over time when controlling for other factors.
3. The relationship in hypothesis #2 will be stronger than the relationship in hypothesis #1.

To expand on the above statements, it is hypothesized that individuals with higher general health self-efficacy and/or nutrition self-efficacy are more likely to experience positive change in nutrition behaviour over time than individuals with lower self-efficacy, irrespective of being in the intervention or in the control group. Conversely, it is hypothesized that individuals with lower general health-self efficacy and/or nutrition

self-efficacy will be more likely to experience negative nutrition behaviour change over time as compared to those with higher self-efficacy, irrespective of treatment group. It is also hypothesized that the relationships between nutrition self-efficacy and nutrition behaviour change over time will be stronger than the relationships involving general health self-efficacy. It is predicted that this component of the research will lend support for the reciprocal relationship between cognition as a personal factor (self-efficacy) and behaviour (nutrition) outlined in the Social Cognitive Theory developed by Bandura (1977).

The second component of this research will further explore the above relationships by introducing co-variates drawn from the social determinants of health model, including socio-demographic variables, overall health status, and specific measures of social support and healthcare utilization. It is predicted that the associations resulting from this research will therefore support the application of the social determinants of health model to the mid-life population at risk for CVD. The next chapter will provide a more detailed description of the analysis.

Chapter 5: Methodology

This chapter includes two sections, the first of which provides a general overview of the intervention study used in this thesis (The Cardiovascular Health Best Practice Project [CHBPP]) and a description of the study sample and intervention characteristics. Next, an outline of the statistical analyses conducted in this thesis will be provided, as well as a description of the measurement of the dependent and independent variables used and the protocol for handling missing data.

The Cardiovascular Health Best Practice Project (CHBPP)

Overview

The methodology involves secondary data analysis of the Cardiovascular Health Best Practice Project (CHBPP) (Wister, Loewen, Kennedy-Symonds, McGowan, McCoy, & Singer, 2007). Funded by the Canadian Institutes of Health Research, this research project sought to test a lifestyle intervention designed to reduce the risk of CVD for mid-life individuals. The CHBPP is unique to research on CVD because it addresses gaps in current literature with respect to maintenance of behaviour change through collection of longitudinal data. Participants in this randomized controlled trial were divided into two groups: those at the primary prevention stage of CVD (a Framingham risk score of 10% or higher) and those in the secondary prevention stage of CVD (previously diagnosed with coronary artery disease). The Framingham methodology provides a global risk level and includes risk factors such as systolic blood pressure, diabetes, smoking status, and cholesterol (CCHS, 2005; Genest et al., 2003 as cited in Wister et al., 2007; Grundy et al.,

1999; Wilson et al., 2002). The current research uses the data collected for the primary prevention group of participants.

Sample Characteristics

Participants were recruited via physicians, mail-outs, media, and community notices within the Fraser Health Region which is currently the largest health region in British Columbia, encompassing approximately 1.5 million individuals (see Wister et al., 2007 for more information). There were a total of 315 participants in the primary prevention group at baseline. All participants were between 45 and 64 years of age when the study began, with a mean age of 55. Participants were also selected based upon their cardiovascular risk profile as determined by current literature on primary and secondary prevention of CVD. A flowchart illustrating the movement of the primary prevention group participants through the study process can be found in Appendix A. Of the 315 participants, 131 are male and 184 are female. The average level of education for this sample was "completion of some community college, university, or nursing school or holding a diploma or certification in a trade, technical, vocational school or business college". The average annual household income category was "$40,000 to $59,999". Approximately 63% of participants were married at the time of the study and 73% were born in Canada.

The CHBPP Intervention

There are two elements to the CHBPP intervention, the first of which is the Simon Fraser Heart Health Report Card System, whereby fundamental lifestyle factors (physical activity, body mass index, waist circumference, stress level, health confidence, and nutrition status) were chosen based on expert panel reviews and were graded using a letter system (A, B, C, D, F). Current literature on CVD provided the basis for risk scores

for each lifestyle factor and behavioural theory provided the desired level of improvement for each participant. Researchers gave each participant and his or her family doctor a copy of this report card. The second component of the intervention involved the Telehealth counselling approach, whereby two clinical lifestyle counsellors contacted participants in the intervention group ten days after receiving their report card and every six months thereafter (more frequent contact was provided for participants who smoke). Telephone sessions provided participants with knowledge of CVD prevention, which intended to motivate them to engage in positive health-related behaviours. Individually tailored telephone sessions focused on the lifestyle factors of each participant in order of priority for lifestyle counselling based on literature. Top priority for the sessions was smoking, followed by physical activity, dietary habits, weight management, and lastly, stress. If a participant were a smoker ready to quit the habit, the telephone counsellors provided extra 20-30 minute sessions in addition to the intervention during weeks 2, 4, 8 and 12. In contrast, the control group received typical physician care as determined by the participants. Collection of baseline and follow-up data occurred annually using the telephone survey method. Exposure to the intervention is included in the current research as a major predictor of nutrition behaviour change.

The primary outcome variable for the CHBPP was the Framingham global score for cardiovascular risk. Upon analysis of baseline and 1-year data, the primary prevention group underwent a statistically significant reduction in global risk score for cardiovascular risk. Total cholesterol and systolic blood pressure levels determined by a physician showed statistically significant improvement, as did nutrition level (measured in the questionnaire as food consumption according to Canada's Food Guide) and health confidence. The lifestyle factor of health confidence measured in the CHBPP is equated with the concept of self-efficacy in this thesis due to the nature of measurement of this

factor (to be described later). These improvements remained upon introduction of co-variates, including age, sex, education, income, and a measure of general health (36-item short-form general health survey).

Statistical Analysis and Design

Overview

The main statistical technique used in this analysis is hierarchical logistic regression. This particular technique was chosen because it allows modelling of the outcomes of a skewed dichotomous dependent variable such as the one used in this study (DeMaris, 1995; Pallant, 2007; Tabachnick & Fidell, 2007). In contrast, a multiple regression requires a continuous dependent variable in the analysis. Further, both categorical and continuous independent variables can be used simultaneously within logistic regression models. There are assumptions associated with logistic regression, including sample size. Testing a model with a large number of predictor (independent) variables with a small sample size may not yield accurate relationships between variables. It is therefore important to examine the frequencies of each variable in the analysis and to collapse or discount categories with a small number of participants (Pallant, 2007). For the purposes of this analysis, categories with less than 25 participants were collapsed into the next category.

In logistic regression, interpretation of results includes the use of beta coefficients that are presented in log format. Taking the exponential value of a beta coefficient [Exp(B)] yields a simplified odds ratio that is interpreted differently based on the nature of the variable. For continuous independent variables, the odds ratio describes the estimated factor change of a positive response for participants who are one unit apart. The same is true for categorical variables; however in this case participants are being

compared to a reference category. When an odds ratio is a value between 0 and 1, smaller values indicate increasing odds. For example, an odds ratio of 0.5 for gender means that being female, compared to male (reference category) decreases the likelihood of experiencing nutrition behaviour change by a factor of 0.5. The statistical package for the social sciences (SPSS), version 16.0, was used for statistical calculations.

Each of the four logistic regression models includes five blocks encompassing ten independent variables. The independent variables are organized hierarchically into the blocks based on logic and a review of the literature. Logistic regression tests the blocks in a step-wise fashion, with each block controlling for the next. Whether or not a participant was randomly placed into the intervention group or the control group of the CHBPP is controlled for by placing this variable in the first block. Exposure to the intervention is expected to have an effect on nutrition behaviour and therefore needs to be taken into account. The main independent variables of nutrition self-efficacy change and general health self-efficacy change are placed in the second block, each in distinct analyses. Entering the main independent variables of interest at the beginning of each model allows us to determine whether or not this variable acts as a predictor of the dependent variable and how this potential relationship may be affected by subsequently entered variables. Socio-demographic factors were placed in block three (including age, sex, education, income, and marital status). Block four includes the overall score of the short-form general health survey. The fifth and final block includes mutual aid as a measure of social support and the number of family physician visits as a measure of healthcare utilization. The measurement of the dependent and independent variables will be described in the section to follow.

Measurement

Dependent Variable

Nutrition as a form of dietary behaviour is referred to as 'nutrition behaviour' in this thesis and is the dependent variable for the analysis. This variable was measured at baseline and at one-year follow-up in the participant report card. The clinician gave each participant a nutrition behaviour letter grade of A, B, C, D, or F based upon the number of servings consumed of each category in Canada's Food Guide. These categories include fruits and vegetables (5-10 servings per day), meat and alternatives (2-3 servings per day), dairy (2-4 servings per day), and breads and grains (5-12 servings per day) (Wister et al., 2007). A letter grade of 'A' was assigned to participants who consumed foods from all four categories within the recommended range. A grade of 'B' was assigned to those consuming foods from three categories within range, 'C' for two categories, 'D' for only one category, and finally, 'F' for those who did not consume foods from any categories within the recommended range. Letter grades were then equated with a numerical score (A=1, B=2, C=3, D=4, F=5) and baseline measures were subtracted from follow-up measures to yield a negative, neutral, or positive nutrition behaviour change score. Using the three categories of nutrition behaviour change scores, two dichotomies were created for the purposes of the analysis: negative versus no change (dichotomy 1) and positive versus no change (dichotomy 2). A relatively large proportion of participants underwent no change, and this group therefore served as a reference group. The 'negative change versus no change' and the 'positive change versus no change' groups were used in distinct logistic regression analyses.

Table 5.1: Frequency Distributions for the Dependent Variables in Logistic Regression Analyses

Dependent Variables	Coding	Frequency	Valid %
Nutrition Behaviour Change (Dichotomy 1)	0 = No Change 1 = Negative Change	124 104 Cases Removed (Positive change group): 87	39.4 33.0 27.6
Nutrition Behaviour Change (Dichotomy 2)	0 = No Change 1 = Positive Change	124 87 Cases Removed (Negative change group): 104	39.4 27.6 33.0

Independent Variables

The baseline response for each independent variable was used with the exception of the main independent variable of self-efficacy change (to be discussed). For clarity, these variables are listed according to how they were entered into the logistic regression models. Certain independent variables were deleted from the regression models throughout the process, yielding a simplified model used in the final analysis. Elimination of independent variables was executed as a result of the small sample size of this study to ensure that existing relationships were not masked.

Treatment Group

The first block in the model includes treatment group, whereby participants were identified as either undergoing normal treatment (control group) or undergoing the intervention (intervention group) for cardiovascular risk.

Main Independent Variable

The main independent variable in this analysis is self-efficacy change. This variable is examined separately in both a general health and a nutrition context. For the purposes of this thesis, the lifestyle factor of health confidence is considered a measure of self-efficacy. Health confidence was measured in the CHBPP using Likert scales to pose the following questions: "*How good of a job do you feel that you are doing in taking*

care of your general health? Would you say 1 (poor), 2 (fair), 3 (good) or 4 (excellent)?" and "*How much control do you think you currently have over making healthy nutritional choices? Would you say 1 (no control), 2 (a little control), 3 (moderate control), or 4 (complete control)?"* Although there are other measures of these concepts, including multiple-item scales, the items used for measuring general health and nutrition self-efficacy have been used in other research (Wister et al., 2007). It is assumed that these measures have adequate levels of reliability and validity. Change scores between baseline and follow-up for each participant were calculated. Measurement of change in this psychological independent variable over time is a unique contribution of this study to a wealth of cross-sectional nutrition research. Researchers in the field of nutrition have suggested that while psychological measures may be associated with food intake when measured at baseline, this alone may not predict future nutrition behaviour change (Steptoe et al., 2004). Participants are often susceptible to overestimation of their level of self-efficacy and a more accurate assessment of this construct often requires an adjustment period over time. For example, an individual may feel a high nutrition self-efficacy for eating a balanced diet in theory; however, this assessment may change when someone is put to the test. The same view of psychological variables is often adopted in the large body of literature on self-efficacy and physical activity (e.g., McAuley, Lox, Rudolph, & Travis, 1994). Results from the self-efficacy change scores yield three distinctive groups: positive change, no change, and negative change in self-efficacy over time.

Socio-demographic Factors

Socio-demographic factors include age, sex, education, income, and marital status. The age range of participants was 44-65 with an average of 55 years old. The focus of this study is the middle-aged population and age effects are therefore irrelevant.

Age remained an interval variable for the purposes of the analysis. The education and income variables were both collapsed for simplicity into three distinct categories. Looking at marital status, many studies dichotomize this variable into married/not married. However, the support from a significant other when making nutritional choices can be present in common law relationships as well as when living with a partner. Research has extended the view of marriage as simply a legal union to suggest the use of marital status as a proxy for social support (Kuper & Marmot, 2003). For the purposes of this analysis, marital status therefore provides a measure of potential presence or absence of social support from a significant other and is dichotomized as "married/common law/living with a partner" or "single/widowed/separated/divorced".

Short-Form 36 (General Health Survey)

The overall score for the short-term health survey is one of the most commonly accepted measures of quality of life and has been extensively tested for reliability and validity in previous research (Amarantos et al., 2001). This measure is a compilation of responses from eleven questions regarding a variety of health-related factors. Questions address general health and limitations imposed on physical functioning as a result of health status (e.g., walking more than a mile, lifting or carrying groceries). Social functioning is addressed by asking respondents whether their physical or emotional health has limited or interfered with normal social activities (e.g., with family, friends, neighbours, or groups). Physical role limitations are also addressed with respect to having difficulty accomplishing tasks without exerting extra effort. The same question is posed for emotional health as limiting roles at work or during daily life. Current level of bodily pain is assessed on a six-point scale ranging from no pain to very severe pain. General mental health and vitality are addressed by asking respondents to rank how often they experience a given feeling (e.g., nervous, happy, tired). The final question

contributing to the overall SF-36 score includes perceived health, asking respondents how they identify with the following statement: "*My health is excellent.*" The original logistic regression model for this study included each component of the SF-36 score as a separate entity. For simplicity and in order to achieve the maximum reduction in degrees of freedom for this small sample size, the decision was made to include the overall SF-36 score as representative of each component.

Health Behaviours

The measure of social support chosen for the analysis is mutual aid, asking participants to estimate how often they discuss their health condition(s) with another person who has a similar condition. In the interest of reducing degrees of freedom, this variable was dichotomized into yes/no responses indicating a presence or an absence of mutual aid. In this analysis it is assumed that interactions between individuals with similar health-related experiences may result in more supportive and empathetic relations than measures of social support networks.

The last independent variable entered in block five addresses an element of healthcare utilization. Respondents were asked how often in the past three months had they seen or talked to a variety of healthcare professionals, including their family physician, physiotherapist, and naturopathic physician, among others. Due to the small number of responses for different healthcare professionals, only visits or conversations with a family physician were considered.

Variables Removed from the Analysis

The variable of ethnicity contained many small categories (some with n=1) identifying distinct ethnic backgrounds which could not be logically collapsed. Determining ethnicity by asking a participant whether he/she was born in Canada

provided only a crude measure of this variable and it was therefore removed from the final analysis.

The link between obesity and nutrition and nutrition behaviour is broadly acknowledged whereby poorer dietary habits (e.g., overconsumption of unhealthy foods) may contribute to an expanding waistline. Waist circumference measured at baseline by the clinician (in centimetres) was originally included in the analysis as an interval variable to determine whether this measure might play a role in the hypothesized relationship between self-efficacy and nutrition behaviour change over time. In the interest of decreasing degrees of freedom and reducing the number of model blocks for logistic regression, waist circumference was removed from the analysis. A second measure of health history was also originally included; a yes/no response for previous maternal, paternal, and sibling heart health was entered into the analysis as three separate questions and in a separate analysis as a combination variable. Descriptive statistics show that more than two thirds of responses were 'no'. By posing a question in this manner we are unable to capture important details such as whether or not the participant identifies with these particular family members. Therefore, no health history variables were entered into the final regression models.

Amount of social support from family and friends was also measured in the CHBPP. While this question addresses the quantity of social support received by an individual, it fails to capture the quality of such support and this variable was therefore dropped from the analysis. The number of confidants an individual has was determined using a scale where answers varied from zero to thirty confidants. This variable was also removed based on the notion that while having thirty confidants is quantitatively higher than having a single confidant, it is impossible to compare these responses without measuring quality of interactions.

Lastly, participants were asked whether or not they had been hospitalized in the past three months. Subsequent open-ended questions addressed the reason for this hospitalization and the number of days spent in hospital. These follow-up responses are therefore inappropriate for quantitative analysis. A simple yes/no response to hospitalization in recent months provides only a crude measure of healthcare utilization and this variable was not included in the final analysis.

Table 5.2 below provides the frequency distributions for all independent variables used at different stages throughout the analysis. The shaded rows represent variables dropped from the final regression models.

Table 5.2: Frequency Distributions for Independent Variables in Logistic Regression Analysis

INDEPENDENT VARIABLES	CODING	FREQUENCY	VALID %
Group	1=Control 2=Intervention	157 158	49.8 50.2
Main Variables Nutrition Self-Efficacy Change	0=No Change 1=Negative Change 2=Positive Change	178 53 84	56.5 16.8 26.7
General Health Self-Efficacy Change	0=No Change 1=Negative Change 2=Positive Change	86 84 145	27.3 26.7 46.0
Socio-demographic Factors Age	Interval Variable	315	100.0
Sex	1=Male 2=Female	131 184	41.6 58.4
Education	1=Secondary School Graduation or Less 2=Some/Diploma/Certificate from College, Nursing, Trades 3=Undergraduate or Graduate/Professional Degree	83 148 84	26.3 47.0 26.7
Income	1=<$39,999 2=$40,000-$79,999 3=$80,000+	93 144 78	29.5 45.7 24.8
Marital Status	1=Married/Common Law/Living with Partner 2=Single/Widowed/Separated/ Divorced	211 104	67.0 33.0
Ethnicity (Born in Canada)	1=No 2=Yes	86 229	27.3 72.7
Health Status/History Waist Circumference	Interval Variable	315	100.0
Family History of Heart Problem Mother	1=No 2=Yes	280 35	88.9 11.1

INDEPENDENT VARIABLES	CODING	FREQUENCY	VALID %
Father	1=No 2=Yes	265 35	84.1 15.9
Sibling	1=No 2=Yes	282 33	89.5 10.5
Short-Form 36 General Health Survey (Overall Score)	Interval Variable	315	100.0
Health Behaviours Social Support	 1=None/Slight Support 2=Moderate Support 3=Quite a bit of Support 4=Extreme Support	 44 71 140 60	 14.0 22.5 44.4 19.0
Mutual Aid	1=No 2=Yes	77 238	24.4 75.6
# of Confidants	0=No Confidants 1=One Confidant 2=Two Confidants 3=Three Confidants 4=Four Confidants 5=Five or more Confidants	19 50 117 57 31 41	6.0 15.9 37.1 18.1 9.8 13.0
Hospitalization (in last 3 months)	1=No 2=Yes	285 30	90.5 9.5
# of Family Physician Visits (in last 3 months)	1= Zero/One Visit 2=Two Visits 3=Three Visits 4=Four or more Visits	136 85 45 49	43.2 27.0 14.3 15.6

Missing Data

Tabachnick and Fidell (2007) describe missing data as a persistent problem in statistical analysis, particularly when working with a longitudinal study where attrition can occur. Missing data can also result from participant non-responses or human error (e.g., incorrect data entry). Depending on the magnitude of missing cases, this issue can be dealt with in a variety of ways. There were a total of 37 participants lost to follow-up in the CHBPP data; 20 participants from the intervention group and 17 from the control group. Missing data for the independent variables was imputed as part of the original analysis to maintain the sample size (n=315) (see Wister et al., 2007 for further detail). Thus, there were very few missing cases for the variables examined in this thesis. Small amounts of missing data can be dealt with appropriately using mean and modal imputation methods (Tabachnick & Fidell, 2007). This method is described as conservative, as it does not change the distribution of a variable as whole and avoids speculation. This technique was executed based upon the rule that missing data for interval variables is imputed to the mean, while missing data for ordinal and nominal variables is imputed to the mode or most frequently occurring response (Tabachnick & Fidell, 2007). The raw dependent variable was examined and the missing values were therefore recoded to the most frequently occurring response: no nutrition behaviour change.

Chapter 6: Results

This chapter presents the results from the bivariate and multivariate analyses. First, statistically significant bivariate relationships between the main independent and dependent variables will be examined. Then, the four logistic regression models will be discussed in the context of the hypotheses made in Chapter 4. Finally, exploratory results of the relationship or lack of relationship between the remaining independent variables and the dependent variable will be discussed.

Bivariate Analysis

Bivariate analyses are used in this study to determine relationships (or lack thereof) between the dependent variable (nutrition behaviour change: negative versus no change [1] and positive versus no change [2]) and the independent variables. Statistically significant relationships are interpreted using Chi square statistics. From this interpretation it is possible to either accept or reject the null hypothesis indicating that no relationship exists. Rejection of a null hypothesis can therefore provide support for the alternative hypotheses outlined in Chapter 4. For simplicity, only the results from the bivariate cross-tabulations between the main independent variables and the dependent variable will be discussed below. Note that within results tables, NS=not statistically significant. Table 6.1 shows the relationship between nutrition behaviour change (negative versus no change) and general health self-efficacy change over time. This relationship is not statistically significant. The null hypothesis is accepted; therefore this finding does not support the first hypothesis whereby a positive relationship was predicted.

Table 6.1: Cross-Tabulation of Nutrition Behaviour Change Dichotomy 1 (Negative vs. No) and General Self-Efficacy Change

		General Self-Efficacy Change			
		No Change	Negative Change	Positive Change	Total
Nutrition Behaviour Change Dichotomy (Negative versus No)	No Change	34 57.6%	38 59.4%	52 49.5%	124 54.4%
	Negative Change	25 42.4%	26 40.6%	53 50.5%	104 45.6%
	Total	59 100.0%	64 100.0%	105 100.0%	228 100.0%

(Chi Square=1.89, NS)

Table 6.2 below demonstrates the relationship between nutrition behaviour change (positive versus no change) and general self-efficacy change over time. Again, this relationship is not significant and the null hypothesis is therefore accepted. This finding does not support the relationship predicted in hypothesis #1.

Table 6.2: Cross-Tabulation of Nutrition Behaviour Change Dichotomy 2 (Positive vs. No) and General Self-Efficacy Change

		General Self-Efficacy Change			
		No Change	Negative Change	Positive Change	Total
Nutrition Behaviour Change Dichotomy (Positive versus No)	No Change	34 55.7%	38 65.5%	52 56.5%	124 58.8%
	Positive Change	27 44.3%	20 34.5%	40 43.5%	87 41.2%
	Total	61 100.0%	58 100.0%	92 100.0%	211 100.0%

(Chi Square=1.51, NS)

The cross-tabulation of the relationship between nutrition behaviour change and nutrition self-efficacy change was only significant using one of the two behaviour

dichotomies. Table 6.3 shows the relationship between negative and no nutrition behaviour change and nutrition self-efficacy change over time (Chi Square=.17, NS). This relationship is not statistically significant, and the null hypothesis is accepted. This finding does not provide support for hypothesis #2, predicting a statistically significant relationship between nutrition behaviour change (negative versus no change) and nutrition behaviour change over time.

Table 6.3: Cross-Tabulation of Nutrition Behaviour Change Dichotomy 1 (Negative vs. No) and Nutrition Self-Efficacy Change

		Nutrition Self-Efficacy Change			
		No Change	Negative Change	Positive Change	Total
Nutrition Behaviour Change Dichotomy (Negative versus No)	No Change	62 51.2%	17 47.2%	45 63.4%	124 54.4%
	Negative Change	59 48.8%	19 52.8%	26 36.6%	104 45.6%
	Total	121 100.0%	36 100.0%	71 100.0%	228 100.0%

(Chi Square=.17, NS)

The cross-tabulation in Table 6.4 shows a statistically significant relationship between nutrition self-efficacy change and positive or no nutrition behaviour change (Chi Square=11.738, $p<.01$). This relationship is moderate and negative.

Table 6.4: Cross-Tabulation of Nutrition Behaviour Change Dichotomy 2 (Positive vs. No) and Nutrition Self-Efficacy Change

		Nutrition Self-Efficacy Change			
		No Change	Negative Change	Positive Change	Total
Nutrition Behaviour Change Dichotomy (Positive versus No)	No Change	62 52.1%	17 50.0%	45 77.6%	124 58.8%
	Positive Change	57 47.9%	17 50.0%	13 22.4%	87 41.2%
	Total	119 100%	34 100%	58 100%	211 100%

Chi Square=11.74, p<.01

Percentage differences in the above table show that participants who experienced a positive change in nutrition self-efficacy (77.6%) have a higher probability of no change in nutrition behaviour over time than individuals who experienced no change in nutrition self-efficacy (52.1%). Similarly, those who experienced a positive change in nutrition self-efficacy (77.6%) have a higher probability of no change in nutrition behaviour than those who experienced negative nutrition self-efficacy change (50.0%). Participants with positive nutrition self-efficacy change (22.4%) are less likely to undergo positive nutrition behaviour change as compared to those undergoing negative nutrition self-efficacy change (50.0%). Based on this statistically significant finding, the null hypothesis is rejected. This finding provides support for hypothesis #2, predicting that nutrition self-efficacy is associated with nutrition behaviour change over time. However, the direction of this relationship is contradictory to the positive relationship predicted.

Summary of Bivariate Cross-Tabulations

Results from the bivariate cross-tabulations did not provide support for the hypothesized association between general self-efficacy change and nutrition behaviour change over time (hypothesis #1). However, the literature suggests that other variables

(e.g., socio-demographic factors, mutual aid) could act as co-variates, warranting further examination of this potential relationship via multi-variate analysis. Further, although the relationship between nutrition self-efficacy change and positive nutrition behaviour change is statistically significant, the direction of that relationship is the opposite of that predicted. Overall, the findings also provide support for hypothesis #3, predicting that the relationship between a domain-specific measure of self-efficacy change and nutrition behaviour change is stronger than the relationship between general self-efficacy and nutrition behaviour change. Thus, findings at the bivariate level advocate the use of domain-specific nutrition self-efficacy in the context of nutrition behaviour in mid-life adults at risk for CVD.

Multivariate Analysis

Results from the logistic regressions executed in the analysis will be presented here. As previously described, the dependent variable is examined as two dichotomies of nutrition behaviour change: negative versus no change (1) and positive versus no change (2). There are two distinct main independent variables of interest measuring self-efficacy change in the contexts of general health and nutrition. These change variables were created by subtracting follow-up scores from baseline scores. The rationale for using change scores extends to the scarcity of longitudinal research in the area of nutrition and CVD risk in mid-life persons. Therefore there are a total of four logistic regressions presented (see Figure 6.1 for illustration) followed by a brief summary of the results.

Figure 6.1: Logistic Regression Model

Block 1:	⇨ Block 2: Main IV	⇨ Block 3: Socio-Demo-graphic Factors	⇨ Block 4: Overall Health Status	⇨ Block 5: Health Behaviour	⇨ DV: Nutrition Behaviour Change
Treatment Group	1) General Health Self-Efficacy or 2) Nutrition Self-Efficacy	-Age -Sex -Education -Income -Marital Status	-Short-Form General Health Survey Overall Score	-Mutual Aid -Number of family physician visits	1) Negative vs. No Change or 2) Positive vs. No Change

IV=Independent Variable; DV=Dependent Variable

Logistic Regression Nutrition Behaviour Dichotomy 1: Negative vs. No Change

Analysis 1

The first analysis uses *general health self-efficacy change* as the main independent variable of interest. As shown in Table 6.5, the overall model Chi Square for the nutrition behaviour dichotomy (negative versus no change) as predicted by the independent variables is statistically significant (Model Chi Square=31.39, df=15, p<.01). Modelling negative nutrition behaviour change is in keeping with a focus on health risk. Block one [*treatment group* (Chi Square=7.38, df=1, p<.01)] and block five [*mutual aid* and *number of family physician visits* (Chi Square=15.30, df=4, p<.01)] are statistically significant, contributing to the overall explained variance of the model.

Table 6.5: Logistic Regression for Nutrition Behaviour Dichotomy 1 (Negative vs. No Change): Model Significance

	Block Chi Square	Block Significance	Model Chi-Square	Model Significance
Block 1	7.38	.007	7.38	.007
Block 2*	1.97	NS	9.34	.025
Block 3	5.04	NS	14.38	NS
Block 4	1.70	NS	16.09	NS
Block 5	15.30	.004	31.39	.008

*Main independent variable: General Health Self-Efficacy Change

Looking at each block in turn, the first block including *treatment group* was statistically significant throughout the entire regression, beginning in block 1. Here, the likelihood of undergoing negative change in nutrition behaviour is .48 times lower for participants in the intervention group compared to those in the control group (b=-.73, p<.01, odds ratio=.48). *Treatment group* remains significant until the remaining block with only slight fluctuations in the beta value. For example, in the final block, the likelihood of undergoing negative change in nutrition behaviour is .43 times lower for participants in the treatment group compared to those in the control group (b=-.85, p<.01, odds ratio=.43). Looking at the second block, g*eneral health self-efficacy change* (main independent variable of interest) is not statistically significant at any stage of the model when controlling for treatment group. Therefore, the hypothesized negative association between general health self-efficacy change and negative nutrition behaviour change over time when controlling for treatment group is not supported (see Table 6.6). In blocks three and four, socio-demographic factors (*age, sex, education, income, and marital status)* and *general health status* are not statistically significant predictors of negative nutrition behaviour change over time. The fifth and final block shows statistically significant relationships between negative nutrition behaviour change and *mutual aid* (b=.97, p<.01, odds ratio=2.62) as well as *number of family physician visits*

(b=.71, p<.05, odds ratio=2.03). The first finding means that the odds of undergoing negative change in nutrition behaviour over time is 2.62 times more likely for an individual who currently receives mutual aid as compared to those who do not receive mutual aid. Further, participants who made 2 visits to their family physician in the last 3 months are 2.03 times more likely to undergo negative nutrition behaviour change than those who made no visits or only one family physician visit. Table 6.6 provides the statistics of each independent variable in blocks one through five.

Table 6.6: Logistic Regression for Nutrition Behaviour Dichotomy 1 (Negative vs. No Change) and Independent Variables

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Treatment Group															
-Control (REF)															
-Intervention	-.73**	.27	.48	-.74**	.27	.48	-.82**	.28	.44	-.81**	.29	.44	-.85**	.30	.43
Gen. Self-Efficacy Change															
-No Change (REF)	-	-	-	.01	.37	1.01	.14	.39	1.15	.02	.40	1.02	-.05	.42	.95
-Negative Change				.38	.33	1.47	.51	.35	1.66	.58	.35	1.79	.36	.37	1.43
-Positive Change															
Age	-	-	-	-	-	-	-.01	.03	1.00	-.01	.03	.99	-.01	.03	.99
Sex															
-Male (REF)															
-Female	-	-	-	-	-	-	-.17	.30	.85	-.27	.31	.77	-.30	.33	.74
Education															
-Secondary/less (REF)															
-Some College, Nursing, Trades	-	-	-	-	-	-	.46	.36	1.59	.46	.36	1.56	.48	.37	1.61
-Under-/Grad/Prof. Degree							.50	.40	1.65	.51	.41	1.66	.54	.43	1.72
Income															
-<$39,999 (REF)															
-$40,000 - $79,999	-	-	-	-	-	-	.07	.35	1.07	.16	.36	1.18	.12	.37	1.12
-$80,000+							.31	.46	1.36	.42	.47	1.52	.38	.49	1.46

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Marital Status															
-Significant Other (REF)	-	-	-	-	-	-	.45	.33	1.57	.46	.34	1.58	.34	.35	1.41
-No Significant Other															
SF-36 Overall Score	-	-	-	-	-	-	-	-	-	-.01	.01	.99	-.02	.01	.99
Mutual Aid															
-No (REF)															
-Yes	-	-	-	-	-	-	-	-	-	-	-	-	.97**	.36	2.62
# of Doctors Visits															
- 0-1 Visits (REF)															
- 2 Visits	-	-	-	-	-	-	-	-	-	-	-	-	.71*	.36	2.03
- 3 Visits													.53	.47	1.69
- 4+ Visits													-.64	.47	.53

*p<.05; **p<.01; ***p<.001; β=beta coefficient, SE=standard error, OR=odds ratio

Analysis 2

The second analysis uses *nutrition self-efficacy change* as the main independent variable of interest. As shown in Table 6.7, the overall model Chi Square for the nutrition behaviour dichotomy (negative versus no change) as predicted by the independent variables is statistically significant (Model Chi Square=33.71, df=15, p<.01). Blocks one and five within the model are statistically significant and therefore contribute to the overall explained variance of the model: *treatment group* (Chi Square=7.38, df=1, p<.01) and *mutual aid* and *number of family physician visits* (Chi Square=16.19, df=4, p<.01).

Table 6.7: Logistic Regression for Nutrition Behaviour Dichotomy 1 (Negative vs. No Change): Model Significance

	Block Chi Square	Block Significance	Model Chi-Square	Model Significance
Block 1	7.38	.007	7.38	.007
Block 2*	4.24	NS	11.62	.009
Block 3	4.86	NS	16.48	NS
Block 4	1.04	NS	17.52	NS
Block 5	16.19	.003	33.71	.004

*Main independent variable: Nutrition Self-Efficacy Change

Beginning with the first block, *treatment group* is again statistically significant throughout the entire model with slight fluctuations in the odds ratio. In block one, the likelihood of undergoing negative nutrition behaviour change over time is .48 times lower for participants in the intervention group compared to those in the control group (b=-.73, p<.01, odds ratio=.48). After entering all other independent variables, group remains statistically significant in block five, whereby the odds of engaging in negative

nutrition behaviour change is .42 times less likely for participants in the intervention group compared to those in the control group (b=-.88, p<.01, odds ratio=.42). In block two, *nutrition self-efficacy change* is not statistically significant, refuting the hypothesized relationship with nutrition behaviour change over time. The main independent variable of interest (*nutrition self-efficacy change*) is not statistically significant at any stage throughout the model. This finding refutes the hypothesis stating that *nutrition self-efficacy change* is negatively associated with undergoing negative nutrition behaviour change over time. Contrary to the social determinants of health model, block three including *socio-demographic factors* was not statistically significant. *General health status* was also not statistically significant. In the fifth and final block, *mutual aid* is statistically significant; the likelihood of experiencing a negative nutrition behaviour change is 2.64 times higher for participants who have mutual aid compared to those to do not have mutual aid (b=.97, p<.01, odds ratio=2.64). *Number of family physician visits* is also statistically significant when introduced in block five (b=.74, p<.05, odds ratio=2.10). This means that participants who made 2 visits to their family physician in the last 3 months are 2.10 times more likely to undergo negative nutrition behaviour change over time than participants who made no visits or only 1 visit.

Table 6.8: Logistic Regression for Nutrition Behaviour Dichotomy 1 (Negative vs. No Change) and Independent Variables

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Treatment Group															
-Control (REF)															
-Intervention	-.73**	.27	.48	-.77**	.28	.46	-.85**	.29	.43	-.84**	.29	.43	-.88**	.30	.42
Nut. Self-Efficacy Change															
-No Change (REF)															
-Negative Change	-	-	-	.20	.39	1.22	.30	.40	1.35	.28	.40	1.32	.15	.42	1.16
-Positive Change				-.55	.31	.58	-.54	.32	.58	-.60	.33	.55	-.58	.34	.56
Age	-	-	-	-	-	-	.00	.03	1.00	.00	.03	1.00	-.01	.03	1.00
Sex															
-Male (REF)															
-Female	-	-	-	-	-	-	-.21	.30	.81	-.30	.31	.74	-.32	.33	.73
Education															
-Secondary/less (REF)															
-Some College, Nursing, Trades	-	-	-	-	-	-	.55	.36	1.74	.58	.36	1.79	.58	.37	1.78
-Under-/Grad/Prof. Degree							.56	.41	1.75	.58	.41	1.79	.60	.43	1.82
Income															
-<$39,999 (REF)															
-$40,000 - $79,999	-	-	-	-	-	-	.00	.35	1.00	.05	.35	1.06	.05	.37	1.05
-$80,000+							.14	.46	1.15	.20	.47	1.22	.23	.49	1.26

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Marital Status															
-Significant Other (REF)															
-No Significant Other	-	-	-	-	-	-	.35	.33	1.41	.34	.33	1.40	.24	.35	1.27
SF-36 Overall Score	-	-	-	-	-	-	-	-	-	-.01	.01	.99	-.01	.01	.99
Mutual Aid															
-No (REF)															
-Yes	-	-	-	-	-	-	-	-	-	-	-	-	.97**	.36	2.64
# of Doctors Visits															
- 0-1 Visits (REF)															
- 2 Visits	-	-	-	-	-	-	-	-	-	-	-	-	.74*	.36	2.10
- 3 Visits													.61	.47	1.84
- 4+ Visits													-.62	.47	.54

*p<.05; **p<.01; ***p<.001; β=beta coefficient, SE=standard error, OR=odds ratio

Logistic Regression Nutrition Behaviour Dichotomy 2: Positive vs. No Change

Analysis 3

The second set of analyses was conducted using the nutrition behaviour change dichotomy of positive versus no change over time. Modelling positive nutrition behaviour change is in keeping with reduction of health risk. Using *general health self-efficacy change* as the main independent variable of interest, the overall model was not significant. Only block five was statistically significant (Chi Square=12.12, df=4, p<.05) as demonstrated in Table 6.9.

Table 6.9: Logistic Regression for Nutrition Behaviour Dichotomy 2 (Positive vs. No Change): Model Significance

	Block Chi Square	Block Significance	Model Chi-Square	Model Significance
Block 1	.034	NS	.034	NS
Block 2*	1.55	NS	1.58	NS
Block 3	4.02	NS	5.60	NS
Block 4	.785	NS	6.38	NS
Block 5	12.12	.017	18.49	NS

*Main independent variable: General Health Self-Efficacy Change

Treatment group is not statistically significant in this model. Further, this finding refutes the hypothesized positive relationship between *general health self-efficacy* and positive nutrition behaviour change. None of the *socio-demographic factors* or the *general health status score* in blocks three and four contributed to the variance in nutrition behaviour change. In the fifth and final block, however, both *mutual aid* and *number of family physician visits* are statistically significant. Looking first at *mutual aid,* the likelihood of engaging in positive nutrition behaviour change

over time is 2.30 times higher if a participant experiences mutual aid compared to a participant who does not (b=.83, p<.05, odds ratio=2.30). Participants who paid 2 visits to their family physician in the past 3 months are 2.52 times more likely to experience positive nutrition behaviour change than participants who paid no visits or only 1 visit (b=.92, p<.05, odds ratio=2.52). In addition, participants who paid 3 visits to their family physician in the past 3 months are 2.87 times more likely to undergo positive nutrition behaviour change than participants who paid no visits or only 1 visit (b=1.05, p<.05, odds ratio=2.87). Table 6.10 demonstrates the statistics for the independent variables at each of the five blocks.

Table 6.10: Logistic Regression for Nutrition Behaviour Dichotomy 2 (Positive vs. No Change) and Independent Variables

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Treatment Group															
-Control (REF)															
-Intervention	-.05	.28	.95	-.06	.28	.94	-.17	.29	.85	-.16	.30	.85	-.29	.31	.75
Gen. Self-Efficacy Change															
-No Change (REF)															
-Negative Change	-	-	-	-.41	.38	.66	-.32	.40	.72	-.24	.41	.79	-.13	.42	.88
-Positive Change				-.03	.33	.97	.04	.34	1.04	-.03	.36	.97	-.12	.37	.88
Age	-	-	-	-	-	-	.01	.03	1.01	.01	.03	1.01	.02	.03	1.02
Sex															
-Male (REF)															
-Female	-	-	-	-	-	-	.03	.31	1.04	.10	.32	1.11	.09	.33	1.09
Education															
-Secondary/less (REF)															
-Some College, Nursing, Trades	-	-	-	-	-	-	.07	.35	1.07	.08	.35	1.08	.08	.37	1.08
-Under-/Grad/Prof. Degree							.22	.42	1.24	.25	.42	1.28	.58	.44	1.78
Income															
-<$39,999 (REF)															
-$40,000 - $79,999	-	-	-	-	-	-	-.49	.35	.61	-.57	.36	.57	-.71	.38	.49
-$80,000+							.16	.43	1.17	.07	.44	1.07	-.03	.46	.97

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Marital Status															
-Significant Other (REF)															
-No Significant Other	-	-	-	-	-	-	.03	.35	1.03	.04	.35	1.04	.01	.36	1.01
SF-36 Overall Score	-	-	-	-	-	-	-	-	-	.01	.01	1.01	.01	.01	1.01
Mutual Aid															
-No (REF)															
-Yes	-	-	-	-	-	-	-	-	-	-	-	-	.83*	.36	2.30
# of Doctors Visits															
- 0-1 Visits (REF)															
- 2 Visits	-	-	-	-	-	-	-	-	-	-	-	-	.92*	.40	2.52
- 3 Visits													1.05*	.47	2.87
- 4+ Visits													.28	.45	1.32

*p<.05; **p<.01; ***p<.001; β=beta coefficient, SE=standard error, OR=odds ratio

Analysis 4

The fourth and final analysis used *nutrition self-efficacy change* as the main independent variable of interest. As shown in Table 6.11, the overall model Chi Square for the nutrition behaviour dichotomy (positive versus no change) as predicted by the independent variables is statistically significant (Model Chi Square=31.10, df=15, p<.01). Blocks two and five are statistically significant and therefore contribute to the overall explained variance of the model: *nutrition self-efficacy change* (Chi Square=12.50, df=2, p<.01) and *mutual aid* and *number of family physician visits* (Chi Square=12.38, df=4, p<.05).

Table 6.11: Logistic Regression for Nutrition Behaviour Dichotomy 2 (Positive vs. No Change): Model Significance

	Block Chi Square	**Block Significance**	**Model Chi-Square**	**Model Significance**
Block 1	.03	NS	.03	NS
Block 2*	12.50	.002	12.53	.006
Block 3	5.86	NS	18.39	.049
Block 4	.31	NS	18.70	NS
Block 5	12.38	.015	31.09	.009

*Main independent variable: Nutrition Self-Efficacy Change

The first independent variable of *treatment group* was not statistically significant at any step throughout the model. In block two, *nutrition self-efficacy change* showed a statistically significant relationship with positive nutrition behaviour change. Findings here demonstrate that the likelihood of undergoing positive nutrition behaviour change is .31 times lower for participants in the positive nutrition self-efficacy change group compared to participants who experienced no change in nutrition self-efficacy (b=-1.16, p<.01, odds ratio=.31). This relationship remained throughout the model and became

slightly stronger in the final block (b=-1.30, p<.01, odds ratio=.28). This finding provides support for the hypothesized relationship between nutrition self-efficacy change and positive nutrition behaviour change over time. Further, it provides partial support for the hypothesis stating that nutrition self-efficacy will be more strongly related to nutrition behaviour change than general health self-efficacy, suggesting the importance of using domain-specific self-efficacy in a health context for the mid-life population. However, the direction of this relationship is opposite to that predicted.

None of the *socio-demographic factors* introduced in the third block were statistically significant. This finding is particularly interesting given the link between *age, sex, education, income,* and *marital status* outlined in the literature review. Further, *general health status* was not identified as a statistically significant predictor of positive behaviour change when entered in block four. Upon entering *mutual aid* and *number of family physician visits* (block five), *income* became statistically significant. The likelihood of undergoing positive nutrition behaviour change over time is .47 times lower for those earning between $40,000 and $79,999 per year as compared to those earning less than $39,999 (b=-.77, p<.05, odds ratio=.47). This indicates a suppressor effect, whereby introduction of *mutual aid* and *number of family physician visits* in the final block increases the strength of the association for *income*.

In the fifth and final block, both *mutual aid* and *number of family physician visits* were both statistically significant. Participants who receive mutual aid are 2.35 times more likely to experience a positive change in nutrition behaviour over time than participants who do not receive mutual aid (b=.85, p<.05, 2.35). Two categories within the variable *number of family physician visits* were significant. The likelihood of undergoing positive nutrition behaviour change over time is 2.60 times higher for a participant who paid 2 visits to their family physician in the past 3 months as compared

to those who paid no visits or only 1 visit (b=.96, p<.05, odds ratio=2.60). Further, a participant who paid 3 visits to their family physician in the past 3 months is 3.09 times more likely to undergo positive nutrition behaviour change than a participant who paid no visits or only one visit (b=1.13, p<.05, odds ratio=3.09).

Table 6.12: Logistic Regression for Nutrition Behaviour Dichotomy 2 (Positive vs. No Change) and Independent Variables

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Treatment Group															
-Control (REF)															
-Intervention	-.05	.28	.95	-.12	.29	.89	-.25	.31	.78	-.24	.31	.78	-.39	.32	.68
Nut. Self-Efficacy Change															
-No Change (REF)	-	-	-	.10	.39	1.11	.14	.41	1.15	.15	.41	1.16	.06	.43	1.06
-Negative Change				-1.16**	.37	.31	-1.25**	.37	.29	-1.21**	.38	.30	-1.28**	.39	.28
-Positive Change															
Age	-	-	-	-	-	-	.00	.03	1.00	.00	.03	1.00	.01	.03	1.01
Sex															
-Male (REF)															
-Female	-	-	-	-	-	-	.05	.32	1.05	.10	.33	1.11	.11	.34	1.12
Education															
-Secondary/less (REF)															
-Some College, Nursing, Trades	-	-	-	-	-	-	.19	.36	1.21	.18	.35	1.19	.14	.37	1.15
-Under-/Grad/Prof. Degree							.20	.43	1.23	.21	.43	1.23	.56	.46	1.75
Income															
-<$39,999 (REF)															
-$40,000 - $79,999	-	-	-	-	-	-	-.60	.36	.55	-.64	.37	.53	-.77*	.39	.47
-$80,000+							.17	.44	1.19	.13	.45	1.14	.11	.47	1.11

Independent Variable	Block 1			Block 2			Block 3			Block 4			Block 5		
	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR	β	SE	OR
Marital Status															
-Sig. Other (REF)															
-No Significant Other	-	-	-	-	-	-	-.08	.36	.93	-.06	.36	.94	-.07	.37	.94
SF-36 Overall Score	-	-	-	-	-	-	-	-	-	.01	.01	1.01	.01	.01	1.01
Mutual Aid															
-No (REF)															
-Yes	-	-	-	-	-	-	-	-	-	-	-	-	.85*	.37	2.35
# of Doctors Visits															
- 0-1 Visits (REF)															
- 2 Visits	-	-	-	-	-	-	-	-	-	-	-	-	.96*	.41	2.60
- 3 Visits													1.13*	.48	3.10
- 4+ Visits													.38	.47	1.46

*p<.05; **p<.01; ***p<.001; β=beta coefficient, SE=standard error, OR=odds ratio

Summary of Logistic Regression Analyses

Overall, participating in either the treatment or the control group is only statistically related to negative nutrition behaviour over time. Considering the hypotheses of this study, the larger picture provided by the results above tells us that general health self-efficacy does not predict negative or positive change in nutrition behaviour over time in the CHBPP. However, a domain-specific view of self-efficacy in a nutrition context plays a significant role in whether or not an individual engages in positive nutrition behaviour change. The implications of the direction of this relationship will be discussed in Chapter 7.

There was no statistically significant relationship between overall health status and negative or positive nutrition behaviour change. None of the socio-demographic factors played a statistically significant role in nutrition behaviour change with the exception of income. The relationship between income and positive behaviour change was suppressed until mutual aid and family physician visits over the past three months were added to the analysis. The last block in each of the four analyses that includes the variables mutual aid and number of family physician visits was statistically significant, suggesting that these two variables play an important role in undergoing nutrition behaviour change over time in the mid-life population at risk for CVD.

Chapter 7: Discussion

This chapter uses the literature to explain and expand upon the findings generated by this research. Secondly, the limitations of both this research and the literature used to inform and discuss this study are examined. Implications of the findings are highlighted and future research directions are suggested.

Research Findings

CHBPP Intervention

Consistent with the findings reported in the CHBPP study (Wister et al., 2007), participation in the intervention group is statistically associated with change in dietary status over a one-year period. This thesis contributes to this finding by differentiating groups of change, finding that participants in the intervention group were statistically less likely to experience negative nutrition behaviour change than those in the control group. Interestingly, there is no association between treatment group and positive behaviour change, suggesting that participants in the intervention group are not statistically more likely to undergo positive nutrition behaviour change in nutrition behaviour compared to those in the control group. This finding warrants a closer look at the participants in each behaviour change group to determine whether there are differences among the groups that may account for this absence of relationship.

Self-Efficacy

This thesis demonstrates that nutrition self-efficacy can be modified in a mid-life adult population at risk for CVD and that this change is associated with changes in

nutrition behaviour. The relationship between nutrition self-efficacy change and nutrition behaviour change over time is consistent with Bandura and Locke's (2003) summary of self-efficacy research showing that this construct is not only a predictor of behaviour but also predicts behaviour change over time. However, the direction of the relationship emerging in this thesis is contrary to that hypothesized, suggesting that irrespective of treatment group, a person who experiences negative change in self-efficacy over time is more likely to positively change their nutrition behaviour. As mentioned in the literature review, there is a body of research that has made a similar discovery and provides rationalizations for this finding (e.g., Meland et al., 1999; Steptoe et al., 2004).

One issue that has arisen in previous research is the measurement of self-efficacy at baseline as a potentially poor estimation of this construct. Steptoe and colleagues (2004) suggest that while psychological and social measures may be initially associated with food intake, they may not predict future nutrition behaviour change. Steptoe and colleagues (2004) set out to determine the value of baseline measures in predicting future dietary behaviours, finding that only social support was a predictor, not psychological measures. However, these researchers did find that short-term (eight-week) changes in dietary self-efficacy played a significant role in predicting 12-month dietary behaviour change independently of gender, age, ethnicity, income, and baseline intake. The subjective nature of these measures could explain this; individuals may over- or under-estimate these measures at baseline because they have never been challenged. An individual may be confident in the idea of eating more fruits and vegetables (having high nutrition self-efficacy), yet struggle when faced with putting this confidence into action. Some researchers acknowledge the idea of “falsely high self-efficacy levels” (p.7) and liken them to anticipation of participating in a given program (Shannon, Kirkley,

Ammerman, Keyserling, Kelsey, DeVellis, & Simpson, 1997). Shannon and co-researchers (1997) measured self-efficacy between the second and third screening visits prior to the implementation of an intervention to reduce cholesterol in low-income rural populations. Initial measures of self-efficacy were nonetheless quite high (an average scoring of 3.56 out of a possible 4 points) and remained high at follow-up, limiting the potential for improvement over time. Higher self-efficacy scores at pre-intervention were significantly associated with positive change in diet behaviour, indicating a causal relationship of self-efficacy on behaviour. Further, results reported by Steptoe and co-researchers (2004) also show an increase in perceived barriers to eating healthy over time, suggesting that an enhanced awareness of psychological factors may lead to more realistic assessments and may play a role in becoming less self-efficacious when making dietary choices. Similarly, results in this thesis suggest that a ceiling effect occurred. Measures of self-efficacy for nutrition at baseline were quite high with 44% of individuals reporting 'good' control over nutrition choices and 41% reporting 'excellent' control over nutrition choices, limiting the potential range of improvement for these individuals. Only 5 participants identified their nutrition self-efficacy as 'poor'.

Over-estimation has also been attributed to using self-report methods to measure health behaviour. Langenberg and colleagues (2000) found in their sample of adult women that those who self-reported their fruit and vegetable consumption as 5 servings per day (high) at baseline were not likely to increase their consumption over time, also suggestive of a ceiling effect. In many cases, intake actually decreased over time. Researchers suggest the idea of having no feasible margin of improvement, and that perhaps participants are over-estimating their consumption at baseline and once they begin to learn more about nutrition over the course of the intervention they tend to adjust their self-reports based on this new knowledge.

Researchers also suggest that initial assessments of self-efficacy may be difficult to change over time given the obstacles that are often associated with nutrition behaviour change (Clark & Dodge, 1999). Similar findings have also emerged within exercise self-efficacy literature, suggesting that while the predictive ability of self-efficacy may increase over a short-term period, long-term follow-up may demonstrate an overall decrease over time (McAuley, Courney, Rudolph, & Lox, 1994). Further, researchers propose that perhaps a subjective factor such as self-efficacy is more useful for an individual when making spur-of-the-moment nutrition-related choices. Steptoe and colleagues (2004) suggest that initiating behaviour change over time is a process that is accompanied by other changes in factors such as attitude, knowledge, social support networks, among others. This idea leads to a second issue emerging from the literature involving the use of self-efficacy in as a construct in isolation (Burke et al., 2003). Self-efficacy is described by Bandura (2004) as the greatest determinant of health behaviour because of its direct influence and the indirect influence through other determinants. Other important determinants of health behaviour include knowledge of benefits and risks of behaviour, outcome expectations regarding health-related actions, goals set by an individual and plans to carry them out, and the perceived facilitators or impediments (both social and structural) that might affect the desired health-related change. It may not be possible to understand the complex relationship between self-efficacy and nutrition without considering the role of other psychological factors. Taking the conflicting results of this thesis into consideration, it appears that further investigation is required to more fully understand the construct of self-efficacy to determine if, and to what degree, it can be appropriately applied in the context of nutrition behaviour over time in this particular segment of the population.

Socio-Demographic Factors

Results from this study show that age, sex, education, and marital status are not significantly associated with nutrition behaviour change over time in mid-life adults at risk for CVD. These findings are contradictory to the majority of studies described in the review. Although there is a somewhat consistent relationship between these factors and nutrition in the literature, directions of these relationships are often inconsistent as well. Other research provides support for the lack of relationship seen here; work by Langenberg and colleagues (2000) discussed earlier found that demographic factors including age, ethnicity, and marital status were not powerful predictors of fruit and vegetable intake over an eight-month nutrition intervention period. Looking at the distribution of the education variable may help explain the lack of relationship; three categories were created from a larger set of 11 possible choices, and some of the pertinent information may have been lost as a result. One category was rather large; 47% of participants classify themselves in the mid-range of education, having a diploma, certificate, or some level of education from college, nursing, or trades. The small sample in this thesis strained the flexibility with degrees of freedom where choices to collapse categories were made. Perhaps a larger sample may have been able to detect differences using more categories in the analysis. Some research has come to similar conclusions with respect to marital status, finding a lack of relationship between this variable and subsequent health behaviour (Janevic et al., 2004). Janevic and colleagues (2004) suggested that the lack of support from a significant other could potentially be compensated for by other means of social support, including family friends, and confidants with similar conditions. Given the strong predictive value of mutual aid discovered in the current analysis, the same explanation of compensation applies here.

An interesting relationship that was suppressed in the results of this thesis is between income and nutrition behaviour change. This positive relationship emerged when health behaviours (mutual aid and number of family physician visits) was introduced into the logistic regression model, suggesting that these variables mediate the relationship between income and positive nutrition behaviour change. Further, the direction of this relationship is contradictory to the majority of studies whereby higher income levels are often associated with better nutrition status. There is some research that has suggested that while an individual with a higher income may have better access to healthy and nutritious foods; this might not lead them to consume foods according national dietary guidelines. Perhaps this finding also speaks to the measurement of nutrition behaviour as compliance with Canada's Food Guide (to be discussed later) (Martikainen et al., 2003; Roos et al., 1996). Beyond access to nutritious food itself, we must also consider that individuals with higher income may also have greater access to nutrition information about what constitutes a 'healthy' diet. Research examining the mediating role of self-efficacy in health promotion and subsequent dietary health behaviours has discovered that simply knowing that eating a healthy diet will reduce CVD risk factors is not enough to implement change (Rimal, 2000). For example, a group of researchers assessing social and psychological predictors of fruit and vegetable consumption in a population of adults (aged 18-70 years) found that behavioural counselling yielded a greater increase in consumption over time than nutrition education counselling (Steptoe, Perkins-Porras, Rink, Hilton, & Cappuccio, 2003). Similarly, Krummel and colleagues (2002) conducted focus groups to determine the needs and knowledge levels of rural-dwelling women with respect to CVD health and risk. Participants identified that a health scare is often the initial motivation to change and is therefore a powerful factor in the decision to eat well. Participants said that despite being knowledgeable with respect to a heart-healthy diet, this was not enough to initiate

eating behaviour change. Overall in this sample there was also a lack of understanding of the risk factors for CVD and their level of personal risk (Krummel, Humphries, & Tessaro, 2002). There is also a vast literature on what constitutes a healthy diet; however, obesity, malnutrition and various other Canadian health statistics suggest that this information is often lost in translation. Rimal (2000) also concluded that the ability of an individual to act in accordance with their knowledge of dietary behaviour is largely dependent on their perceived ability to do so. These findings highlight knowledge-behaviour translation as a major stumbling block in health research and acknowledge the complexity of this area of interest. A potential future research direction regarding income in mid-life populations at risk for CVD could examine how to develop interventions that disseminate appropriate nutritional information and education to individuals at differing levels of socio-economic status.

Short-Form 36 (General Health Survey)

This thesis used the sum of the components of the SF-36 general health survey to provide a measure of overall health that is quite often used in health research. This decision was made based on the small sample size and in the interest of minimizing the degrees of freedom within the model. While there was no statistically significant relationship between the SF-36 score and nutrition behaviour change, the direction of the relationship shown is consistent with the literature; the higher the SF-36 score (i.e., better overall health status), the more likely an individual would undergo positive behaviour change and the less likely an individual would undergo negative behaviour change. It is possible that the general nature of this variable is not conducive to the specific change in nutrition behaviour. Future research could therefore pursue this relationship using the components of the SF-36 to identify potentially specific linkages. For example, the link between perceived health and health behaviour has been

established in previous research where this variable is described as "the most global and the most subjective of our physical health measures, but nonetheless has important predictive power for future morbidity and mortality" (Janevic et al., 2004, p. 169). Perhaps focusing specifically on perceived health could shed light on the relationship between this subjective measure and nutrition behaviour change in the mid-life population at risk for CVD.

Health Behaviours

The variable mutual aid is often examined in the literature in regards to the management of chronic illness (e.g., Janevic et al., 2004; Stewart, Davidson, Meade, Hirth, & Makrides, 2000; Wister & Wong, 2002), yet is limited in the context of CVD risk. The benefits of social support on nutrition behaviour change have been documented; this variable can play an enabling role where self-efficacy to engage in healthy eating behaviours is enhanced (Bandura, 2004). The analyses in this thesis revealed that individuals who have mutual aid in their lives are more likely to undergo positive or negative change in nutrition behaviour over time when compared to no change. This suggests that the presence of mutual aid may not be beneficial for all individuals at risk for CVD. Bandura (2004) describes social support as potentially detrimental to health behaviour when its presence leads to dependence on another person. Some research has made similar conclusions; for example, over-involvement of a spouse when recovering from a heart attack can result in a feeling of dependence and of being a burden to a loved one (Stewart et al., 2000). Mutual aid is classified as a type of social support and is defined in many ways. For example, it has been defined as participation in a self-help group in some studies, and as a source of emotional support in others (Stewart et al., 2000). Future directions in this area could include posing more detailed questions regarding mutual aid to participants in the intervention and control

groups of the CHBPP to clarify the conceptualization of this variable. For instance, a group of researchers testing the effects of a social support intervention on cancer patients assessed mutual aid by asking participants to identify how many confidants they currently had and their level of satisfaction with them overall (Fukui, Koike, Ooba, & Uchitomi, 2003). Although research has outlined the specific components of mutual aid (social learning, social comparison, and supportive social exchanges), perhaps difficulty also lies in conceptualizing this concept at a group level. In other words, given the potential for mutual aid to have a negative impact, perhaps a comparison at an individual level would be more fruitful in understanding the processes involved and their relationship with nutrition behaviour.

Looking at an element of healthcare utilization, the findings in this thesis suggest that people who visited their family doctor either twice or three times in the recent past are more likely to undergo positive change in nutrition behaviour when compared with those who visited once or not at all. The nature of CVD is an issue when considering healthcare utilization in mid-life individuals. Research suggests that we must differentiate between subjective and objective health factors to understand individual health behaviour and self-efficacy level. For example, McDonald-Miszczak, Wister, and Gutman (2001) studied the management of chronic disease, finding that people with heart problems rely mostly on perceptual health beliefs and that in general, those beliefs are more likely to predict self-care behaviours than overt symptoms of illness. Moreover, results showed that people with a higher number of physician visits engaged in more self-care behaviours. McDonald-Miszczak and colleagues (2001) suggest that perhaps formal healthcare provides a cue to action by increasing awareness and knowledge of symptoms, in turn positively influencing the perceived benefits of self-care. Factors that might delay or promote physician visits are thus an integral part of the perceptual

picture. It is also important to note that participants who made the most visits to the doctor could be in poorest health, having the most to gain from visiting their doctor.

Another important patient perception is that of the family physician and their role in individual health. For example, research has shown that many patients believe that family physicians play a role in nutrition communication only when patients have something wrong with them (Fuller, Backett-Milburn, & Hopton, 2003). Correspondingly, at the physician level, it has also been suggested that physicians are more likely to make recommendations for diet and physical activity to individuals who are already sick or visibly ill (Kreuter, Scharff, Brennan, & Lukwago, 1997), again speaking to the difficulty with covert CVD symptoms. This limited patient-physician communication has a direct impact on the preventative care of individuals, particularly in mid-life where the level of primary prevention is the most productive (Oldridge, Stump, Nothwehr, & Clark, 2001).

Results of this thesis also suggest that individuals who visited their doctor twice in the past three months were more likely to undergo negative change in nutrition behaviour. From a logical standpoint one would assume that going to the doctor would positively affect a given health behaviour as presented above. Some research has suggested otherwise. In a sample of nurses (n=1,957) identified as having high cholesterol, dietary change, weight, exercise, and smoking behaviours were assessed after implementing a cholesterol reduction program to determine levels of CVD risk factor modification (Wang, Carson, Lapane, Eaton, Gans, & Lasater, 1999). For some of the participants, the intervention included a cholesterol-related physician referral, which did not increase the level of CVD risk factor reduction significantly.

This thesis was not able to capture the nature of patient-physician interactions that might shed light on this negative finding. Specific research in this area has revealed

that the quality of this interaction is dependent on both patient and physician characteristics. For example, Eaton, Goodwin and Stange (2002) looked at the components of physician-patient interactions in 138 family physician visits. Only 6% of the physicians provided nutrition counselling for an average length of 55 seconds. Nutrition counselling occurred in 25% of the visits that were related to CVD, compared to 45% of the visits related to diabetes. Discussing nutrition was also more likely to occur with patients over the age of 65. Kushner (1995) had a similar finding when looking at general patient-physician interactions where the majority of physicians spent 5 minutes or less talking about dietary change in only 40% of their patients overall. Kushner (1995) went a step further to discover existing barriers that limit nutrition counselling in patient visits. These barriers include time constraints, patient noncompliance, inadequate teaching materials, lack of knowledge and physician training in this area, inadequate compensation, and low physician confidence (Kushner, 1995). Perhaps the absence of discussion surrounding dietary change during a physician visit may communicate the perception that this is not an important issue for the patient to address. Further, physicians may be inclined to take a pharmacological approach to CVD risk reduction with their patients (e.g., cholesterol-lowering drugs) rather than suggesting behavioural changes that could produce lower CVD risk or a combination of both approaches.

It is also possible that as a result of physician demands, visits are becoming shorter in length and patients are required to make more than one visit to receive adequate care. One recent longitudinal study examining the length of physician visits over a 10 year period found that contrary to patient beliefs, physician visits have not become shorter for the average patient and have increased slightly in length for individuals with common and serious diagnoses (Mechanic, McAlpine, & Rosenthal, 2001). In summary, the small pocket of research discussed here suggests that there are

many important components to a physician visit that could affect healthcare utilization. These issues could be magnified when dealing with reducing CVD risk factors and the often subtle nature of this disease. The content of family physician visits with mid-life individuals plays an important role and exploration in future research endeavours is needed to fully understand these relationships.

Limitations

Limitations of the CHBPP Data

Sample size in the CHBPP study was not conducive to detection of effect sizes greater than 0.35. Data collection for the study included provision of results from blood tests and this could serve as a cue for the patient and the physician to monitor risk factors more intensely. Not all possible lifestyle changes were included as measures in the study. The two lifestyle counsellors selected for the Telehealth portion of the intervention may not be representative of their professional population, leaving the results open to measurement error. Ethnic diversity was not a variable of consideration in the sample selection, thus results cannot necessarily be generalized to older adults from all ethnic backgrounds.

Theoretical Constraints

Application of theory in research is beneficial in three distinct ways (Babbie & Benaquisto, 2002). Theory can provide a logical explanation for a given finding and in turn avoids accepting results as occurring by chance. For example, explaining why a nutrition behaviour change occurred allows researchers to predict whether or not it will occur in the future. Theory can also provide the basis or framework for posing research questions, and is instrumental in directing research beyond the initial stages. Lastly, theory can be utilized to explain patterns of nutrition behaviour and formulate new

research questions or potential solutions to low nutrition self-efficacy. Some researchers claim that a "true test" (p. 3) of self-efficacy requires longitudinal design where measurement of the construct accompanies assessment of subsequent behaviour (Clark & Dodge, 1999), which was achieved here. However, self-efficacy is not the sole construct within Social Cognitive Theory (SCT). SCT also depicts the concept of outcome expectancy as contributing to behaviour (Bandura, 1997). Some studies have applied both constructs in a similar context to this thesis. For example, Gaughan (2003) conducted a study validating the use of a healthy eating self-efficacy scale and applied it to two populations suffering from high cholesterol. This study was based upon SCT and focused on self-efficacy as well as outcome expectations. Specific objectives were to examine the predictive power of self-efficacy, the interaction of this construct with other factors, and the change in beliefs themselves as a result of the nutrition intervention. Overall self-efficacy scores were high, while women scored significantly higher on self-efficacy subscales. Self-efficacy also increased with age. Interestingly, self-efficacy was not a direct predictor of heart healthy behaviour change. The author speculates that outcome expectancies may have weakened the relationship between self-efficacy and behaviour change (Gaughan, 2003). This thesis is limited by having applied only one of the major tenets of SCT to the mid-life population at risk for CVD.

Study Sample

Many studies in the literature discussed above examined small and/or non-random samples, yielding results that can be invalid or unreliable and therefore not representative of the population in question (Chima et al., 1997; Davis et al., 2000; Ford et al., 2000; Hendy & Nelson, 1998; Keller et al., 2006; Keller & Hedley, 2002). Examples of sample characteristics that may compromise generalizability include those with primarily high-education (Keller & Hedley, 2002) and high-income participants

(Ferrini et al., 1994), low-education and low-income participants (Conn, 1997; Hendy & Nelson, 1998; Langenberg et al., 2000; Steptoe et al., 2004), and an over-representation of females (Conn, 1997; Keller & Hedley, 2002; Langenberg et al., 2000; Martikainen et al., 2003). Further, the majority of studies in this area comes from European countries (James et al., 1997; Johansson et al., 1999; Lynch et al., 1997; Martikainen et al., 2003; Roos et al., 1998; Roos et al., 1996); results may not be applicable to the Canadian population. Recruitment bias or attrition rates often favour participants who are of higher nutritional status than non-participants (Grundy & Sloggett, 2003; Johansson et al., 1999; Payette et al., 1995; Roos et al., 1996; Shatenstein et al., 2004). Individuals with the healthiest nutritional lifestyles/beliefs are more likely to be alive to participate in research (survival bias) (Ferrini et al., 1994; Keller & Hedley, 2002). Sampling limitations can impact the quality of data collected and our ability to compare results across studies (Babbie & Benaquisto, 2002). The participants in the current research, although not randomly selected from the population, are randomly assigned to either the intervention or the control group. This is a relatively small sample (intervention: n= 157; control: n=158), however, the presence of a control group determines whether findings can be attributed to the intervention itself as opposed to extraneous factors, and therefore adds to the strength of the findings (Babbie & Benaquisto, 2002). Further, as recommended by past research on the general adult population (Anderson et al., 2000), the present study focuses on mid-life as a specific segment of the population.

Measurement

Measurement choice is also of concern, particularly given the complex nature of nutrition. Self-reports for dietary information are common; however, data can be skewed by the participants' perceived expectations of the researchers and/or by inaccurate (CCHS, 2004; Conn, 1997; Ferrini et al., 1994; Johansson et al., 1999; Langenberg et al.,

2000; Martikainen et al., 2003; Roos et al., 1998; Roos et al., 1996; Shatenstein et al., 2004; Wandel, 1995; Wilson et al., 2002) or short-term recall (Davis et al., 2000; Hendy & Nelson, 1998; Murphy et al., 1990). Studies relying heavily on dietary measurements of nutritional status or BMI as an indicator of body fat specifically in the older adult should be considered with the limitations of these tools in mind (e.g., Murphy et al 1990; Shatenstein et al., 2004). For example, suggested dietary intakes are designed to meet the needs of males and females of any age or condition. However, universal dietary recommendations are considerably limited by the assumed homogeneity of the population over the age of 50 (Schlenker, 1998; Schneider, Vining, Hadley, & Farnham, 1986; Wakimoto & Block, 2001). Thus, a single gold standard of nutrition behaviour for individuals with differing cognitive and physical capabilities and potential chronic illness is inappropriate. Further, BMI is a limited measure of obesity when fat is distributed differently for different individuals as a result of gender or ethnic background. For example, the BMI would not reveal excess abdominal fat, which is specifically associated with increased health risks. The large scope of differing nutrition measurement tools in the literature also questions the comparison of results across studies.

Considering the measurement of nutrition behaviour, Health Canada initiated the process of transforming guidelines into Canada's Food Guide in 1992, a document that is described as readable and realistic for all consumers (Bush & Kirkpatrick, 2003). Some research has questioned the use of Canada's Food Guide as a measure of nutrition behaviours across the population; for example, cross-cultural application among immigrant and non-immigrant individuals in this country. For example, one study examined the relationship between birthplace and following Canada's Food Guide (1992) in adults over 18 years of age living in Ontario (Pomerleau, Ostbye, & Bright-See, 1997). Using provincial health survey data, results show that compared to Canadian-born

individuals, Asian groups were less likely to consume the recommended serving of dairy products, while both European and Asian individuals were more likely to consume the recommended serving of grain products. Pomerleau and co-researchers (1997) conclude that food choice is therefore dependent upon birthplace and suggest that healthy habits of immigrant populations be reinforced. Future research focusing on the mid-life population at risk for CVD could place special emphasis on cultural differences and the role of self-efficacy in making nutritional choices. Varghese and Moore-Orr (2002) also conducted research in Canada looking at whether traditional Indian diets were complementary to the foods recommended in Canada's Food Guide. In a small sample (n=132) of well-established Indian immigrants living in Newfoundland (ages 10-65), it was found that overall consumption of grains and fruits and vegetables did not correspond with the servings outlined in Canada's Food Guide. Researchers conclude that there is a necessity for further cross-cultural research in this area.

In other words, Canada's Food Guide is likely a better indicator of dietary balance than it is of nutrition per se. This is particularly problematic for different cultural groups who may have dietary practices that do not conform to Canada's Food Guide but may be healthy or unhealthy. Perhaps a future research direction could examine self-reported dietary behaviours in conjunction with physiological measures of nutrition to provide a well-rounded assessment of nutrition health.

It is also likely that this study did not include all of the variables or factors that might play a role in predicting nutrition behaviour. Schnoll and Zimmerman (2001) studied a sample of college students (n=113) in a nutrition class and found that knowledge of healthy nutrition habits alone was not enough to produce nutrition behaviour change. Participants were required to set specific nutrition goals and execute self-monitoring as part of the intervention group. Results show that these two elements

led to an increased sense of nutrition self-efficacy and positive behaviour change. This research is another illustration of the dangers of looking at self-efficacy in isolation given that there are many ways of influencing how this concept is perceived over time. For example, Anderson and colleagues (2007) examined the role of self-efficacy, outcome expectations, and self-regulation (i.e., setting goals, planning, and monitoring progress) in nutritional content of food purchases in adults. While self-efficacy was shown as strongly associated with healthy nutrition behaviour, the effect of this construct was determined as largely indirect via outcome expectations and self-regulation. Further, self-regulatory behaviour was shown as the overall best predictor of healthy nutrition choices (Anderson et al., 2004).

In consideration of the statistical analysis for this study, the process of logistic regression has been criticized for allowing a researcher to include or remove certain variables from the analysis based on statistical criteria (Pallant, 2007). Misinterpretation of results can occur when a variable is excluded from the analysis when there may be significant associations that are suppressed by the presence of one or more other variables (Tabachnick & Fidell, 2007). Thus the creation of logistic regression models is often data-driven as opposed to theory-driven. The small sample size of this study limited the flexibility of including all variables of interest in the logistic regression analysis. Results are therefore inevitably limited by the removal of variables based partly on results demonstrating a 'lack' of relationship. However, careful consideration of the literature also informed this decision as well as close examination of the way in which questions were posed and the distribution of each variable.

Finally, undertaking secondary data analysis in this research is ultimately constrained to the limitations of the research in question. Control over chosen variables, sample type and size and measurement was relinquished. For example, this thesis is

limited by the collection of data at only two points (baseline and follow-up) and is unable to examine the potential fluctuations in predictive ability of self-efficacy over time in a nutrition context. Further, researchers have used domain-specific measures of psychological and social factors, including social support for dietary change, suggesting the importance of specific measures of these subjective factors (Steptoe et al., 2004). The present study could not achieve the domain-specific aspect of all subjective measures simply because these questions were not posed to the participants in this manner and because nutrition was not the sole lifestyle factor of interest. Similar to many research studies reviewed here, the scope or direction of secondary analysis is therefore limited by the data previously collected (e.g., James et al., 1997; Keller et al., 1997; Lynch et al., 1997; Martikainen et al., 2003; Murphy et al., 1990; Roos et al., 1996; Shatenstein et al., 2004).

Implications and Future Directions

The results of this thesis have implications for stabilizing how and when to measure self-efficacy when conducting intervention research in this area. Firstly, self-efficacy as a psychological construct does not work in isolation. Research focusing on multiple psychological factors (e.g., encouragement, perceived barriers, knowledge) in the context of nutrition behaviour has demonstrated a lack of inter-correlation between these factors, indicating that each factor plays an important yet distinctive role (Anderson et al., 2004). It would be useful to study multiple psychological principles simultaneously to determine whether they play competing or corresponding roles in the area of nutrition. It is important that future undertakings explore these relationships in the context of CVD risk, expanding on the breadth of information on established CVD.

Further, the conflicting relationship between baseline measures of psychological constructs suggests that it would be beneficial to examine self-efficacy levels more

frequently throughout longitudinal nutrition studies to better understand the pathway of change, expanding on the 'before and after' picture provided here. This thesis, as well as other studies reviewed here (e.g., Langenberg et al., 2000), is limited by being unable to identify whether change in self-efficacy is a precursor for nutrition behaviour change. Future research directions could therefore measure self-efficacy at multiple time points throughout the intervention period to determine causality as well as examine potential fluctuations in this construct over time.

The same implication can be applied to nutrition behaviour and the notion of using a general guideline such as Canada's Food Guide to statistically measure dietary behaviour. Researchers suggest that the specific nature of self-efficacy requires a unique measurement instrument for a given health behaviour that has shown to be reliable and valid in past studies (AbuSabha & Achterberg, 1997). However, following recommended intakes of certain foods outlined in this guide is not mandatory nor does it function in isolation to effectuate good health. Societal changes such as the abundance of previously prepared food, differing meal patterns, larger quantities of foods, as well as technology as reducing the need to expend energy have all contributed to the current difficulties associated with eating healthy (Anderson et al., 2000). Perhaps individuals who are not within the range of servings for each of the four food groups could be following a strict dietary regimen where adherence to this regimen increases their nutrition self-efficacy. A direction for this research could therefore use multiple avenues to examine the complex area of nutrition, for example, using physiological measures or a combined quantitative and qualitative approach. Qualitative measures of psychological constructs (e.g., focus groups) have shown to be useful in nutrition research and CVD (Krummel et al., 2002). Perhaps in-depth interviews and focus groups could be integrated as part of

the intervention to better understand the complicated relationships that exist in the area of nutrition and CVD risk at the individual level.

A measurement of prior success in the domain of nutrition behaviour was found to be associated with current perception of self-efficacy with respect to similar behaviours (Burke et al., 2003). This result supports the importance of personal mastery as a source of self-efficacy as outlined in the Social Cognitive Theory (Bandura, 1977). Personal mastery, identified as the most powerful source of self-efficacy, requires achievement over time. This finding highlights the importance of conducting longitudinal research with respect to psychological constructs. Future research endeavours could explore the relationship between personal mastery, self-efficacy, and nutrition behaviour in middle-aged adults at risk of CVD. An alternative theoretical foundation may also broaden our understanding in this area; the Health Belief Model (Rosenstock, 1974) is an example of a psychologically-based model used to explain and predict health behaviours by focusing on the attitudes and beliefs individuals hold with respect to their health. Self-efficacy is one of six constructs forming the Health Belief Model, in addition to perceived benefits and barriers to engaging in a given health-related action, cues to undertake that action, perceived severity of an illness, and how susceptible a person perceives they are to that illness. The constructs that make up this model are very broad and could be more predictive of behaviour if they were placed in the more specific context of nutrition and CVD risk. Perhaps using the Health Belief Model as a foundation in this area of research could illuminate how an intervention might be adapted to maximize the positive impact of psychological variables on lifestyle change.

Conclusion

The link between CVD, nutrition, and mid-life is a complex yet important issue within the Canadian population, particularly given the apparent disconnect between knowledge of healthy eating and consumption of healthy foods. The findings generated by this thesis offer some very preliminary evidence that nutrition self-efficacy change is predictive of nutrition behaviour change in a sample of mid-life adults at risk for CVD, suggesting that this psychological construct is a fruitful avenue for improving nutrition health in a lifestyle intervention. Income level, mutual aid, and frequency of family physician visits also play a role in the likelihood of experiencing positive or negative nutrition behaviour change. Conflicting results within the literature indicate that self-efficacy in the context of nutrition behaviour and change in that behaviour is a multifaceted issue that requires further attention beyond the first steps achieved in this thesis.

Reference List

AbuSabha, R., & Achterberg, C. (1997). Review of self-efficacy and locus of control for nutrition- and health-related behavior. *Journal of American Dietetic Association, 97*(10), 1122-1132.

Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2007). Self-regulation, self-efficacy, outcome expectations, and social support: Social cognitive theory and nutrition behavior. *Annals of Behavioral Medicine, 34*(3), 304-312.

Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2000). Social-cognitive determinants of nutrition behavior among supermarket food shoppers: A structural equation analysis. *Health Psychology, 19,* 479-486.

Amarantos, E., Martinez, A., & Dwyer, J. (2001). Nutrition and quality of life in older adults. *Journals of Gerontology: SERIES A, 56A*(II), 54-64.

Appel, L. J., Moore, T. J., Obarzanek, E., Vollmer, W. M., Svetkey, L. P., Sacks, F. M., Bray, G. A., Vogt, T. M., Cutler, J. A., Windhauser, M. M., Lin, P., & Karanja, N. (1997). A clinical trial of the effects of dietary patterns on blood pressure. *The New England Journal of Medicine, 336*(16), 1117-1124.

Babbie, E., & Benaquisto, L. (2002). *Fundamentals of social research: First Canadian edition*. Scarborough, ONT: Nelson.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education and Behaviour, 31*(2), 143-164.

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

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bandura, A., & Locke, E. A. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology, 88*(1), 87-99.

Bates, C. J., Benton, D., Biesalski, H. K., Staehelin, H. B., Van Staveren, W., Stehle, P., Suter, P. M., & Wolfram, G. (2002). Nutrition and aging: A consensus statement. *The Journal of Nutrition, Health, & Aging, 6*(2), 103-116.

Burke, L. E., Dunbar-Jacob, J., Sereika, S., & Ewart, K. (2003). Development and testing of the cholesterol-lowering diet self-efficacy scale. *European Journal of Cardiovascular Nursing, 2,* 265-273.

Bush, M., & Kirkpatrick, S. (2003). Setting dietary guidance: The Canadian experience. *Journal of the American Dietetic Association, 103,* S22-S27.

Canadian Community Health Survey (2004). *Nutrition (Cycle 2.2)*. Retrieved January 5th, 2008 from http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/index_e.html.

Canadian Diabetes Association (2000). *Diabetes Facts*. Retrieved January 14, 2008 from: http://diabetes.ca/Section_About/thefacts.asp.

Carrels, R. A., Darby, L. A., Cacciapaglia, H. M., & Douglass, O. M. (2004). Reducing cardiovascular risk factors in postmenopausal women through a lifestyle change intervention. *Journal of Women's Health, 13*(4), 412-426.

Chernoff, R. (2001). Nutrition and health promotion in older adults. *Journals of Gerontology: SERIES A, 56A*(II), 47-53.

Chima, C. S., Barco, K., Dewitt, M. L. A., Maeda, M., Teran, J. C., & Mullen, K. D. (1997). Relationship of nutritional status to length of stay, hospital costs, and discharge status of patients hospitalized in the medicine service. *Journal of American Dietetic Association, 97*(9), 975-978.

Chung, S., & Sohn, C. (2005). Nutritional status of hospitalized geriatric patients using the mini nutritional assessment. *Korean Journal of Community Nutrition, 10*(5), 645-653.

Clark, N. M., & Dodge, J. A. (1999). Exploring self-efficacy as a predictor of disease management. *Health & Education Behavior, 26*(1), 72-89.

Conn, V. S. (1997). Older women: Social cognitive theory correlates of health behavior. *Women and Health, 26*(3), 71-85.

Davis, M. A., Murphy, S. P., Neuhaus, J. M., Gee, L., & Quiroga, S. S. (2000). Living arrangements affect dietary quality for U.S. adults aged 50 years and older: NHANES III 1988-1994. *The Journal of Nutrition, 130I, 2256-2264.*

DeMaris, A. (1995). A tutorial in logistic regression. *Journal of Marriage and Family, 57,* 956 968.

Denton, M., Prus, S., & Walters, V. (2004). Gender differences in health: a Canadian study of the psychosocial, structural and behavioural determinants of health. *Social Science & Medicine, 58,* 2585-2600.

DiPietro, L. (2001). Physical activity in aging: Changes in patterns and their relation to health and function. *Journal of Gerontology: Biomedical Science and Medical Science, 56A*(II), 13-22.

Drewnowski, A., & Evans, W. J. (2001). Nutrition, physical activity, and quality of life in older adults: Summary. *Journals of Gerontology: SERIES A, 56A*(II), 89-94.

Eaton, C. B., Goodwin, M. A., Stange, K. C. (2002). Direct observation of nutrition counseling in community family practice. *American Journal of Preventive Medicine, 23*(3), 174-179.

Ferrini, R. Edelstein, S., & Barrett-Connor, E. (1994). The association between health beliefs and health behaviour change in older adults. *Preventive Medicine, 23,* 1-5.

Ford, E. S., Ahluwalia, I. B,. & Galuska, D. A. (2000). Social relationships and cardiovascular disease risk factors: Findings from the third national health and nutrition examination survey. *Preventive Medicine, 30,* 83-92.

Fukui, S., Koike, M., Ooba, A., & Uchitomi, Y. (2003). The effect of a psychosocial group intervention on loneliness and social support for Japanese women with primary breast cancer. *Oncology Nursing Forum, 30*(5), 823-830.

Fuller, T. L., Backett-Milburn, K., & Hopton, J. L. (2003). Healthy eating: The views of general practitioners and patients in Scotland. *The American Journal of Clinical Nutrition, 77*(4S), 1043S-1047S.

Gaudreau, P., Morais, J. A., Shatenstein, B., Gray-Donald, K., Khalil, A., Dionne, I., Ferland, G., Fülöp, T., Jacques, D., Kergoat, M., Tessier, D., Wagner, R., & Payette, H. (2007). Nutrition as a determinant of successful aging: Description of the Quebec longitudinal study NuAge and results from cross-sectional pilot studies. *Rejuvenation Research, 10*(3), 377-386.

Gaughan, M. E. (2003). Heart healthy eating self-efficacy: An effective tool for managing eating behavior change interventions for hypercholesterolemia. *Topics in Clinical Nutrition, 18*(4), 229-244.

German, P. S. & Shapiro, S. (1997). Heterogeneity and multiple risk factors in aging populations: Implications for research. *In* T. Hickey, M. A. Speers, & Prohaska (Eds.) *Public Health and Aging*. Baltimore, Maryland: The Johns Hopkins Press Ltd., 190-206.

Glanz, K., Kristal, A. R., Tilley, B. C., & Hirst, K. (1998). Psychosocial correlates of healthful diets among male auto workers. *Cancer Epidemiology, Biomarkers & Prevention, 7,* 119-126.

Gottlieb, B. H. (2000). Self-help, mutual aid, and support groups among older adults. *Canadian Journal of Aging, 19*(Supp.1), 58-74.

Grembowski, D., Patrick, D., Diehr, P., Durham, M., Beresford, S., Kay, E., & Hecht, J. (1993). Self-efficacy and health behaviour among older adults. *Journal of Health and Social Behaviour, 34,* (89-104).

Grundy, E., & Sloggett, A. (2003). Health inequalities in the older population: The role of personal capital, social resources, and socio-economic circumstances. *Social Science and Medicine, 56,* 935-947.

Health Canada (2000). *The changing face of heart disease and stroke in Canada.* Retrieved February 28th, 2006, 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 28th, 2006, from http://www.phac-aspc.gc.ca/ccdpc-cpcmc/cvd-mcv/pub_e.html.

Heart and Stroke Foundation (2008). High blood pressure: health information. Retrieved February 5, 2008 from: http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3484023/.

Hendy, H. M., & Nelson, G. K. (1998). Social cognitive predictors of nutritional risk in rural elderly adults. *International Journal of Aging & Human Development, 47*(4), 299-326.

James, W., Nelson, M., Ralph, A., & Leather, S. (1997). Social determinants of health: The contribution of nutrition to inequalities in health. *BMJ, 314,* 1545-1549.

Janevic, M. R., Janz, N. K., Dodge, J. A., Wang, Y., Lin, X., & Clark, N. M. (2004). Longitudinal effects of social support on the health and functioning of older women with heart disease. *International Journal of Aging and Human Development, 59*(2), 153-175.

Johansson, L., Thelle, D. S., Solvoll, K., Bjornboe, G. A., & Drevon, C. A. (1999). Healthy dietary habits in relation to social determinants and lifestyle factors. *British Journal of Nutrition, 81,* 211-220.

Kant, A. K., Schatzkin, A., Graubard, B. I., & Schairer, C. (2000). A prospective study of diet quality and mortality in women. *American Medical Association, 283*(16), 2109-2115.

Keller, H. H., & Hedley, M. R. (2002). Nutritional risk needs assessment of community-living seniors: Prevalence of nutrition problems and priorities for action. *Journal of Community Health, 27*(2), 121-132.

Keller, H. H., Hedley, M. R., Wong, S. S.-L., Vanderkooy, P., Tindale, J., & Norris, J. (2006). Community organized food and nutrition education: Participation, attitudes and nutritional risk in seniors. *The Journal of Nutrition, Health & Aging, 10*(1), 15-20.

Keller, H. H., Ostbye, T., & Bright-See, E. (1997). Predictors of dietary intake in Ontario seniors. *Canadian Journal of Public Health, 88*(5), 305-309.

Keller, H. H., Ostbye, T, & Goy, R. (2004). Nutritional risk predicts quality of life in elderly community-living Canadians. *Journal of Gerontology: MEDICAL SCIENCES, 59AI(1), 68-74.*

Kreuter, M. W., Scharff, D. P., Brennan, L. K., & Lukwago, S. N. (1997). Physician recommendations for diet and physical activity: Which patients get advised to change? *Preventive Medicine, 26*(6), 825-833.

Krummel, D. A., Humphries, D., & Tessaro, I. (2002). Focus groups on cardiovascular health in rural women: Implications for practice. *Journal of Nutrition Education and Behaviour, 34*(1), 38-46.

Kumari, M., Head, J., & Marmot, M. (2004). Prospective study of social and other risk factors for incidence of type 2 diabetes in the Whitehall II study. *Archives of Internal Medicine, 164,* 1873-1880.

Kuper, H., & Marmot, M. (2003). Intimations of mortality: Perceived age of leaving middle age as a predictor of future health outcomes within the Whitehall II study. *Age & Ageing, 32*(2), 178-184.

Kushner, R. F. (1995). Barriers to providing nutrition counseling by physicians: A survey of primary care practitioners. *Preventive Medicine, 24*(6), 546-552.

Lachman, M. E., & Prenda Firth, K. M. (2004). The adaptive value of feeling in control during midlife. In O. G. Brim, C. D. Ryff, & R. C. Kessler (Eds.), *How Healthy Are We?* (pp.320-349). Chicago: University of Chicago Press.

Langenberg, P., Ballesteros, M., Feldman, R., Damron, D., Anliker, J., & Havas, S. (2000). Psychosocial factors and intervention-associated changes in those factors as correlates of change in fruit and vegetable consumption in the Maryland WIC 5 a day promotion program. *Annals of Behavioral Medicine, 22*(4), 307-315.

Lynch, J. W., Kaplan, G. A., & Salonen, J. T. (1997). Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic lifecourse. *Sociology, Science, Medicine, 44*(6), 809-819.

Marmot, M. (2006). Introduction. In (M. Marmot, & R. G. Wilkinson (Eds.), *Social determinants of health: Second edition* (pp. 1-5). New York: Oxford University Press Inc.

Martikainen, P., Brunner, E., & Marmot, M. (2003). Socioeconomic differences in dietary patterns among middle-aged men and women. *Social Science & Medicine, 56,* 1397 1410.

Mechanic, D., McAlpine, D., & Rosenthal, M. (2001). Are patients' office visits with physicians getting shorter? *New England Journal of Medicine, 344,* 198-204.

Meland, E. Gunnar Maeland, J., & Laerum, E. (1999). The importance of self-efficacy in cardiovascular risk factor change. *Scandinavian Journal of Public Health, 27*(1), 11-17.

McAuley, E., Courney, K. S., Rudolph, D. L., & Lox, C. L. (1994). Enhancing exercise adherence in middle-aged males and females. *Preventive Medicine, 23,* 198-206.

McAuley, E., Jerome, G. J., Elavsky, S., Marquez, D. X., & Ramsey, S. N. (2003). Predicting long-term maintenance of physical activity in older adults. *Preventive Medicine, 37,* 110 118.

McAuley, E., Lox, C., Rudolph, D., & Travis, A. (1994). Self-efficacy and intrinsic motivation in exercising in middle-aged adults. *Journal of Applied Gerontology, 13*(4), 355-370.

McDonald-Miszczak, L., Wister, A. V., & Gutman, G. (2001). Self-care among older adults: An analysis of the objective and subjective illness context. *Journal of Aging and Health, 13*(1), 120-145.

McIntyre, L. (2004). Food insecurity. In D. Raphael (Ed.), *Social Determinants of Health: Canadian Perspectives* (pp. 173-186). Toronto, Ontario: Canadian Scholars' Press Inc.

Menec, V. H., Chipperfield, J. G., & Perry R. P. (1999). Self-perceptions and health: A prospective analysis of mortality, control, and health. *Psychological Sciences, 54B*(2), 32-57.

Morrongiello, B.A., & Gottlieb, B. H. (2000). Self care among older adults. *Canadian Journal on Aging, 19*(1), 32-57.

Murphy, S. P., Davis, M.A., Neuhaus, J. M., & Lein, D. (1990). Factors influencing the dietary adequacy and energy intake of older Americans. *Journal of Nutrition Education, 22*(6), 284-291.

Nickols-Richardson, S. M., Johnson, M. A., Poon, L. W., & Martin, P. (1996). Demographic predictors of nutritional risk in elderly persons. *Journal of Applied Gerontology, 15*(3), 361-375.

Oldridge, N. B., Stump, T. E., Nothwehr, F. K., & Clark, D. O. (2001). Prevalence of outcomes of comorbid metabolic and cardiovascular conditions in middle- and older-age adults. *Journal of Clinical Epidemiology, 54,* 928-934.

Pallant, J. (2007). *SPSS survival manual* (3rd Ed.). New York, NY: McGraw-Hill.

Passer, M. W., & Smith, R. E. (2001). *Psychology: Frontiers and applications*. New York, NY: McGraw-Hill.

Payette, H. (2005). Nutrition as a determinant of functional autonomy and quality of life in aging: A research program. *Canadian Journal of Physiological Pharmacology, 83,* 1061 1070.

Payette, H., Gray-Donald, K., Cyr, R., & Boutier, V. (1995). Predictors of dietary intake in a functionally dependent elderly population in the community. *American Journal of Public Health, 85*(5), 677-683.

Pomerleau, J., Ostbye, T., & Bright-See, E. (1997). Food intake of immigrants and non-immigrants in Ontario: Food group comparison with the recommendations of the 1992 Canada's Food Guide to Healthy Eating. *Journal of the Canadian Dietetic Association, 58*(2), 68-76.

Public Health Agency of Canada (2006). *Diabetes: Facts and figures.* Retrieved January 8, 2008 from: www.phac-aspc.gc.ca/ccdpc-cpcmc/diabetes-diabete/english/facts/index.html.

Raphael, D. (2004). Introduction to the social determinants of health. In D. Raphael (Ed.), *Social Determinants of Health: Canadian Perspectives* (pp. 1-18). Toronto, Ontario: Canadian Scholars' Press Inc.

Rimal, R. N. (2000). Closing the knowledge-behavior gap in health promotion: The mediating role of self-efficacy. *Health Communication, 12*(3), 219-237.

Robertson, A., Brunner, E., & Sheiham, A. (2006). Food is a political issue. In (M. Marmot, & R. G. Wilkinson (Eds.), *Social determinants of health: Second edition* (pp. 172-195). New York: Oxford University Press Inc.

Rodin, J. (1986). Aging and health: Effect of the sense of control. *Science, New Series, 233*(4770), 1271-1276.

Roos, E., Lahelma, E., Virtanen, M., Prättälä, R., & Pietinen, P. (1998). Gender, socioeconomic status and family status as determinants of food behaviour. *Sociology, Science, Medicine, 46*(12), 1519-1529.

Roos, E., Prättälä, R., Lahelma, E., Kleemola & Pietinen, P. (1996). Modern and healthy? Socioeconomic differences in the quality of diet. *European Journal of Clinical Nutrition, 50,* 753-760.

Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*(4), 328-335.

Schlenker, E. D. (1998). *Nutrition in aging* (3rd ed.). New York: McGraw-Hill.

Schneider, E. L., Vining, E. M., Hadley, E. C., & Farnham, S. A. (1986). Recommended dietary allowances and the health of the elderly. *New England Journal of Medicine, 314*(3), 157- 160.

Schnoll, R., & Zimmerman, B. J. (2001). Self-regulation training enhances dietary self-efficacy and dietary fiber consumption. *Journal of American Dietetic Association, 101*(9), 1006-1011.

Shannon, J., Kirkley, B., Ammerman, A., Keyserling, T., Kelsey, K., DeVellis, R., & Simpson, R. J. (1997). Self-efficacy as a predictor of dietary change in a low-socioeconomic status southern adult population. *Health Education & Behaviour, 24*(3), 357-368.

Shatenstein, B., Nadon, S., & Ferland, G. (2004). Determinants of diet quality among Quebecers aged 55-74. *The Journal of Nutrition, Health, and Aging, 8*(2), 83-91.

Stamler, J., Stamler, R., & Neaton, J. D., Wentworth, D., Daviglus, M. L., Garside, D., Dyer, A. R., Liu, K., & Greenland, P. (1999). Low risk-factor profile and long-term cardiovascular and noncardiovascular mortality and life expectancy. *Journal of American Medical Association, 292,* 2012-2018.

Statistics Canada (2005). *Canadian Community Health Survey: Obesity among children and adults.* Retrieved January 5th, 2008 from: www.statcan.ca/Daily/English/050706/d050706a.htm.

Statistics Canada: Health Statistics Division (2006). *Smoking and diabetes care: results from the CCHS cycle 3.1.* Ottawa: Minister of Industry.

Steptoe, A., Doherty, S., Kerry, S., Rink, E., & Hilton, S. (2000). Socio-demographic and psychological predictors of changes in dietary fat consumption in adults with high blood cholesterol following counseling in primary care. *Health Psychology, 19,* 411-419.

Steptoe, A., Perkins-Porras, L., Rink, E., Hilton, S., & Cappuccio, F. P. (2004). Psychological and social predictors of changes in fruit and vegetable consumption over 12 months following behavioral nutrition education counseling. *Health Psychology, 23*(6), 574-581.

Steptoe, A., Perkins-Porras, L., Rink, E., Hilton, S., & Cappuccio, F. P. (2003). Psychological factors associate with fruit and vegetable intake and with biomarkers in adults from a low-income neighbourhood. *Health Psychology, 22*(6), 574-581.

Stewart, M., Davidson, K., Meade, D., Hirth, A., & Makrides, L. (2000). Myocardial infarction: Survivors' and spouses' stress, coping, and support. *Journal of Advanced Nursing, 31*(6), 1351-1360.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*: *Fifth Edition*. Boston: Pearson Education, Inc.

Terry, D. F., Pencina, M. J., Vasan, R. S., Murabito, J. M., Wolf, P. A., Hayes, M. K., Levy, D., D'Agostino, R. B., & Benjamin, E. J. (2005). Cardiovascular risk factors predictive for survival and morbidity-free survival in the oldest-old Framingham Heart Study participants. *Journal of American Geriatrics Society, 53*(11), 1944-1950.

Varghese, S., & Moore-Orr, R. (2002). Dietary acculturation and health-related issues of Indian immigrant families in Newfoundland. *Canadian Journal of Dietetic Practice and Research, 63*(2), 72-79.

Vogt, T. M., Appel, L. J., Obarzanek, E., Moore, T. J., Vollmer, W. M., Svetkey, L. P., Sacks, F. M., Bray, G. A., Cutler, J. A., Windhauser, M. M., Lin, P., & Karanja, N. M. (1999). Dietary approaches to stop hypertension rationale, design, and methods. *Journal of the American Dietetic Association, 99*(8), S12-S18.

Vozoris, N., & Tarasuk, V. (2003). Household food insufficiency is associated with poorer health. *Journal of Nutrition, 133*, 120-126.

Wakimoto, P., & Block, G. (2001). Dietary intake, dietary patterns, and changes with age: An epidemiological perspective. *Journals of Gerontology: SERIES A, 56A*(II), 65-80.

Wandel, M. (1995). Dietary intake of fruits and vegetables in Norway: Influence of life phase and socio-economic factors. *International Journal of Food Sciences and Nutrition, 46*(3), 291-301.

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

Wamsteker, E. W., Geenen, R., Iestra, J., Larsen, J. K., Zelissen, P. M. J., & Van Staveren, W. A. (2005). Obesity-related beliefs predict weight loss after an 8-week low-calorie diet. *Journal of American Dietetic Association, 105*, 441-444.

Whitmer, R. A., Gunderson, E. P., Barrett-Connor, E., Quesenberry, C. P., & Yaffe, K. (2005). Obesity in middle age and future risk of dementia: a 27 year longitudinal population-based study. *British Medical Journal, 330,* 1360-1366.

Wilson, D. K., Friend, R., Teasley, N., Green, S., Reaves, I. L., & Sica, D. A. (2002). Motivational versus social cognitive interventions for promoting fruit and vegetable intake and physical activity in African American adolescents. *Annals of Behavioral Medicine, 24*(4), 310-319.

Wister, A. V., Loewen, N., Kennedy-Symonds, 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.

Wister, A. V., & Wong, M. (2002). Using alternative therapies to manage chronic illness among older adults: an examination of the health context, predisposing and enabling processes. *Canadian Journal on Aging, 21*(1), 47-62.

Zizza, C., Herring, A. H., Stevens, J., & Popkin, B. (2004). Length of hospital stays among obese individuals. *American Journal of Public Health, 94,* 1587-1591.

Appendices

- **Appendix A: CHBPP Participant Flowchart**