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THE INFLUENCE OF FOOD CHOICES ON FRUIT AND VEGETABLE CONSUMPTION AND SELF-RATED HEALTH: IS IT MODERATED BY SELF-EFFICACY?

by

Natalie Phillips
Bachelor of Arts (Honours), Bishop's University, 2006

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Abstract

Food choices are deliberate decisions to consume or avoid foods that ultimately affect diet and health. This study examined the health protective properties of self-efficacy by examining the relations between food choices and two outcomes: fruit and vegetable consumption and self-rated health. Data were collected from 7,520 Manitoba residents in Cycle 4.1 of the Canadian Community Health Survey. The study found that: 1) food choices based on personal health or product content did not relate to daily fruit and vegetable consumption; 2) females were more cognisant than males of their own health and of the content of a given food when making food choices; 3) relations between self-efficacy and food choices were overshadowed by effects of sociodemographic factors; and 4) food choices based on the chooser's health were more closely related to daily fruit and vegetable consumption and to self-rated health when self-efficacy was high than when self-efficacy was low. The findings revealed a complex interplay of sociodemographic and psychological factors in determining dietary behaviour. Current findings also suggest that healthful eating, and subsequently good health, can best be achieved through targeted, comprehensive nutrition programs and policy that supports healthy lifestyle.

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The Influence of Food Choices on Daily Fruit and Vegetable Consumption and Self-Rated Health: Is it Moderated by Self-efficacy?

Poor diet is a controllable risk factor for several chronic diseases, including obesity. Carrying excess body weight is associated with a wide range of poor health outcomes (Katzmarzyk & Ardern, 2004). The current prevalence of overweight and obesity is unprecedented (WHO, 2003a; Tjepkema, 2005), and the global rate of increase over the past few decades is alarming.

Overweight and obesity can be screened for using the Body Mass Index (BMI), whereby the percentage of body fat is estimated based on a ratio of height to weight (kg/m^2). Health Canada (2003b) outlined BMI weight classifications for adults over age 20 to include: underweight (<18.5), normal weight (18.5-24.9), overweight (25-29.9), obese (30-35), and morbidly obese (>35). The BMI-for-age index is used for children aged 2 to 18. The index is calculated in the same manner as for adults, except that BMI-for-age growth charts project BMI at age 18 based on current BMI in relation to international gender norms (Cole, Bellizzi, Flegal, & Dietz, 2000). A BMI below the 5th percentile is identified as underweight, between the 5th and 85th percentile as within normal range, between the 85th and 95 percentile as overweight, and equal to or greater than the 95th percentile as obese (Cole et al., 2000). The presenting problem is the growing number of children that have a BMI in the uppermost ranges, which signifies an increase of overweight and obesity amongst this age group (Cole et al., 2000). Obesity was formally considered a health problem of the affluent Western world, where issues of

overconsumption outweighed those of food security. In the last decade however, obesity has become a global epidemic. The burden of overweight and obesity on health care systems are costly whether measured in dollars or in quality of life (McAmmond, 2000; Finkelstein, Fiebelkorn & Wang, 2003). Therefore, the motivating factors that result in healthful versus unhealthful lifestyle choices require further investigation.

The data speak to how desperately intervention is needed. In Canada, approximately 8.2% of children aged 2 to 17 are obese. According to Health Canada (2007), rates of obesity are highest in Newfoundland and Labrador (16.6%) and New Brunswick (13%) and lowest in British Columbia (6.7%) and Québec (7.1%). The prevalence of adult obesity nearly doubled between 1978 and 2004, increasing from 13.8% to 23.1% of the population (Tjepkema, 2004). Across the ten provinces, Health Canada (2007) found the prevalence of adult obesity to be highest in Newfoundland and Labrador (34.7%) and Saskatchewan (30.6%), and lowest in British Columbia (19.3%) and Québec (21.9%). In the United States, 44% of children aged 2 to 19 are either overweight or obese (National Centre for Health Statistics, 2006). Nearly one-third (31.4%) of Americans aged 20 and older is overweight (National Centre for Health Statistics, 2008), and an additional one-third is obese (Ogden, Carroll, McDowell, and Flegal, 2007). Recent global estimates indicate that more than 20 million children (< 5 years old) are overweight, 1.6 billion people aged 15 and older are overweight, and at least 400 million adults are obese (WHO, 2005).

Health research has established strong links between diet, obesity and other chronic forms of illness. Type-2 diabetes, heart disease, and endometrial, breast, and colon cancers, to name a few, can be precipitated by unhealthful diet (Health Survey for

England, 2007). Each year, over 60,000 new cases of diabetes are diagnosed in Canada, 90% of which receive a type-2 diagnosis (Health Canada, 2004). Phrased differently, each year 54,000 Canadians acquire an illness that healthy life style and better food choices could have helped to prevent. Today, more than one in every four Canadians is diabetic (Dawson, Gomes, Gerstein, Blanchard & Kahler, 1998) and global projections estimate that 6.4% of all adults will have diabetes by 2030 (WHO, 2002). Cardiovascular disease and cancer also rank high amongst chronic diseases that can result from unhealthful diet (WHO, 2003b). Global surveys have found that up to 31% of coronary heart diseases and 11% of strokes are partially attributable to insufficient intake of fruit and vegetables (WHO, 2002). Cardiovascular disease is the leading cause of death in Canada and the United States (WHO, 2002), and kills 4.3 million people in Europe each year (Allender, Scarborough, Peto, Rayner, Leal, Luengo-Fernandez, & Gray, 2008). These chronic diseases, in addition to overweight and obesity, share a simple first step in primary prevention – a diet high in whole grains, omega fats, and fruit and vegetables, and low in saturated and trans fats, sodium and refined sugars (Mancino, 2007).

Food Choices

Choosing what foods to eat is determined by an interplay of sensory preferences, socio-economic considerations and personal ideals (Lindeman and Stark, 1999), and the foods one enjoys are determined by an evolving set of physiological, metabolic, cultural, and psychological variables (Logue, 2004, pp. 310, 338). However, the principles that should guide our food choices are often overshadowed by considerations of convenience. The volume and varieties of food available are so great that people can theoretically eat whatever they want, whenever they want it. This is problematic for two reasons: 1) what

we eat has a substantive impact on how long and how well we live, and 2) it undermines the personal responsibility toward self-care.

The link between food choices and health has long been established, yet Canadians' understanding of this relationship and its role within their own lives is variable. Some people perceive healthy eating to mean following a balanced diet according to Canada's Food Guide to Healthy Eating (House, Su & Levy-Milne, 2006), and they identify the benefits of healthy eating to include an improved sense of well being, maintaining a healthy weight, and preventing disease (House, et al., 2006). Indeed, there are indications that some Canadians are motivated to improve personal health through diet and weight loss (Nielsen Reports, 2009). However, for the vast majority, healthful food and lifestyle choices are diluted by unhealthful ones. For example, a national poll on eating habits revealed that 59% of Canadians were making a concerted effort to limit their fat intake, though only 26% said they were trying to eat more fibre (Statistics Canada, 1995). Another survey found that many Canadians are reluctant to reduce their intake of sugar even when trying to improve their diet to better health and lose weight (Nielsen Reports, 2009). Misinformation about nutritional and caloric needs may precipitate inconsistencies between intentions to eat healthfully and healthful foods actually consumed, and bridging this gap requires improved surveillance initiatives.

Food and nutrition surveillance monitors and forecasts population health (McAmmond, 2000). It involves the study of food and nutrient intakes, food safety, determinants of healthy eating, demographics, and food security, and it is one of the means through which nutritional guidelines came into existence (McAmmond, 2000). Current tools that disseminate nutritional guidelines are in place, but their effectiveness in

terms of facilitating healthful food choices is inadequate. *Canada's Food Guide to Healthy Eating* was introduced to assist Canadians with food selection. For nearly seventy years it has outlined a variety of nutritious food choices that offer variety and help to minimize the risk of developing diet-related disease. Canada's Food Guide recommends daily servings from each of the five food groups (fruits and vegetables, grains, milk and alternatives, meat and alternatives, other foods) for all persons based on their age and gender (Health Canada, 2003b). Even with the aid of nutritional guidelines, recent studies have found that as many as seven out of 10 elementary school-aged children (Garriguet, 2004) and approximately half of adults (McAmmond, 2000; Garriguet, 2004) do not get the recommended five daily servings of fruits and vegetables. Females consistently consume fewer servings of fruits and vegetables than males in every province, despite the fact that both genders are recommended to consume the same quantity. The percentage of females who eat at least five servings of fruits and vegetables each day ranges from 16.9% in Newfoundland and Labrador to 56.3% in Québec, while the range for males is 31.4% in Newfoundland and Labrador to 65.2% in Québec (Health Canada and Statistics Canada, 2007). Canadians also eat too much from the Other Foods group, which is comprised of fats, oils and processed foods (Garriguet, 2004).

Rates of adherence are also low in other countries that offer similar food guides. Only 35% of American adults eat the minimum 2.5 cups of fruits and vegetables per day (WHO, 2003a.). In England, a mere 27% of men, 31% of women, and 21% of children consume five or more servings of fruit and vegetables per day, even though the majority of adults and children surveyed knew they were not meeting the daily minimum requirements (NHS, 2009). The Food and Agricultural Office (FAO) and the World

Health Organisation collect information on dietary patterns across European countries. In 2003, the average adult intake of fruit and vegetables was below WHO recommendations in 80% of the 46 European countries surveyed, while consumption of saturated fats exceeded WHO recommendations in most countries (WHO, 2003b). We can neither fully nor confidently account for these unhealthful choices, however we can conclude that nutrition knowledge and good dietary habits are not strongly related (De Almeida, Graca, Lappalainen, Giachetti, Kafatos, Remaut de Winter & Kearney, 1997)

The disconnect between health knowledge and behaviour is partially due to conflicting information about healthful foods and food choices. Contradictions can undermine motivation to adopt healthful changes, which is why communiqués from healthcare professionals, food distributors, media and government must be both accurate and consistent (De Almeida et al. 1997). Furthermore, they must also consider how individual differences manifest in food choices and prominently affect dietary behaviours.

Sociodemographic determinants of food choices.

Gender. Females engage in more health-protective behaviours than males. There is some evidence to suggest that this trend is conditioned into the genders early on as part of child-rearing practices. In a Belgian study on parental restriction of junk foods and its effect on food choices made in adolescence, 429 students aged 12 to 22 answered questions pertaining to parental control over their diets (de Bourdeaudhuij, 1997). Females compared to males reported significantly more parental restrictions on unhealthful foods in childhood, and consumed fewer unhealthful foods in adolescence (de Bourdeaudhuij, 1997).

Gender differences in food choices are further exacerbated amongst college-age

students. The influence of gender on dietary trends, eating habits, and nutrition self-assessment was assessed for 105 male and 181 female undergraduate students at a large midwestern university in the United States (Davy, Benes & Driskell, 2006). Significantly more females than males believed that their diets were too rich in carbohydrates and that limiting fat was crucial to weight loss (Davy et al., 2006), although 94% of all students believed it was important to eat a variety of foods for good health (Davy et al., 2006). Huang, Song, Schemmel & Hoerr (1994) also examined the dietary behaviours of 1,912 college students, using food diaries to determine the frequency of meals skipped and specific foods favoured by each gender. Of those students sampled, 22% skipped breakfast, 8% skipped lunch, 5% o skipped dinner, and 80% of the students snacked at least once a day (Huang et al., 1994). Carbonated beverages, lower fat milks, and lean white meats were amongst the top foods selected by both genders, whereas vegetables and fruits were ranked more highly for females only (Huang et al., 1994). Males consumed more calorie dense foods, high-fat foods, and fast foods (Huang et al., 1994).

Age. Some research has found age differences in perceptions of healthful eating. An opinion poll of women and their mothers from 58 families living in Scotland asked which foods were considered good for children (Blaxter & Paterson, 1983). The older generation responded with meat, soup, potatoes and other vegetables, porridge, fish and fruit, and placed emphasis on combining such foods into complete meals (Blaxter & Paterson, 1983). The younger generation, on the other hand, answered with milk, eggs, fruit and vegetables, and placed less importance on cooked meals that incorporated different healthful foods (Blaxter & Paterson, 1983). The notion of healthfulness remains ideally organic despite the increasing role of industrial processes in modern food systems.

In North America, the average child is exposed to approximately 40,000 food advertisements per year, of which 30,000 market candy, sugary cereals, and fast foods (Mello, Studdard & Brennan, 2006). Most children under the age of eight lack the capacity to understand the persuasive intent of commercials, and are more vulnerable to advertisements that promote unhealthfulness (Mello et al., 2006). However, because parents are more likely to monitor the food choices of younger children more so than for older children and adolescence, diets of younger children tend to be better balanced. A study of 4,746 adolescents from public middle- and high schools in Minnesota found that middle-school girls reported higher intakes of calcium, fruit, vegetables, and grains than high-school girls, and middle-school boys consumed more fruits and vegetables than high school boys (Neumark-Sztainer, Story, Hannan & Croll, 2002). For older children and adolescence, and for adults who make their own food choices, education may be the most effective means to improving diet quality.

Education. Level of education relates positively to dietary behaviour during adulthood (Kearney, Jearney, Dunne, & Gibney, 2000). A sample of 758 females and 580 males, aged 18 to 24 years, were asked to complete a questionnaire regarding food choices as well as health-related characteristics and habits (Georgiou, Betts, Hoerr, Keim, Peters, Stewart & Voichick, 1997). The study compared responses for college students, college graduates, and nonstudents and found that female nonstudents were more often overweight than female students or graduates (Georgiou et al., 1997), and that college students and graduates consumed more dietary fibre, more fruits and dark-green vegetables, lower-fat milk and more meat than nonstudents (Georgiou et al., 1997). Caregivers' level of education has also affects food choices and the quality of nutrition of

dependents (Vereecken, Keukelier & Maes, 2004). Three-hundred-and-sixteen mothers with children aged 2.5 to 7 years completed a self-administered questionnaire on food choices (Vereecken et al., 2004). Differences between levels of education were found in both children's and mothers' consumption of fruits, vegetables and soft drinks, and in mothers' use of restrictions, verbal praise, negotiation, discouragement of sweets (Vereecken et al., 2004). Mothers' permissiveness positively correlated with children's consumption of soft drinks and sweets and negatively correlated with their vegetable consumption, and highly educated mothers who completed an undergraduate degree were less permissive than mothers with had not completed high school (Vereecken et al., 2004). Highly educated mothers also praised their children more for eating fruits and vegetables, and they themselves consumed more fruits and vegetables, fewer soft drinks themselves than mothers with low levels of education (Vereecken et al., 2004).

Similar to formal education, specialised nutrition education has demonstrated health-protective benefits. Allen, Smith-Taylor and Kuiper (2007) assessed the effect of nutritional education on fast food meal choices in a sample of adolescents, aged 13 to 15. Allen et al. (2007) found significant improvements in terms of calories, fat, carbohydrate, and fibre content between the pre- and post-intervention meals.

Income. Morbidity rates in industrialised countries follow a socioeconomic gradient, where less affluent groups show a greater prevalence of diet-related diseases such as obesity, diabetes, cardiovascular disease, osteoporosis, and cancer (Darmon & Drewnoski, 2008). Income disparities in most nations are wide enough to demonstrate the divide between socioeconomic classes on matters of health, in terms of knowledge and diet quality (Drewnowski, Darmon & Briend, 2004; Darmon & Drewnowski, 2008;

Mancino, 2007). Some argue that healthful diets are driven by a simple economic reality: low-quality diets cost less than high-quality diets and therefore more affluent groups can afford healthier food than poorer groups. Much of the literature supports this point of view, however unhealthful food choices also correlate with psychological stress and emotional distress, which too follows a socioeconomic gradient (Marmot, 2004).

Several studies have compared diet quality on the basis of income. A study on the daily cost of food was conducted on 527 families living in France (Drewnowski et al., 2004). It found that diets that consisted of grains, fats and junk foods cost less than diets of fruit and vegetables, fish, and meat (Drewnowski et al., 2004). Calnan (1990) examined differences between social classes and eating beliefs and behaviours amongst 37 women. Compared to working-class women, middle-class women had a better understanding of healthy versus unhealthy foods and were more likely to buy groceries that reflected their nutritional beliefs. Neumark-Sztainer et al. (2000) also examined social class differences in adolescent eating behaviours and found that adolescents from low socioeconomic backgrounds consumed less calcium, fruits, and vegetables and grains per day than adolescents from high socioeconomic backgrounds. In schools, reducing the cost of fresh fruit and vegetables, as well as healthy vending machine snacks, led to increased consumption of these foods (Neumark-Sztainer, 1999), implying a direct relationship between the cost and consumption of healthful food options.

Research also suggests that practical constraints (e.g., cost and availability) combine to prevent nutritional knowledge from being put into practice (Donkin, Dowler, Stevenson & Turner, 2000). This conclusion stems from research that indicates greater financial resources do not necessarily translate into better quality diet, although it may

make a broader range of foods accessible. Proximity to grocery stores together with cost affect the quality of food choices, as fresh foods (fruits, vegetables, dairy, meats, and seafood) are less expensive closer to the source (Donkin et al. 2000). The 1996 Pan-European Survey of Consumer Attitudes to Food, Nutrition and Health (Glanz, Basil, Maibach, Goldberg & Snyder, 1998) surveyed 15 countries about factors that influenced food choices and found that cost was not the leading predictor. In fact, the number one influence of food choices for respondents was quality/freshness (74%), then cost (43%), taste (38%), health (32%). and likes/dislikes (29%), but priorities differed according to sub-population. For some low and fixed-income households, cheap, calorie-dense foods is the most cost-effective way to feed a family, although it is also likely increasing awareness of nutritious food options would lead to inexpensive, healthier food choices.

Health promotion relies on the development of effective interventions, which require knowledge of the psychological and social processes that underlie our decision-making. Therefore, interventions that are intended to teach healthful food choices must consider the psychological determinants of food choices for a specific target population. The application of psychological theory is an important step towards framing health promotion problems and developing effective intervention strategies.

Self-efficacy Theory

Self-efficacy Theory emerged from a branch of Bandura's (1977) Social Cognitive Theory, which asserts that human functioning results from interplay between behaviour, environment, and personal factors. In this triad, self-efficacy is a personal factor that Bandura (1986) defined as a person's belief that he or she can perform a behaviour required to produce their desired outcome in a given situation. Self-efficacy is

influenced by past experiences, vicarious experiences, verbal persuasion, and emotional and physiological feedback (Bandura, 1977) – all of which can occur independently or in conjunction with one another (see Figure 1).

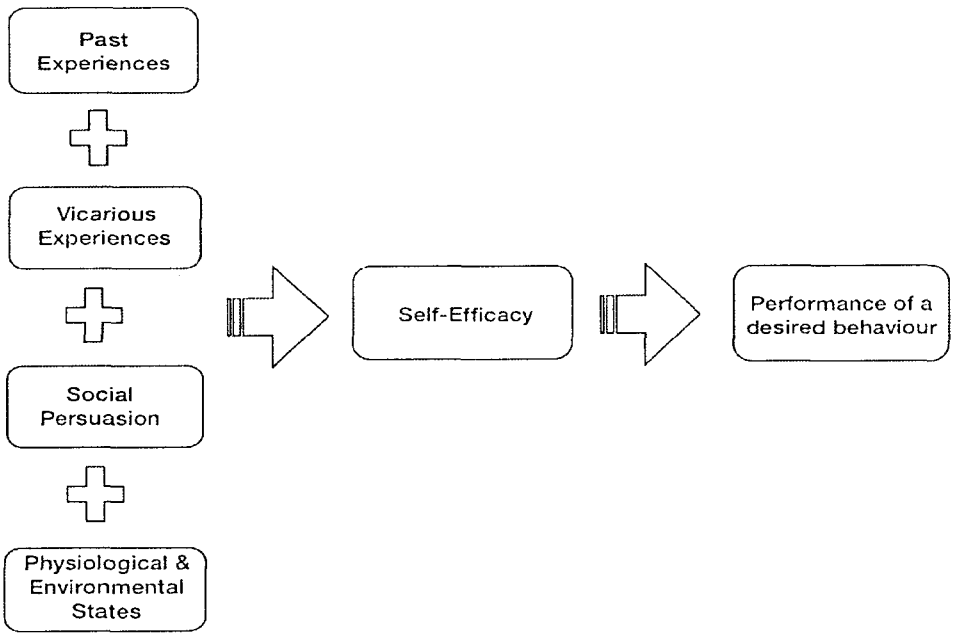

Figure 1. *Self-efficacy model adapted from Bandura (1977).*

These four factors forge high self-efficacy following repetitive, successful executions of behaviours that lead to a desired outcome. Alternatively, they produce low self-efficacy following a series of failures at a given task (Bandura, 1994). Self-efficacy is typically conceptualized as domain-specific, but each domain-specific feeds into a larger, general sense of personal mastery.

Mastery, a feeling of control over one's own life and environment, associates with physical and emotional well-being (Pearlin & Schooler, 1978). It is a construct that closely relates to self-efficacy and produces feelings of competence that transfers across a

range of difficult or novel situations (Bandura, 1977). A commonly used measure of mastery is the Pearlin-Schooler's (1978) Mastery Scale, which was used in the present study as a measure of self-efficacy beliefs.

Self-efficacy has become an increasingly refined construct during the last few decades. A strong body of empirical evidence demonstrates self-efficacy beliefs are a determining factor of motivation, affect, thought and action (Bandura, 1997). Low self-efficacy associates with symptoms of depression and anxiety, helplessness, and negative affect (Bandura, 1997), and people with low self-efficacy are often pessimistic about their abilities (Schwarzer, 1999). Conversely, high self-efficacy relates to high self-esteem, assertiveness, decision-making, and academic and occupational achievement (Schwarzer, 1999), and people with high self-efficacy more often master or perceive mastery over a particular domain (Bandura, 1997). In the face of setback or failure, highly self-efficacious people rebound more quickly than low self-efficacious people (Bandura, 1997), they are more likely to be intrinsically motivated, and to challenge themselves with difficult tasks. Therefore, Self-efficacy Theory became a practical framework through which to analyse individual health behaviours.

Associations between Self-efficacy and Health Outcomes

Self-efficacy directly relates to health and a broad range of health-protective behaviours (Bandura, 1997). For instance, oncology research reports patients with high self-efficacy are more likely adhere to courses of treatment, and less likely to report physical and psychological complaints than patients with low self-efficacy (Lev, 1997). Research in addictions also focuses on self-efficacy in relation to drug use and relapse, particularly for smoking cessation. Relapse after quitting smoking is less common

amongst people with high self-efficacy compared to smokers with low self-efficacy (Shiffman, Balabanis, Paty, Engberg, Gwaltney & Liu, 2000). In fact, low self-efficacy interacts with negative affect to increase relapse amongst smokers (Gwaltney, Shiffman, & Sayette, 2005), and following initial relapse, gains versus losses in self-efficacy predict additional relapse (Gwaltney, Shiffman, Balabanis, & Paty, 2005). Highly self-efficacious people are also more likely to abstain from cigarettes during cravings (Shiffman et al., 2000). Addiction research, as it pertains to rehabilitation, also shows that patterns of recovery can be predicted by an addict's level of self-efficacy. Dolan, Martin, Rohsenow (2008) examined self-efficacy beliefs about quitting and abstaining in high-risk situations amongst 163 cocaine addicts. Self-efficacy strongly associated with a desire to stop using and confidence to abstain in high-risk situations (Dolan et al., 2008). Self-efficacy does not appear to counteract the physiological withdrawal from chemical substances, which is to say that high self-efficacy will not stop an addict from using, but it can predict whether a recovering addict will relapse (Dolan et al., 2008).

Self-efficacy has also been studied within the context of birth control to explain unprotected sexual behaviour. Self-efficacy beliefs in one's capability to negotiate safer sex practices emerged as the most important predictor of protective behaviours (Levinson, 1982), and sexually-active adolescent females use contraceptives more effectively if they believe themselves to be in control of their sexual encounters (Levinson, 1982).

A further application of Self-efficacy Theory, and the focus of this paper, is dietary behaviour. Nutrition self-efficacy operates in concert with changes in lifestyle and is a predictor of healthful food choices. Self-efficacious patients in weight loss programs demonstrate better adherence to new diets and lower rates of relapse to previous eating

habits (Bagozzi, Moore & Leon, 2004; Daniel, Brown, Dhurrkay, Cargo & O'Dea, 2008). Bernier and Avard (1986) examined self-efficacy beliefs and weight change amongst 62 women in a weight loss treatment program. Measurements of self-efficacy and weight loss were taken pre- and post-treatment, and at follow-up assessments (Bernier & Avard, 1986). Self-efficacy predicted weight loss outcomes up to six months following the termination of the program, and attrition rates were lower amongst participants with high self-efficacy (Bernier & Avard, 1986). Linde, Rothman, Balwin, and Jeffrey (2006) also assessed self-efficacy beliefs, weight control behaviours, and weight loss among 379 individuals (87% women) in a weight loss treatment program. Eating and exercise self-efficacy beliefs were robustly correlated with weight loss while participants were receiving treatment (Linde et al., 2006). Daniel et al. (2008) examined self-efficacy beliefs in relation to stress, diet and exercise amongst an indigenous population in Australia. For individuals 25 years of age and older, eating vegetables three or fewer times per week was associated with less mastery than those eating vegetables four or more times per week (Daniel et al., 2008). Similarly, exercising less than twice per week was associated with lower mastery than exercising three or more times per week, whereas for individuals under the age of 25, exercising less than twice per week associated with greater mastery than exercising three or more times per week (Daniel et al., 2008).

Despite significant research into food choices, there is little reason to believe that dietary practices will improve in the future. It is important for food choices, as they vary according to age, gender, culture, socioeconomic background and physiological and psychological states, to be better understood. It is also important for the research community to be better informed about which segments of the Canadian population have

the most to gain from self-efficacy beliefs, and who are at greatest risk for unhealthful food choices, poorest quality diet, obesity, and so forth. Health promotion research should be directed to addressing the problems of specific sub-populations, rather than disseminating blanket health information to the general population (Povey, Connor, Sparks, James & Shepherd, 1998). Doing so is arguably the most effective meant through which to narrow the knowledge gaps that permeate health promotion research today.

The Present Study

This study contributes to existing research on the importance of food choices by applying the theoretical framework of Self-efficacy to explore linkages between Food Choices, Fruit and Vegetable Consumption and Self-Rated Health. It considers several sociodemographic variables and compares them on the basis of these main variables.

This study used data collected in Cycle 4.1 of the Canadian Community Health Survey (CCHS). The CCHS gathered health-related data at the sub-provincial level to be used for health surveillance and population health research. An important advantage of using data from the CCHS in this study is that differences in behaviours and beliefs can be studied across sociodemographic groups that represent the Canadian population. Much of the extant research on self-efficacy theory is based on smaller, clinical samples, which does not inform about which segments of the population have unhealthful diets or have the most to gain from self-efficacy beliefs in terms of their diet and health.

This CCHS survey had four content components: the core content, the theme content, the optional content and the rapid response content (Health Canada, 2009). The core content was asked of all respondents and includes items that pertain to alcohol use, flu shots, health care utilization, physical activities, smoking, administrative information,

and socio-demographic characteristics to name a few. The theme content was also collected from the entire sample and covers a two-year theme (2007-2008: Healthy Living) and an annual theme (2007: Health Services and Access, 2008: Prevention of Chronic Illness). The optional content allowed health regions to select content that addresses their public health priorities. In Cycle 4.1, the optional content was a measure of Mastery (Self-efficacy). Lastly, the rapid response component was offered to organizations interested in national estimates on an emerging or specific issue related to the health of our population. These items appeared in the questionnaire for two months during the cycle and were asked of all respondents during that time.

The CCHS used three overlapping frames to select samples of participants in all health regions. The area frame adopted from the Canadian Labour Force Survey served as the primary frame for CCHS (Brisebois & Thivierge, 2001). However, telephone frames were added due to the high cost of face-to-face interviews in remote regions, which resulted in difficulty obtaining a representative sample in those regions. Telephone sampling involved random digit dialling procedures using electronic telephone directories (Brisebois & Thivierge, 2001). Using three frames simultaneously allowed researchers to better access to the population of interest. Given the use of stratified sampling and data weighting, the data from the CCHS Cycle 4.1 survey are believed to represent the Canadian population and be ideally suited to studying dietary behaviours in Canadian adults. The CCHS sample is representative of persons aged 12 years and older who lived in private dwellings across the ten provinces and three territories of Canada. Persons living on Aboriginal settlements, residing in institutions, full-time members of the Canadian Forces, and people living in certain remote regions of the country were

excluded from the survey.

Purpose

This cross-sectional, population study was designed to test the associations between Food Choices and two outcome variables: Fruit and Vegetable Consumption and Self-Rated Health. It also examined the moderating effects of Self-efficacy beliefs in each of these associations. Specifically, the following four hypotheses were tested:

Hypothesis 1: Food Choices based on personal health and/or product content would associate positively with (a) Fruit and Vegetable Consumption and (b) Self-Rated Health;

Hypothesis 2: Females base Food Choices based on personal health and product content more than males;

Hypothesis 3: Self-efficacy shares positive associations with Food Choices based on personal health and product content;

Hypothesis 4: Self-efficacy moderates the relationships between a) Food Choices and Fruit and Vegetable Consumption such that Food Choices and Fruit and Vegetable Consumption would be more closely related with high Self-efficacy than with low Self-efficacy; and b) Food Choices and Self-Rated Health, such that Food Choices and health would be more closely related with high Self-efficacy than with low Self-efficacy.

Methods

Participants

The sample consisted of Manitoba residents (n = 7,519) who completed core content items on Food Choices, Fruit and Vegetable Consumption and Self-Rated Health, as well as optional content on Self-efficacy beliefs. Manitoba was the only jurisdiction in

the CCHS Cycle 4.1 that collected data on the main variables of interest in this study. Participation in this survey was voluntary; therefore no remuneration was given to respondents. The sample was stratified and data were weighted to best represent all health regions and sociodemographic conditions in Manitoba, however Non-White Aboriginal populations were under-represented (Statistics Canada, 2008).

Measures

Demographic profile. Data on six sociodemographic variables were used to gain background information about the participants: Gender, Age group (12-19 years, 20-29 years, 30-39 years, etc.), Race (White or Non-White), Education (Less than Secondary, Secondary Graduation, Some Post-Secondary, or Post-Secondary Graduation), and household Income, before taxes (less than $20,000, $20,000 to 39,999, $40,000 to 59,999, $60,000 to 79,999, $80,000 or more) and Health Region (Winnipeg, Brandon/Assiniboine, North and South Eastman, Interlake, Central, Parkland, and Norman/Burntwood/Churchill).

Pre-existing Illness. Respondents were presented with a comprehensive list of chronic conditions and asked which, if any, they had ever received a diagnosis. At six points throughout the 32-item section, the phrase "Remember, we're interested in conditions diagnosed by a health professional" appeared to discourage respondents from engaging in self-diagnoses.

BMI Group. BMI is a screening tool that compares a person's weight to their height by dividing the weight measurement in kilograms by the square of the height in meters (kg/m^2). The calculation generates a number that is used to estimate body fat and to define weight classifications. Respondents self-reported their height and weight, which

was then used to calculate BMI. Standard classifications were used to identify Underweight (BMI < 18.5), Normal weight (BMI > 18.5 and < 24.9), Overweight (BMI > 25 and < 29.9), Obese (BMI > 30). BMI groupings for participants in the 12-19 age group were determined using Cole et al.'s (2000) international BMI-for-age growth charts.

Food Choices. Food Choices are deliberate decisions to consume or avoid foods for reasons relating to physical health and/or food content. Participants were asked three sets of questions to identify what concerns determine food choices. The first set of four items assessed participants' food choices that originated from health considerations: Do you choose certain foods or avoid others because you are concerned about your body weight? Heart disease? Cancer? Osteoporosis (brittle bones)? The second set of items assessed choosing foods based on their content: Do you choose certain foods because of the lower fat content? The fibre content? The calcium content? The third set of items assessed avoiding foods based on their content: Do you avoid certain foods because of the fat content? The type of fat they contain? The salt content? The cholesterol content? The calorie content? Each question was answered with 'Yes' or 'No.' Two dichotomous variables were generated to identify participants who responded 'Yes' to any of the four questions about Food Choices for health considerations (FC Health) and participants who responded 'Yes' to any of the eight questions about Food Choices based on product content (FC Content).

Self-efficacy. Mastery is the extent to which one's abilities, choices and life are regarded as being under one's own control (Pearlin & Schooler, 1978). Accumulating a number of mastery experiences is the most effective way to develop a strong sense of

self-efficacy (Bandura, 1994). Participants in this study were administered Pearlin and Schooler's (1978) seven-item personal mastery scale, for which they rated their level of agreement with the following statements: You have control over the things that happen to you, There is really no way you can solve some of the problems you have, There is little you can do to change many of the important things in your life, You often feel helpless in dealing with problems of life, Sometimes you feel that you are being pushed around in life, What happens to you in the future mostly depends on you, and You can do just about anything you really set your mind to. Participants responded to each item on a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). With two items reverse scored, total scores can range from 7 to 35, where higher scores indicated greater feelings of self-efficacy. Scores below 20 indicate lower self-efficacy (Pearlin & Schooler, 1978). Self-efficacy scores were centred.

Fruit and Vegetable Consumption. Fruit and vegetable consumption was operationalised as the total number of daily servings of fruit, fruit juice, green salad, potatoes, carrots and other vegetables. Participants were asked the following questions: How often do you usually drink fruit juices such as orange, grapefruit or tomato? Not counting juice, how often do you usually eat fruit? How often do you (usually) eat green salad? How often do you usually eat potatoes, not including french fries, fried potatoes, or potato chips? How often do you (usually) eat carrots? Not counting carrots, potatoes, or salad, how many servings of other vegetables do you usually eat? These were quantitative questions, and therefore the numbers in the responses represented the number of servings consumed on a daily, weekly, monthly or yearly basis, as specified by the participant.

Self-Rated Health. The Self-Rated Health indicator measured perceptions of overall health. Participants answered the question "How would you evaluate your health?" on a 5-point scale (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent). Though there is no measure of internal consistency for this item, it has been used extensively in the past. The Self-Rated Health indicator was constructed by Ware and Sherbourne (1992) for the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). Previous research has found that this brief assessment of health is a sensitive indicator of morbidity (Idler & Benyamini, 1997) and predictor of disease-related mortality (Singh-Manoux, Guéguen, Martikainen, Ferrie, Marmot, & Shipley, 2007).

Procedure

Sampling. The selection of individual respondents was designed to ensure over-representation of youth aged 12 to 19, and seniors aged 65 and older. According to Health Canada (2007), in CCHS Cycle 4.1, 49% of the sampled households came from an area frame, 50% came from the list frame, and 1% came from the random digit dialling. Selection of respondents from households in the area frame depended on the household composition and was intended to increase the representation of the two age groups of special interest. For households selected from the random digit dialling frame, one person aged 12 or older was randomly chosen from all household members (Health Canada, 2009). There were seven Health Regions sampled in Manitoba: Winnipeg, Brandon/Assiniboine, North and South Eastman, Interlake, Central, Parkland, and Norman/Burntwood/Churchill.

Data collection and processing. The data used for this study were collected between January and December 2008. Data collection was spread out over the course of

a year in order to balance interviewer workload and to minimize seasonal effects on certain health-related characteristics (Health Canada, 2009). Data editing was performed on a continual basis throughout the course of data collection using a computer-assisted interviewing application that detects and prompts a correction of inconsistencies in participants' responses (Health Canada, 2009).

Interviewing. At the initial contact, field interviewers from Statistics Canada visited all dwellings selected from the area frame. An inventory was made of everyone residing in the household, and then one member was randomly selected to complete the survey. Interviewers administered the questionnaire directly to the selected respondent whenever possible. The procedure was similar for the sampling units from the random digit dialing frame. If the respondent was unavailable at the time of the visit or telephone call to complete the survey, interviewers returned at a later date or attempted to reach the respondent by telephone. If the selected respondent remained unavailable after repeated contact attempts, interviewers requested that another resident of the household complete a proxy interview on behalf of the first respondent. However, proxy's interviews were used for just 1.8% of the sample. In all, 30.14% of all interviewers were conducted by telephone, 65.88% were carried out in person, and another 3.97% used both methods.

The interview for the health region-level survey took approximately 45 minutes: 30 minutes of common content, 10 minutes of optional content as determined by the respondent's health region, and 5 minutes of socioeconomic and demographic content. The focused provincial-level survey took about 60 minutes and consisted of general health content and one focus content specific to the cycle.

Weighting. Data weights for the CCHS survey were supplied by Statistics Canada

in a public use microdata file. Once applied, the data better represented the population of Manitoba. Data weights reflected the sample stratification by region, age, gender and other sociodemographic characteristics. The average data weight was approximately 50, meaning that each case in the provincial sample represented approximately 50 cases in the population (Health Canada, 2009). Initially, the Manitoba sample was calculated to have a mean weight of 126.32 (See Table 1). These population weights were applied to the data but were rescaled so as not to inflate the sample size of 7,519. That is, original data weights were divided by the average data weight (126.32) to produce new weights that had a mean of 1. The rescaled data weight took into account the unequal probabilities of selection.

Table 1.

Data Weights for the Population of Manitoba in CCHS Cycle 4.1.

	N	Sum	*M*	*SD*
Weights	7520	949,993.82	126.32	170.05

Results

Preliminary analyses dealt with missing cases, outliers, assessed the data's compliance with the statistical assumptions of general linear model analyses, and then examined characteristics of the sample, descriptive statistics and correlations among the variables. The main analyses tested four hypotheses: (1a) Food Choices based on personal health and/or product content would associate positively with Fruit and Vegetable Consumption and (1b) Self-Rated Health; (2) Females make Food Choices based on personal health and product content more than males; (3) Self-efficacy shares positive associations with Food Choices based on person4l health and product content; and (4a) Self-efficacy moderates the relationships between Food Choices and Fruit and Vegetable Consumption and (4b) Food Choices and Self-Rated Health. All statistical analyses were performed using PASW Statistics 18.0 for Mac OS X (SPSS Inc., Encino, CA).

Preliminary Analyses

Data Preparation. Data were screened for outliers using boxplots and histograms of frequency distributions. Cases that exceeded three standard deviations above or below the mean for each variable were recognised as outliers. Outliers were detected in Age, Income, and Fruit and Vegetable Consumption variables but these values were retained in order to preserve the composition of the sample. The range of responses was expected to vary widely given the weighted data reflected the sociodemographic make-up of the Manitoba population.

A case-by-case examination was performed to identify and eliminate influential cases but none were found. Missing values were replaced with mean series values

estimated by regression. The percentages of missing data were 2.3% (Education), 16.5% (Income), 1.9% (Race), 14.3% (BMI), 2.5% (FC Health), 2.6% (FC Content), 6.8% (Fruit and Vegetable Consumption), and 0.1% (Self-Rated Health). A total of 7,520 usable responses were analysed for this study.

Requirements for linear regression analyses were also examined; specifically, homogeneity of variance and normality. Results of these analyses are shown in Table 2. The Kolmogorov-Shapiro (K-S) statistic tested the assumption of normality for each variable. Skewness, kurtosis values and histograms were also examined for each variable. The assumption of homogeneity of variance was tested for each variable using the Levene Test for Equality of Variances (*W*). Levene statistics were based on median values, with the exception of Fruit and Vegetable Consumption distributions across Gender, BMI, Education, Income, FC Health, and FC Content. These distributions were heavily tailed; therefore the Levene statistic was based on the trimmed mean instead of the median as recommended by Brown and Forsythe (1974). The distributions of data on Fruit and Vegetable Consumption and Self-Rated Health were skewed and had unequal variances across genders, Age groups, BMI classifications and levels of Education and FC Content. Self-Rated Health also had unequal variances across health regions, having a Pre-existing Illness, and Income. For these reasons, Fruit and Vegetable Consumption and Self-Rated Health were analysed using both linear and logistic regression models using both the full range of data on these variables as well as established thresholds.

Table 2.

Tests of Normality and Homogeneity of Variance in Daily Fruit and Vegetable Consumption and Self-Rated Health across Demographic Variables.

	FVC			Self-Rated Health		
	K-S Statistic	Levene		K-S Statistic	Levene	
		W	*p*		*W*	*p*
Gender		5.82	.02		19.56	.01
Male	.11**			.23**		
Female	.09**			.24**		
Age Group		5.19	.01		15.11	.01
12-19	.11**			.20**		
20-29	.16**			.27**		
30-39	.10**			.25**		
40-49	.10**			.23**		
50-59	.09**			.24**		
60-69	.09**			.21**		
70-79	.10**			.20**		
80 and older	.13**			.20**		

Region		2.02	.07		3.89	.02
Winnipeg	.10**			22**		
Brandon/Assinboine	.10**			.26**		
North and South Eastman	.08**			.26**		
Interlake	.13**			.28**		
Parkland	.11**			.25**		
Norman/Burntwood/Churchill	.11**			.23**		
BMI Group		7.72	.01		8.60	.01
Normal weight	.11**			.24**		
Underweight	.18**			.22**		
Overweight	.10**			.25**		
Obese	.09**			.25**		
Pre-existing Illness		.11	.74		118.93	.01
Yes	.10**			.20**		
No	.10**			.25**		
Race		.12	.62		2.08	.07
White	.10**			.25**		
Non-White	.10**			.21**		

Education		9.76	.01		12.08	.01
Less than Secondary	.10**			.18**		
Secondary Graduation	.07**			.26**		
Some Post-Secondary	.10**			.26**		
Post-Secondary Graduation	.11**			.23**		
Income		1.02	.40		24.99	.01
Less than $20, 000	.07**			.20**		
$20, 000 to $39, 000	.10**			.19**		
$40, 000 to $59, 000	.11**			.25**		
$60, 000 to $79, 000	.10**			.25**		
$80, 000 or more	.12**			.25**		
Food Choices						
Health		5.17	.01		1.92	.14
Yes	.37**			.23**		
No	.45**			.23**		
Content		25.49	.01		1.93	.11
Yes	.38**			.24**		
No	.47**			.22**		

Notes: K-S = Kolmogorov-Smirov statistic. FVC = Fruit and Vegetable Consumption.

*$p < .05$. **$p < .01$.

Characteristics of the sample. Demographic information was collected from participants. For descriptive purposes, unweighted and weighted *N*s and percentages are presented in Table 3 for each demographic group, however no significant differences were detected between weighted and unweighted values. The sample was evenly split for gender: 50.7% female and 49.3% male. Median Age range was 40 to 49 years. Eighty-six percent of participants identified as White, and the remaining 14% identified as unspecified Non-White. Approximately 60% of the sample resided in Winnipeg, 10.1% in Brandon, 8.8% in North and South Eastman, 6.6% in Interlake, 8.5% in Parkland, and the remaining 6.2% came from Norman, Burntwood, or Churchill. Self-reported BMI suggested that a very small percentage of the sample was Underweight (2.7%), while most were either of Normal Weight (42.4%), Overweight (35.3%), or Obese (19.5%). Approximately half of the sample reported having a Pre-existing Illness (52.3%), with ailments ranging from asthma to cancer to migraines to mood disorders. With regards to Education, approximately 27% of the sample completed Less than Secondary, 17% were Secondary Graduates, 8.6% completed Some Post-Secondary, and 47.2% were Post-Secondary Graduates. The average annual household Income was between $40, 000 and $59,000. Self-efficacy amongst the sample was good ($M = 25.72$, $SD = 4.14$), as scores > 20 indicate high self-efficacy (Pearlin & Schooler, 1978). Sixty-one percent of the sample reported basing food choices on health, and 73.2% reported content as a consideration in making food choices. Still, average Fruit and Vegetable Consumption fell below Canada's Food Guide recommended five to ten servings ($M = 4.56$, $SD = 2.61$). Self-Rated Health was generally.

Table 3.

Characteristics of the Sample.

		Unweighted		Weighted	
		N	%	N	%
Gender	Male	3715	46.8	3705	49.3
	Female	4002	53.2	3814	50.7
Age group	12-19	893	11.9	982	13.1
	20-29	905	12.0	1218	16.2
	30-39	1074	14.3	1207	16.1
	40-49	1042	13.9	1300	17.3
	50-59	1181	15.7	1162	15.5
	60-69	1022	13.6	791	10.5
	70-79	794	10.6	532	7.1
	80 and older	608	8.1	328	4.4
Region	Winnipeg	2112	28.1	4505	59.9
	Brandon	1277	17.0	758	10.1
	N. & S. Eastman	1183	15.7	661	8.8
	Interlake	669	8.9	494	6.6
	Parkland	799	10.6	637	8.5
	Norman/Burntwood/ Churchill	1480	19.7	465	6.2

Education	Less than Secondary	2364	32.2	2001	27.2
	Secondary Graduation	1256	17.1	1249	17.0
	Some Post-Secondary	522	7.1	636	8.6
	Post-Secondary Graduation	3206	43.6	3468	47.2
Income	Less than $20,000	838	13.3	585	9.2
	$20,000 to 39,999	1598	25.4	1354	21.3
	$40,000 to 59,999	1194	19.0	1178	18.5
	$60,000 to 79,999	1019	13.6	1196	18.8
	$80,000 and over	1633	21.7	2035	32.1
Race	White	6191	84.0	5767	78.3
	Non-White	1182	16.0	1598	21.7
BMI group	Normal	2490	38.6	2698	42.4
	Underweight	136	2.1	175	2.7
	Overweight	2292	35.7	2247	35.3
	Obese	1521	23.6	1240	19.5
Pre-existing Illness	Yes	4323	57.5	3935	52.3
	No	3196	42.5	3584	47.7
FC Health	Yes	4449	61.1	4449	61.1
	No	2830	38.9	2830	38.9
FC Content	Yes	5316	73.2	5316	73.2
	No	1948	26.8	1948	26.8
FVC	Fewer than 5	4497	64.2	4508	64.2

	5 to 10	2277	32.5	2257	32.1
	Greater than 10	235	3.4	262	3.7
Self-Rated Health	Poor	255	3.4	193	2.6
	Fair	815	10.9	709	9.4
	Good	2397	31.9	2325	31.0
	Very Good	2878	38.3	2929	39.0
	Excellent	1164	15.5	1354	18.0

Descriptive statistics. Means, standard deviations, ranges and the skewness and kurtosis values for all continuous variables are presented in Table 4. These values were calculated with and without the use of data weights. However, as no significant differences were detected, only the weighted values are presented. Although FC Content and FC Health are dichotomous variables, they are presented here as well given that they were subsequently used in linear regression analyses to examine their interactions with Self-efficacy in their associations with Fruit and Vegetable Consumption and Self-Rated Health.

Table 4.

Descriptive Statistics of Key Variables.

	N	M	SD	Range	Skewness	Kurtosis
Gender (female)	7519	1.51	.50	1.00 – 2.00	-.03	-2.0

Age groups	7519	3.88	1.97	1.00 – 8.00	.28	-.82
Education	7354	2.76	1.29	1.00 – 4.00	-.30	-1.65
Income	6349	3.43	1.37	1.00 – 5.00	-.27	-1.25
Race	7366	12.22	.41	1.00 – 2.00	1.37	-.11
BMI group	6360	2.72	.81	1.00 – 4.00	.24	-.90
Pre-existing Illness	7519	1.48	.50	1.00 – 2.00	.09	-1.99
Self-efficacy	7519	25.72	4.14	6.0 – 34.0	-.35	.35
FC Health	7279	1.39	.49	1.00 – 2.00	.46	-1.79
FC Content	7264	1.27	.44	1.00 – 2.00	1.05	-.91
Self-Rated Health	7510	.57	.50	1.00 – 5.00	-.28	-1.92

Bivariate correlations. A Pearson correlation matrix is presented in Table 5. Weak correlations ($r < .20$), while statistically significant, are not discussed below given that they represent less than 4% of shared variance. Fruit and Vegetable Consumption positively correlated with FC Health and FC Content, $r = .23$ and $r = .24$, respectively. Self-Rated Health shared positive correlations with Age, $r = .23$, Self-efficacy, $r = .27$, and FC Health, $r = .34$, but was negatively related to having a Pre-existing Illness, $r = -.34$ and Income, $r = -.22$. FC Health produced weak, positive correlations to female gender, $r = .20$, and to Education, $r = .24$, but shared a strong, positive relationship with FC Content, $r = .69$. FC Content related positively with female Gender, $r = .20$, and with Education, $r = .25$. Correlation results also indicated a moderate, negative relationship between Age groups and Pre-existing Illness, $r = -.38$. As expected, Education was positively correlated to Income group, $r = .23$. These correlations and several others shown in Table 5, whist statistically significant, reflected just 1 to 5% of shared variance. Therefore, to better examine their independent contributions to Fruit and Vegetable Consumption and Self-Rated Health, a series of linear and logistic regression analyses were carried out next.

Table 5.

Bivariate Correlations Between Variables (n = 7,519).

	1.	2	3.	4	5.	6.	7.	8.	9.	10.	11.	12.
1. Gender (female)	-	.05**	-.13*	-.01	-.11**	.02	-.12**	.20**	.20**	-.04**	.13**	.05**
2. Age group		-	-.38**	-.17**	.11**	.11**	-.16**	.13**	.18**	-.14**	-.02	.23**
3. Pre-existing Illness			-	.08**	-.14**	-.02	.11**	-.11**	-.13**	.15**	.01	-.34**
4. Race				-	-.05**	-.06**	-.11**	-.06**	-.06**	-.09**	-.02	.03**
5. BMI group					-	-.05**	-.02	.04**	.05**	-.03*	-.07**	.14**
6. Education						-	.23**	.24**	.22**	.16**	.05**	-.12**
7. Income							-	.07**	.03*	.19**	.03*	-.22**
8. FC health								-	.61**	.03*	.15**	-.02
9. FC content									-	.06**	.14**	-.01
10. Self-efficacy										-	.09**	-.27**
11. FVC											-	-.09**
12. Self-Rated Health												-

Note: FVC = Fruit and Vegetable Consumption

*$p < .05$. ** $p < .01$.

Main Analyses

Hypothesis 1a – FC Health and FC Content relate to Fruit and Vegetable Consumption. A logistic regression was performed to identify which demographic variables increased the probability of eating five or more servings of fruits and vegetables daily, in accordance with Canada's Food Guide (Table 6). The likelihood achieving optimal Fruit and Vegetable Consumption was 25% greater (odds ratio = 1.25) with every decade of Age above 12-19 years. Self-efficacy increased the likelihood of eating five or more daily servings of fruit and vegetables daily for Underweight individuals (odds ratio = 1.26) and Parkland residents who based Food Choices on their personal health (odds ratio = 1.04), but decreased the likelihood for Secondary School Graduates (odds ratio = 93), and Overweight individuals who based Food Choices on personal health (odds ratio = 0.97). However, neither FC Health nor FC Content related to the likelihood of eating five or more servings of fruit and vegetables daily.

Table 6.

Logistic Regression of Five or More Servings of Fruits and Vegetables Daily by Demographic Characteristics and Self-efficacy (n = 7, 520).

Variable	B	SE	Odds Ratio	95% CI
Gender (female)	.13	.40	1.13	.52 – 2.47
Age groups (12-19)	.30	.12	1.25	1.05 – 1.74
Region (Winnipeg)				
Brandon/Assiniboine.	1.56	.71	4.77	1.18 – 19.24

N. & S. Eastman	.73	.71	2.08	.52 – 8.36
Interlake	-1.69	.83	.19	.04 – .94
Parkland	.57	.79	1.77	.38 – 8.41
Norman/Burntwood/Churchill	-.62	.84	.54	.11 – 2.76
Pre-existing Illness	-.11	.44	.90	.38 – 2.12
Race	.02	.08	1.02	.88 – 1.20
BMI group (Normal weight)				
Underweight	-4.58	1.43	.01	.00 – .17
Overweight	-.77	.45	.46	.19 – 1.11
Obese	.12	.53	1.17	.41 – 3.29
Education (Less than Secondary)				
Secondary Graduation	1.59	.68	4.89	1.29 – 18.61
Some Post-Secondary	-.08	.85	.93	.18 – 4.91
Post-Secondary Graduation	.65	.57	1.92	.63 – 5.85
Income (Less than $20,000)	-.01	.02	.99	.95 – 1.04
Self-efficacy	.11	.04	1.11	1.04 – 1.20
FC Health	.60	.56	1.82	.61 – 5.48
FC Content	.01	.63	1.01	.29 – 3.51
Gender x Self-efficacy	-.02	.02	.98	.95 – 1.01
Age groups x Self-efficacy	-.02	.01	.99	.98 – 1.00
Region x Self-efficacy				

Brandon/Assiniboine.	-.05	.03	.95	.90 – 1.01
N. & S. Eastman	-.05	.03	.96	.90 – 1.01
Interlake	.07	.03	1.07	1.00 – 1.14
Parkland	-.05	.03	.96	.90 – 1.02
Norman/Burntwood/Churchill	.03	.03	1.03	.96 – 1.10
Pre-existing Illness x Self-efficacy	-.00	.02	1.00	.96 – 1.03
BMI x Self-efficacy				
Underweight	.23	.06	1.26	1.12 – 1.41
Overweight	.04	.02	1.04	1.00 – 1.08
Obese	-.00	.02	1.00	.96 – 1.04
Education x Self-efficacy				
Secondary graduation	-.08	.03	.93	.88 – .98
Some post-secondary	.03	.03	1.03	.96 – 1.10
Post-secondary graduation	-.23	.23.	.98	.93 – 1.02
FC Health x Self-efficacy	-.01	.02	.99	.94 – 1.03
FC Content x Self- efficacy	.00	.03	1.00	.95 – 1.06
Gender x FC Health x Self-efficacy	-.00	.01	1.00	.99 – 1.01
Age groups x FC Health x Self-efficacy	.00	.00	1.00	1.00– 1.01
Region x FC Health x Self-efficacy				
Brandon/Assiniboine.	.00	.01	1.00	.98 – 1.02
N. & S. Eastman	.01	.01	1.01	.98 – 1.03

Interlake	-.01	.01	.99	.97 – 1.01
Parkland	.03	.01	1.04	1.01 – 1.06
Norman/Burntwood/Churchill	-.00	.01	1.00	.97 – 1.02
Pre-existing Illness x FC Health x Self-efficacy	.01	.01	1.01	1.00 – 1.03
BMI x FC Health x Self-efficacy				
Underweight	.11	.03	1.01	.96 – 1.06
Overweight	-.03	.01	.97	.96 - .99
Obese	-.02	.01	.98	.96 – 1.00
Education x FC Health x Self-efficacy				
Secondary Graduation	.01	.01	1.01	.99 – 1.03
Some Post-Secondary	-.01	.01	.99	.96 – 1.01
Post-Secondary Graduation	.02	.01	1.02	1.00 – 1.01
Gender x FC Content x Self-efficacy	-.00	.01	1.00	.99 – 1.01
Age groups x FC Content x Self-efficacy	.00	.00	1.00	1.00– 1.01
Region x FC Content x Self-efficacy				
Brandon/Assiniboine.	-.02	.01	.98	.96 – 1.01
N. & S. Eastman	.01	.02	1.01	.98 – 1.04

Interlake	.01	.02	1.01	.98 – 1.04
Parkland	-.01	.02	.99	.96 – 1.02
Norman/Burntwood/Churchill	.003	.02	1.00	.97 – 1.03
Pre-existing Illness x FC Content x Self-efficacy	-.02	.01	.99	.97 – 1.00
BMI x FC Content x Self-efficacy				
Underweight	-.06	.03	.95	.90 – 1.00
Overweight	.01	.01	1.01	.99 – 1.03
Obese	.00	.01	1.00	.98 – 1.02
Education x FC Content x Self-efficacy				
Secondary graduation	.00	.01	1.00	.98 – 1.03
Some post-secondary	-.01	.01	1.00	.97 – 1.02
Post-secondary graduation	-.01	.01	.99	.97 – 1.01

Hypothesis 1b – FC Health and FC Content relate to Very Good or Excellent Self-Rated Health. A logistic regression model was used to determine which demographic variables associated with Very Good or Excellent Self-Rated Health (Table 7). The results indicated that residents of Interlake were more likely than residents of Winnipeg (odds ratio = 6.10) to rate their health as Very Good or Excellent. Being Overweight increased the likelihood of Very Good or Excellent health (odds ratio = 2.75), and so too

did annual household Income above $20,000 (odds ratio = 1.17), Self-efficacy (odds ratio = 1.11), and FC Health (odds ratio = 8.56). Only Pre-existing Illness decreased the likelihood of Very Good or Excellent (odds ratio = 0.39).

Significant two-way interactions were found amongst several of these demographic variables in their contributions to health. Self-efficacy interacted with Race to ameliorate the negative association between identifying as a Non-White and health; Non-Whites were only 4% less likely than Whites to rate their health as Very Good or Excellent. Overweight interacted with FC Content to increase the probability of Very Good or Excellent health by 3%. Self-efficacy erased the perceived poor health of persons with a Pre-existing Illness, and increased the likelihood of self-rating health as Very Good or Excellent by 9%. Self-efficacy interacted with FC Health to decrease the likelihood of Very Good or Excellent by 10% but combined with FC Content to increase the odds by 3%.

Regression analysis also indicated the presence of three-way interactions in predicting the likelihood of Very Good or Excellent Self-Rated Health. A significant three-way interaction was found between Region, FC Health and Self-efficacy. The outcome was a 3% increase in the probability of Very Good or Excellent Self-Rated Health amongst residents of North and South Eastman compared to residents of Winnipeg. Age interacted with FC Health and Self-efficacy to increase the odds by 1% in the decades following adolescence. Overweight interacted with FC Health and Self-efficacy, which decreased the probability of Very Good or Excellent Self-Rated Health by 3%. There were two significant three-way interactions obtained for Education; the first with FC Health and Self-efficacy, which increased the probability of optimal health by

2% amongst Secondary School Graduates compared to those with Less than Secondary education, and the second with FC Content and Self-efficacy, which decreased the probability of optimal health by 3% amongst Secondary School Graduates compared to those with Less than Secondary education.

Table 7.

Logistic Regression of Very Good or Excellent Self-Rated Health by Demographic Characteristics and Self-efficacy (n = 7,519).

Variable	B	SE	Odds Ratio	95% CI
Gender (female)	-.20	.42	.82	.36 – 1.87
Age group (12-19)	-.11	.13	.90	.69 – 1.16
Region (Winnipeg)				
Brandon/Assiniboine	1.24	.77	3.44	.75 – 15.88
N. & S. Eastman	.73	.73	2.08	.50 – 8.67
Interlake	1.84	.78	6.28	1.31 – 28.30
Parkland	.37	.79	1.45	.31 – 6.89
Norman/Burntwood/Churchill	.37	.89	1.45	.25 – 8.27
Pre-existing Illness	-3.27	.45	.39	.02 – .10
Race	-.42	.08	.66	.56 – .77
BMI group (Normal Weight)				
Underweight	-.29	1.45	.60	.04 – 10.11
Overweight	.98	.47	2.75	1.11 – 6.84

Obese	.29	.56	1.34	.45 – 3.98
Education (Less than Secondary)				
Secondary Graduation	1.08	.68	2.94	.78 – 11.07
Some Post-Secondary	1.01	.85	2.76	.52 – 14.66
Post-Secondary Graduation	.17	.58	1.18	.38 – 3.68
Income	.16	.02	1.17	1.11 – 1.23
Self-efficacy	.11	.04	1.11	1.04 – 1.20
FC Health	2.17	.60	8.56	2.67 – 27.38
FC Content	-.24	.64	.79	.23 – 2.77
Gender x Self-efficacy	-.02	.02	1.02	.98 – 1.05
Age groups x Self-efficacy	-.00	.01	1.00	.99 – 1.01
Region x Self-efficacy				
Brandon/Assiniboine	-.01	.03	1.00	.93 – 1.05
N. & S. Eastman	-.01	.03	1.00	.94 – 1.06
Interlake	-.05	.03	.95	.89 – 1.01
Parkland	.01	.03	1.01	. 95 – 1.08
Norman/Burntwood/Churchill	-.01	01	1.00	.93 – 1.07
Pre-existing Illness x Self-efficacy	.09	.02	1.09	1.05 – 1.13
Race x Self-efficacy	-.04	.02	.96	.93 – .99
Self-efficacy (Whites)	.18	.04	1.19	1.10 – 1.29
Self-efficacy (Non-Whites)	-.04	.08	1.12	.83 – 1.12

BMI x Self-efficacy				
Underweight	.04	.06	1.04	.92 – 1.17
Overweight	-.04	.02	.96	.93 – 1.00
Obese	-.03	.02	.98	.93 – 1.02
Education x Self-efficacy				
Secondary graduation	-.02	.03	.98	.93 – 1.03
Some post-secondary	-.00	.03	1.00	.93 – 1.07
Post-secondary graduation	.01	.02	1.01	.96 – 1.05
Income x Self-efficacy	.00	.01	1.00	.99 – 1.01
FC Health x Self-efficacy	-.12	.04	.90	.83 – .95
FC Content x Self-efficacy	.09	.04	1.03	1.01 – 1.17
Gender x FC Health x Self-efficacy	-.00	.01	.99	.98 – 1.01
Age groups x FC Health x Self-efficacy	.01	.00	1.00	1.00 – 1.01
Region x FC Health x Self-efficacy				
Brandon/Assiniboine	-.01	.01	.99	.97 – 1.02
N. & S. Eastman	.03	.01	1.03	1.00 – 1.05
Interlake	.01	.01	1.01	.99 – 1.04
Parkland	.02	.01	1.02	. 99 – 1.04
Norman/Burntwood/Churchill	.01	.01	.1.01	.98 – 1.04
Pre-existing Illness x FC Health x Self-efficacy	.01	.01	1.01	1.00 – 1.03

Race x FC Health x Self-efficacy	.00	.01	1.00	.98 – 1.02
BMI x FC Health x Self-efficacy				
Underweight	-.02	.03	.98	.94 – 1.03
Overweight	-.03	.01	.97	.96 - .99
Obese	-.02	.01	1.01	.97 – 1.00
Education x FC Health x Self-efficacy				
Secondary Graduation	.03	.01	1.03	1.01 – 1.05
Some Post-Secondary	-.01	.01	.99	.97 – 1.02
Post-Secondary Graduation	.02	.01	1.02	1.00 – 1.04
Income x FC Health x Self-efficacy	.00	.00	1.00	1.00 – 1.01
Gender x FC Content x Self-efficacy	.00	.01	1.00	.99 – 1.02
Age groups x FC Content x Self-efficacy	-.02	.00	1.00	.99 – 1.00
Region x FC Content x Self-efficacy				
Brandon/Assiniboine	-.01	.01	.99	.96 – 1.01
N. & S. Eastman	-.03	.01	.97	.94 – 1.00
Interlake	-.02	.02	.98	.96 – 1.01
Parkland	-.03	.02	.97	.94 – 1.00
Norman/Burntwood/Churchill	-.03	.02	.98	.95 – 1.00
Pre-existing Illness x FC Content x Self-efficacy	-.01	.01	.99	.97 – 1.01
Race x FC Content x Self-efficacy	-.03	.01	.97	.96 – .99

BMI x FC Content x Self-efficacy				
Underweight	-.01	.03	.99	.94 – 1.05
Overweight	.02	.01	1.02	1.00 – 1.03
Obese	.00	.01	1.00	.98 – 1.02
Education x FC Content x Self-efficacy				
Secondary Graduation	-.03	.01	.97	.95 - .99
Some Post-Secondary	-.01	.01	.99	.96 – 1.02
Post-Secondary Graduation	-.01	.01	1.00	1.00 – 1.03
Income x FC Content x Self-efficacy	.00	.00	1.00	1.00 – 1.01
FC Health x FC Content x Self-efficacy	-.03	.01	.97	.96 - .99

Hypothesis 2 –Females base more Food Choices on health and product content than males. Since both dependent variables suffered from abnormal data distributions, logistic regression analyses were carried out to examine links between demographic characteristics and FC Health (Table 8) and FC Content (Table 9).

The results indicated that females were in fact more likely to base Food Choices on personal health than males (odds ratio = 2.66; Table 8). One regional difference was also detected for residents of Brandon, who were significantly less likely than residents of Winnipeg to base Food Choices on personal health (odds ratio = .74). Pre-existing Illness increased the likelihood of FC Health (odds ratio = 1.20), whereas identifying as a Non-

White rather than as White decreased this likelihood (odds ratio = .78)%. Education and Income also increased the probability of FC Health.

Table 8.

Logistic regression of FC Health by Demographic Characteristics.

Variable	B	SE	Odds Ratio	95% CI
Gender (female)	.98	.64	2.66	2.35 – 3.01
Age groups (12-19)	.04	.02	1.04	1.00 – 1.08
Region (Winnipeg)				
Brandon/Assiniboine	-.31	.10	.74	.60 – .90
N. & S. Eastman	-.21	.11	.81	.65 – 1.01
Interlake	-.07	.12	.93	.73 – 1.19
Parkland	-.19	.12	.83	.65 – 1.04
Norman/Burntwood/Churchill	-.18	.13	.83	.65 – 1.07
Pre-existing Illness	.18	.07	1.20	1.05 – 1.37
Race	-.26	.08	.78	.67 – .90
BMI (Normal weight)				
Underweight	-.59	.20	.55	.38 – .81
Overweight	-.20	.07	1.22	1.06 – 1.40
Obese	.35	.09	1.42	1.20 – 1.68
Education				

Secondary Graduation	.14	.10	1.15	.96 – 1.39
Some Post-Secondary	.57	.12	1.78	1.40 – 2.25
Post-Secondary Graduation	1.03	.09	2.80	2.37 – 3.32
Income	.10	.02	1.10	1.05 – 1.15

Another logistic regression model estimated the odds ratios of FC Content according to demographic characteristics (Table 9). Females were more likely base Food Choices on content than males (odds ratio = 2.49). The likelihood of FC Content also increased 16% per decade after adolescence and into late adulthood. Compared to residents from Winnipeg, the probability FC Content was lower amongst residents of Brandon/Assiniboine (odds ratio = .71), North and South Eastman (odds ratio = .74), and Parkland (odds ratio = .77). FC Content was also less likely amongst non-Whites (odds ratio = .77) and Underweight respondents (odds ratio = .63), but more likely for those who were Obese (odds ratio = 1. 35). Pre-existing Illness increased the odds of FC Content (odds ratio = 1.17), as did Education. Compared to participants with Less than Secondary schooling, FC Content was 30% more likely amongst Secondary School Graduates, 95% more likely amongst respondents with Some Post-Secondary, and 188% more likely amongst Post-Secondary Graduates. The likelihood of FC Content increased by 7% when annual household Income exceeded $20,000.

Table 9.

Logistic Regression of FC Content by Demographic Characteristics.

Variable	B	SE	Odds Ratio	95% CI
Gender (female)	.91	.72	2.49	2.16 – 2.87
Age group (12-19)	.15	.02	1.16	1.12 – 1.23
Region (Winnipeg)				
Brandon/Assiniboine	-.34	.11	.71	.57 - .89
N. & S. Eastman	-.31	.12	.74	.58 - .94
Interlake	.10	.15	1.10	.83 – 1.46
Parkland	-.27	.13	.77	.60 – .98
Norman/Burntwood/Churchill	-.21	.14	.81	.62 – 1.07
Pre-existing Illness	.16	.07	1.17	1.01 – 1.12
Race	-.26	.08	.77	.65 – .91
BMI group (Normal Weight)				
Underweight	-.46	.21	.63	.42 – .95
Overweight	.04	.08	1.04	.89 – 1.21
Obese	.30	.10	1.35	1.11 – 1.63
Education (Less than Secondary)				
Secondary Graduation	.26	.11	1.30	1.06 – 1.59
Some Post-Secondary	.67	.13	1.95	1.51 – 2.53
Post-Secondary Graduation	1.06	.09	2.88	2.39 – 3.46

Income	.06	.03	1.07	1.01 – 1.35

Hypothesis 3 –Self-efficacy positively relates to FC Health and FC Content. Bivariate correlations tested associations between FC Health, FC Content and Self-efficacy (Table 5). These correlations indicated that Self-efficacy not strongly associated with FC Health, $r(7,518) = .03, p < .05$, nor with FC Content, $r(7,518) = .06, p < .01$. However, once several sociodemographic factors were taken into account in a linear regression model (Table 10), it was found that FC Health negatively related to Self-efficacy, $b = -.39$, $t(5417)$, $p < .01$, and positively related to FC Content, $b = .73$, $t(5417)$, $p < .001$. Self-efficacy was also positively associated with having a Pre-existing Illness, $b = .99$, $t(5417) = 8.10$, $p < .001$, Education, $b = .40$, $t(5417) = 7.91$, $p < .001$, and Income, $b = .73$, $t(5417) = 4.30$, $p < .01$, and negatively associated with Age, $b = -.33$, $t(5417) = -9.34$, $p < .001$, and Non-White racial status, $b = -.99$, $t(5417) = -7.39$, $p < .001$. When fit to the data, the model explained 9% of the variance in Self-efficacy, $R^2 = .09$, $F(7, 5410) = 76.59$, $p < .001$.

Table 10.

Linear Regression of Self-efficacy by Demographic Characteristics.

Variable	*B*	SE	β	*T*	*P*
Constant	.16	.06		2.75	< .001
Gender (female)	-.13	.12	-.02	-1.08	.28

Age groups	-.33	.04	-.13	-9.34	< .001
Pre-existing Illness	.99	.12	.11	8.10	< .001
Race (Non-White)	-1.04	.14	-.10	-7.39	<.001
BMI Group	-.07	.07	-.01	-.98	.33
Education	.40	.05	.11	7.91	< .001
Income	.73	.17	.07	4.30	< .001
FC Health	-.39	.15	-.04	-2.59	< .01
FC Content	.73	.17	.07	4.30	< .001

Hypothesis 4a – Self-efficacy moderates the relations between Food Choices and Fruit and Vegetable Consumption. A linear regression model examined the association between Fruit and Vegetable Consumption and demographic characteristics and assessed the moderating influence of Self-efficacy on this relationship. Results are presented in Table 11. The model accounted for 10.6% of the total variance in Fruit and Vegetable Consumption, $R^2 = .11$, $F\ (12, 5267) = 51.83$, $p < .001$.

Female gender was positively associated with Fruit and Vegetable Consumption, $b = .45$, $t(5267) = 6.32$, $p < .001$, as was Age, $b = .04$, $t(5267) = 1.96$, $p < .05$, Education, $b = .13$, $t(5267) = 4.40$ $p < .001$, and Self-efficacy, $b = .05$, $t(5267) = 6.06$, $p < .001$. Fruit and Vegetable Consumption also shared positive linkages with FC Health and FC Content, $b = .53$, $t(5267) = 5.77$, $p < .001$ and $b = .74$, $t(5267) = 7.22$, $p < .001$, respectively. Fruit and Vegetable Consumption negatively related to BMI Group, b = -

.25, $t(5267) = -5.72, p < .001$.

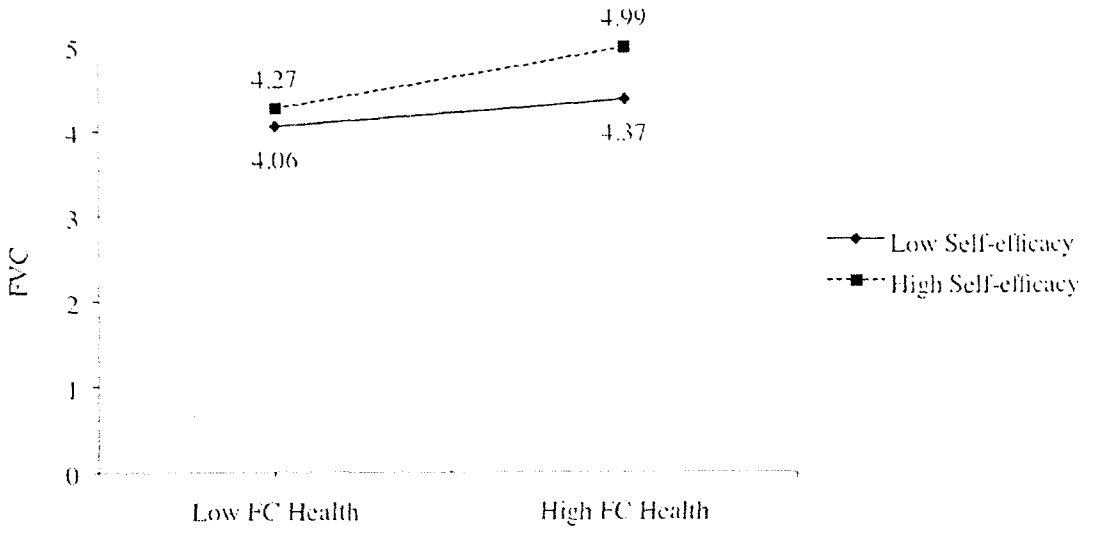

Figure 2. Simple slopes showing moderation by Self-efficacy on the association between FC Health and Fruit and Vegetable Consumption.

Self-efficacy was found to interact with the relation between FC Health and FVC, $b = .05, t(5267) = 2.19, p < .05$. A simple slopes analysis was carried out to probe this interaction by first testing the relation between FC Health and FVC at high Self-efficacy (1 SD below the mean) and low Self-efficacy (1 SD below the mean). As shown in Table 11 and summarized in Figure 2, FC Health and FVC shared a weaker relation amongst participants with low Self-efficacy, $b = .99, t(5267) = 11.23, p = .01$, than amongst high Self-efficacy participants, $b = 1.14, t(5267) = 3.39, p = .01$. Self-efficacy did not moderate the association between FC Content and FVC.

Table 11.

Linear Regression of Fruit and Vegetable Consumption by Psychosocial Characteristics.

Variable	*B*	SE	β	*t*	*P*
Constant	4.42	.04		126.34	.01
Gender (female)	.45	.07	.09	6.32	.01
Age groups	.04	.02	.03	1.96	.05
Pre-existing Illness	.10	.07	.02	1.34	.18
Race	-.04	.09	-.01	-.46	.65
BMI group	-.25	.04	-.08	-5.72	.01
Education	.13	.03	.06	4.40	.01
Income	.05	.03	.03	1.81	.07
Self-efficacy	.05	.01	.09	6.06	.01
FC Health	.53	.09	.10	5.77	.01
FC Content	.74	.10	.12	7.22	.01
FC Health x Self-efficacy	.05	.02	.04	2.19	.03
Low Self-efficacy	.99	.09	.19	11.23	.01
High Self-efficacy	1.14	.09	.21	3.39	.01
FC Content x Self-efficacy	-.02	.02	-.01	-.62	.54

Hypothesis 4b – Self-efficacy moderates the association between Food Choices and Self-Rated Health. A linear regression analysis explored the moderating effect of

Self-efficacy on the linkages between FC Health and Self-Rated Health, and FC Content and Self-Rated Health (Table 12). The regression model accounted for 21.2% of the total unexplained variance in Self-Rated Health, $R^2 = .21$, $F\ (12, 5377) = 120.68$, $p < .01$.

The demographic characteristics that associated positively with Self-Rated Health were Age group, $b = .04$, $t(5389) = 5.35$, $p < .01$, identifying as White, $b = .13$, $t(5389) = 4.44$ $p < .01$, and having a higher BMI, $b = .10$, $t(5389) = 6.57$ $p < .01$. Self-Rated Health was also found to associate negatively with several variables, although only the relationship with having a Pre-existing Illness was anticipated, $b = -.50$, $t(5389) = -19.30$ $p < 01$. Unexpectedly, Self-Rated Health was inversely related to more Education, $b = -.06$, $t(5389) = -6.09$ $p < .01$, higher Income, $b = -.07$, $t(5389) = -7.80p < .01$, higher Self-efficacy, $b = -.04$, $t(5389) = -15.22$ $p < .01$, and FC Health, $b = -.07$, $t(5389) = -2.16$ $p < .05$.

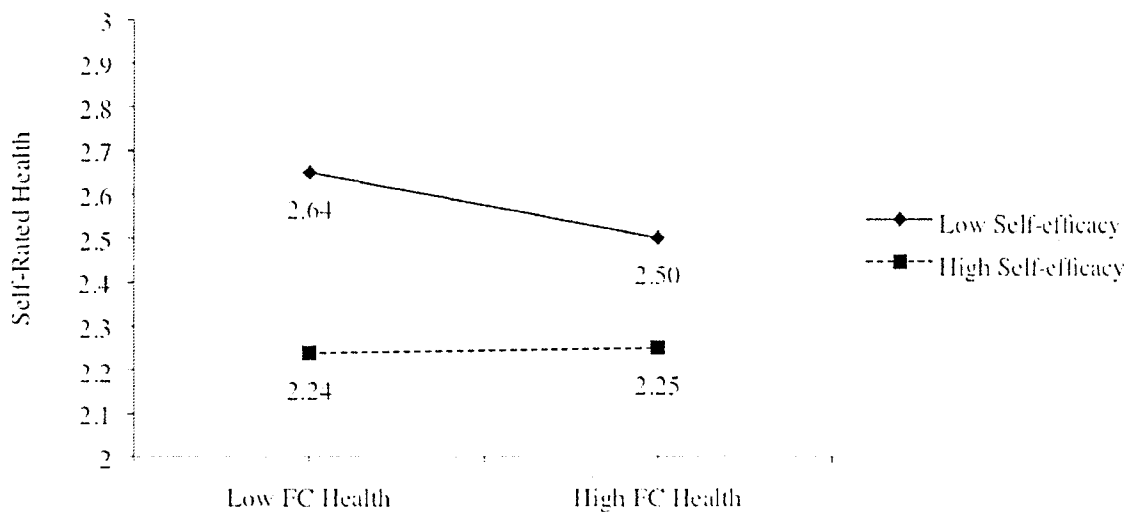

Figure 3. Simple slopes showing moderation by Self-efficacy on the association between FC Health and Self-Rated Health.

Results indicated that Self-efficacy moderated the relation between FC Health and Self-Rated Health, $b = .02$, $t(5389) = 2.26$ $p < .05$ (Figure 3). Simple slopes analysis probed the moderating effect of Self-efficacy on the relationship between Food Choices and Self-Rated Health. It was found that FC Health shared a negative association with Self-Rated Health at low levels (i.e., 1 SD below the mean) of Self-efficacy $b = -.07$, $t(5389) = -2.18$ $p = .03$, but no association at high levels (i.e., 1 SD above the mean) of Self-efficacy $b = .04$, $t(5389) = 1.31$, n.s.

Table 12.

Linear regression of Self-Rated Health by Self-efficacy and Food Choices

Variable	*B*	SE	β	*t*	*p*
Constant	2.41	.01		199.05	.01
Gender (female)	.00	.03	.00	.04	.97
Age group	.04	.01	.07	5.35	.01
Pre-existing Illness	-.50	.03	-.26	-19.30	.01
Race	.13	.03	.06	4.44	.01
BMI group	.10	.02	.08	6.57	.01
Education	-.06	.01	-.08	-6.09	.01
Income	-.07	.01	-.10	-7.80	01
Self-efficacy	-.04	.00	-.20	-15.22	.01
FC Health	-.07	.03	-.03	-2.16	.03
FC Content	-.04	.04	-.02	-1.01	.31

Self-efficacy x FC Health	.02	.01	.03	2.26	.02
Low Self-efficacy	-.07	.03	-.04	-2.18	.03
High Self-efficacy	.04	.03	.02	1.31	.19
Self-efficacy x FC Content	-.01	.01	-.02	-1.45	.15

Discussion

This research examined the relations between Food Choices, Fruit and Vegetable Consumption, and Self-Rated Health through the conceptual framework of Self-efficacy Theory. Using self-report data collected in a population survey of 7,519 Manitoba residents, the aim of the study was to further the understanding of the social and psychological determinants of Food Choices and the subsequence impact on Fruit and Vegetable Consumption and Self-Rated Health. It was hypothesised that Food Choices, Fruit and Vegetable Consumption and Self-Rated Health were interrelated; females base more Food Choices on personal health and product content than males; Self-efficacy positively relates to Food Choices based on health and product content; and, Self-efficacy moderates the associations between Food Choices and Fruit and Vegetable Consumption and between Food Choices and Self-Rated Health. The insights gained from this research are intended to contribute towards advancing the research agenda on healthful eating and obesity intervention in Canada.

The key finding from this study was the moderating role of Self-efficacy in the association between Food Choices and Fruit and Vegetable Consumption. As predicted in Hypothesis 4a, Food Choices based on the chooser's health were more closely related to daily Fruit and Vegetable Consumption when Self-efficacy was high than when Self-efficacy was low (Table 11). When personal health was a priority in making Food Choices, Self-efficacy accounted for an additional .62 servings daily. When personal health was not a priority in Food Choices, Self-efficacy still corresponded to an increase of .21 daily servings of Fruit and Vegetable Consumption. This interaction was not significant in a logistic regression analysis of consuming five or more servings of fruits

and vegetables daily (Table 6), which suggests that the combination of Self-efficacy and Food Choices influences all fruit and vegetable intake. The benefits of Self-efficacy correspond to those found in previous research on health promotion (Bandura, 1997) and diet change (Daniel et al., 2008), though they were not equally represented across the population.

Although Self-efficacy related to Fruit and Vegetable Consumption in general, more important is that high Self-efficacy related to the greatest change in diet when making health-based Food Choices become priority. High Self-efficacy corresponded to a 14% difference in Fruit and Vegetable Consumption (about .72 servings daily) as compared to low Self-efficacy, which related to only a 7% increase (about .31 servings daily). These results indicate that individuals who already form dietary decisions based on their health implications will commit to more positive health behaviours than individuals who do not. Differences may appear small, yet they show a large impact on the health of the Manitoba population and the potential burden of disease that is associated with poor eating habits. In 2008, the prevalence of consuming less than 5 servings of fruits and vegetables was 64.8% (Table 3).

Evidence of moderation was also found in the associations between Food Choices and Self-Rated Health. Hypothesis 4b conjectured moderation of the link between Food Choices and Self-Rated Health by Self-efficacy, such that Food Choices and good health would relate more closely with high Self-efficacy than with low Self-efficacy. This prediction was not fully supported by the data. Unexpectedly, a small but significant negative association was found between FC Health and Self-Rated Health. Due to abnormal distributions in the data and heterogeneity of the variance across groups, this

finding was verified using a logistic regression analysis (Table 7). Self-efficacy nullified this association; a simple slopes analysis showed a negative association between FC Health and Self-Rated Health at low Self-efficacy but no such association at high Self-efficacy (Table 12; Figure 3).

This finding may speak to the presence of illness within the sample more than it conveys that low Self-efficacy combined with a disregard for health in Food Choices is the path to optimal Self-Rated Health. In this study, 52% of the sample reported having been diagnosed with a Pre-existing Illness; as such, a large portion of the variance in Self-Rated Health was accounted for by the presence of illness at the time of the survey. Having a Pre-existing Illness strongly related to poor Self-Rated Health, but it also related to high Self-efficacy, so it might be the case that people who are battling illness gain some ground by having high Self-efficacy which motivates health-protective behaviours, such as choosing foods that aid good health.

Females were expected to base more of their Food Choices on personal health and product content compared to males, given previous findings (Huang et al., 1994; Neumark-Sztainer et al., 2002; Davy et al., 2006). There was strong evidence to support Hypothesis 2. Females were found to be far more cognisant than males of their own health (2.66 times more) and of the content of a given food (2.5 times more) when making Food Choices. There are several plausible interpretations of these findings. There is evidence that females are conditioned by family from an early age to be mindful of which foods they eat, and to avoid so-called junk foods (de Bourdeaudhuij, 1997), which in turn can effect the quality and types of food choices that females select in later life. Social influences simultaneously offer indirect conditioning that reinforce the

message that females should be conscious of their diets. While similar messages are targeted at males, they are of lesser frequency and intensity. This is not because ensuring and maintaining the good health status of males is less important than for females; it is because the motivation behind encouraging females to eat healthfully is firstly to control weight and secondly to ensure good health.

Contrary to Hypothesis 1a, the data did not indicate that FC Health or FC Content related to higher Fruit and Vegetable Consumption, although initial predictions had hoped to make this link. Instead, inconsistencies were noted between intent to make healthful food choices and healthful foods actually consumed. Descriptive statistics revealed that 61% of the sample claimed their health as a consideration when making Food Choices and 73% claimed food content as a consideration, however only one-third of the sample consumed the minimum of five servings of fruits and vegetables each day.
The data indicated that Region, Self-efficacy, not being Obese, and Education were more influential on the consumption of fruits and vegetables than health- or content-related Food Choices (Table 6).

Hypotheses 3a and 3b were initially supported by the data, however the significant associations between Self-efficacy on Food Choices were overshadowed by interactions between Self-efficacy and several sociodemographic variables in other analyses (Table 7). It appeared that psychological determinants of Food Choices were trumped by the importance of these sociodemographic characteristics, and therefore the health-protective effects of Self-efficacy should be considered alongside sociodemographic characteristics of the respondents.

For this Manitoba sample, the subgroups for which dietary change may be

especially important were exposed in two profiles: 1) *Smart Eater*, which identified factors that facilitated the highest daily consumption of fruits and vegetables; and 2) *Healthy*, which was comprised of factors that most closely related to very good or excellent health status.

Smart Eater. This profile determined who in the Manitoba sample was most likely to consume five or more daily servings of fruits and vegetables (c.f., Table 6). It was determined that persons who were at least 20 years old and had received their secondary school diploma were most likely to consume five or more daily servings of fruits and vegetables. Self-efficacy increased the likelihood of consuming five or more servings of fruits and vegetables daily for respondents who were Underweight, and for Parkland residents who based Food Choices on their health.

Healthy. The second profile identified factors that most increased the likelihood of self-rating one's health as Very Good or Excellent (c.f. Table 7). Achieving Very Good or Excellent Self-Rated Health was most likely amongst residents of Interlake, and when household Income exceeded $20,000 annually. Self-efficacy was particularly pertinent to having Very Good or Excellent Self-Rated Health for respondents suffering from a Pre-existing Illness, for Whites, and for those who based Food Choices on their health. Secondary School Graduates were more likely to have Very Good or Excellent Self-Rated Health if they were self-efficacious and made Food Choices on the bases of their health or on the healthfulness of food content. Finally, Self-efficacy and the practice of basing Food Choices on personal health resulted in Very Good or Excellent ratings of health amongst Overweight respondents. Self-efficacy decreased the odds of Very Good or Excellent health for Secondary School Graduates who based their Food Choices on

product content, for Overweight respondents who based their Food Choices on personal health, and for all respondents whose Food Choices considered both personal health and content.

Implications.

It is important to public health policy to understand how health and diet are affected by food choices. Past research posited that associations between health protective behaviours and healthy outcomes are moderated by Self-efficacy, so this study tested that moderation on the links between Food Choices and Fruit and Vegetable Consumption with Self-Rated Health. Self-efficacy increased healthful Food Choices, but not equally across the sample (Tables 10, 11, 12). Though the observational, cross-sectional design of this study precluded causal pathways from being drawn, these findings imply that the majority of Manitobans require further help in selecting healthful foods and reducing the prevalence of overweight and obesity. The selection of healthful diets and good health status might be enhanced if intervention strategies considered the demographic, social, psychological needs of the population and how these factors tie into food choices.

Nutrition self-efficacy pertains to cognitions about food choices, discipline, and weight management. The results of the present research suggest that dietary self-efficacy was absent or low in this sample (Tables 6, 8, 9). Although the majority of respondents reported an intention to eat for their health or with the nutrient value of their food in mind, the majority of respondents also consistently fell short of the number of servings that are recommended as part of a healthful diet. Self-efficacy cannot develop without the successful completion of a desired task (Bandura, 1977) and therefore it can be

inferred that nutrition self-efficacy was lacking in this sample. Improving nutrition self-efficacy as a means to improving diet require interventions that empower and educate.

Some studies have found that a formal education positively relates to diet quality; however that was not found here. In most instances, a post-secondary degree was no better a predictor of fruit and vegetable consumption than a high school diploma. It is plausible that education contributes to self-efficacy when the knowledge gained can effectively be put to use, but it is oversimplifying the benefits of education to say that a post-secondary degree in any discipline will also provide an in-depth understanding of nutrition. Specialized forms of education, however, show some promise.

Bowen and Beresford (2002) found positive changes in diet when educational interventions are brought down to the individual level, and advocated taking sessions with a nutritionist, and incorporating dietary counselling into yearly physicals as these strategies are easy to implement and emphasize personal responsibility for eating healthfully. For school-aged children and adolescents, though, school-based health education programs are more practical. These programs teach primary and secondary students about personal diet and nutrition, and have been shown to produce healthful food choices and healthy lifestyle. For example, Veugelers & Fitzgerald (2005) compared students from 282 schools across Nova Scotia on various dimensions of health. The schools were categorized as offering no nutritional program, a healthy menu program or an intensive, multifaceted health program lifestyle (Veugelers & Fitzgerald, 2005). Students attending schools with intensive nutrition programs ate healthier, had higher rates of physical activity and lower rates of obesity than students who attended schools that offered a healthy menu program or nothing at all (Veugelers & Fitzgerald, 2005).

The Kahnawake Schools Diabetes Prevention Project introduced school- and community-based policies that improved diet quality and lessened the risk of type II diabetes in children living in a Mohawk community outside Montreal (Macaulay, Paradis & Potvin, Cross, Saad-Haddad, & McComber 1998). Schools adopted a hard line on junk food, limiting the school canteen to the sale of healthy snacks and requiring students to bring healthy lunches, and then sessions of physical activity were made mandatory at home and at school (Macaulay et al., 1998). Strict health policies are needed in schools, workplaces and communities across Canada, and especially in the jurisdictions that are most at-risk for obesity and obesity-related diseases. They are needed because, for various reasons, most people cannot or will not adopt healthful lifestyles on their own.

Social engineering strategies to have also been used to facilitate positive behavioural changes that people are reluctant to make on their own. Social engineering involves modifying a person's environment in ways that regulate his of her ability engage in certain behaviours (Taylor & Sirois, 2009, pp. 74). In the past decade, regulations to eliminate trans fats in foods in products has significantly reduced consumption of trans fats, thereby helping to improve diet quality. People eat more healthfully when healthful options are made available to them (Neumark-Sztainer, 1999) and when healthful options are forced onto them Macaulay et al. (1998). Healthful foods are also consumed more when the cost of these items is lowered (Neumark-Sztainer, 1999; Neumark-Sztainer et al., 2000). Research consistently demonstrates that cost is the foremost barrier to healthy eating (Neumark-Sztainer, 1999; Neumark-Sztainer et al., 2000; Raine, 2004). Imposing a tax on foods items (i.e., fast foods, heavily processed foods) with little or no nutrient value can generate funds that can in turn be used to and subsidize the cost of healthful

foods. At the point-of-purchase, announcements in grocery stores that encourage the purchase healthful foods bring about attitude change (Raine, 2004). Several years ago, eight supermarkets in the United States introduced computerized, interactive nutritional information system to improve the nutritional knowledge of consumers (Jeffery, Price, Rosenthal, Gerber & Murray, 1982). The outcome was fewer high-fat products, and more high-fibre products for the duration of the trial (Jeffery et al., 1982). I suggest going a step further and partnering supermarkets with nutrition counsellors. Since diet quality is inextricably linked to income (Neumark-Sztainer, 1999; Neumark-Sztainer et al., 2000; Darmon & Drewnowski, 2004; Darmon & Drewnowski, 2008; Mancino, 2007), consumers must be taught how to make nutritious food choices within their budget. Personal, tailored in-store instruction is a practical means to this end.

Strengths and Limitations

The unique scale and breath of the CCHS offers several research advantages over smaller observational studies. First, its large sample size and stratified recruitment procedures ensured that the sample and results were representative of the population. This study had ample statistical power to probe interactions among Self-Efficacy, Food Choices, Fruit and Vegetable Consumption, Self-Rated Health and an array of sociodemographic factors. Second, the CCHS survey included detailed assessments of Fruit and Vegetable Consumption and the many factors that are considered when consuming foods.

Limitations of the study should also be noted. The cross-sectional design precluded conclusions about causal paths. Longitudinal studies are better suited to determine how Food Choices relate to Fruit and Vegetable Consumption and Self-Rated

Health. For example, Togo, Osler, Sorenson and Heitmann (2004) conducted a longitudinal, observational study on the relation between changes in food intake and changes to BMI on a sample of Danish adults. Questionnaire scores and physical measurements were obtained at the time of induction into the study, and five and 11 years following. They determined that food intake factors could not consistently predict changes in BMI or obesity development (Togo et al., 2004). Similarly, Lake, Maters, Rugg-Gunn and Adamson (2006) performed a study on dietary change in 198 respondents at two time points – in 1980, when respondents were 11/12 years old and in 2000, when respondents were 32/33 years old. Dietary tracking journals written at the first time point were employed as a means of predicting food intake at the second time point. Food intake in adolescence was found to predict intake in adulthood, however sociodemographic influences were found to have the largest affect on diet (Lake et al., 2006).

The second limitation was using only the Pearlin-Schooler Mastery Scale (1978) to tap nutrition self-efficacy. Weight management, diet and food choices can be regulated by nutrition self-efficacy beliefs, and it was believed, given insights from Bandura (1994), that there would be overlap in measurement between mastery and self-efficacy. Domain-specific measures of nutrition self-efficacy might have led to greater insight into the role of self-efficacy in shaping diet and health. For instance, the Nutrition Self-Efficacy Scale developed by Schwartzer and Renner (2000) asks respondents to speculate on their ability to make healthful food choices in the following situations using a four-point Likert scale (1 – definitely not, 4 – exactly true): I can manage to stick to healthful foods even if, 1) I need a long time to develop the necessary routines; 2) I have to try

several times until it works; 3) I have to rethink my entire way of nutrition; 4) I do not receive a great deal of support from others when making my first attempts; 5) I have to make a detailed plan. Arguably, had this study employed the use of the Nutrition Self-Efficacy Scale (Schwarzer & Renner, 2000) in lieu of a general mastery scale to assess respondents' Self-efficacy, results might have differed.

The third caveat was the use of self-report measures of health behaviours, which have known limitations in accuracy and reliability. Results alluded to discrepancies in responses, particularly between reports of intent to make healthful food choices and healthful foods actually consumed. There are several possible explanations for this discrepancy, not the least of which might be that Canadians do not know how to eat healthfully. As the literature suggests (Cowburn & Stockley, 2005; NHS, 2009; Nielsen Reports, 2009), poor nutritional knowledge is one cause of poor quality diet. Even when attempting to eat healthfully, most people do not understand the nutritional needs of their body. Instead, they are familiar with nutritional buzzwords, which are easier to learn and easier to recite when being questioned about personal diet habits. Discrepancies between reported and actual dietary practices may also be evidence of social desirability bias. Participants in social science research are known to engage in ego-defensive behaviour by distorting personal information on self-reports to present themselves in ways that meet societal approval (Fisher, 1993). In the case of self-report questionnaires that demand sensitive information, prospective respondents, even when stripped of identifiers, may experience pressure alter their actual responses to resemble known ideals (Fisher, 1993).

The fourth limitation was the use of BMI, particularly to survey the prevalence of Overweight and obesity in the population. The effects of BMI on Food Choices and

health were not significant in this study, although clear relationships exist between these three factors. The literature steadily concludes that self-report data, specifically self-report BMI, are biased and often misleading (Villanueva, 2001; Elgar & Stewart, 2008). Trends in the data indicate that self-report weight underestimates actual weight and self-report height overestimates actual height in both men and women. Social desirability bias, which is linked to the drive for thinness under these circumstances, may persuade respondents to liken their actual height and body weight with current social ideals (Foreyt & Goodrick, 1994), the effect of which can result in an under-representation in the prevalence of overweight and obesity. BMI is sensitive to small changes in height and weight, therefore invalid values for either or both are compounded in the calculation (Shields, Conner Berber & Tremblay, 2008a).

For example, a recent study explored the level of agreement between measured and self-reported height, weight and BMI of 4,615 respondents in CCHS Cycle 3.1 (Elgar & Stewart, 2008). Self-report weight was found to underestimate actual weight, while self-report height overestimated actual height, resulting in a underestimation of BMI by 1.16 kg/m^2, on average (Elgar & Stewart, 2008). Shields, Conner Gerber and Tremblay (2008b) presented comparable findings using CCHS data from 2005. In this study, the self-report heights and body weights of 2,667 respondents were judged against direct measurements. On average, calculations of BMI based on self-reported height and weight were 1.3 kg/m^2 lower than BMIs calculated with direct measurements resulting in the misclassification of overweight and obese individuals in lower BMI groups (Shields et al., 2008b). Self-report questionnaires are easier to administrate and more cost-effective than having trained interviewers perform direct body measurements, which is partially why

they have retained their popularity. Still, there is sufficient research to preclude their exclusive use as a diagnostic weight tool.

Future research

Food choices are determined by numerous factors, some static, some that change over time. Individual preferences such as taste, physical ideals, culture and religion can influence what food we enjoy (Logue, 2004, pp. 310, 338), while practical consideration including costs and availability determine what foods are accessible (Donkin et al., 2000). The extant literature on determinants of food choices is substantial, yet definitive conclusions on these associations are sparse. This incomplete knowledge base means that we are unable to discern motivations for food choices amongst various groups. At the core of this challenge is the need to understand the relative contribution of unhealthy eating habits to chronic diseases, and so we must refocus our research directives.

A substantial portion of the Canadian population is overweight or obese, and a substantial portion of the Canadian population is comprised of immigrants. This should push nutrition and obesity research to adopt a multi-cultural approach, especially since ethnicities show varying degrees of vulnerability to diet-related illness (Wang, Thornton, Russell, Burastero, Heymsfield, & Pierson, 1994; Tremblay, Pérez, Ardern, Bryan & Katzmarzyk, 2005). BMI corresponds poorly with percentage of body fat, distribution of body fat, or subsequent health consequences for certain ethnicities, meaning that the BMI threshold for overweight and obesity may be inadequate for identifying health risk equally in all ethnic groups (Wang et al., 1994). This creates demand for measures that can accurately infer rates of overweight and obesity, and assess health risks amongst Canada's growing Non-White populations.

To better gauge the prevalence of disease, we must replace flawed and low-reliability measures with proven methods. Trending rates of obesity using calculations derived from self-report data means that actual of rates of prevalence are unknown, or are underestimated at best (Shields et al., 2008b). The use of physical measurements (e.g., blood pressure, anthropometry, physical activity, lung function, an oral health exam), blood measures (e.g., lipid profile, infectious disease markers, vitamin and mineral levels), and urine samples to assess nutrition, and test for chronic diseases is one method to overcoming problems with reliability (Shields et al., 2008b; Statistics Canada, 2009).

A persistent limitation to Canadian national surveys is their exclusivity. Most aim to sample individuals between 6 and 79 years of age living in privately occupied dwellings in accessible regions of every province and territory, but exclude individuals living on Indian Reserves or Crown lands, residents of institutions, full-time members of the Canadian Forces (Statistics Canada, 2009). In the 2000 Food and Nutrition Surveillance in Canada: An Environmental Scan, McAmmond stressed, "Improving health outcomes for Aboriginal peoples, requires better surveillance information." Ten years later and steps towards improving aboriginal health remain inadequate. In 2007, the first edition of *Eating Well with Canada's Food Guide: First Nations, Inuit and Métis* was published, but without incisive, culturally appropriate intervention strategies to help implement dietary change, the prevalence of diet-related illness affecting this group will surely continue to grow.

Findings from the 2003 Cree Health Survey included reports of low access to fruits and vegetables in northern and isolated communities due to barriers such as high costs, lack of variety and spoiled products (Nolin, Blancet & Kuzmina, 2003). This provides

one explanation as to why only 21% of Iiyiyiu Aschii residents aged 12 and over eat five or more daily servings of fruits and vegetables (Nolin et al., 2003). Compared to lower regions of Canada, the cost of living in the north is significantly higher, which has much to do with the prevalence of food insecurity (Nolin et al., 2003). Low-income and limited access to fresh foods are prominent determinants of food choices in northern communities, and they further relate to poor health. In the community of Iiyiyiu Aschii, over 80% of adults and over half of adolescents are either overweight or obese (Nolin et al., 2003). Obesity is a major risk factor for type-2 diabetes, and Aboriginals are more vulnerable to this disease than some other ethnicities (Tremblay et al., 2005). Therefore, managing obesity should be priority for health care providers and health researchers, and research so far suggests that rigorous school- and community-based intervention programs are key (Macaulay et al., 1998).

Changes to school policy, nutritional education and regulated physical activities can motivate vulnerable populations to adopt a more healthful lifestyle (Macaulay et al., 1998). Groups that are marginalised and disenfranchised lack feelings of empowerment (Lord & Hutchinson, 1993) and self-efficacy might also be low amongst these groups. This study and others highlight the role of Self-efficacy in making healthful food choices, however more could be done to examine role of self-efficacy on dietary behaviours in low-income households. Future research could assess how comprehensive health programs and improved community resources (i.e., fresh foods food bank) promoting healthy diets in low-income households. The needs of vulnerable populations must be accounted for in ongoing efforts to increase health positive behaviour and decrease the prevalence of diet-related illness. Better nutrition surveillance must be made a policy

priority at every level of government so that we can stay in tune with the health and health needs of all Canadians.

Conclusion

Health research continues to folly in its push for blanket solutions to poor dietary behaviours. A research agenda that identifies determinants of healthful eating for subgroups (e.g., college students, immigrants, Aboriginals), especially vulnerable subgroups (e.g., seniors, disabled individuals, low-income households, isolated communities, overweight and obese individuals) within the greater population of Canada is essential to preventing and controlling diet-related illness. Future research must approach these subgroups on issues of food knowledge and food insecurity in order to have a menu of prepared, cost-effective programs that suit the Canadian context and can help mitigate the firmly entrenched social inequalities in health and health behaviours (Marmot, 2004).

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