LIFESTYLE ACCULTURATION AND HEALTH AMONG OLDER FOREIGN-BORN PERSONS

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Mary Edith Rogers
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Name: **Mary Rogers**

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Examining Committee:

Chair: **Dr. Nancy Olewiler,** Director, Public Policy Program, SFU

Dr. Andrew Wister, Professor, Gerontology Program, SFU
Senior Supervisor

Dr. Barbara Mitchell, Associate Professor, Gerontology Program, SFU
Examining Committee Member

Dr. Habib Chaudhury, Assistant Professor, Gerontology Program, SFU
Examining Committee Member

Dr. Pamela Ratner, Associate Professor, School of Nursing, UBC
External Examiner

Date Approved: Oct 21/03

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Author:
(signature)

Mary Rogers
(name)

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(date)

Abstract

This thesis investigates the influence of acculturation, measured as duration of residence, on the health status of mid-life and older foreign-born persons in Canada. Previous research has revealed a 'healthy immigrant effect,' which suggests that those who immigrate to Western nations initially have fewer health problems than the native-born population. However, this superior health status tends to diminish over time. Although many explanations have been proposed, none have been successful in fully explaining this phenomenon. It is hypothesized that lifestyle acculturation in the areas of smoking, physical activity, fruit and vegetable consumption, and body mass index, will partially explain this increase in health conditions with longer residence duration.

Data from the 2001 Canadian Community Health Survey were used for this thesis. The study sample consisted of 9,992 foreign-born individuals aged 45 and older. Logistic regression analyses indicated that the likelihood of having a chronic condition, arthritis/rheumatism, high blood pressure, diabetes and fair or poor self-rated health was higher for immigrants who had been in Canada for ten or more years when compared to their counterparts with shorter residence status. However, none of the independent variables fully accounted for this duration of residence effect, including lifestyle behaviours, demographics, visible minority status, language ability, health care utilization, perceived stress and socio-economic status.

Since the observed health decline among foreign-born persons with longer stay in Canada was not fully explained, a sub-analysis was conducted to examine age

interactions with residence status. The results of this analysis reveal striking age effects and a basic pattern where the influence of residence length on health declines with age. As previous researchers have not considered age differences in the duration of residence effect, these findings make an important and original contribution to this body of literature.

Explanations for the observed age effects are discussed, including differential acculturation and varying circumstances around immigration between mid-life and older immigrants. Also, several predictors of chronic health conditions for the foreign-born population aged 45 and older are identified. Results suggest a need for future studies to explore how the association between acculturation and health varies within particular age and ethno-cultural groups.

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Chapter One: Introduction

Immigrants are defined by Statistics Canada as persons born outside of the country who have been granted the right to live in Canada permanently by immigration authorities (Boyd & Vickers, 2000). For the sake of clarity, this paper will utilize the same definition of an immigrant and will use the terms 'foreign-born' and 'immigrant' synonymously. As a group, foreign-born individuals comprise a substantial share of the Canadian population accounting for 17.4%, or almost one fifth of the total populace in 1996 (Statistics Canada, 1996). Furthermore, immigration into the country has continued at a considerable rate with 205,711 newcomers entering Canada in 2000 and 252,088 in 2001, increases of approximately 32,000 and 47,000 respectively from the previous year (Statistics Canada, 2000; 2001a).

Along with rising rates of immigration, Canada has also witnessed tremendous change in the ethnic composition of its foreign-born population over the past century (Driedger, 2001; Kalbach & Kalbach, 1999a). Prior to 1961, the majority of newcomers to Canada hailed from the United Kingdom and Europe while over half of those who arrived in the 1990s are from Asian countries (Statistics Canada, 1996). The total immigrant population originating from the United Kingdom and Europe fell from 90.3% before 1961 to 19% between 1991and 1996 whereas the percentage of Asian and Middle Eastern immigrants rose from 3.0% before 1961 to 57.1% between 1991 and 1996 (Statistics Canada, 1996). Hence, the majority of European and British immigrants in Canada have lived here for decades while a large proportion of the Asian-born immigrant

population are recent arrivals to the country. Furthermore, a sizeable proportion of these recent immigrants are middle aged or older (Boyd & Vickers, 2000); for example, 15% of newcomers in 2001 were over the age of 45 (Statistics Canada, 2001a). These developments may be attributed to changes in immigration policy introduced throughout the latter half of the past century including the elimination of restrictions based on country of origin and an increased emphasis on family reunification (Boyd & Vickers, 2000; Driedger, 2001; Green & Green, 1995; Laroche, 2000).

Two other factors that have had significant impact on the Canadian population over the past few decades are decreased birth rates and increased life expectancy. These forces have contributed to population aging – a phenomenon where older adults gradually represent a larger proportion of a nation's populace. This demographic shift is occurring not only in Canada but also on a global level. It is projected that by 2041, 23% of the Canadian population will be 65 and over compared to just 10% in 1981 (Statistics Canada, 1999a). Thus, the reality of an aging population and the anticipation of the retirement of the first baby boomer cohort in 2011 have brought greater attention to issues relevant to older adults and an aging society. However, net migration, the third population component, also has a notable affect on the age, structure and size of a nation's populace. In fact, almost 30% of Canadian seniors are foreign-born (Statistics Canada, 1999a). Thus, immigration patterns and characteristics of the foreign-born population must also be a consideration in the development of strategic plans and modification of existing policies and programs that are aimed at dealing with the ramifications of an expanding senior sub-population.

Health care is one facet of Canadian society expected to experience tremendous change as the population ages. While longevity has increased due to medical advancements over the past century, the prevalence of chronic illness has also risen in middle and older adult populations. According to the 1998/99 National Population Health Survey, within the middle-aged Canadian population aged 45 to 64, 19% reported having professionally-diagnosed arthritis, 16.2% had hypertension, 4.8% reported heart disease and 5.1% had diabetes. The corresponding prevalence rates for Canadians aged 65 or older were 41.5% for arthritis, 35.6% for hypertension, 17.4% for heart disease and 11.6% for diabetes (Statistics Canada, 1999b). Despite such high rates of chronic illness, however, organized health care in many Western countries still operates primarily from an acute-care perspective. Thus, the health care system in Canada must continue to adjust in order to effectively address issues associated with long-term chronic conditions. As these conditions are associated with lifestyle factors, there is need for more widespread adoption of illness prevention and health promotion policies targeting relevant health behaviours. In order to ensure these policies and programs are also relevant to the substantial foreign-born population, it is vital that chronic illness and the role of lifestyle behaviours are investigated within this group.

Immigrant health is an issue of great relevance as health policymakers and professionals anticipate and plan to meet future needs. Since the Immigration Act requires that potential newcomers pass a medical exam before entering the country, Canadian immigrants as a group are in some ways pre-selected for good health (Laroche, 2000). According to the Second Report on the Health of Canadians (1999) prepared by the Federal, Provincial and Territorial Advisory Committee on Population Health, age-

adjusted mortality and morbidity rates are consistently lower for newcomers to the country in comparison to those born in Canada. Researchers in the area of immigrant health have termed this finding the 'healthy immigrant effect' (Chen, Wilkins & Ng, 1996; Kliewer, 1992). However, health status does not remain static throughout a person's life. Indeed, morbidity and mortality rates of immigrant groups tend to converge over time toward those within the host country (Berry, 1998; Kliewer, 1992; Kliewer & Smith, 1995). Among Canada's foreign-born population, this convergence is clearly observed for chronic illnesses – including arthritis, hypertension, heart disease, stroke and diabetes – with higher rates associated with longer duration of residence in the country (Chen, Ng & Wilkins, 1996).

As all immigrants face the challenging task of adjusting to a new culture, some researchers have focused on the role of acculturation in explaining the health changes observed within foreign-born groups (Berry, 1998; Marmot, Adelstein, & Bulusu, 1984; Myers & Rodriguez, 2002). Since acculturation inevitably involves lifestyle changes that have the potential to impact long-term health outcomes, and since lifestyle behaviours themselves are considered to be risk factors for chronic illness, it is reasonable to examine these factors. Four aspects of lifestyle that are important in explaining this change in immigrant health include those related to diet and nutrition, weight management, tobacco use and physical activity. These four components will be referred to as 'lifestyle behaviours or factors' or 'health behaviours' throughout this thesis. A better understanding of how the acculturation of lifestyle practices of immigrants affects their long-term health status will help to inform health promotion efforts targeting foreign-born individuals in Canada. Moreover, this knowledge may also

increase our awareness of specific elements of Canadian culture that negatively influence the health of the native-born population and inform efforts to effect change in these areas.

Chapter Two: Literature Review

2.1 Assimilation and Acculturation Theory

Culture is the "way of life of a society" (p. 32) consisting of the prescribed behaviours, beliefs, values, skills, morals, customs and norms that are passed down through generations by means of formal and informal instruction (Gordon, 1964). Since the cultural milieu exerts a strong influence on the development and display of human behaviour, the change of cultural environment experienced by immigrants will inevitably lead to alterations in their habits and behaviours (Berry, 1998; Lonner & Berry, 1986). Based on this culture-behaviour linkage, theories of assimilation and acculturation describe the process of adjustment faced by persons, such as immigrants, who live amongst or come into frequent contact with populations who have a different cultural background than their own.

Milton Gordon (1964), an influential theorist in this area, clarified the distinction between the related processes of acculturation and assimilation. Citing several prominent early sociologists, he described assimilation as a process whereby peoples of diverse racial and ethnic origins, through social contact and shared experiences, create a single collective national existence and cultural life. In contrast, Gordon argued that acculturation – also called 'cultural' or 'behavioural' assimilation – may be viewed as an inevitable first step in the multi-stage process of assimilation (Alba & Nee, 1997). Thus, whereas acculturation involves adaptation primarily in the cultural domain, assimilation

involves a more complete integration into and acceptance of the host society (Teske & Nelson, 1974).

Acculturation theory describes the process of culture change occurring within one or more groups with differing ethnic, racial or religious backgrounds as they come into continuous first-hand contact with one another (Berry, 1998; Gordon, 1964; Redfield, 1936). This process may be reflected in several different areas including: perceived cultural identity, language use, neighbourhood ethnic composition, religious affiliation, media preferences, social relations, and daily lifestyle practices such as modes of dress or food-related habits (Lonner & Berry, 1986; Schnittker, 2002; Zane & Mak, 2002). Berry (1992) describes lifestyle changes occurring as a result of acculturation as 'behavioural shifts' that consist of two distinguishable phenomena: cultural learning, the acquisition of practices of a new culture, and cultural shedding, giving up features from one's original culture. Both forms of behaviour change have the potential to affect immigrant health.

While acculturation theory suggests that both cultural groups give up their original cultural heritage in favour of a jointly created new culture, some theorists concede that the reality for immigrant populations is that they are expected to abandon their traditional cultural practices and beliefs and adopt those of the host society (Gordon, 1964; Lonner & Berry, 1986; Teske & Nelson, 1974). Many critics have noted that an inherent assumption of acculturation and assimilation theories has been that immigrants will ultimately benefit from abandoning their former cultural heritage and embracing that of the host society (Alba & Nee, 1997; Rumbaut, 1997). This adjustment is thought to aid newcomers in their task of making a home within a foreign cultural environment (Gordon, 1964; Schnittker, 2002). Most research investigating the effects of assimilation

or acculturation versus ethnic retention for immigrant groups has considered either social or psychological implications. While many social scientists maintain that progressive assimilation ultimately benefits immigrants in terms of socio-economic status and psychological health, some research refutes this simple assertion (Berry, 1998; Schnittker, 2002). Although considerably less empirical attention has been paid to the long-term physical health effects of acculturating to Western society on immigrant populations (Myers & Rodriguez, 2002), recent studies suggest that there may be notable health benefits of ethnic retention. In light of such research, Rumbaut (1997) asserts that the "patronizing ethnocentrism built into assumptions about immigrant adjustment that equated 'foreign' with 'inferior' and the ways of the 'host' or 'core' society and culture with 'superior'" (p. 487) are not only inappropriate, but also unsubstantiated with regard to health outcomes. Thus, this thesis seeks to address an apparent gap in acculturation research by considering how adoption of certain aspects of the Canadian lifestyle affects chronic illness rates of immigrant groups. While it is acknowledged that no singular Canadian lifestyle exists, for the purposes of this thesis, trends including increased body mass index, tobacco use, inactivity, and poor nutrition will be referred to as components of a 'Canadian' or 'Western' lifestyle.

2.2 Acculturation in Canada

In the 1970s, Prime Minister Pierre Trudeau announced his multicultural vision that Canada be a nation that "will support and encourage the various cultures and ethnic groups that give structure and vitality to our society" and will encourage immigrants to "share their cultural expression and values with other Canadians and so contribute to a

richer life for us all" (Driedger, 2001, p. 429). Since then, multiculturalism has become an oft-cited characteristic of the Canadian identity based on this vision of a country where cultural differences are encouraged and embraced (Goldmann, 1998). In fact, this characteristic has been one feature that Canadians have used to distinguish their country from the United States where assimilation and the erasure of ethnic and cultural diversity in the American 'melting pot' has been the favoured approach.

Nevertheless, the manifestation of this multicultural ideal has proven difficult at times since a multitude of differing cultural practices, beliefs and traditions can conflict with policies applicable to all Canadians. Hence, some social scientists suggest that immigrants should be more strongly encouraged to adopt those practices and behaviours that are normative within Canadian society. In this vein, Kalbach and Kalbach (1999a) assert that "the foreign-born and their native-born children cannot expect to be fully accepted as Canadians until their original and distinctive cultural differences have been reduced through their assimilative and acculturative experiences" (p. 13). Thus, despite the multicultural agenda, immigrants may still experience a degree of external pressure or internal desire to conform to social norms in order to better fit into Canadian society. Some of these acculturative pressures may influence lifestyle behaviours and, in turn, their health status.

2.3 Canadian Immigrants, Acculturation and Health

Research conducted in several different countries has compared the mortality and/or morbidity of immigrants with that of the native-born population. An overwhelming majority of these studies have been conducted within Western countries

such as Canada (Ali, 2002; Chen, Ng & Wilkins, 1996; Chen, Wilkins, & Ng, 1996; Dunn & Dyck, 2000; Kaplan, Chang, Newsom & McFarland, 2002; Parakulam, Krishnan & Odynak, 1992; Pérez, 2002b; Sharma, Michalowski & Verma, 1990; Trovato, 1993; Trovato & Clogg, 1992), the United States (Hummer, Rogers, Nam, & LeClere, 1999; Singh & Siahpush, 2001; Singh & Siahpush, 2002; Stephen, Foote, Hendershot & Schoenborn, 1994; Swallen, 1997) and Australia (Bennett, 1993; Kliewer & Smith, 1995). In general, they find evidence supportive of the healthy immigrant effect whereby the foreign-born have lower mortality, morbidity, disability and dependency rates than the native-born population. The healthy immigrant effect may be observed even after controlling for demographic variables including age, gender, marital status, race/ethnicity and socio-economic status suggesting that while these variables may partially explain the superior health status of foreign-born groups, other factors are also at work.

Two primary hypotheses that have been proposed in the literature to explain the health and mortality advantages of foreign-born persons are positive selection and cultural buffering (Frisbie, Cho & Hummer, 2001; Marmot, 1993; Singh & Siapush, 2001). According to the selectivity hypothesis, those who migrate to another country are part of an elite group that is usually advantaged in terms of income, education and health when compared to the population in their country of origin (Berkanovic, Lubben, Kitano & Chi, 1994; Chen, Wilkins & Ng, 1996; Marmot, 1993; Parakulam, Krishnan & Okynak, 1992; Sharma, Michalowski & Verma, 1990; Swallen, 1997). For immigrants to Canada, this selection occurs in part due to immigration policy that favours the applications of potential newcomers who have a university or college education, occupational skills, financial security and no major health problems (Green & Green,

1995; Kliewer, 1992; Laroche, 2000; Trovato, 1985). Moreover, due to the stressful nature of the migration experience, this process would naturally select younger, healthier and more robust persons (Kliewer, 1992; Singh & Siahpush, 2002; Swallen, 1997).

The cultural buffering hypothesis asserts that compared to persons born in Canada or the United States, immigrants arriving in North America from less modernized regions such as Asia or South America are more likely to live by cultural norms and beliefs that disapprove of risky behaviours (e.g., substance use) and promote healthy lifestyle factors (e.g., a nutritional diet; strong familial support; an active daily routine). Thus, the health advantage of immigrants in Canada may also be related to the fact that they follow cultural expectations and practices that are associated with low rates of chronic disease and/or disability in old age (Kliewer & Smith, 1995; Marmot, 1993; Singh & Siahpush, 2002; Swallen, 1997).

While some researchers treat these two hypotheses as discrete or competing explanations for the health advantage of immigrant groups, Frisbie, Cho and Hummer (2001) assert that they are actually complementary. Indeed, the selectivity perspective indicates why immigrants have better health than the general population in their country of origin while the cultural buffering perspective helps to explain their more favourable health status in comparison to the new host population. In addition, this latter hypothesis takes the explanation one step further, pointing to culture as the key to understanding why immigrants' health may change with more time spent in their new home. As foreign-born individuals renounce or relax some of their traditional practices, perhaps adopting those of the host society, their health may be negatively affected.

Somewhat in contrast to the cultural buffering hypothesis, acculturation theory has traditionally posited that immigrants who adopt the language, behaviour and beliefs of the host population will experience socio-economic, social and psychological benefits (Schnittker, 2002). Since these types of advantages are associated with good health, this theory may lead to the expectation that over time, as immigrants become acculturated to Canadian society, they should maintain or improve their already superior health status. Surprisingly however, research shows that rates of chronic conditions, the primary health concern of the Western world, tend to increase for immigrants the longer they reside in these countries (Berry, 1998; Chen, Ng & Wilkins, 1996; Eaton, 1977; Kaplan et al., 2002; Marmot, Adelstein, & Bulusu, 1984; Pérez, 2002b; Singh & Siahpush, 2002). This pattern has been found for conditions such as coronary heart disease, hypertension, diabetes, arthritis, and stroke as well as measures of self-rated health, activity-related disability and dependency (Frisbie, Cho & Hummer, 2001; Stephen et al., 1994). Only a relatively few number of studies report results that are not in support of this pattern (Berkanovic et al., 1994; Hazuda, Haffner, Stern & Eifler, 1988).

According to Berry (1998), one truth that may be gleaned from the literature is that the simplistic question of whether acculturation will improve or threaten the well-being of the foreign-born population cannot be clearly answered. As acculturation may occur within many different aspects of an immigrant's life, a separate consideration of the health implications of each may be warranted. Thus, this thesis will focus on the health-related consequences of just one of the many different components of acculturation – healthy lifestyle practices – in order to further contribute to this area of research.

2.4 Lifestyle and Chronic Illness

Researchers investigating the positive correlation between immigrants' chronic illness rates and duration of residence, a commonly used proxy measure of acculturation (Kaplan et al., 2002), in Canada and other Western host countries have attempted to uncover the factors that underlie this phenomenon. Many of these studies have focused on socio-economic variables such as income and education (Angel, Buckley & Sakamoto, 2001; Dunn & Dyck, 2000; Wei, Valdez, Mitchell, Haffner, Stern & Hazuda, 1996). While a few researchers have considered the contribution of lifestyle behaviours, including smoking, diet, physical activity and weight management, to an explanation of immigrant health, this component has received relatively little attention in the literature. However, these lifestyle factors play a notable role in the development of four major chronic conditions affecting Canadians in middle and older adulthood: arthritis, hypertension, coronary heart disease, and type II diabetes mellitus.

One recent study (Pérez, 2002b) using Canadian Community Health Survey data included lifestyle variables (e.g., smoking, heavy drinking, physical activity, overweight and obesity, and fruit and vegetable consumption) in an analysis of health status among Canadian immigrants. This researcher concluded that there is little evidence in support of the hypothesis that rising rates of chronic illness among the foreign-born may be attributed to lifestyle factors. Notably, the sample chosen for analysis included immigrants aged 12 and older. However, since chronic illness is most prevalent among middle-aged and older individuals, a different pattern of association may occur within this age group. Nevertheless, the majority of studies examining the affect of duration of residence on health among immigrants have included individuals from young, middle,

and older adulthood (Chen, Ng & Wilkins, 1996; Dunn & Dyck, 2000; Singh & Siahpush, 2002). This study, therefore, will address an apparent gap in the literature by considering only the latter two age groups.

The importance of the association between lifestyle behaviour change and chronic illness development within the immigrant population is heightened by the fact that the majority of Canada's newcomers originate from non-Western and less developed countries (Driedger, 2001; Kalbach & Kalbach, 1999a). Their cultural practices and daily routines are less likely to involve the unhealthy behaviours that characterize our technologically advanced North American culture. For instance, due to the accessibility of modern technology, popularity of media entertainment and the computerization of the workplace, much of the Canadian and United States population lead a largely sedentary existence. Also, the hurried pace of modern life and pervasive advertising campaigns have influenced the diet of Western countries toward processed foods that are convenient and fast, but also higher in saturated fat and lower in nutritional value. Therefore, it is likely that the acculturation process of immigrants in Canada will involve, to some degree, the adoption of unhealthy aspects of the Western lifestyle (Cairney & Ostbye, 1999; Stephen et al., 1994).

Indeed, research indicates that acculturation of this type does occur, leading to increases in chronic disease risk factors such as elevated blood cholesterol and blood pressure (Bennett, 1993; Espino & Maldonado, 1990; Kaplan et al., 2002; Marmot, Syme, Kagan, Kato, Cohen & Belsky, 1975; Nichaman, Hamilton, Kagan, Grier, Sacks & Syme, 1975; Singh & Siahpush, 2002) and obesity (Bennett, 1993; Cairney & Ostbye, 1999; Singh & Siahpush, 2002). Moreover, the health of foreign-born persons can be

negatively affected by the adoption of a Western 'affluent diet', which can be characterized by an excess of energy-dense foods that are rich in fat and sugar but deficient in complex carbohydrates, dietary fibre and important vitamins and minerals (Freimer, Echenberg & Kretchmer, 1983; Satia, Patterson, Kristal, Hislop, Yasui & Taylor, 2001; World Health Organization, 1990).

Similarly, studies that have compared ethnic or cultural groups living in modernized environments with their counterparts living in more traditional communities generally find that the less modernized groups have fewer risk factors (e.g. hypertension, high percentage of body fat, elevated blood cholesterol) and lower rates of chronic illness (Eaton, 1977; Prior & Prior, 1966; Schaefer, Timmermans, Eaton, & Matthews, 1980). For instance, the well-known series of research studies conducted in the 1970s that compared Japanese-origin males living in Japan, Hawaii and California found a gradient for rates of coronary heart disease and the risk factors associated with this condition (Marmot et al., 1975; Syme, Marmot, Kagan, Kato, & Rhoads, 1975; Worth, Kato, Rhoads, Kagan & Syme, 1975). Those living in the least modernized environment, Japan, had the lowest rates and those in the most modernized environment, California, had the highest. Interestingly, the rates for the subjects residing in Hawaii were intermediate to the other two.

Moreover, other researchers have observed the health-related consequences of the gradual increase of Western influence upon less developed countries such as China, India and Chile (Cruz-Coke, 1987; Popkin, Horton, Kim, Mahal, & Shuigao, 2001). These studies report detrimental lifestyle and health effects such as obesity or weight gain, less nutritional dietary practices and psychosocial stress as well as chronic illnesses including

hypertension, coronary heart disease and stroke. Thus, lifestyle behaviours and their associated risk factors appear to be at least partly responsible for rising rates of chronic illness in developed countries (Binkley, Eales & Jekanowski, 2000; Holland & Breeze, 1986; Posner, Franz, & Quatromoni, 1994). Similarly, rates of chronic health conditions may increase in acculturated immigrant groups (Singh & Siahpush, 2002; Stephen et al., 1994).

Generally, research indicates that health risk factors related to chronic disease, including diet, excess body weight, smoking and physical activity, tend to cluster in the North American population (Sherwood & Jeffery, 2000). Both poor diet and low physical activity are causally associated with high body weight (Binkley, Eales & Jekanowski, 2000). Furthermore, the appearance of multiple unfavourable lifestyle variables tends to be more common in North Americans with low levels of income and education (Binkley, Eales & Jekanowski, 2000; Gillman, Pinto, Tennstedt, Glanz, Marcus, & Friedman, 2001; Gilmore, 1999). Literature related to each lifestyle component, and how it changes in acculturating immigrant populations, will be separately examined below.

2.4.1 Diet

Research reveals a relationship between a poor diet and health conditions such as cardiovascular disease, type II diabetes mellitus, various cancers, gastrointestinal disorders, dental caries and osteoporosis (Epstein, 1989; Gillman, Cupples, Gagnon, Posner, Ellison, Castelli & Wolf, 1995; Hertog, Feskens, Hollman, Katan & Kromhout, 1993; Posner, Cupples, Gagnon, Wilson, Chetwynd, & Felix, 1993; Hu, Rimm, Stampfer,

Ascherio, Spiegelman, & Willett, 2000; Schaefer, 2002; World Health Organization, 1990). Dietary variables are also related to obesity, unfavourable blood cholesterol levels, hyperinsulinaemia, hypertension, atherosclerosis and other chronic disease risk factors (Binkley, Eales & Jekanowski, 2000; Brouwer, van Dusseldorp, West, Meyboom, Thomas, Duran, van het Hof, Eskes, Hautvast & Steegers-Theunissen, 1999; Fung, Rimm, Spiegelman, Rifai, Tofler, Willett & Hu, 2001; Jenkins, Popovich, Kendall, Vidgen, Tariq, Ransom, Wolever, Vuksan, Mehling, Boctor, Bolognesi, Huang & Patten, 1997; Kromhout, Bloemberg, Seidell, Nissinen, Menotti, 2001; Marshall, Bessesen & Hamman, 1997; Schaefer, 2002; Schaefer, Timmermans, Eaton, & Matthews, 1980; Tucker, Selhub, Wilson & Rosenberg, 1996; World Health Organization, 1990). A study conducted by the INTERHEALTH division of the World Health Organization (WHO) links high or rising global rates of chronic diseases between 1954 and 1986 with simultaneously occurring unhealthy nutrition-related trends observed in several countries (Posner, Franz, Quatromoni & the INTERHEALTH Steering Committee, 1994). Specifically, unhealthy nutritional practices that are most associated with chronic illness include: high consumption of total, saturated and trans fatty acids, simple carbohydrates, processed foods and total calories as well as an inadequate intake of fruits and vegetables, complex carbohydrates and other sources of dietary fibre (Freimer, Echenberg & Kretchmer, 1983; Posner et al., 1994; Schaefer, 2002; World Health Organization, 1990). Research indicates that dietary habits tend to cluster into healthy and unhealthy patterns so that persons with a high intake of processed/fast-food, red meat, refined grains and sweets are less likely to eat adequate servings of fruits, vegetables, legumes, fish or whole grains; the reverse is also true (Fung et al., 2001; Hu et al., 2000).

These unfavourable dietary practices are most prevalent in Westernized nations when compared to countries less affected by Western influences (Epstein, 1989; Posner et al., 1994; World Health Organization, 1990). The current typical North American diet consists of a considerable number of unhealthy food items, such as soft drinks, salty snacks, hamburgers and French fries, and the portion sizes of these foods has grown significantly over the past two decades (Nielsen & Popkin, 2003). According to Statistics Canada (2002), the level of total calories available per Canadian increased 16% and the availability of total fat increased 22% from 1991 to 2000. While saturated fat levels did not rise significantly during this time period, Canadians have not decreased their intake of high-fat animal products despite health promotion admonitions. Another study comparing the diet of Canadian adults with the Canada Food Guide revealed lower than recommended intakes of fruits and vegetables, grains and cereals and diary products for most age by gender groups (Starkey, Johnson-Down & Gray-Donald, 2001). Equally disturbing, however, was the finding that "Other Foods", including processed snack foods with high amounts of fat, sugar and/or salt, comprised the bulk of energy intake for a large proportion of this sample.

Types of food consumed and dietary habits of immigrant groups are likely to undergo some degree of change during their adaptation to Canadian society (Todd & Gelbier, 1988). A study conducted by Pomerleau, Ostbye and Bright-See (1998) found that non-European immigrants living in Canada were less likely to report a high-fat diet and more likely to report a higher consumption of carbohydrates than native-born Canadians and European immigrants (including immigrants from the United States). However, with greater acculturation to Canadian or similar Western societies,

immigrants' nutritional patterns tend to reflect those of the host population including a higher intake of dietary fat, higher consumption of food from take-out/fast food sources and habits such as eating between meals and having sweets or desserts after dinner (Brock, Lockwood, Cant, Bermingham & Tran-Dinh, 2001; Satia et al., 2001). Dietary change has also been observed in the populations of less developed countries, such as China and India, where Western influences have increased in recent years. Within these countries, more saturated fat and sugar and less complex carbohydrate in the population's diet has been paralleled by increasing rates of hypertension, coronary heart disease, stroke, diabetes and obesity (Popkin et al., 2001). Thus, acculturation in the area of dietary practices may be one factor contributing to increased rates of chronic illness observed over time in the foreign-born Canadian population.

2.4.2 Overweight and Obesity

Body mass index (BMI) is a measure expressing body weight as a function of height (BMI = weight (kg)/height $(m)^2$) that may be used to identify overweight and obese individuals (Bray, 1987). In general, a BMI of 25 to 29 is considered overweight while a BMI of 30 or greater is regarded as obese. Health researchers have noted that the number of people with a BMI that classifies them as overweight or obese has risen sharply in Canada and other Western nations over the last decade (Holland & Breeze, 1986; Kromhout et al., 2001). According to the World Health Organization (1990), an average BMI of 24 to 26 observed in most developed countries implies that a substantial proportion of these populations are overweight. In contrast, the mean BMI in China, a less developed and less Westernized nation, is four points lower at 20 to 21 (Folsom, Li,

Rao, Cen, Zhang, Liu, He, Irving & Dennis, 1994). This trend observed in developed countries is alarming considering the mounting evidence linking obesity and excess body fat to unfavourable health outcomes including heart disease, hypertension, stroke, type II diabetes, arthritis, dyslipidemia, migraines, asthma, stomach problems, some forms of cancer and poorer self-rated health (Cairney & Wade, 1998; Rabkin, Chen, Leiter, Liu, Reeder, 1997; Statistics Canada, 2001b; World Health Organization, 1990). The association between obesity and diabetes is particularly strong. Among participants in Canada's 1994/95 National Population Health Survey, the odds of being diagnosed with diabetes were almost four times higher for obese/overweight males and over five times higher for obese/overweight females compared to their counterparts of acceptable weight (Statistics Canada, 2001b).

Most research has found that obese and overweight BMI are less prevalent in the recently arrived foreign-born population when compared to the native population of Western countries (Bermingham, Brock, Nguyen & Tran-Dinh, 1996; Gilmore, 1999; Hummer et al., 1999) although immigrant rates of obesity vary considerably by country of origin (Bennett, 1993; Pomerleau, McKeigue & Chaturvedi, 1999). However, body weight and body fat indices rise within immigrant populations with longer duration of residence and increased acculturation (Bennett, 1993; Cairney & Ostbye, 1999; Freimer, Echenberg & Kretchmer, 1983; Singh & Siahpush, 2002). Likewise, obesity rates increase in small communities, such as the Eskimo, that acculturate to Western cultural influences but remain stable in similar ethnic communities that maintain traditional cultural practices (Schaefer et al., 1980). Summarizing research in this area, the World Health Organization (1990) states, "there is little evidence that some populations are

more susceptible to obesity for genetic reasons" and asserts that "differences in prevalence of obesity in different populations are largely attributable to 'environmental factors' (especially diet and physical activity)" (p. 69).

Demonstrating the link between body weight and these two lifestyle factors highlighted by the WHO, one study found that physical activity and diet-related variables explained 90% of the variance in population body-fat levels in seven different countries (Kromhout et al., 2001). Specifically, population average work-related physical activity and dietary fibre intake were both strongly and inversely related to population average subscapular skinfold thickness. A recently published report based on the Canadian Community Health Survey data also found an association between greater fibre consumption, in the form of fruit and vegetable intake, and a healthy body weight (Pérez, 2002a). Fast food and other high fat dietary sources have been identified as primary culprits of rising obesity rates in North America (Binkley, Eales & Jekanowski, 2000; Jeffery & French, 1998). Furthermore, studies indicate that declines in work-related physical activity connected to social and economic development occurring in developing countries (Bell, Ge & Popkin, 2001) and increased rates of television-watching in developed nations (Jeffery & French, 1998) are related to obesity or excess weight gain.

2.4.3 Smoking

The prevalence of tobacco use in Canada has decreased in recent decades from the high levels observed mid-20th century (Chen & Millar, 2000; Stephens & Siroonian, 1998). However, within the population aged 15 and older, 29% of males and 26% of females still smoke occasionally or on a daily basis according to the 1998/99 National

Population Health Survey (NPHS) (Statistics Canada, 1999c). Furthermore, NPHS data indicates that smoking did not significantly decline throughout the 1990s in several age by gender groups (e.g., males aged 15-24 and 65+; females aged 15-24 and 45+). Tobacco use is higher for teenage and young-adult Canadians and, recently, has shown disturbing increases among teenage females (Statistics Canada, 1999c; Stephens & Siroonian, 1998). This habit is also more common among low income and unemployed individuals when compared to those who are employed and have higher incomes (Birch, Jerrett & Eyles, 2000). Interestingly, this strong inverse association between smoking and socio-economic status observed within the native-born population of Western countries is not found for the immigrants who live there (Chen, Ng & Wilkins, 1996; King et al., 1999).

While the decrease in smoking behaviour observed in Canada is encouraging, the present rates of tobacco use are still cause for concern. In addition to the well-known relationship between tobacco use and lung cancer, research also indicates that smoking is a risk factor for several chronic illnesses such as respiratory conditions including bronchitis, emphysema and asthma, cardiovascular disease and arthritis (Statistics Canada, 2001b). Moreover, self-perceived health is lower for smokers compared to non-smokers (Birch, Jerrett & Eyles, 2000).

Rates of smoking tend to be lower for newcomers compared to the native population of Western host countries, although variations by ethnic or cultural group exist. Addressing this issue in the Canadian context, Millar (1990) found a lower prevalence of daily cigarette smoking for foreign-born individuals (16%) than for native-born Canadians (23%). Also, immigrant smokers were less likely to use high tar yield

cigarettes and smoked fewer cigarettes per day than their non-immigrant counterparts. Finally, never having smoked was more common among foreign-born persons than native-born Canadians. Other studies describe similar lower rates of smoking for immigrants compared to the rates within developed nations; this pattern is most consistent for non-European immigrant groups (Bennett, 1993; Chen, Ng & Wilkins, 1996; Jirojwong & Manderson, 2002; King, Polednak, Bendel & Hovey, 1999; Singh & Siahpush, 2002; Swallen, 1997).

Researchers describing the relationship between acculturation indices and smoking behaviour within the foreign-born population report inconsistent results. For instance, longer duration of residence has been found to be associated with no change in immigrants' smoking status (Bennett, 1993; King et al., 1999) as well as a lower likelihood of smoking (Brock et al., 2001). Nonetheless, the predominant pattern observed is one where smoking rates increase with greater acculturation of foreign-born groups (Chen, Ng & Wilkins, 1996; Jirojwong & Manderson, 2002; Singh & Siahpush, 2002). In addition, a U.S. study focusing on Hispanic immigrants suggests that the smoking behaviour of highly acculturated foreign-born smokers tends to resemble the habits of the native-born smoking population more so than less-acculturated smokers (Marin, Perez-Stable & Marin, 1989). For example, highly acculturated immigrant smokers had their first cigarette of the day earlier and smoked more cigarettes per day than their less-acculturated peers who smoked.

There is need for more research that investigates the ethnic and cultural variables associated with tobacco use (Edwards & MacMillan, 1990). The initial smoking behaviour of Canadian immigrants originating from different countries may vary due to

different knowledge regarding the health effects of tobacco use and cultural meanings attached to smoking behaviour (Beardall & Edwards, 1995; Tseng, 1986). Furthermore, smoking rates of immigrants may be increasingly affected by aggressive tobacco marketing campaigns that have taken place in developing countries over recent decades as the popularity of smoking in wealthier Western countries has declined (Ball & Simpson, 1987; Edwards & MacMillan, 1990; Fielding, 1985; Tseng, 1986; Yach, 1986).

2.4.4 Physical Activity

There is ample empirical support indicating positive health effects of regular exercise. This research points to a relationship between an inactive or sedentary lifestyle and chronic health conditions including coronary heart disease, other forms of cardiovascular disease, diabetes and depression (Berlin & Colditz, 1990; Chen & Millar, 1999; Haapanen, Miilunpalo, Vuori, Oja & Pasanen, 1997; Sesso, Paffenbarger, Ha & Lee, 1999; Sesso, Paffenbarger & Lee, 2000; Statistics Canada, 2001b) as well as risk factors such as obesity and dyslipidemia (Binkley, Eales & Jekanowski, 2000).

Physical activity through work, transportation and domestic chores has largely been eliminated through mechanization and technological advances in Western countries such as Canada (Sherwood & Jeffery, 2000). Therefore, in these countries, voluntary leisure-time physical activity has become the primary means of exercise. Similar rates of physically active leisure pursuits among Canadians were reported in the 1994/95 and 1996/97 NPHS (Chen & Millar, 1999). Specifically, of the population aged 20 and older, 18% were regular high-intensity exercisers, 22% were regular moderate-intensity exercisers and 15% exercised at a light-intensity level on a regular basis. However, the

largest group, 40%, did not exercise regularly. Considering the popularity of sedentary forms of leisure within Western culture, such as watching television (Jeffery & French, 1998), the sizeable proportion of the population who remain inactive is not surprising.

Unlike the other health behaviours discussed, research studies tend to report a less favourable exercise profile in immigrant groups when compared to their Western host populations. Rates of inactivity are consistently found to be higher for foreign-born individuals, especially those from non-European countries (Bennett, 1993; Chen, Ng & Wilkins, 1996; Pérez, 2002b). Furthermore, although exercise participation may improve with a longer duration of residence among some immigrant groups, such as those from European nations (Bennett, 1993; Brock et al., 2001; Chen, Ng & Wilkins, 1996), this pattern of convergence does not occur for all foreign-born groups (Pérez, 2002b).

The unique nature of exercise participation among immigrants when compared to that of the other health behaviours is somewhat perplexing. Considering the lower rates of morbidity among immigrants and the strong relationship between physical activity and lower prevalence of chronic disease, one would expect to find a greater likelihood of exercise behaviour among these groups. One explanation for this anomaly may be the narrow definition of physical activity used by most studies on this topic. As explained by Berlin and Colditz (1990), the type of physical activity chosen as the independent variable – leisure, occupational, or both – can have a notable effect on a study's findings relative to exercise-related effects. The vast majority of research describing exercise behaviour among immigrants living in Western countries considers only physical activity during leisure (Bennett, 1993; Chen, Ng & Wilkins, 1996; Pérez, 2002b). However, research conducted in developing nations is more likely to consider work-related activity

when investigating the relationship between physical activity and health outcomes (Kromhout et al., 2001; Popkin et al., 2001). Bell, Ge and Popkin (2001) note that leisure-time physical activity is unpopular in Chinese culture where physical exertion, until recent years, has been necessary in the vast majority of occupational and domestic tasks. In contrast, technological advances have drastically reduced the amount of manual labour necessary within Canadian homes and workplaces. For this reason, measurement of physical activity among immigrants that only considers activity related to leisure, and ignores the contribution of work-related activity, may result in an incomplete and inaccurate picture of energy expenditure. However, given the strong relationship between physical inactivity and chronic health conditions, this variable must be included in an investigation considering the effect of acculturation on immigrant health.

This thesis addresses an identified gap in immigrant health research by performing a direct test of lifestyle factors and health status among foreign-born persons.

2.5 Alternative Explanations

Other explanations and hypotheses addressing the associated increase in chronic illness with length of residence among immigrant populations have also been proposed. Since Canadian immigrants who have lived longer than 10 or 20 years in the country are usually significantly older than recently arrived immigrants, age partially explains the increased number of chronic conditions for those with longer durations of residence (Dunn & Dyck, 2000). However, as noted previously, even after controlling for age, this association holds true (Chen, Ng & Wilkins, 1996; Kaplan et al., 2002; Stephen et al., 1994).

The stress paradigm has also been utilized to explain changes in health in relationship to acculturation. This perspective implies that the stress involved in migratory and acculturation experiences leads to health declines in immigrant groups (Berry, 1998; Berry & Kim, 1988; Kliewer, 1992). However, this hypothesis has been most often and most successfully used to explain psychological health issues in immigrant populations (Berry & Kim, 1988; Zheng & Berry, 1991). It has been employed less frequently to explain declines in physical health and the development of chronic illnesses (Berry, 1998).

Differential access and utilization of health care among less acculturated and more acculturated immigrants may also be an explanatory factor based on the fact that duration of residence is positively associated with increased contact with the health care system (LeClere, Jensen & Biddlecom, 1994). Thus, increased acculturation of foreign-born persons may be positively associated with climbing rates of chronic illness because the greater exposure to physicians lends itself to greater opportunity for diagnosis.

It is also important to consider whether the changing characteristics of immigrants over time in response to immigration policy may explain the inverse relationship between health status and duration of residence observed within cross-sectional studies. Is increased chronic illness among foreign-born persons due to a cohort effect where more recent entrants are simply healthier than earlier immigrants to Canada? An analysis of the major changes in immigration policy that have occurred within the last thirty years suggests the opposite: that recent immigrants may have characteristics associated with *lower* health status, not better health, than earlier cohorts. For instance, whereas the vast majority of earlier newcomers entered Canada under a points system favouring persons of

younger age, higher education, language skill and economic stability, recent applicants may be accepted for residence on the basis of family reunification or humanitarian grounds (Boyd & Vickers, 2000). Presently, Immigration Canada gives priority to family class and refugee applications over those applying independently under the point selection system (Economic Council of Canada, 1991). Also, family class immigrants comprised nearly 30% of all newcomers in 2002 (Citizenship and Immigration Canada, 2002a) and, of these, 35% were parents or grandparents (Citizenship and Immigration Canada, 2002b). Thus, possible differences in terms of socio-economic status and age suggest that present-day immigrants may be disadvantaged in terms of health relative to their earlier arriving counterparts.

In fact, many researchers in this area have examined socio-economic factors in order to explain poor health in immigrant groups, arguing that the disadvantages experienced by newcomers in terms of employment, income and social status lead to declines in well-being (Angel, Buckley & Sakamoto, 2001; Dunn & Dyck, 2000; Wei et al., 1996). Certainly, the link between lower socio-economic status and poorer health outcomes has been well established in the literature. Further, certain foreign-born groups, especially visible minorities, tend to be more disadvantaged than the native-born White majority population in Canada in terms of employment opportunities, financial stability and social status (Boyd & Vickers, 2000; Harvey, Siu & Reil, 1999; Kazemipur & Halli, 2000; Neuwirth, 1999). However, evidence also reveals that increased duration of residence, while associated with declining health, is also related to greater integration of immigrants into Canadian society, and subsequently, higher socio-economic status (Chen, Ng & Wilkins, 1996; Harvey, Siu, & Reil, 1999; Kalbach & Kalbach, 1999b;

Statistics Canada, 2003). Therefore, a somewhat paradoxical pattern is apparent -- duration of residence and increased acculturation result in improvements in immigrant socio-economic status but worsening health status (Rumbaut, 1997; Scribner, 1996). Not surprisingly then, income and education variables, while certainly part of the picture, do not fully explain the increase in chronic illness experienced by immigrants with longer periods of residence in North American countries (Dunn & Dyck, 2000; Espino & Maldonado, 1990; Mutchler & Burr, 1991; Pérez, 2002b; Singh & Siahpush, 2002; Wei et al., 1996).

Interestingly, the relationship between socio-economic factors and immigrant health does not follow the pattern observed among the Canadian-born population, where higher income and education are positively associated with better health outcomes. For instance, Dunn and Dyck (2000) found no clear or consistent pattern of relationship between socio-economic factors and several specific health indicators among Canadian immigrants aged 20 and older using NPHS data. In addition, these authors reported results that were somewhat surprising, including a weak positive relationship between educational attainment and likelihood of reporting a chronic condition.

Perhaps health behaviour acculturation may help explain the complexity of this relationship between socio-economic factors and immigrant health. As described earlier, the positive association between lower socio-economic status and unhealthy lifestyle behaviours (e.g., smoking) observed within the general Canadian population is not replicated among foreign-born groups. Myers and Rodriguez (2002) state that the acculturative experience may be very different for persons of lower socio-economic status than their higher socio-economic status counterparts. In fact, it appears as though

acculturation tends to occur more extensively and rapidly among immigrants with more 'human capital' who have been granted immigration status based on professional, educational and economic qualifications in comparison to those entering the country on humanitarian grounds (i.e., refugees) or through family reunification programs. Alba and Nee (1997) explain that the former, more affluent group tends to have greater participation in and contact with various institutions of the host society than the latter group who often settle in ethnic enclave communities where integration with the host population occurs to a lesser degree. Thus, we may expect that acculturation to various aspects of the host society culture, including lifestyle and health behaviours, will be more extensive for immigrants of higher socio-economic status who have more opportunity to integrate with persons of the dominant culture. If this adaptation includes the adoption of unhealthy aspects of Western culture, socio-economic status and health may be inversely associated within this group. Clearly, the contribution of lifestyle acculturation to an explanation of the association between increasing chronic illness and longer duration of residence among foreign-born groups in Canada deserves further research attention.

2.6 Research Hypotheses

Based on the previous literature review, the following three hypotheses have been developed and comprise the focus for this study:

1. Rates of chronic conditions within the foreign-born population aged 45+ in Canada will be positively associated with duration of residence, after controlling for other key variables.

2. Foreign-born persons with a longer duration of residence (10+ years) will have more unhealthy lifestyle behaviours than foreign-born persons with a shorter duration of residence (0 to 9 years).
3. The association between duration of residence and chronic illness among foreign-born persons will be partly explained by the inclusion of lifestyle variables (smoking, BMI, diet, physical activity), after controlling for other key variables.

Chapter Three: Methodology

This section describes the data source and the variables that are used to test the hypotheses. The filtering, weighting and variable recoding procedures employed to prepare the data for statistical analysis are explained. Also, a description of the sample in terms of each variable is provided.

3.1 Data Source

The hypotheses will be tested using data derived from cycle 1.1 of the Canadian Community Health Survey (CCHS). Statistics Canada developed the CCHS with the objective of providing timely cross-sectional information about health determinants, health status, and health system utilization at the sub-provincial, provincial, and national levels (Béland, 2002). The first of the two cross-sectional surveys comprising the CCHS allows analysis pertaining to the 136 health regions across the country while the second provides provincial-level data on a particular health topic. These two surveys were conducted over a two-year, repeating cycle; data for cycle 1.1 was collected between September 2000 and September 2001.

The CCHS target population includes all household residents aged 12 and older and represents approximately 98% of the Canadian population in this age range. Excluded from the sample are residents of Indian reserves, Crown lands, certain remote areas or institutions and full-time members of the Canadian Armed Forces. A

combination of random digit dialling and area sampling frames were employed to generate a representative sample of households within each health region. Both youths (aged 12-19) and seniors (aged 65+) were over-represented in the selection of individual respondents. Interviews with selected household residents were conducted in person or over the telephone and a proxy interview was held with an alternate household member when the selected individual was repeatedly unavailable. The response rate was 84.7% and 6.3% of the interviews were obtained by proxy (Pérez, 2002b). The Public Use Microdata File (PUMF) for cycle 1.1 was released by Statistics Canada in January 2003.

Since this analysis focuses on the mid-life to older Canadian immigrant population, persons younger than age 45 and native-born individuals were excluded from the total sample (n=130,880). Thus, only individuals who were (1) aged 45 and older (n=61,383) and (2) born outside of Canada (n=16,896) were included. This resulted in a final sample size of 9,992.

The sampling weight coefficient provided by Statistics Canada was used in the process of weighting the cases to match known population distributions. This procedure was done to compensate for the unequal probabilities of selection and under- and over-coverage of some subgroups within the population due to, for example, differential non-response. The data were subsequently rescaled back to the original target sample size of 9,992 by using a calculated multiplier. This was done in order to conduct statistical analyses on the data.

The content of cycle 1.1 of the CCHS covers a wide range of health topics. In order to provide information relevant to individual health regions, the questionnaire consisted of a common content section administered to all participants and an optional

content section designed to address issues specific to a given health region. For this study, analysis will focus on data derived from the 35-minute long common content questionnaire. Variables of interest to the proposed hypotheses include demographics, chronic conditions, self-rated health, body habitus measurements, physical activity patterns, smoking, fruit and vegetable consumption, health care utilization, and perceived stress. Visible minority status, duration of residence and language ability information are available for foreign-born participants.

3.2 Measurement

The specific dependent and independent variables that are used in the statistical analysis are described below.

3.2.1 Dependent variables

Six dichotomous variables were used as dependent variables. Five of these are drawn from the Chronic Conditions section of the questionnaire and the sixth was derived from the general health section. Chronic conditions were defined in the survey as professionally diagnosed long-term health conditions lasting six months or more. Subjects were asked if they had a series of specific conditions including allergies, asthma, migraine headaches, glaucoma, cataracts, thyroid condition, Alzheimer's disease or another dementia, cancer, urinary incontinence, stroke, bowel disease, Parkinson's disease, multiple sclerosis, chronic fatigue syndrome, chronic bronchitis, emphysema or chronic obstructive pulmonary disease, fibromyalgia, epilepsy, arthritis or rheumatism,

back problems, diabetes, hypertension, heart disease or any other long-term condition. The PUMF provided a variable derived from this series of questions indicating whether a respondent reported having any chronic condition at all. The dependent variables utilized in this analysis indicate the presence of any chronic condition as well as the presence of four chronic diseases that are prevalent within the older population: hypertension, arthritis or rheumatism, diabetes and heart disease. All five of these variables are dichotomous with 'yes' and 'no' as the two possible categories.

Table 3.1 shows the percentage and number breakdown for each of the dependent variables. A majority of respondents reported having at least one chronic condition (n=7,440, 74.5%) while over a quarter of the sample reported having arthritis/rheumatism (n=2,776, 27.8%) or high blood pressure (n=2,620, 26.2%). Nearly ten percent indicated that they had been diagnosed with diabetes (n=878, 8.8%) or heart disease (n=954, 9.5%).

Table 3.1 Dependent Variable Frequencies

Variable	Yes		No	
Any chronic condition	7,440	74.5	2,552	25.5
Arthritis/rheumatism	2,776	27.8	7,216	72.2
High blood pressure	2,620	26.2	7,372	73.8
Diabetes mellitus	878	8.8	9,114	91.2
Heart disease	954	9.5	9,038	90.5
Fair/poor self rated health	2,173	21.8	7,819	78.2

Additionally, a more subjective measure of well-being, self-perceived health, was chosen as a supplementary dependent variable. Self-rated health has been established as a valid predictor of many health-related outcomes including diagnosed illness, somatic symptoms, self-care behaviours, body mass index and mortality (Idler & Benyamini,

1997; Smith, Shelley & Dennerstein, 1994). Responses to the question: "In general, would you say your health is excellent, very good, good, fair, or poor?" were dichotomized to create a dependent variable comparing persons who rated their health as 'fair' or 'poor' (n=2,173, 21.8%) to persons rating their health more favourably.

For each of the dependent variables, modal substitution was used to deal with missing data. This method is acceptable when the percentage of missing is small, as in this case. Thus, missing cases for 'has a chronic condition' (n=25, 0.2%) were recoded as 'yes'. The small number of missing cases for all five of the other variables, including arthritis/rheumatism (n=10, 0.1%), hypertension (n=28, 0.3%), diabetes (n=16, 0.2%), heart disease (n=11, 0.1%), and fair/poor self rated health (n=3, 0.03%), were recoded as 'no'. Those reporting having any of the conditions were coded as '1' and those who did not were coded as '0'.

3.2.2 Independent variables

Fifteen independent variables are included in the analyses and are organized into six categories, each representing a specific context (see Results section). These contexts include: demographics, immigrant characteristics, lifestyle behaviours, health care utilization, perceived stress, and socio-economic status. Several of the variables comprising the latter five categories (e.g., language ability, smoking status, physical activity, fruit and vegetable consumption, body mass index, doctor visits, perceived stress, household income, education level and employment status) may be considered mediating variables since they intercede between immigrants' length of residence and health outcomes.

In some instances, recoding of variables may have been necessary for two reasons. First, there was a variable amount of missing data for those questions that included 'don't know', 'not stated', and 'refused' as possible responses. Therefore, in order to retain as much data as possible for the multivariate analyses, the small numbers of missing cases were usually recoded as the mean for continuous variables or as the mode for categorical and ordinal variables. Second, for the purposes of regression analysis, several nominal and ordinal level variables were recoded into dichotomies. Each recoding strategy is outlined below.

3.2.2.1 Demographic Variables

Age, sex and marital status were used to represent the demographic context. Ten-year groups were created from the five-year age categories provided in the CCHS PUMF for the logistic regression analysis. The 45-54 age group (n=3,783, 37.9%) was set as the reference category compared to those aged 55-64 years (n=2,681, 26.8%), 65-74 years (n=2,082, 20.8%) and 75 and older (n=1,446, 14.5%). For the sex and marital status dichotomous variables, females (n=5,142, 51.5%) were compared to males (n=4,850, 48.5%, reference) and persons who were widowed, separated, divorced or single (n=2,490, 24.9%) were compared to persons who were married or in a common-law relationship (n=7,502, 75.1%, reference). The small number of respondents who did not state their marital status (n = 12, 0.1%) were recoded as the modal category, 'married'. It was expected that a higher prevalence of health conditions would be related to older age, female gender and non-married status.

3.2.2.2 Immigrant Characteristic Variables

Three different variables comprise the second grouping. The duration of residence variable, based on the number of years an immigrant has lived in Canada, is the proxy measure of acculturation included in the analysis. The dichotomous variable provided in this data file separates those who have resided in the country for 0-9 years (n=1,101, 11.0%) from residents of 10 or more years (n=8,891, 89.0%); the former group was set as the reference. Longer duration of residence is expected to be associated with a greater prevalence of health conditions than shorter residence.

The second variable measures visible minority status. Statistics Canada asked respondents to identify themselves as: White, Chinese, South Asian, Black, Filipino, Latin American, Southeast Asian, Arab, West Asian, Japanese, Korean, Aboriginal, or Other. However, due to confidentiality reasons, detailed information was not accessible in the PUMF. Instead, a variable was provided that separated 'non-visible minorities', persons who identified themselves as 'White' (n=6,586, 65.9%, reference), from 'visible minorities', individuals who identified themselves as belonging to any other racial or cultural background (n=3,324, 33.3%). This variable was included for two main reasons. First, 'White' immigrants, as compared to 'visible minority' immigrants, are more likely to have originated from geographical areas (e.g., United States and Europe) where the culture and lifestyle are more Westernized, and therefore similar to native-born Canadians. Second, the prevalence of certain health conditions differs among various ethno-cultural groups (Sheth, Nair, Nargundkar, Anand & Yusuf, 1999). Thus, this variable is included to capture the health differences that may exist between these groups

(Chen, Wilkins & Ng, 1996) and visible minority individuals are expected to have fewer health conditions than non-visible minority persons.

Finally, language may be viewed as another indication of acculturation (Black & Markides, 1993; Kalbach & Kalbach, 1999b) comparing persons who do not speak English or French (n=1,243, 12.4%) to those able to speak at least one of the country's official languages (n=8,749, 87.5%; reference). The category associated with lower acculturation, non-English or French speaking ability, is expected to be associated with fewer diagnoses.

3.2.2.3 Lifestyle Variables

An individual's lifestyle context is measured using four variables that were developed from questions drawn from separate sections within the survey. These include: smoking status, physical activity, fruit and vegetable consumption and body mass index. With regard to smoking status, respondents were asked: "At the present time, do you smoke cigarettes daily, occasionally or not at all?" A dichotomous smoking variable was created that compares participants who reported 'daily' (n=1,160, 11.6%) or 'occasionally' (n=253, 2.5%) to those who reported 'not at all' (n=8,580, 85.9%). It is anticipated that the former category will be associated with poorer health status. The single missing case for this variable was assigned the modal category, 'not at all'.

The physical activity index, a derived variable provided within the PUMF, separates active, moderately active, and inactive individuals. This classification is based on a person's average daily energy expenditure (kcal/kg/day) over the past three months and is calculated from the duration and frequency of reported leisure activities during this time frame. Respondents were asked about their involvement in 20 specific physical

activities (e.g., walking, bowling, gardening/yard work) and were also given the opportunity to report their participation in other leisure activities that were not on the list. Within the Statistics Canada dataset, the energy expenditure for an active individual is greater than or equal to 3.0 kcal/kg/day, for a moderately active person is 1.5 to 2.9 kcal/kg/day and for an inactive person is less than 1.5 kcal/kg/day. 'Active' (n=1,539, 15.4%) was set as the reference category against which 'moderate' (n=1,933, 19.4%) and 'inactive' (n=6,520, 65.3%) were compared.

Since the physical activity index was created from several other variables, there are a large number of missing cases (n=1,233; 12.3%). These were substituted with the modal category, 'inactive'. In order to test this recoding strategy, the missing cases were recoded as a separate category and the test variable was entered into a logistic regression equation with 'active' as the reference. Since there was virtually no difference in the Exp(B) and significance levels for both the missing cases category and the inactive category, this substitution was deemed acceptable.

Body mass index (BMI) was calculated based on subjects' self-reported height and weight measurements (BMI = weight (kg)/height $(m)^2$). Statistics Canada provides this calculation within the data file for persons aged 20 to 64 only because this measure is less reliable for individuals over age 65. Therefore, in order to deal with the large number of missing cases (n=3,636, 36.4%), BMI values for individuals aged 65 and older were computed separately using their height and weight measurements. Height was provided in inches and was converted into metres for the BMI calculation. Missing cases for height (n=42, 0.4%) and weight (n=146, 1.5%) were assigned the median value for a corresponding age by sex category. The 5-year age categories used in this recoding

procedure were: 45-49, 50-54, 55-59, 60-64, 65-69, 70-74 and 75 and older. Finally, a new variable was created combining the original BMI values provided within the PUMF for those aged 45 to 65 and the values calculated for those older than 65. Body mass index was entered into the logistic regression analysis as a continuous variable ranging from 13.99 to 52.10 (mean = 25.80) and a positive relationship was expected with this variable and the six health conditions.

This cycle of the CCHS included a series of questions about fruit and vegetable consumption that enquired about respondents' intake of the following specific items: fruit juices, whole fruit, green salad, carrots, potatoes (excluding french fries, fried potatoes or potato chips), and 'other vegetables'. This information was the basis for assessment of diet and nutrition, the fourth health behaviour variable. The PUMF contained an interval variable representing a person's daily fruit and vegetable consumption as well as an ordinal variable representing the number of servings/times per day a person eats fruit and vegetables. This latter variable was dichotomized into 'less than 5 servings/times per day' (n=5,773, 57.8%) and, the reference category, '5 or more servings/times per day' (n=4,219, 42.2%). It was expected that the latter category would be associated with fewer health conditions. The missing cases (n=122, 1.2%) were assigned the modal category, 'less than 5 servings/times per day'.

3.2.2.4 Health Care Utilization

The health care utilization context was represented by an interval-level variable corresponding to the number of visits to a general practitioner or other medical doctor that a respondent reported having within the past 12 months. The responses ranged from

'0' to '31' and the mean was five visits. Missing cases (n=41, 0.4%) were assigned the mean ('5'). As increased contact with the health care system provides opportunity for diagnoses of health conditions, it is expected that this variable will be positively related to the six dependent variables.

3.2.2.5 Stress

Chronic stress is included in this analysis as another variable that may mediate the relationship between duration of residence and foreign-born persons' health. Self-perceived stress was measured by the question: "Thinking about the amount of stress in your life, would you say that most days are: not at all stressful, not very stressful, a bit stressful, quite a bit stressful or extremely stressful?" For the regression analyses, 'not at all/not very stressful' (n=4,076, 40.8%) was the reference category in comparison to 'a bit stressful' (n=3,662, 36.6%) and 'quite a bit/extremely stressful' (n=2,251, 22.5%). Substitution with the mode, 'a bit stressful', was applied to the small number of missing cases (n=19, 0.2%). It is anticipated that greater stress will be associated with poorer health status.

3.2.2.6 Socio-economic Variables

Three socio-economic variables are included in this analysis: total household income, education level, and employment status. Information about financial status was gained from respondents' best estimate of the total combined household income before taxes and deductions generated in the past 12 months. An ordinal yearly household income variable was created with the following categories: 'less than $15,000' (n=892,

8.9%), '$15,000 to $29,999' (n=1,936, 19.4%), '$30,000 to $49,999' (n=2,527, 25.3%), '$50,000 to $79,999' (n=2,624, 26.3%) and 'over $80,000' (n=2,012, 20.1%; reference category). Missing cases (n=1,167, 11.7%) were assigned the median income category according to their age by sex group. The age categories used in this recoding procedure were: 45-49, 50-54, 55-59, 60-64, 65-69, 70-74 and 75 and older.

Level of education was represented by another ordinal variable where post-secondary graduates (n=4,546, 45.5%) were compared to individuals with 'some post-secondary' (n=628, 6.3%), 'secondary school graduation' (n=2,006, 20.1%) and 'less than secondary school graduation' (n=2,811, 28.1%). The missing cases (n=116, 1.2%) were assigned the modal category, 'post-secondary graduate'. It is expected that both higher income and education will be associated with better health, although previous research suggests that findings inconsistent with this general pattern may also emerge.

Finally, employment status was also included in this group. The PUMF provided a nominal variable representing employment status throughout the past year that was based on responses to survey questions enquiring about the number of weeks that a respondent reported being employed and/or looking for a job within the past year. The categories for the nominal variable were: 'has had a job through the past year' (n=4,086, 40.9%), 'was without job, looking/not looking' (n=3,286, 32.9%), 'had job part year looking/not looking' (n=1,069, 10.7%), 'other' (n=46, 0.5%), and 'not applicable' (n=1,446, 14.5%). A new ordinal variable was created based on this information comparing those who had a job during the entire past year (n=4,146, 41.5%) to those who were unemployed throughout the year (n=3,332, 33.3%), those who had a job for only part of the year (n=1,069, 10.7%) and those who were in some other employment

situation such as retirement (n=1,446, 14.5%). However, the latter category was highly correlated with age and thus would not function properly in the logistic regression equation. Thus, a new dichotomous variable was created that compared persons who had been employed for all or part of the past year (n=5,215, 52.2%) to those who were unemployed/retired/other during this time period (n=4,777, 47.8%). Since good health is an important prerequisite to steady employment, it is expected that the fewer health problems will be associated with the former category.

Chapter Four: Analysis

This chapter describes the bivariate and multivariate statistical analysis techniques that were employed to test the research hypotheses and presents the results of these analyses. In order to test the hypotheses, CCHS data were analyzed using a statistical database software package (SPSS 11.5). The contribution of lifestyle to the observed positive association between increased duration of residence and rates of chronic illness within the Canadian immigrant population were isolated using logistic regression. This multivariate statistical technique produces the odds ratio of developing (1) any chronic condition, (2) one of four specific chronic illnesses and (3) fair or poor self-rated health for immigrants with different lifestyle behaviours while controlling for all other variables entered into the model. Significance for all statistical tests was set at the $p<0.05$ level.

4.1 Bivariate Analysis

A series of bivariate analyses are presented in this section. These serve as a preliminary test of the research hypotheses by providing information about basic relationships between the dependent and independent variables in general, and between health conditions and duration of residence in particular. However, since bivariate analyses involve only two variables, they are limited by their ability to elaborate the cause of observed relationships. Therefore, multivariate techniques are subsequently

performed to test whether the associations are spurious, or, explained by extraneous variables.

Table 4.1 presents the strength, direction, and significance level of the association between each dependent and independent variable pair. Pearson's r describes the strength of the association between interval pairs. For the purpose of these analyses, dichotomous nominal variables (e.g., 'male/female', 'yes/no') were treated as interval variables because a dichotomy can be converted to a percentage and therefore treated at the interval level. The strength of the relationship between ordinal-level variable pairs that have an unequal number of categories is described by the tau c statistic. Within this study, a correlation magnitude that is less than 0.05 is interpreted as indicating no relationship; 0.05 to 0.19 represents a weak relationship; 0.20 to 0.39 represents a moderate strength correlation; and a magnitude that is 0.40 or greater indicates a strong relationship. Therefore, only those associations that have at least a correlation strength 0.05 and that have reached the minimum level of significance ($p<.05$) are reported below.

4.1.1 Health Conditions and Demographics

In Table 4.1 we observe that age displays a weak to moderate, positive association with all of the health conditions. As expected, persons who are older are more likely to report the presence of: any chronic condition (tau c=.24, $p\leq.001$), arthritis/rheumatism (tau c=.29, $p\leq.001$), high blood pressure (tau c=.24, $p\leq.001$), diabetes (tau c=.08, $p\leq.01$) heart disease (tau c = .26, $p\leq.001$) and fair/poor self-rated health (tau c=.19, $p\leq.001$). Any chronic condition is reported by 62.3% of 45 to 54 year olds (n=2,357),

75.5% of 55 to 64 year olds (n=2,023), 83.7% of 65 to 74 year olds (n=1,743), and 91.1% of those aged 75 and older (n=1,317). A diagnosis of arthritis or rheumatism had been received by 14.1% (n=534) of 45 to 54 year olds, 26.0% (n=698) of 55 to 64 year olds, 40.2% (n=836) of 65 to 74 year olds and 48.9% (n=707) of persons aged 75 and older. Fifteen per cent of respondents between the ages of 45 and 54 reported having high blood pressure (n=568); these rates increased by age group to 23.9% (n=642) for persons aged 55 to 64, 37.0% (n=771) for those aged 65 to 74, and 44.2% (n=638) for the highest age category. Diabetes was reported by almost five per cent of those aged 45 to 54 (4.8%, n=180), rose to 8.6% (n=231) among 55 to 64 year olds, and increased to over one tenth of 65 to 74 year olds (12.9%, n=268) and persons aged 75 plus (13.8%, n=199). The proportion of persons reporting a diagnosis of heart disease was 2.4% (n=89) for 45 to 54 year olds, 7.4% (n=198) for 55 to 64 year olds, 15.5% (n=323) for 65 to 74 year olds and 23.7% (n=343) for those over age 75. Finally, poor/fair self-rated health is reported by less than one fifth of the youngest age category (13.4%, n=507), exactly one fifth of persons age 55 to 64 (n=537), over one quarter of 65 to 74 year olds (26.8%, n=557), and over one third of the oldest age group (39.6%, n=572).

Table 4.1 Crosstabulation: Dependent Variables by Independent Variables

Dependent variables	Independent Variables														
	Age	Sex	Marital Status	Duration of Residence	Visible Minority Status	Language	Smoking	Physical Activity	BMI	Fruit & Vegetables	Doctor Visits	Stress	Income	Education	Employment Status
statistic:	*tau c*	*r*	*r*	*r*	*r*	*r*	*r*	*tau c*	*r*	*r*	*r*	*tau c*	*tau c*	*tau c*	*r*
Any Chronic condition	.24***	.11***	.07***	.16***	-.09***	-.05***	.01	0	.07***	.01	.28***	.04***	-.12***	-.10***	.23***
Arthritis/ Rheumatism	.29***	.17***	.11***	.13***	-.17***	-.02	0	0	.12***	.01	.21***	.03**	-.16***	-.15***	.29***
High blood pressure	.24***	.07***	.07***	.07***	-.02*	0	.07***	.05***	.14***	.01	.22***	0	-.12***	-.10***	.20***
Diabetes Mellitus	.08**	-.01	.02*	.05***	.04***	.01	.04**	.02**	.13***	-.01	.15***	-.01*	-.06***	-.05***	.11***
Heart Disease	.16***	-.03**	.06***	.04***	-.09***	-.01	.04***	.02***	.03**	.04***	.21***	-.02*	-.07**	-.06***	.21***
Fair/poor self rated health	.19***	.05***	.07***	.04**	-.05***	.09***	-.01	.10***	.08***	-.01	.39***	.13***	-.19***	-.19***	.29***

*p≤.05, **p≤.01, ***p≤.001

According to Table 4.1, sex displays a weak, positive association with four of the dependent variables: any chronic condition (r=.11, p≤.001), arthritis/rheumatism (r=.17, p≤.001), high blood pressure (r=.07, p≤.001) and fair/poor self-rated health (r=.05, p≤.001). This confirms the expectation that women in the sample were more likely than men to experience these health conditions. Nearly eighty per cent of women (79.1%, n=4066) reported having any chronic condition; rates for men were ten per cent lower (69.6%, n=3,375). Close to one third of female respondents had arthritis or rheumatism (35.1%, n=1803) or high blood pressure (29.1%, n=1,494) whereas corresponding rates for males (20.1%, n=973 and 23.2%, n=1,125, respectively) were closer to one fifth. Just over one fifth of women perceived their health to be fair or poor (23.8%, n=1,223) whereas just under this proportion of men (19.6%, n=950) rated their health this way.

Marital status was weakly associated with the presence of five of the dependent variables. The positive direction of these weak associations indicate that when compared to their counterparts, immigrant respondents who were not in a married or common-law relationship were more likely to report having any chronic condition (r=.07, p≤.001), arthritis or rheumatism (r=.11, p≤.001), high blood pressure (r=.07, p≤.001), heart disease (r=.06, p≤.001) and fair/poor self rated health (r=.07, p≤.001). Eighty per cent of persons not married or in a common law relationship had any chronic condition (80.0%, n=1993) compared to 72.6% (n=5,447) of those in such a union. Over thirty percent not living common-law or married had arthritis or rheumatism (36.6%, n=913) or hypertension (31.5%, n=785) whereas 24.8% (n=1,863) of those who were in one of these types of relationships had arthritis or rheumatism and 24.4% (n=1,834) had high blood pressure. Also, over ten per cent of persons not living in a married or common-law relationship had

heart disease (12.7%, n=316) compared to less than ten per cent of those who were (8.5%; n= 637). Finally, among those not married or common-law, over one quarter rated their health as fair or poor (n=26.9%, n=670); the corresponding rate for respondents living as a married/common law couple was 20% (n=1,503).

4.1.2 Health Conditions and Immigrant Characteristics

Examination of Table 4.1 indicates that duration of residence is weakly and positively associated with four of the dependent variables. As anticipated, foreign-born individuals who have lived in Canada for over ten years are more likely than their recently arrived counterparts (0 to 9 years) to report having: any chronic condition ($r=.16$, $p\leq.001$), arthritis or rheumatism ($r=.13$, $p\leq.001$), high blood pressure ($r=.07$, $p\leq.001$) and diabetes ($r=.05$, $p\leq.001$). Just over one half of foreign-born persons residing in Canada for less than ten years reported having any chronic condition (54.9%, n=604) compared to over three quarters of those with a longer duration of residence (76.9%, n=6,836). The rate of arthritis for persons who arrived in Canada greater than ten years ago (29.7%, n=2,645) was double that observed for those people who arrived more recently (11.9%, n=131). Nearly one third of respondents residing in the country for more than ten years reported high blood pressure (27.2%, n=2,422) while almost ten per cent reported diabetes (9.3%, n=828). The corresponding lower rates for persons living in Canada for a shorter period of time were 17.9% (n=197) for high blood pressure and 4.5% (n=50) for diabetes.

The visible minority status variable was also weakly associated with four health conditions in the expected direction (see Table 4.1). Compared to non-minority

respondents, those of minority status were less likely to have any chronic condition (r=-.09, p≤.001), arthritis or rheumatism (r=-.17, p≤.001), heart disease (r=-.09, p≤.001) and fair/poor self-rated health (r=-.05, p≤.001). Accordingly, among respondents identifying themselves as 'White', 75.2% (n=6,579) had any chronic condition compared to 67.8% (n=2,253) of visible minorities. One third of White immigrants had arthritis or rheumatism (33.2%; n=2,189) whereas less than one fifth of those who identified as any other racial or cultural group had one of these conditions (17.1%; n=567). Over ten per cent of White respondents had heart disease (11.5%; n=755); the corresponding rate for visible minority immigrants was half this amount (5.8%; n=194). Lastly, the rates of fair/poor self-rated health were relatively similar; 23.2% (n=1530) of White respondents and 18.9% (n=629) of visible minority respondents rated their health accordingly.

Finally, Table 4.1 reveals that language was only associated with having any chronic condition and fair/poor self-rated health. Compared to those able to speak English or French, immigrants unable to speak either language were less likely to have any chronic condition (69.2%, n=860; r=-.05, p≤.001) and more likely to report fair/poor self-rated health (31.8%, n=395; r=.09, p≤.001). In contrast, 75.2% (n=6,579) of English and/or French speaking respondents reported any chronic condition and 20.3% (n=1,778) rated their health as fair/poor.

4.1.3 Health Conditions and Lifestyle Behaviours

In Table 4.1 we observe a weak, positive association between smoking status and high blood pressure, where respondents who smoke regularly or daily are almost twice as

likely to report this condition than those who do not smoke at all (smokers: 27.4%, n=2,350; non-smokers: 19.1%, n=270; r=.07, p≤.001).

Physical activity also displays a very weak, positive association with two health conditions: high blood pressure (tau c=.05, p≤.001) and fair/poor self-rated health (r=.10, p≤.001). Self-reported high blood pressure rates were highest among inactive persons (27.9%, n=1,817) and were lower for moderately active (22.9%; n=443) and active individuals (23.4%, n=360). Again, inactive persons were more likely to rate their health as fair/poor (25.3%, n=1652) compared to moderately active (16.2%, n=313) and active persons (13.6%, n=209).

A weak, positive relationship exists between body mass index and five of the dependent variables. A higher BMI is associated with the presence of: any chronic condition (r=.07, p≤.001), arthritis or rheumatism (r=.12, p≤.001), high blood pressure (r=.14, p≤.001), diabetes (r=.13, p≤.001) and fair/poor self-rated health (r=.08, p≤.001). Contrary to expectation, none of the correlations with fruit and vegetable consumption were statistically significant and above the minimum association level.

4.1.4 Health Conditions and Doctor Visits

Table 4.1 reveals that the number of doctor visits reported within the past year is related to the presence of each of the health conditions. A greater number of visits to a physician is moderately and positively associated with reporting: any chronic condition (r=.28, p≤.001), arthritis or rheumatism (r=.21, p≤.001), high blood pressure (r=.22, p≤.001), heart disease (r=.21, p≤.001) and fair/poor self-rated health (r=.39, p≤.001). This variable also exhibits a weak association with diabetes (r=.15, p≤.001).

4.1.5 Health Conditions and Perceived Stress

Perceived stress is only associated with the subjective health variable, fair/poor self-rated health (see Table 4.1). A weak, positive association in the expected direction is observed between greater stress and fair/poor health (tau c=.13, $p \leq .001$). Of those who reported most days as 'not at all/not very' stressful, 16.8% (n=684) rated their health as fair/poor compared to 20.2% (n=741) of persons whose days are 'a bit' stressful and 33.3% (n=749) of persons whose days are 'quite a bit/extremely' stressful.

4.1.6 Health Conditions and Socio-economic Variables

Examination of Table 4.1 indicates that socio-economic status is also related to immigrants' health. Yearly household income is inversely and weakly associated with having any chronic illness (r=-.12, $p \leq .001$) and each of the specific conditions: arthritis or rheumatism (r=-.16, $p \leq .001$), high blood pressure (r=-.12, $p \leq .001$), diabetes (r=-.06, $p \leq .001$), and heart disease (r=-.07, $p \leq .01$). A self-report of any chronic condition was obtained by over eighty per cent of persons with a yearly household income of less than $15,000 (83.4%, n=744) and $15,000 to $29,999 (81.4%, n=1577), over three quarters of persons with a household income between $30,000 to $49,000 (77.2%, n=1,952), 66.4% (n=1,952) of persons whose household income falls between $50,000 and $79,999, and 70.8% (n=1,424) of persons with a household income over $80,000. From lowest to highest income groups, rates of arthritis or rheumatism are 41.7% (n=372), 34.9% (n=675), 30.9% (n=780), 21.6% (n=568), and 18.9% (n=381), respectively.

Corresponding rates for high blood pressure are 32% (n=286), 35.4% (n=686), 26.4%, (n=668), 22.2% (n=582), and 19.7% (n=397). Respective rates of self-reported diabetes are 12.1% (n=108), 12.2% (n=237), 10.2% (n=257), 6.2% (n=162), and 5.6% (n=113). Finally, the equivalent rates of heart disease are 13.3% (n=119), 14.1% (n=273), 10.9% (n=276), 5.1% (n=133), and 7.6% (n=153).

The inverse relationship between income and self-rated health is slightly stronger ($r=-.19$, $p\leq.001$). Fair/poor self-rated health clearly follows an income gradient with the highest rates (37.1%, n=331) for persons with an annual household income of less than $15,000 followed by 31.8% (n=616) for persons reporting $15,000 to $29,999, 23.2% (n=587) for those reporting $30,000 to $49,999, 15.1% (n=397) for respondents reporting $50,000 to $79,999, and 12% (n=242) for those with an annual household income greater than $80,000.

A weak inverse association is also observed between education level and any chronic illness ($r=-.10$, $p\leq.001$), arthritis or rheumatism ($r=-.15$, $p\leq.001$), high blood pressure ($r=-.10$, $p\leq.001$), diabetes ($r=-.05$, $p\leq.001$) and heart disease ($r=-.06$, $p\leq.001$). Rates of any chronic condition were 81.4% (n=2,287) for persons with less than secondary school education, 74.5% (n=1,494) for high school graduates, 76.4% (n=392) for persons with some post-secondary education, and 70.1% (n=3,267) for post-secondary graduates. Rates of arthritis or rheumatism were 38.4% (n=1,080), 26.7% (n=535), 29.1% (n=149), and 21.7% (n=1,011), respectively. Corresponding rates for high blood pressure were 33.1% (n=930), 27.2% (n=545), 24.4% (n=125) and 21.9% (n=1,020) and for diabetes were 12.8% (n=361), 6.8% (n=137), 9.2% (n=47) and 7.1% (n=333). Respective rates of heart disease were 13.6% (n=383), 10.3% (n=206), 7.6%

(n=39) and 7.0% (n=325). The relationship between education and self-rated health is the same as that for income (r=-.19, p≤.001) and also displays a clear gradient with level of education. Among persons with less than secondary school education, fair/poor self-rated health was the highest (35.3%, n=993) followed by those who graduated high school (21.5%, n=431), those with some post-secondary education (17.8%, n=91) and those who graduated from a post-secondary institution (14.1%, n=658).

Finally, employment status displays a positive, weak to moderate association with all of the dependent variables. As expected, the percentage of respondents who reported the presence of each of the six health conditions was higher for those who had been unemployed/retired/other during the past year when compared to persons employed for all or part of the year. Respective rates and numbers of respondents reporting of each of the health conditions are as follows: 85.1% (n=4,063) and 64.7% (n=3,377) for any chronic condition (r=.23, p≤.001); 41.2% (n=1,966) and 15.5%, (n=810) for arthritis or rheumatism (r=.29, p<.001); 35.6% (n=1,700) and 17.6% (n=920) for high blood pressure (r=.20, p<.001); 12.0% (n=574) and 6.0% (n=304) for diabetes (r=.11, p<.001); 15.9% (n=759) and 4.0% (n=195) for heart disease (r=.21, p<.001); and 34.1% (n=1630) and 10.4% (n=543) for fair/poor self-rated health (r=.29, p<.001).

4.1.7 Lifestyle Behaviours and Duration of Residence

Table 4.2 indicates that body mass index is the single health behaviour variable weakly related to duration of residence in a positive direction (r=.08; p≤.001). A crosstabulation between health behaviours and duration of residence was repeated while controlling for visible minority status to determine whether ethno-cultural background

affects the relationship between health behaviours and acculturation. The association between BMI and duration of residence was replicated for visible minority immigrants only (r=.06, p≤.001) and became not statistically significant in the case of non-visible minority immigrants. No change was observed in the remainder of the original bivariate results.

Table 4.2 Crosstabulation: Lifestyle Behaviours by Duration of Residence

	[illegible]	[illegible]	[illegible]
Smoking			
Daily/occasionally	N=141, 12.8%	N=1,272, 14.3%	r=-.01
Not at all	N=960, 87.2%	N=7,619, 85.7%	
Physical Activity Index			
Active	N=115, 10.4%	N=1,423, 16.0%	tau c=-.03***
Moderate	N=189, 17.2%	N=1,744, 19.6%	
Inactive	N=797, 72.4%	N=5,723, 64.4%	
Fruit & Vegetable Consumption			
<5 servings/day	N=673, 61.2%	N=5,100, 57.4%	r=.03*
5+ servings/day	N=427, 38.8%	N=3,791, 42.6%	
Body Mass Index	-----	-----	r=.08***

*p≤.05, **p≤.01, ***p≤.001

4.2 Multivariate Analysis

4.2.1 Bivariate Analysis, Controlling for a Single Variable

Multivariate analyses were performed in order to further explore the relationship between duration of residence and health conditions among foreign-born individuals in middle and older adulthood. First, the crosstabulations between the six health conditions and duration of residence were examined across categories of age and visible minority

status. It is important to observe the effect of controlling for these two variables on the bivariate association between health and length of residence since both age and minority status tend to vary according to immigrants' residence duration. In particular, older age and non-visible minority status are more commonly associated with longer duration whereas younger age and visible minority status are more likely associated with shorter duration periods. Furthermore, health status also differs according to age and minority status such that poorer health and chronic illness are correlated with older age and certain ethno-cultural groups.

A correspondence rule was created for the purpose of interpreting the difference between Pearson r statistics that describe the association strength between two categories of variables (Wister, 2001). A difference of 0.05 or greater will be considered substantively important. Additionally, a disparity of 0.05 to 0.09 will be considered small, 0.10 to 0.19 will be considered moderate, and greater than 0.20 will be considered large.

4.2.2 Health Conditions by Duration of Residence by Age

The crosstabulations between each of the health conditions and the main acculturation variable, duration of residence in Canada, were performed with a control for age. Since average length of residence and health status both differ with age, it is important to observe whether the association between duration and health is maintained when an age control is employed. It was expected that the original associations between the six dependent variables and duration of residence would be replicated with the addition of the age control, as is consistent with the literature

Ten-year groups were used for this exercise since the n size for some of the categories was too small for multivariate analyses. The four age groups used were: 45 to 54, 55 to 64, 65 to 74 and 75 and older. Table 4.3 provides a breakdown by age group of the percentage and total number of respondents reporting each of the health conditions along with the correlation statistic. A decrease in the strength of the original associations occurred along with a loss of statistical significance within certain age groups. However, the relationships originally observed between duration of residence and any chronic condition, arthritis or rheumatism, high blood pressure and diabetes remained significant in several instances.

Self-report of any chronic condition was associated with duration of residence among 45 to 54 year olds ($r=.17$, $p\leq.001$), 55 to 64 year olds ($r=.09$, $p\leq.001$) and 65 to 74 year olds ($r=.07$, $p\leq.01$). The association among those aged 75 and older was not statistically significant. Over one fifth more 45 to 54 year olds who had lived in Canada for longer than ten years had a chronic condition (66.1%, n=2,065) when compared to their counterparts of shorter residence (44.5%, n=293). Similarly, over one tenth more foreign-born persons aged 55 to 64 and 65 to 74 who lived in Canada for a decade or more had a chronic condition (74.0%, n=108 and 84.5%, n=1,635, respectively) compared to their peers who had resided in the country for less time (62.1%, n=139 and 76.7%, n=1,884, respectively).

When controlling for age, an interaction effect is observed between any chronic condition and duration of residence whereby the relationship between these two variables becomes diminished with older age. The association for the 45 to 54 age group is slightly stronger than among 55 to 64 year olds and moderately stronger than among 65 to 74

year olds. Interestingly, the correlation statistic for the 75 and older age span becomes not statistically significant, indicating that the rise in health problems with longer residence may be attributed to age within this group.

Arthritis or rheumatism displayed a weak, positive association with duration of residence among all four age groups (ages 45-54: $r=.10$, $p\leq.001$; ages 55-64: $r=.12$, $p\leq.001$; ages 65-74: $r=.07$, $p\leq.01$; ages 75+: $r=.06$, $p\leq.05$). Among those with greater than ten years residing in the country, this condition was twice as common for 45 to 54 year olds (0-9 years=6.8%, n=45; 10+ years=15.6%, n=489) and three times as common for 55 to 64 year olds (0-9 years=8.9%, n=20; 10+ years=27.6%, n=678) when compared to their peers who had been in the country for less than this amount of time. Furthermore, among those 65 to 74 and 75+, over ten per cent more respondents with ten or more years living in the country had arthritis or rheumatism (41.2%, n=797 and 49.6%, n=680, respectively) than their counterparts with less than ten years residence (26.9%, n=39 and 37.0%, n=27, respectively). No substantive difference in association strength was observed among any of the four age groups.

There was also a weak, positive association between duration of residence and high blood pressure for the 45 to 54 year olds ($r=.05$, $p\leq.01$). Within this group, 11.5% (n=76) of persons who had immigrated less than ten years ago reported having hypertension and 15.7% (n=492) of those who immigrated more than ten years ago had this condition.

Duration of residence was also weakly and positively associated with self-reported diabetes for 45 to 54 year olds ($r=.05$, $p\leq.01$) and 55 to 64 year olds ($r=.05$, $p\leq.01$). The association for the older age categories did not reach statistical significance.

This condition was twice as prevalent among those in Canada greater than ten years (45-54: 5.2%, n=163; 55-64: 9.0%, n=222) when compared to persons who have had fewer years to acculturate to Canadian society (45-54: 2.6%, n=17; 55-64: 4.0%, n=9).

Although fair/poor self-rated health was not significantly related to duration of residence within the original crosstabulation, a weak, negative association between these variables emerged for a single age group. Half of the respondents aged 75 and older who had lived in Canada less than ten years rated their health as fair or poor (50.7%, n=37); this number was ten percent less for those in the country longer (39.0%, n=535). Interestingly, this is the only statistically significant correlation between a health condition and duration of residence that is in an inverse direction.

In summary, after controlling for age, an interaction was found such that the positive association between any chronic condition and duration of residence was stronger among 45 to 54 year olds than 55 to 64 and 65 to 74 year olds. Also, the association disappeared for those 75 and older. All four of the age groups displayed a positive relationship between arthritis or rheumatism and length of residence but no real difference was observed between these weak associations. Finally, the relationship between four of the six health conditions (high blood pressure, diabetes, heart disease and fair/poor self-rated health) and longer residence duration was either very weak (r=0.05) or not statistically significant within all four of the age groups. However, this does not represent a great difference from the original weak associations between each of these health conditions and duration of residence.

Table 4.3 Layered Crosstabulation: Health Conditions by Duration of Residence by Age			
	0 to 5 years	10+ years	Statistic
Has Any Chronic Condition			
Ages 45-54	N=293, 44.5%	N=2,065, 66.1%	r=.17***
Ages 55-64	N=139, 62.1%	N=1,884, 76.7%	r=.09***
Ages 65-74	N=108, 74.0%	N=1,635, 84.5%	r=.07**
Ages 75+	N=65, 89.0%	N=1,253, 91.3%	r=.02
Has Arthritis or Rheumatism			
Ages 45-54	N=45, 6.8%	N=489, 15.6%	r=.10***
Ages 55-64	N=20, 8.9%	N=678, 27.6%	r=.12***
Ages 65-74	N=39, 26.9%	N=797, 41.2%	r=.07**
Ages 75+	N=27, 37.0%	N=680, 49.6%	r=.06*
Has High Blood Pressure			
Ages 45-54	N=76, 11.5%	N=492, 15.7%	r=.05**
Ages 55-64	N=48, 21.4%	N=594, 24.2%	r=.02
Ages 65-74	N=43, 29.7%	N=728, 37.6%	r=.04
Ages 75+	N=31, 42.5%	N=608, 44.3%	r=.01
Has Diabetes			
Ages 45-54	N=17, 2.6%	N=163, 5.2%	r=.05**
Ages 55-64	N=9, 4.0%	N=222, 9.0%	r=.05**
Ages 65-74	N=19, 13.1%	N=248, 12.8%	r=.00
Ages 75+	N=5, 6.8%	N=194, 14.1%	r=.05
Has Heart Disease			
Ages 45-54	N=9, 1.4%	N=81, 2.6%	r=.03
Ages 55-64	N=21, 9.4%	N=177, 7.2%	r=-.02
Ages 65-74	N=16, 11.0%	N=307, 15.8%	r=.03
Ages 75+	N=18, 24.7%	N=325, 23.7%	r=-.01
Has Fair/Poor Self-Rated Health			
Ages 45-54	N=69, 10.5%	N=438, 14.0%	r=.04*
Ages 55-64	N=44, 19.7%	N=493, 20.1%	r=.00
Ages 65-74	N=44, 30.3%	N=513, 26.5%	r=-.02
Ages 75+	N=37, 50.7%	N=535, 39.0%	r=-.05*

*p≤.05, **p≤.01, ***p≤.001

4.2.3 Health Conditions by Duration of Residence by Visible Minority Status

In order to observe whether visible minority status affects the relationship between the dependent variables and duration of residence, a series of crosstabulations between the six health conditions and duration of residence were performed using visible

minority status as the control variable. This investigation is important for two reasons. First, visible minority status differs greatly with duration of residence. In large part due to immigration policy changes throughout the past century, foreign-born persons of longer residence are more likely to be of European descent (i.e., White) whereas those of shorter residence are more likely visible minorities who are predominantly from Asian countries. Second, health status varies with visible minority status and certain health conditions are more prevalent among certain ethnic and cultural groups. Based on previous research in this area, it was expected that the correlation between health conditions and duration of residence would remain statistically significant when controlling for visible minority status.

An examination of Table 4.4 reveals that rates of chronic health conditions increase similarly with duration of residence among White and visible minority foreign-born groups. In addition, rates of diabetes were slightly higher for visible minority immigrants whereas White immigrants had higher rates of a chronic condition, arthritis or rheumatism and heart disease.

Specifically, self-report of any chronic condition was positively associated with length of residence for both White ($r=.11$, $p\leq.001$) and visible minority immigrants ($r=.16$, $p\leq.001$) but the association was slightly stronger for the latter group. Over half of White immigrants residing in Canada for less than ten years had any chronic condition (56.4%, n=162) compared to over three-quarters of those living here longer (78.9%, n=4,969). Rates for visible minority immigrants were similar; respectively, these are 54.5% (n=439) and 72.0% (n=1,813).

Arthritis and rheumatism are also weakly and positively related to duration of residence among White (r=.08, p≤.001) and visible minority (r=.09, p≤.001) foreign-born persons. This association is replicated for both conditions of visible minority status. Arthritis and rheumatism increase two-fold when comparing recently-arrived White immigrants (15.0%, n=43) and visible minority immigrants (10.8%, n=87) to White (34.1%, n=2,147) and visible minority (19.1%, n=480) immigrants of long-term status.

Another chronic condition that increases with time spent in Canada for all immigrants is hypertension. Also, there is no difference in the association between residence duration and high blood pressure across the two visible minority categories. Within the group of immigrants who identify themselves as 'White', high blood pressure increases from 13.6% (n=39) among those who arrived less than 10 years ago to 27.4% (n=1,729; r=.06, p≤.001) among those living in the country for a longer period of time. The corresponding figures are 19.5% (n=157) and 26.7% (n=673; r=.07, p≤.001) for respondents who chose to identify themselves as belonging to an ethnic or cultural group other than 'White'.

A weak, positive association between self-reported diabetes and duration of residence among visible minority foreign-born individuals is also observed (r=.10, p≤.001). This association is two times stronger than the original bivariate correlation. The proportion of these persons who have been diagnosed with diabetes is double for those who have been in Canada longer than ten years (12.1%, n=304) compared to those who have lived in the country for a shorter amount of time (5.0%, n=40). In contrast, the bivariate relationship between diabetes and duration of residence for non-visible minority immigrants is very weak and does not reach the correlation strength cut off level of 0.05.

Thus, an interaction is observed where the effect of duration of residence on diabetes is stronger on foreign-born persons of visible minority status than their foreign-born White counterparts.

The bivariate associations between heart disease and duration of residence and self-rated health and duration of residence for both immigrant groups do not reach statistical significance or are below the correlation strength cut off level of 0.05.

In summary, any chronic condition, arthritis or rheumatism and high blood pressure are weakly and positively associated with longer duration of residence in Canada for both visible minority and non-visible minority foreign-born individuals. However, the relationship between any chronic condition and residence length is slightly stronger for visible minority immigrants than for their White counterparts. Also, a weak, positive correlation between diabetes and duration of residence is observed for visible minorities but this association does not reach the minimum correlation strength level for their non-visible minority peers.

Table 4.4 Layered Crosstabulation: Health Conditions by Duration of Residence by Visible Minority Status			
	0 to 9 years	10+ years	Statistic
Has Any Chronic Condition			
White	N=162, 56.4%	N=4,969, 78.9%	r=.11***
Visible Minority	N=439, 54.5%	N=1,813, 72.0%	r=.16***
Has Arthritis or Rheumatism			
White	N=43, 15.0%	N=2,147, 34.1%	r=.08***
Visible Minority	N=87, 10.8%	N=480, 19.1%	r=.09***
Has High Blood Pressure			
White	N=39, 13.6%	N=1,729, 27.4%	r=.06***
Visible Minority	N=157, 19.5%	N=673, 26.7%	r=.07***
Has Diabetes			
White	N=9, 3.1%	N=517, 8.2%	r=.04**
Visible Minority	N=40, 5.0%	N=304, 12.1%	r=.10***
Has Heart Disease			
White	N=19, 6.6%	N=736, 11.7%	r=.03**
Visible Minority	N=46, 5.7%	N=148, 5.9%	r=.00
Has Fair/Poor Self-Rated Health			
White	N=49, 17.1%	N=1,481, 23.5%	r=.03**
Visible Minority	N=144, 17.9%	N=485, 19.3%	r=.02

*p≤.05, **p≤.01, ***p≤.001

4.2.4 Logistic Regression Analysis

Logistic regression was used to test a number of models organizing the prediction of self-reported diagnoses of: a chronic condition, arthritis or rheumatism, high blood pressure, diabetes, heart disease and fair/poor self-rated health. Using this statistical technique, it is possible to evaluate the influence of multiple explanatory variables on a dichotomous response. The dependent variable dichotomy categories are coded as 0 and 1. For example, 1=has any chronic condition and 0=does not have any chronic condition. The explanatory variables, or covariates, may be continuous or categorical and are represented as $X_1,\ldots, X_K$. Within the equation $\log(\pi/1-\pi) = \alpha + \beta_1X_1 + \beta_2X_2 + \ldots + \beta_KX_K$, the term $(\pi/1-\pi)$ represents the beta coefficient and specifies the true probability

of having any chronic condition, divided by the probability of not having a chronic condition (DeMaris, 1995). The results are made more interpretable by taking the exponential of the beta coefficient, producing an odds ratio. This number may fall between 0 and infinity and signifies the estimated odds of having each of the health conditions for respondents who are a unit apart on X_k (for continuous variables), or compared to a reference category (for categorical variables), after statistically controlling for all of the other independent variables (DeMaris, 1995). Positive associations are indicated by odds ratios that range between 1 and infinity, whereas inverse associations result in odds ratios that range between 0 and 1.

A six-context hierarchical model was created that includes fifteen independent variables suggested in the literature as affecting the relationship between duration of residence and health within immigrant populations (see Table 4.5). The six blocks were entered into the regression in the following order: demographics, immigrant characteristics, lifestyle behaviours, health care utilization, perceived stress, socio-economic status. The model was organized based on three factors. First, variables that are closely related to one another are grouped into individual blocks. Second, Models 1 and 2 were entered sequentially based on the time in which these variables emerge in a person's life. Third, health behaviours were incorporated in Model 3 in order to allow the observation of the duration of residence effect both before and after the inclusion of the additional variable contexts represented in Models 4 through 6. This logistic regression model is replicated for each of the six dependent variables.

Table 4.5 Hierarchical Model

Model 1: Demographics	*Model 2: Immigrant Characteristics*	*Model 3: Lifestyle*	*Model 4: Health Care Utilization*	*Model 5: Perceived Stress*	*Model 6: Socio-economic Status*
1. Age • 45-54 yrs* • 55-64 yrs • 65-74 yrs • 75+ yrs 2. Sex • Male* • Female 3. Marital status • Married/ common law* • Not married/ common law	1. Duration of residence • 0-9 yrs* • 10+ yrs 2. Visible Minority Status • White* • Visible minority 3. Language • Speaks English or French* • Speaks neither English or French	1. Smoking status • Not at all • Daily/occasionally* 2. Physical activity • Inactive • Moderate • Active* 3. Fruit & vegetable consumption • <5 X/svgs per day* • 5+ X/svgs per day 4. BMI • 13.99 – 52.10	1. Number of physician visits (past year) • 0 – 31	1. Perceived stress • Not at all/not very stressful* • A bit stressful • Quite a bit/extremely stressful	1. Yearly household income • <$15,000 • $15,000 to $29,999 • $30,000 to $49,999 • $50,000 to $79,999 • $80,000+* 2. Education • <Secondary school grad • Secondary school grad • Some post-secondary • Post-secondary grad* 3. Employment status (past year) • Employed for part/all of year* • Unemployed/Retired/ Other

* indicates the reference category in the regression analysis for nominal and ordinal-level variables

Tables 4.6 to 4.11 report the model chi square and its significance level for each context. Also, the beta coefficient, its standard error, significance level, and odds ratio (for statistically significant results) associated with each of the independent variables are presented. The effect of acculturation, measured as duration of residence in Canada, on these health conditions is of particular interest in these analyses. Furthermore, the performance of the health behaviour variables and their impact on the duration of residence variable is also relevant to the research hypotheses. A correspondence rule was

used to interpret changes in the odds ratio for duration of residence from one model to another. A change of 10% or greater was considered substantively important.

4.2.5 Logistic Regression Results: Any Chronic Condition

The results of the logistic regression for 'has any chronic condition' will be reported first. The demographic context (Model 1) was statistically significant (Model Chi Square = 730.25, p<001; see Table 4.6). Both age and sex were associated with having a chronic condition. The odds of having a chronic condition are lower for persons aged 45 to 54 when compared to those aged 55 to 64 (odds ratio = 1.87), 65 to 74 (odds ratio = 3.10), and 75 and older (odds ratio = 5.94). The odds of reporting being diagnosed with a chronic condition are increased by a factor of 1.59 for women compared to men.

Model 2 introduced the immigrant characteristics into the analysis (Model Chi Square = 874.63, p<.001) and statistically significant associations were observed with all three variables. The likelihood of having a chronic condition (compared to not having a chronic condition) is almost twice as high for those with a longer period of residence compared to immigrants who had lived in Canada for less than ten years (odds ratio = 1.96) even after controlling for age and the other variables in Model 1. The odds of having a chronic health condition are lower for visible minorities compared to White respondents (odds ratio = 0.89) and for non-English or French speakers compared to persons able to speak one of these languages (odds ratio = 0.79). The associations observed in Model 1 were replicated in Model 2 with only slight changes in the odds ratios.

The addition of the block of lifestyle-related variables represented in Model 3 resulted in a statistically significant Model Chi Square (936.90, $p<.001$). Two of the four variables were associated with having a chronic condition: smoking and BMI. The odds of reporting any chronic condition are lower (odds ratio = 0.85) for persons who did not smoke at all at the time of the survey compared to those who smoked daily or occasionally. Furthermore, the likelihood of having a chronic condition is increased by a factor of 1.05 for each unit change in BMI. The odds ratio observed for duration of residence and the other associations observed in Models 1 and 2 were replicated in Model 3 with the exception of visible minority status. This variable became not statistically significant with the addition of the lifestyle variables.

Model 4 included the health care utilization variable, number of doctor visits in the past 12 months, and resulted in a statistically significant Model Chi Square (1957.01, $p<.001$). The likelihood of having been diagnosed with a chronic condition increased by a factor of 1.27 for each additional physician visit reported. The inverse association with visible minority status that was not statistically significant in the previous Model regained significance in Model 4 with a similar odds ratio observed in Model 2 (0.85). Duration of residence was replicated with the inclusion of the doctor visits variable. The other associations observed in earlier models were replicated with some minor reduction in odds ratios with the inclusion of these variables. However, the decrease of almost two points in the odds ratio representing the contrast between 45 to 54 year olds and persons aged 75+ was somewhat more dramatic.

The health-related variable 'perceived stress' was introduced in Model 5 (Model Chi Square = 1994.37, $p<.001$). In comparison to the reference group of persons who

said that most days were 'not at all/not very stressful', both stress contrasts exhibited statistically significant positive associations. The likelihood of having a chronic condition is higher (odds ratio = 1.27) for those who reported that most days were 'a bit stressful' or 'quite a bit/extremely stressful' (odds ratio = 1.53) compared to those reporting 'not at all/not very stressful'. Again, the previous associations, including that with duration of residence, were replicated with very minimal change.

Finally, the socio-economic status context incorporated into Model 6 also resulted in a statistically significant association with self-report of a chronic condition (Model Chi Square = 2066.21, $p<.001$). Income and employment status were both associated with this health condition. However, only one income comparison is statistically significant. The odds of having a chronic condition are reduced by a factor of 0.75 for the $50,000 to $79,999 category compared to the annual household income category of $80,000 or higher. With regard to employment status, the likelihood of a chronic condition is increased by a factor of 1.47 for persons who were unemployed or retired over the past 12 months compared to persons who had been employed for all or part of the past year. With the inclusion of the socio-economic variables, the inverse association between having a chronic condition and visible minority status became not statistically significant once again and the odds ratios for each of the age contrasts were reduced. No substantive change was observed for duration of residence. The other associations revealed in Models 1 through 5 were replicated.

Table 4.6 Logistic Regression for Chronic Condition

	[illegible]			[illegible]			[illegible]		
Model Chi Square	730.25, 5*df****			874.63, 8*df****			936.90, 13*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.63***	0.06	1.87	0.56***	0.06	1.74	0.57***	0.06	1.77
65 to 74	1.13***	0.07	3.10	1.06***	0.07	2.89	1.10***	0.07	3.00
75+	1.78***	0.10	5.94	1.70***	0.10	5.45	1.78***	0.10	5.92
Sex	0.46***	0.05	1.59	0.49***	0.05	1.63	0.53***	0.05	1.70
Marital Status	0.09	0.06	---	0.05	0.06	---	0.04	0.06	---
Duration of Residence				0.67***	0.07	1.96	0.65***	0.08	1.92
Visible Minority Status				-0.11*	0.05	0.89	-0.03	0.06	0.97
Language				-0.24**	0.08	0.79	-0.26***	0.08	0.77
Smoking Status							-0.16*	0.07	0.85
Physical Activity Index									
Active									1.00
Moderate							-0.02	0.08	---
Inactive							-0.02	0.07	---
Fruit & Veg Consumption							-0.07	0.05	---
BMI							0.04***	0.01	1.05

*p≤.05, **p≤.01, ***p≤.001

Table 4.6 (continued) Logistic Regression for Chronic Condition									
	Model 1			Model 2			Model 3		
Model Chi Square	1957.01, 14*df****			1994.37, 16*df****			2066.21, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.44***	0.06	1.55	0.48***	0.06	1.62	0.38***	0.06	1.47
65 to 74	0.87***	0.08	2.39	0.98***	0.08	2.66	0.66***	0.09	1.93
75+	1.40***	0.11	4.06	1.54***	0.11	4.64	1.14***	0.13	3.11
Sex	0.43***	0.05	1.54	0.43***	0.05	1.53	0.37***	0.06	1.45
Marital Status	0.02	0.07	---	0.01	0.07	---	-0.05	0.07	---
Duration of Residence	0.63***	0.08	1.89	0.63***	0.08	1.87	0.68***	0.08	1.98
Visible Minority Status	-0.16**	0.06	0.85	-0.12*	0.06	0.89	-0.11	0.06	---
Language	-0.42***	0.08	0.66	-0.41***	0.08	0.67	-0.46***	0.09	0.63
Smoking Status	-0.27***	0.07	0.76	-0.25***	0.07	0.78	-0.23**	0.08	0.79
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	-0.08	0.09	---	-0.08	0.09	---	-0.05	0.09	---
Inactive	-0.09	0.07	---	-0.12	0.07	---	-0.07	0.08	---
Fruit & Veg Consumption	-0.06	0.05	---	-0.04	0.05	---	-0.04	0.05	---
BMI	0.04***	0.01	1.04	0.04***	0.01	1.04	0.04***	0.01	1.04
# of Doctor Visits	0.24***	0.01	1.27	0.24***	0.01	1.27	0.24***	0.01	1.27
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.24***	0.06	1.27	0.26***	0.06	1.30
Quite a bit/ Extremely stressful				0.42***	0.07	1.53	0.44***	0.07	1.55
Income									
≥$80,000									1.00
$50,000-$79,999							-0.29***	0.07	0.75
$30,000-$49,999							0.03	0.08	---
$15,000-$29,999							-0.06	0.09	---
<$15,000							0.24	0.12	---
Education									
Post-secondary grad									1.00
Some post-secondary							0.12	0.12	---
Secondary grad							-0.02	0.07	---
<Secondary grad							0.05	0.07	---
Employment Status							.39***	0.08	1.47

*p≤.05, **p≤.01, ***p≤.001

4.2.6 Logistic Regression Results: Arthritis or Rheumatism

Turning to the results of the logistic regression performed for arthritis or rheumatism, all three of the independent variables representing the demographic context

in Model 1 were statistically significant (Model Chi Square = 1103.25, p<.001; see Table 4.7). A higher odds ratio for reporting arthritis or rheumatism is observed for persons aged 55 to 64 (2.20), aged 65 to 74 (4.17) and aged 75+ (5.51) in comparison to the reference category of persons aged 45 to 54. In addition, the likelihood of this condition is over twice as high for women than men (odds ratio = 2.10). Finally, the odds of reporting a diagnosis of arthritis or rheumatism are higher for persons who were not living in a married or common-law relationship at the time of the survey (odds ratio = 1.15) than their counterparts.

Model 2, introducing the immigrant characteristic variables, was also statistically significant (Model Chi Square = 1293.91, p<.001). The likelihood of arthritis or rheumatism is almost twice as high for foreign-born individuals who have lived in Canada for over ten years (odds ratio = 1.96) when compared to their counterparts who have been in the country for less time. Furthermore, the odds for having this condition decreases by a factor of one half for visible minorities (odds ratio = 0.57) compared to White respondents. The associations observed in Model 1 were replicated in Model 2.

Four measures of lifestyle behaviour were included in Model 3, resulting in a good overall model fit (Model Chi Square = 1468.26, p<.001). Three of the four variables introduced in this context were statistically significant. First, the odds of arthritis or rheumatism are lower for non-smokers (odds ratio = 0.71) than those who smoke occasionally or daily. Also, a lower likelihood of these conditions is associated with eating five or more servings of fruit and/or vegetables per day (odds ratio = 0.89) in comparison to a daily intake of fewer servings. Finally, the odds ratio for reporting this health condition increased by a factor of 1.07 for every unit increase in BMI. The

inclusion of this context resulted in the earlier weak association between marital status and arthritis becoming not statistically significant. The remainder of the associations from Model 2, including that for duration of residence, were replicated.

Table 4.7 also indicates that Model 4 is statistically significant (Model Chi Square = 1712.81, $p<.001$). The odds of reporting a diagnosis of arthritis or rheumatism increase by a factor of 1.06 for each additional visit to a doctor reported within the past year. With the addition of this variable, duration of residence and most other previously noted associations were replicated with a slight decline in the odds ratio. In addition, a suppressor effect is observed for physical activity where 'inactive' individuals are less likely to report having arthritis or rheumatism (odds ratio = 0.86) compared to their 'active' counterparts. A suppressor effect occurs when the addition of a model (i.e., health care utilization) results in a complex interaction between variables that leads to the emergence of a significant or stronger association between the dependent variable and an independent variable (i.e., physical activity).

The inclusion of perceived stress into the regression in Model 5 also resulted in a statistically significant association with self-reported arthritis or rheumatism (Model Chi Square = 1754.92, $p<.001$). In comparison to the reference group of 'not at all/not very stressful', both stress contrasts were associated with a somewhat higher likelihood of reporting this condition ('a bit stressful': odds ratio = 1.32; 'quite a bit/extremely stressful': odds ratio = 1.51). No substantive change was observed for the residence status variable or the other associations from previous models.

The socio-economic context integrated in Model 6 resulted in a final statistically significant Model Chi Square (1857.05, $p<.001$). After controlling for the other variables

in the model, all three variables are associated with having arthritis or rheumatism. The single statistically significant contrast for the income variable was for those persons reporting an annual household income greater or equal to $80,000 and those with less than $15,000. A higher likelihood of an arthritis or rheumatism diagnosis is observed for persons with an annual household income of less than $15,000 (odds ratio = 1.34) compared to those with $80,000 or more. In addition, the odds of arthritis or rheumatism are 1.24 times greater for persons who did not complete high school (odds ratio = 1.24) when compared to post-secondary graduates. Finally, individuals unemployed or retired over the past year are 1.70 times more likely to report arthritis or rheumatism than employed individuals. The introduction of socio-economic variables made the weak association with fruit and vegetable consumption not significant. However, the association with language became statistically significant. Compared to those who speak one of the nation's official languages, those who do not are less likely to report a diagnosis of arthritis or rheumatism (odds ration = 0.82). The odds ratio for duration of residence increased slightly in this final model, but the change was too small to be considered substantively important. Except for odds ratio reductions for age, the remaining associations were unchanged in this model.

Table 4.7 Logistic Regression for Arthritis or Rheumatism

	Model 1			Model 2			Model 3		
Model Chi Square	1103.25, 5*df****			1293.91, 8*df****			1468.26, 13*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.79***	0.07	2.20	0.67***	0.07	1.96	0.70***	0.07	2.02
65 to 74	1.43***	0.07	4.17	1.27***	0.07	3.57	1.34***	0.07	3.83
75+	1.71***	0.07	5.51	1.51***	0.08	4.52	1.68***	0.08	5.35
Sex	0.74***	0.05	2.10	0.77***	0.05	2.15	0.84***	0.05	2.32
Marital Status	0.14*	0.06	1.15	0.14*	0.06	1.15	0.11	0.06	---
Duration of Residence				0.68***	0.11	1.96	0.64***	0.11	1.89
Visible Minority Status				-0.56***	0.06	0.57	-0.43***	0.06	0.65
Language				0.03	0.08	---	-0.02	0.08	---
Smoking Status							-0.34***	0.07	0.71
Physical Activity Index									
Active									1.00
Moderate							-0.07	0.08	---
Inactive							-0.08	0.07	---
Fruit & Veg Consumption							-0.11*	0.05	0.89
BMI							0.07***	0.01	1.07

*p≤.05, **p≤.01, ***p≤.001

Table 4.7 (continued) Logistic Regression for Arthritis or Rheumatism									
	Model A			Model B			Model C		
Model Chi Square	1712.81, 14*df****			1754.92, 16*df****			1857.05, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.65***	0.07	1.92	0.69***	0.07	2.00	0.54***	0.07	1.71
65 to 74	1.27***	0.07	3.56	1.38***	0.07	3.96	0.96***	0.09	2.61
75+	1.55***	0.08	4.69	1.68***	0.08	5.35	1.20***	0.10	3.31
Sex	0.82***	0.05	2.28	0.81***	0.05	2.25	0.74***	0.05	2.10
Marital Status	0.10	0.06	---	0.10	0.06	---	0.05	0.06	---
Duration of Residence	0.61***	0.11	1.84	0.59***	0.11	1.81	0.64***	0.11	1.90
Visible Minority Status	-0.49**	0.06	0.61	-0.46***	0.06	0.63	-0.44***	0.06	0.64
Language	-0.09	0.09	---	-0.08	0.09	---	-0.19*	0.09	0.82
Smoking Status	-0.36***	0.07	0.70	-0.34***	0.07	0.71	-0.32***	0.07	0.73
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	-0.10	0.08	---	-0.10	0.08	---	-0.09	0.08	---
Inactive	-0.16*	0.07	0.86	-0.19**	0.07	0.83	-0.17*	0.07	0.84
Fruit & Veg Consumption	-0.12*	0.05	0.89	-0.10*	0.05	0.90	-0.08	0.05	---
BMI	0.07***	0.01	1.07	0.07***	0.01	1.07	0.06***	0.01	1.06
# of Doctor Visits	0.07***	0.00	1.06	0.06***	0.00	1.06	0.05***	0.00	1.05
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.28***	0.06	1.32	0.31***	0.06	1.36
Quite a bit/ Extremely stressful				0.42***	0.07	1.51	0.45***	0.07	1.57
Income									
≥$80,000									1.00
$50,000-$79,999							0.03	0.08	---
$30,000-$49,999							0.15	0.08	---
$15,000-$29,999							-0.03	0.09	---
<$15,000							0.29**	0.11	1.34
Education									
Post-secondary grad									1.00
Some post-secondary							0.08	0.12	---
Secondary grad							0.02	0.07	---
<Secondary grad							0.22***	0.06	1.24
Employment Status							.53***	0.07	1.70

*p≤.05, **p≤.01, ***p≤.001

4.2.7 Logistic Regression Results: High Blood Pressure

Next we will consider the results of the regression equation run with 'has high blood pressure' as the dependent variable. As shown in Table 4.8, the demographic

context represented in Model 1 was statistically significant (Model Chi Square = 645.14, $p<.001$). Age and sex were the two variables displaying associations that reached the minimum level of statistical significance. The odds of reporting high blood pressure are higher for 55 to 64 year olds (odds ratio = 1.77), 65 to 74 year olds (odds ratio = 3.31) and persons aged 75 or older (odds ratio = 4.32) compared to the reference group of 45 to 54 year olds. Also, the likelihood of having this condition is 1.3 times greater for women than men.

Model 2 incorporated three immigrant characteristics and was statistically significant (Model Chi Square = 685.85, $p<.001$). All three variables were associated with self-reported hypertension. As hypothesized, the odds of having hypertension are greater for immigrants who have lived in Canada for ten years or more (odds ratio = 1.41) when compared than their counterparts of shorter duration in the country. The likelihood of high blood pressure is also greater for visible minority immigrants (odds ratio = 1.35) than White immigrants. Finally, the odds of reporting this chronic condition are lower for those unable to speak English or French (odds ratio = 0.84) when compared to English- or French-speakers. The demographic associations were replicated in Model 2.

The lifestyle context introduced in Model 3 was statistically significant (Model Chi Square = 945.15, $p<.001$) as were three of the four independent variables. The addition of this model resulted in an increase in the Model Chi Square that was larger than that contributed by any other variable block. The observed association between smoking status and high blood pressure was in an unexpected direction: the likelihood of this condition was slightly higher among non-smokers (odds ratio = 1.20) than smokers. An increased odds of hypertension was also observed for an 'inactive' physical activity

index (odds ratio = 1.19) when compared to the reference, 'active'. The other physical activity contrast was not statistically significant. Lastly, the probability of reporting a diagnosis of high blood pressure rises by a factor of 1.09 for every unit increase in BMI. The associations observed in the previous model for age, sex, duration of residence, visible minority status and language were replicated with the inclusion of the lifestyle behaviour variables.

Model 4 introduces the health care utilization variable, number of doctor visits in the past year, and results in a good overall model fit (Model Chi Square = 1188.19, $p<.001$). This variable demonstrated a positive association with self-reported high blood pressure; the likelihood of this condition escalates by a factor of 1.06 for each additional physician visit. The weak association with physical activity observed in Model 3 becomes not significant in this context. The other associations uncovered in the previous model, including that for duration of residence, were replicated with a slight reduction in odds ratios.

Examination of Table 4.8 reveals that Model 5 is also statistically significant (Model Chi Square = 1201.78, $p<.001$). Perceived stress is positively associated with high blood pressure and a greater likelihood of this condition is observed for those who report most days as 'a bit stressful' (odds ratio = 1.18) and 'quite a bit/extremely stressful' (odds ratio = 1.25) when contrasted with the reference category 'not at all/not very stressful'. The odds ratios for age, sex, duration of residence, visible minority status, language ability, smoking status, BMI and doctor visits were replicated in Model 5.

The socio-economic variable set was included in the sixth and final model (Model Chi Square = 1220.81, p<.001). When controlling for all of the other independent variables in the model, only one of the socio-economic variables in this context was statistically significant. The odds of having hypertension are slightly elevated for persons unemployed or retired during the past 12 months (odds ratio = 1.16) compared to those who had worked for all or part of the year. As in all previous models, the association with duration of residence remains unchanged with the inclusion of this final context. The other previously described associations were also replicated.

Table 4.8 Logistic Regression for High Blood Pressure

	[illegible]			[illegible]			[illegible]		
Model Chi Square	645.14, 5*df****			685.85, 8*df****			945.15, 13*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.57***	0.07	1.77	0.59***	0.07	1.80	0.60***	0.07	1.82
65 to 74	1.20***	0.07	3.31	1.25***	0.07	3.49	1.29***	0.07	3.65
75+	1.46***	0.07	4.32	1.53***	0.08	4.63	1.63***	0.08	5.08
Sex	0.26***	0.05	1.30	0.26***	0.05	1.30	0.27***	0.05	1.32
Marital Status	0.06	0.06	---	0.05	0.06	---	0.06	0.06	---
Duration of Residence				0.35***	0.09	1.41	0.29***	0.09	1.34
Visible Minority Status				0.30***	0.06	1.35	0.42***	0.06	1.52
Language				-0.18*	0.08	0.84	-0.26***	0.08	0.77
Smoking Status							0.18*	0.08	1.20
Physical Activity Index									
Active									1.00
Moderate							-0.03	0.09	---
Inactive							0.17*	0.07	1.19
Fruit & Veg Consumption							-0.01	0.05	---
BMI							0.08***	0.01	1.09

*p≤.05, **p≤.01, ***p≤.001

Table 4.8 (continued) Logistic Regression for High Blood Pressure									
Model Chi Square	1188.19, 14*df****			1201.78, 16*df****			1220.81, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.53***	0.07	1.70	0.55***	0.07	1.73	0.52***	0.07	1.68
65 to 74	1.21***	0.07	3.35	1.27***	0.07	3.56	1.16***	0.09	3.20
75+	1.49***	0.08	4.42	1.56***	0.08	4.74	1.41***	0.10	4.09
Sex	0.24***	0.05	1.27	0.23***	0.05	1.26	0.20***	0.05	1.23
Marital Status	0.05	0.06	---	0.05	0.06	---	0.05	0.06	---
Duration of Residence	0.27**	0.09	1.32	0.26**	0.09	1.30	0.27**	0.10	1.31
Visible Minority Status	0.38***	0.06	1.47	0.40***	0.06	1.49	0.41***	0.06	1.51
Language	-0.33***	0.08	0.72	-0.33***	0.08	0.72	-0.36***	0.08	0.70
Smoking Status	0.17*	0.08	1.19	0.18*	0.08	1.20	0.19*	0.08	1.20
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	-0.06	0.09	---	-0.06	0.09	---	-0.06	0.09	---
Inactive	-0.10	0.07	---	0.08	0.07	---	-0.08	0.07	---
Fruit & Veg Consumption	-0.01	0.05	---	-0.00	0.05	---	0.00	0.05	---
BMI	0.08***	0.01	1.08	0.08***	0.01	1.08	0.08***	0.01	1.08
# of Doctor Visits	0.06***	0.00	1.06	0.06***	0.00	1.06	0.06***	0.00	1.06
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.17**	0.06	1.18	0.17**	0.06	1.19
Quite a bit/ Extremely stressful				0.22***	0.07	1.25	0.23***	0.07	1.25
Income									
≥$80,000									1.00
$50,000-$79,999							0.02	0.08	---
$30,000-$49,999							-0.07	0.08	---
$15,000-$29,999							0.12	0.09	---
<$15,000							-0.05	0.11	---
Education									
Post-secondary grad									1.00
Some post-secondary							-0.08	0.12	---
Secondary grad							0.13	0.07	---
<Secondary grad							0.05	0.06	---
Employment Status							.15***	0.07	1.16

*p≤.05, **p≤.01, ***p≤.001

4.2.8 Logistic Regression Results: Diabetes

The demographic context of Model 1 within the logistic regression analysis for 'has diabetes' was statistically significant (Model Chi Square = 168.06; p<.001; see

Table 4.9) as was one of the independent variables in this group. All three of the age contrasts were positively associated with diabetes. The likelihood of having diabetes was two times greater for 55 to 64 year olds (odds ratio = 1.89) and approximately three times greater for persons aged 64 to 75 (odds ratio = 2.91) and 75 and older (odds ratio = 3.21) in comparison to 45 to 54 year olds.

The introduction of Model 2 and the immigrant characteristic variables results in a statistically significant overall model fit (Model Chi Square = 257.72, $p<.001$). As hypothesized, greater acculturation, as measured by duration of residence, is associated with diagnosed diabetes. In fact, the odds of this chronic condition are over two times greater for foreign-born individuals who have lived in Canada for over ten years (odds ratio = 2.29) than those who have resided here for less time. Additionally, the likelihood of diabetes is elevated for visible minorities (odds ratio = 2.03) compared to White immigrants. Language was not statistically significant. The age association was replicated in Model 2.

Model 3 included lifestyle-related variables (Model Chi Square = 444.65, $p<.001$) and the inclusion of this context produced the largest increase in the overall Model Chi Square. However, the only variable in the block that was related to a diagnosis of diabetes was BMI. The odds of diabetes increase by a factor of 1.11 for each increment in BMI. An association with sex emerges as statistically significant with the introduction of this context where the likelihood of diabetes is stronger for men than women (odds ratio = 0.86). Also, the odds ratio for 45 to 54 versus 75 and older age contrast is strengthened. The residence status association is replicated with the inclusion of the

lifestyle variables. The rest of the odds ratios reported from Models 1 and 2 are also replicated.

It can be observed in Table 4.9 that the incorporation of Model 4 results in a statistically significant association with self-reported diabetes (Model Chi Square = 545.02, $p<.001$). The single variable measuring health care utilization is positively associated with this chronic illness. The odds ratio indicates that for every unit increase in number of visits to a physician in the past 12 months, a person is 1.05 more likely to have diagnosed diabetes. Most of the relationships that emerged in the previous model are replicated with the addition of this variable, including that with duration of residence. However, the association with language becomes statistically significant where a decreased likelihood of having diabetes is found for persons unable to speak either of Canada's official languages (odds ratio = 0.77) compared to those able to speak English or French.

A single variable representing perceived stress was included in Model 5, which resulted in an overall model fit that was statistically significant (Model Chi Square = 546.99, $p<.001$). However, the variable itself was not associated with a diagnosis of diabetes.

The final model incorporated the socio-economic context with a statistically significant Model Chi Square (585.03, $p<.001$). Three of the four income contrasts reached statistical significance. Greater odds of having diabetes are observed for persons who have annual incomes of $30,000 to $49,999 (odds ratio = 1.36), $15,000 to $29,999 (odds ratio = 1.44) and less than $15,000 (odds ratio = 1.45) when compared to those with an income of greater or equal to $80,000. In addition, the odds of reporting this

illness are increased by a factor of 1.24 for persons who did not graduate high school compared to post-secondary graduates. The other two education contrasts and the employment status variable were not statistically significant. The previously described odds ratios for age, sex, duration of residence, visible minority status, language, BMI and doctor visits are replicated with the inclusion of the socio-economic context.

Table 4.9 Logistic Regression for Diabetes

Model Chi Square	168.06, 5*df****			257.72, 8*df****			444.65, 13*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.64***	0.10	1.89	0.69***	0.11	1.99	0.70***	0.11	2.02
65 to 74	1.07***	0.10	2.91	1.19***	0.11	3.27	1.24***	0.11	3.45
75+	1.17***	0.11	3.21	1.33***	0.12	3.79	1.49***	0.12	4.42
Sex	-0.13	0.07	---	-0.14	0.08	---	-0.15*	0.08	0.86
Marital Status	0.03	0.09	---	0.03	0.09	---	0.00	0.09	---
Duration of Residence				0.83***	0.16	2.29	0.78***	0.16	2.13
Visible Minority Status				0.71***	0.08	2.03	0.89***	0.09	2.43
Language				-0.12	0.12	---	-0.20	0.12	---
Smoking Status							0.10	0.12	---
Physical Activity Index									
Active									1.00
Moderate							0.13	0.13	---
Inactive							0.17	0.11	---
Fruit & Veg Consumption							-0.07	0.08	---
BMI							0.10***	0.01	1.11

*p≤.05, **p≤.01, ***p≤.001

Table 4.9 (continued) Logistic Regression for Diabetes									
	Model 1			Model 2			Model 3		
Model Chi Square	545.02, 14*df****			546.99, 16*df****			585.03, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.61***	0.11	1.84	0.60***	0.11	1.83	0.51***	0.11	1.66
65 to 74	1.14***	0.11	3.12	1.12***	0.11	3.07	0.86***	0.13	2.36
75+	1.33***	0.12	3.78	1.31***	0.13	3.72	1.00***	0.15	2.70
Sex	-0.19*	0.08	0.82	-0.20*	0.08	0.82	-0.24**	0.08	0.79
Marital Status	-0.00	0.09	---	-0.00	0.09	---	-0.06	0.09	---
Duration of Residence	0.76***	0.16	2.13	0.75***	0.16	2.13	0.77***	0.16	2.16
Visible Minority Status	0.87***	0.09	2.38	0.86***	0.09	2.36	0.85***	0.09	2.35
Language	-0.27*	0.12	0.77	-0.27*	0.12	0.77	-0.32**	0.12	0.73
Smoking Status	0.09	0.12	---	0.08	0.12	---	0.12	0.12	---
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	0.11	0.13	---	0.11	0.13	---	0.11	0.14	---
Inactive	0.09	0.12	---	0.09	0.12	---	0.10	0.12	---
Fruit & Veg Consumption	-0.07	0.08	---	-0.07	0.08	---	-0.06	0.08	---
BMI	0.10***	0.01	1.11	0.10***	0.01	1.11	0.10***	0.01	1.10
# of Doctor Visits	0.05***	0.01	1.05	0.05***	0.01	1.06	0.05***	0.01	1.05
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.05	0.09	---	0.04	0.09	---
Quite a bit/ Extremely stressful				-0.10	0.11	---	-0.13	0.11	---
Income									
≥$80,000									1.00
$50,000-$79,999							-0.02	0.13	---
$30,000-$49,999							0.31*	0.13	1.36
$15,000-$29,999							0.37**	0.13	1.44
<$15,000							0.37*	0.16	1.45
Education									
Post-secondary grad									1.00
Some post-secondary							0.14	0.17	---
Secondary grad							-0.16	0.11	---
<Secondary grad							0.21*	0.09	1.24
Employment Status							.13	0.11	---

*p≤.05, **p≤.01, ***p≤.001

4.2.9 Logistic Regression Results: Heart Disease

As reported in Table 4.10, the demographic variables of Model 1 were statistically associated with diagnosed heart disease (Model Chi Square = 668.17, p<.001). All three

of the age contrasts in which the reference group was ages 45 to 54 exhibited strong positive associations with this chronic illness. The likelihood of this diagnosis is over three times larger for 55 to 64 year olds (odds ratio = 3.28), seven and a half times greater for 65 to 74 year olds (odds ratio = 7.49), and over twelve and a half greater for those aged 75 and older (odds ratio = 12.62) compared to 45 to 54 year olds. Moreover, the odds of heart disease are lower for women than men (odds ratio = 0.72) whereas the likelihood of this condition is higher for persons not married or common-law (odds ratio = 1.18) than for those in such a relationship.

Model 2 includes the immigrant characteristics into the regression equation, resulting in a statistically significant Model Chi Square (682.72, $p<.001$). The association between heart disease and visible minority status is one where the odds of having this chronic condition are decreased by a factor of 0.73 among immigrants who identified as being from an ethno-cultural group other than 'White' compared to White immigrants. Neither duration of residence nor language ability were associated with this dependent variable. The odds ratios for age were slightly decreased and marital status became not statistically significant with the addition of the immigrant variables. The association with gender was replicated in this model.

Model 3 introduced smoking status, physical activity, fruit and vegetable consumption, and BMI into the equation and was statistically significant (Model Chi Square = 720, 42, $p<.001$). Three of the four variables were associated with self-reported heart disease. Interestingly, the only variable that was not related to this condition was smoking status. It is possible that the diagnosis of heart disease has prompted previous smokers to quit. The likelihood of having this health condition is increased for persons

who are 'inactive' (odds ratio = 1.54) compared to 'active'. A surprising inverse association with fruit and vegetable consumption is also evident where the odds of heart disease are slightly greater for persons who eat more than 5 servings from this food group (odds ratio = 1.26) compared to those who eat less than this amount. Similar to the association with smoking, this unexpected association may reflect change prompted by a diagnosis of heart disease, which is often preceded by a serious and frightening event such as a heart attack. Unfortunately, a causal link between heart disease diagnosis and health promotion change cannot be confirmed without longitudinal data. Finally, the odds of having heart disease rise by a factor of 1.02 for every unit increase in BMI. The association with marital status once again reached statistical significance with the addition of the health behaviour context (odds ratio = 1.20) and the remaining associations from Model 1 and 2 were replicated.

The inclusion of the health care utilization context in Model 4 resulted in another statistically significant Model Chi Square (949.15, $p<.001$). According to Table 4.10, the likelihood of having heart disease is positively influenced by the number of times a foreign-born individual has seen a physician in a 12-month period. The odds of this condition increase by a factor of 1.08 for every additional doctor visit. With the inclusion of Model 4, the association with BMI becomes not significant, the odds ratios for age are slightly reduced, and the remaining relationships are replicated.

Although the introduction of Model 5 results in an overall statistically significant model fit (Model Chi Square = 950.08, $p\leq.001$), the stress variable comprising this model is not associated with heart disease.

In Model 6, the three socio-economic factors were entered into the equation, resulting in a statistically significant final Model Chi Square (1004.09, $p<.001$). After controlling for all other variables, income is clearly associated with heart disease among foreign-born individuals in a somewhat surprising manner. All four of the income contrasts revealed an inverse relationship between this variable and heart disease. The likelihood of this chronic condition are lower for persons with annual incomes of $50,000 to $79,999 (odds ratio = 0.52), $30,000 to $49,999 (odds ratio = 0.75), $15,000 to $29,999 (odds ratio = 0.74), and less than $15,000 (odds ratio = 0.71) when compared with the reference category of $80,000 or more. The education association is less surprising: the odds of having heart disease are 1.34 times higher for high school graduates compared to those who completed post-secondary school. The other two education contrasts were not statistically significant. Lastly, the likelihood of heart disease is over one and a half times greater for persons who were not employed at all during the past year (odds ratio = 1.66) when compared to those who were. With the addition of the socio-economic variables, a suppressor effect (i.e., an association that was previously not statistically significant reaches significance) for language emerges where the odds of heart disease are lower for persons unable to speak English or French (odds ratio = 0.78) compared to their counterparts who have this language skill. Also, the odds ratio for the 55 to 64 age contrast was reduced by 0.40, the ratio for the 65 to 74 contrast was reduced by 2.00 and the ratio for the oldest contrast was over one third lower. The other associations previously observed are replicated in Model 6.

Table 4.10 Logistic Regression for Heart Disease

Model Chi Square	668.17, $5df^{***}$			682.72, $8df^{***}$			720.42, $13df^{***}$		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	1.19^{***}	0.13	3.28	1.15^{***}	0.13	3.17	1.15^{***}	0.13	3.17
65 to 74	2.01^{***}	0.12	7.49	1.96^{***}	0.13	7.09	1.98^{***}	0.13	7.21
75+	2.54^{***}	0.13	12.62	2.46^{***}	0.13	11.71	2.42^{***}	0.13	11.28
Sex	-0.34^{***}	0.07	0.72	-0.33^{***}	0.08	0.72	-0.39^{***}	0.08	0.68
Marital Status	0.16^{*}	0.08	1.18	0.16	0.08	---	0.18^{*}	0.08	1.20
Duration of Residence				-0.06	0.15	---	-0.06	0.15	---
Visible Minority Status				-0.32^{***}	0.10	0.73	-0.32^{***}	0.10	0.73
Language				-0.06	0.12	---	-0.11	0.12	---
Smoking Status							0.21	0.12	---
Physical Activity Index									
Active									1.00
Moderate							0.13	0.13	---
Inactive							0.43^{***}	0.11	1.54
Fruit & Veg Consumption							0.23^{**}	0.07	1.26
BMI							0.02^{*}	0.01	1.02

*p≤.05, **p≤.01, ***p≤.001

Table 4.10 (continued) Logistic Regression for Heart Disease									
	Model 4			Model 5			Model 6		
Model Chi Square	949.15, 14*df****			950.08, 16*df****			1004.09, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	1.07***	0.13	2.91	1.07***	0.13	2.93	0.94***	0.14	2.55
65 to 74	1.86***	0.13	6.41	1.88***	0.13	6.56	1.52***	0.15	4.57
75+	2.24***	0.13	9.43	2.27***	0.14	9.67	1.85***	0.16	6.34
Sex	-0.44***	0.08	0.65	-0.44***	0.08	0.65	-0.51***	0.08	0.60
Marital Status	0.18*	0.08	1.20	0.19*	0.08	1.20	0.20*	0.09	1.22
Duration of Residence	-0.11	0.15	---	-0.12	0.15	---	-0.08	0.16	---
Visible Minority Status	-0.42***	0.10	0.66	-0.41***	0.10	0.67	-0.39***	0.10	0.68
Language	0.19	0.12	---	-0.18	0.12	---	-0.25*	0.13	0.78
Smoking Status	0.18	0.12	---	0.19	0.12	---	0.20	0.12	---
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	0.09	0.13	---	0.08	0.13	---	0.13	0.13	---
Inactive	0.29**	0.11	1.34	0.29**	0.11	1.33	0.32**	0.11	1.38
Fruit & Veg Consumption	0.24***	0.07	1.27	0.24***	0.07	1.27	0.24***	0.08	1.27
BMI	0.01	0.01	---	0.01	0.01	---	0.01	0.01	---
# of Doctor Visits	0.08***	0.01	1.08	0.08***	0.01	1.08	0.07***	0.01	1.07
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.03	0.09	---	0.03	0.09	---
Quite a bit/ Extremely stressful				0.10	0.10	---	0.09	0.10	---
Income									
≥$80,000									1.00
$50,000-$79,999							-0.66***	0.13	0.52
$30,000-$49,999							-0.28**	0.12	0.75
$15,000-$29,999							-0.30**	0.13	0.74
<$15,000							-0.35*	0.15	0.71
Education									
Post-secondary grad									1.00
Some post-secondary							-0.14	0.19	---
Secondary grad							0.29**	0.10	1.34
<Secondary grad							0.15	0.09	---
Employment Status							.50***	0.12	1.66

*p≤.05, **p≤.01, ***p≤.001

4.2.10 Logistic Regression Results: Fair/Poor Self-rated Health

Table 4.11 describes the results for the final logistic regression procedure for fair/poor health'. Examination of this table reveals that the demographic context

represented in Model 1 is statistically significant (Model Chi Square = 460.10, p<.001). Both age and sex are associated with self-reported fair or poor health and marital status is not. The odds of rating one's health as fair or poor are elevated for 55 to 64 year olds (odds ratio = 1.63), 65 to 74 year olds (odds ratio = 2.34) and those age 75 and older (odds ratio = 4.08) when compared to persons aged 45 to 54. The likelihood of fair/poor self-rated health is also higher among women (odds ratio = 1.20) compared to men.

The introduction of the immigrant variables in Model 2 also resulted in a good overall model fit (Model Chi Square = 530.93, p<.001). Longer duration of residence, 'White' cultural/racial origin and an inability to speak English or French are associated with increased likelihood of having fair/poor self-rated health. The odds of rating one's health in this manner are slightly higher for persons who have resided in Canada for 10 or more years (odds ratio = 1.26) compared to those in the country for fewer years. Also, a reduced likelihood of fair/poor self-rated health is found for visible minority immigrants (odds ratio = 0.87) compared to their non-visible minority counterparts. The positive association observed for language is unique to this dependent variable. Higher odds of fair/poor self-rated health are associated with an inability to speak one of Canada's official languages (odds ratio = 1.92) when compared to English or French speaking ability. In each of the other regression equations, the associations with language were in the opposite direction. With the inclusion of Model 2, a weak, positive and statistically significant association between marital status emerges whereby a higher likelihood of fair/poor self-rated health is observed for those not in a married or common-law relationship (odds ratio = 1.13) compared to those who are in such a union. The associations for age and sex are replicated in this context.

The inclusion of Model 3 into the equation was also statistically significant (Model Chi Square = 736.73, $p<.001$). Three of the four variables in this block are associated with fair/poor self-rated health when controlling for demographics and immigrant characteristics. First, the odds of rating their health accordingly are lower among non-smokers (odds ratio = 0.77) when compared to people who smoke. In other words, non-smokers report better perceived health. Second, the odds of fair/poor self-perceived health increase by a factor of 1.29 for those with a physical activity index of 'moderate' and rise by a factor of 2.08 for those who are 'inactive' when contrasted with a physical index rating of 'active'. Third, the odds of fair/poor self-rated health increase by a factor of 1.05 for each BMI increment. Fruit and vegetable consumption was the only variable that was not statistically significant. The associations observed in Model 2 were replicated in Model 3 with the exception of the marital status and visible minority status associations, which became not significant.

Health care utilization is represented by one variable and is entered in Model 4. The inclusion of this variable results in a statistically significant Model Chi Square (1745.02, $p<.001$) and is the largest increase in overall model fit observed within this equation. The number of doctor visits reported in the past year displays a strong positive association with fair/poor self-rated health. The likelihood of rating one's health accordingly is increased by a factor of 1.14 for each additional visit to a physician made within the last 12-month period. Further, the inclusion of this variable representing health care utilization rendered the association with duration of residence not statistically significant. Thus, foreign-born individuals who have lived in Canada for ten or more years are more likely to perceive their health as fair or poor (than those with shorter

residence duration) due to greater exposure to physicians. The association with sex was also described with the addition of the doctor visits variable, indicating that the elevated likelihood of fair/poor self-rated health observed for women compared to men is related to females' extra contact with medical professionals. Alternatively, the visible minority status variable reached statistical significance once again. The associations with age, language, smoking, physical activity, and BMI were replicated with minimal reduction in odds ratios.

As shown in Table 4.11, the incorporation of the single variable representing the stress context in Model 5 resulted in a statistically significant Model Chi Square (1969.61, $p<.001$). Both contrasts with the reference category of persons who rated most days as 'not at all/not very stressful' were positively associated with fair/poor self-rated health. This perceived health rating was over one and a half times as likely for those who rated most days as 'a bit stressful' (odds ratio = 1.57) and over three times as likely for those who rated most days as 'quite a bit/extremely stressful' (odds ratio = 3.04) when compared to those stating 'not at all/not very stressful'. With the addition of the stress context, the odds ratios for the age contrasts were somewhat increased, the association with visible minority status became not statistically significant once again, and the other relationships remained unchanged.

The sixth and last model introducing socio-economic factors resulted in a final statistically significant Model Chi Square (2381.86, $p<.001$). Both income and education are associated with fair/poor self-rated health such that persons with lower levels of each factor are more likely to rate their health in this way. Specifically, the likelihood of rating one's health as fair or poor is greater for those with a annual household income of

$30,000 to $49,999 (odds ratio = 1.47), $15,000 to $29,999 (odds ratio = 1.58), and less than $15,000 (odds ratio = 2.11) compared to a household income of $80,000 or more per year. With regard to education, the odds of fair/poor self-rated health are elevated for both high school graduates (odds ratio = 1.39) and those who did not graduate from high school (odds ratio = 1.72) compared to post-secondary graduates. Employment status is also clearly associated with self-rated health. The likelihood of rating one's health as fair or poor is three times greater for those who did not work at all during the past year (odds ratio = 2.99) when compared to persons who worked for all or part of the year. With the inclusion of this block of variables, two of the age contrasts (55 to 64 and 65 to 74) became not significant while the odds ratio for the age 75+ contrast dropped from 4.43 in Model 5 to 1.44 in Model 6. Also, due to interactions between the variables in this final model, a suppressor effect arose whereby the weak, positive association previously observed with duration of residence became statistically significant once again (odds ratio = 1.24). When controlling for socio-economics, sex also became statistically significant, but in an inverse direction. In this context, the likelihood of reporting one's health as fair or poor is lower among women (odds ratio = 0.86) than men. The other associations observed in Model 5 are replicated in this final model.

Table 4.11 Logistic Regression for Fair/Poor Self-Rated Health

	Model 1			Model 2			Model 3		
Model Chi Square	460.10, 5*df****			530.93, 8*df****			736.73, 13*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.49***	0.07	1.63	0.45***	0.07	1.57	0.48***	0.07	1.62
65 to 74	0.85***	0.07	2.34	0.77***	0.07	2.15	0.86***	0.07	2.36
75+	1.41***	0.07	4.08	1.32***	0.08	3.74	1.40***	0.08	4.06
Sex	0.18***	0.05	1.20	0.15**	0.05	1.16	0.15**	0.05	1.16
Marital Status	0.10	0.06	---	0.12*	0.06	1.13	0.10	0.06	---
Duration of Residence				0.23*	0.09	1.26	0.20*	0.09	1.22
Visible Minority Status				-0.14*	0.06	0.87	-0.10	0.06	---
Language				0.65***	0.08	1.92	0.57***	0.08	1.76
Smoking Status							-0.26***	0.07	0.77
Physical Activity Index									
Active									1.00
Moderate							0.26**	0.10	1.29
Inactive							0.73***	0.08	2.08
Fruit & Veg Consumption							-0.04	0.05	---
BMI							0.04***	0.01	1.05

*p≤.05, **p≤.01, ***p≤.001

Table 4.11 (continued) Logistic Regression for Fair/Poor Self-Rated Health									
	Model 4			Model 5			Model 6		
Model Chi Square	1745.02, 14*df****			1969.61, 16*df****			2381.86, 24*df****		
Independent Variables	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**	**B**	**S.E.**	**OR**
Age									
45 to 54			1.00			1.00			1.00
55 to 64	0.35***	0.08	1.42	0.44***	0.08	1.56	0.08	0.08	---
65 to 74	0.68***	0.08	1.98	0.96***	0.08	2.61	0.02	0.10	---
75+	1.16***	0.09	3.18	1.49***	0.09	4.43	0.36***	0.11	1.44
Sex	0.08	0.06	---	0.06	0.06	---	-0.16**	0.06	0.86
Marital Status	0.08	0.06	---	0.07	0.07	---	-0.06	0.07	---
Duration of Residence	0.15	0.10	---	0.13	0.10	---	0.22*	0.11	1.24
Visible Minority Status	-0.23***	0.07	0.80	-0.13	0.07	---	-0.10	0.07	---
Language	0.52***	0.08	1.68	0.56***	0.09	1.75	0.33***	0.09	1.39
Smoking Status	-0.34***	0.08	0.72	-0.27***	0.08	0.76	-0.19*	0.08	0.83
Physical Activity Index									
Active			1.00			1.00			1.00
Moderate	0.24*	0.11	1.27	0.24*	0.11	1.27	0.29**	0.09	1.33
Inactive	0.65***	0.09	1.91	0.59***	0.09	1.79	0.64***	0.09	1.90
Fruit & Veg Consumption	-0.04	0.06	---	-0.00	0.06	---	0.05	0.06	---
BMI	0.04	0.01	1.04	0.04***	0.01	1.04	0.03***	0.01	1.03
# of Doctor Visits	0.13***	0.01	1.14	0.12***	0.01	1.13	0.11***	0.01	1.12
Perceived Stress									
Not at all/Not very stressful						1.00			1.00
A bit stressful				0.45***	0.07	1.57	0.49***	0.07	1.63
Quite a bit/ Extremely stressful				1.11***	0.08	3.04	1.20***	0.08	3.32
Income									
≥$80,000									1.00
$50,000-$79,999							0.09	0.10	---
$30,000-$49,999							0.39***	0.10	1.47
$15,000-$29,999							0.46***	0.10	1.58
<$15,000							0.75***	0.12	2.11
Education									
Post-secondary grad									1.00
Some post-secondary							-0.04	0.14	---
Secondary grad							0.33***	0.08	1.39
<Secondary grad							0.54***	0.07	1.72
Employment Status							1.10***	0.08	2.99

*p≤.05, **p≤.01, ***p≤.001

4.2.11 Comparison of Duration of Residence Effect Within Ten-Year Age Groups

Since the model did not successfully explain the duration of residence effect in five of six of the logistic regressions, a sub-analysis was done to restrict the age factor to

better control for age and to examine age interactions with residence status. This sub-analysis will examine the effect of residence duration on the health conditions of foreign-born persons *within* ten-year age groups. This exercise is warranted for several reasons. First, since the age groups used were ordinal and not interval, some age effect could be at work in the previously described statistical analyses. Second, both chronic conditions and duration of residence are strongly affected by age. Third, there may be interactions among these variables.

Each of the six regression equations was repeated within the age groups: 45 to 54, 55 to 64, 65 to 74 and over 75. The same hierarchical model that was employed in the previous analyses was used. However, in order to further control for age within the 10-year age group analyses, the original age variable was replaced with one where the younger five-year age category was the reference against which the older five-year age category was compared (e.g., 45-49 year olds compared to 50-54 year olds). Table 4.12 presents the odds ratio and significance level (associated with the beta coefficient) for duration of residence with the addition of each successive variable block within the six logistic regression equations for each of the four age categories.

Table 4.12 reveals that the odds of having a chronic condition and diabetes are approximately twice as high for foreign-born persons between the ages of 45 to 54 who have lived in Canada for ten or more years compared to their counterparts who have lived in the country for less time. Further, the likelihood of reporting high blood pressure and fair/poor self rated health is roughly one and a half times greater for 45 to 54 year olds with ten or more years residence compared to their peers with more limited residence status. Also, the odds of having a chronic condition are nearly twice as high among 55 to

64 year olds with ten or more years in Canada compared to those with less than ten years in Canada. Further, the likelihood of arthritis or rheumatism is three times greater and the likelihood of diabetes is almost five times greater for 55 to 64 year olds with longer residence duration when contrasted with their peers of shorter duration. Among those aged 65-74, the odds of arthritis or rheumatism and high blood pressure are approximately one and a half times greater for those with a longer time since immigration compared to their counterparts who immigrated more recently, although this relationship is later explained by other factors. Finally, heart disease and subjective health are negatively associated with length of residence among those aged 75 and older where the odds of these conditions are one-half for those who have lived in Canada for longer than ten years compared to those in the country for less than this time frame.

However, the duration of residence effect was explained, that is, it became not statistically significant, in several of the age group by health condition regression models. The positive association with arthritis or rheumatism among 65 to 74 year olds is explained by the health care utilization variable and positive associations with high blood pressure were explained by the stress context for 45 to 54 year olds and by the lifestyle behaviour context for 65 to 74 year olds. A negative association between heart disease and length of residence among 65 to 74 year olds emerges only with the addition of the health care utilization variable (odds ratio = 0.52) and then becomes not statistically significant with the integration of socio-economic status. Also, a positive association with fair/poor self-rated health among 45 to 54 year olds (odds ratio = 1.38) is explained within the lifestyle behaviour model and then re-emerges as significant in the final socio-economic status model (odds ratio = 1.70). Finally, within the 75 and older age group, a

negative association with fair/poor self-rated health becomes statistically significant in the health care utilization model (odds ratio = 0.50) and maintains significance throughout the rest of the regression equation.

After controlling for all of the other variables in the model, a basic pattern is observed in which the influence of duration of residence on health is reduced with age. Among 45 to 54 year olds, an increase in health conditions with greater time in Canada is evident for four dependent variables: any chronic condition (odds ratio = 2.29), arthritis or rheumatism (odds ratio = 1.82), diabetes mellitus (odds ratio = 2.54), and fair/poor self-rated health (odds ratio = 1.70). Within the 55 to 64 year old group, a positive duration of residence effect occurs for only three conditions including any chronic condition (odds ratio = 1.78), arthritis or rheumatism (odds ratio = 3.17) and diabetes mellitus (odds ratio = 4.77). None of the final associations with duration of residence is statistically significant for the 65 to 74 age group. Lastly, the single association that emerges as significant in Model 6 among those aged 75 and older is that with fair/poor self rated health. This association, however, is in the opposite direction to all of the other effects: longer duration of residence is associated with lower likelihood of fair or poor self-rated health. Thus, an interaction effect is observed where the development of health conditions with length of time in Canada is not equivalent for all age groups and appears to be strongest among mid-life adults (aged 45 to 64) in comparison to older adults (aged 65 and older). Furthermore, heart disease and subjective health appear to be inversely related to duration of residence among immigrants who are in the oldest age group.

Table 4.12 Duration of Residence Effect For Each Dependent Variable by 10-Year Age Groups

	N	Model 2	Model 3	Model 4	Model 5	Model 6
Chronic Condition						
45-54	3,753	2.08***	2.05***	2.08***	2.09***	2.29***
55-64	2,647	1.92***	1.88***	1.82**	1.79**	1.78**
65-74	2,071	---	---	---	---	---
75+	1,438	---	---	---	---	---
Arthritis or Rheumatism						
45-54	3,753	1.82***	1.76***	1.73**	1.73**	1.82***
55-64	2,647	2.98***	2.86***	2.94***	2.83***	3.17***
65-74	2,071	1.69*	1.56*	---	---	---
75+	1,438	---	---	---	---	---
High Blood Pressure						
45-54	3,753	1.41**	1.35*`	1.35*	1.35*	---
55-64	2,647	---	---	---	---	---
65-74	2,071	1.50*	---	---	---	---
75+	1,438	---	---	---	---	---
Diabetes Mellitus						
45-54	3,753	2.31**	2.21**	2.28*	2.26**	2.54***
55-64	2,647	4.52***	4.29***	4.75***	4.86***	4.77***
65-74	2,071	---	---	---	---	---
75+	1,438	---	---	---	---	---
Heart Disease						
45-54	3,753	---	---	---	---	---
55-64	2,647	---	---	---	---	---
65-74	2,071	---	---	---	---	---
75+	1,438	---	---	0.52*	0.51*	---
Fair/Poor Self-Rated Health						
45-54	3,753	1.38*	---	---	---	1.70**
55-64	2,647	---	---	---	---	---
65-74	2,071	---	---	---	---	---
75+	1,438	---	---	0.50**	0.48**	0.39***

*p≤.05, **p≤.01, ***p≤.001

Note: each odds ratio was observed after controlling for the variables in the model under which it is reported, as well as the variables included in all of the preceding models

Chapter Five: Discussion

This chapter summarizes the results, relates the findings to the hypotheses, acknowledges several study limitations, and discusses the implications of this research. The main purpose of this thesis was to examine factors that contribute to the increase in health conditions among immigrants aged 45 and older as they spend more time in Canada. This age span was chosen as the focus because health problems are more prevalent in later life and the duration of residence effect is under-researched within these ages. Of particular interest was the investigation of lifestyle behaviour acculturation on this effect. The results of the bivariate and multivariate analyses that were conducted are summarized and discussed in relation to the hypotheses and previous research findings.

5.1 Research Hypotheses

5.1.1 Hypothesis I

> Rates of chronic conditions within the foreign-born population aged 45 and older in Canada will be positively associated with duration of residence, after controlling for demographics, visible minority status, language ability, perceived stress, health care utilization, and socio-economic variables.

In general, the results are supportive of Hypothesis I and provide further evidence of an increase in chronic health conditions among immigrant groups with longer duration

of residence in Canada (Chen, Ng & Wilkins, 1996; Dunn & Dyck, 2000). A higher likelihood of having a chronic condition, arthritis or rheumatism, high blood pressure, diabetes and fair or poor self-rated health was found for mid-life and older immigrants with ten or more years of residence in the country than for their counterparts who have lived in Canada for less time. A similar association was not observed for heart disease in any of the analyses. However, small numbers of recent immigrants reporting this condition may have prevented the finding of a true effect.

5.1.1.1 Health Conditions by Duration of Residence

Greater acculturation, as measured by duration of residence, was found to be positively associated with four of the six health conditions. Rates of having a chronic condition and arthritis or rheumatism are 20% higher among immigrants with ten or more years in the country than their counterparts who have lived in Canada less than a decade. Additionally, high blood pressure rates are 10% higher and diabetes rates are doubled for the same contrasts. Specifically, 54.9% of immigrants with a shorter time since immigration have a chronic condition and 11.9% have arthritis or rheumatism. These rates increase to 76.9% and 29.7%, respectively, among those who immigrated ten or more years ago. Similarly, rates of high blood pressure rise from 17.9% to 27.2% and the percentage with diabetes increase from 4.5% to 9.3%. Although heart disease and fair/poor self-rated health did not meet the minimum correlation level to be considered substantively important, both of these associations were in the expected direction.

Dunn and Dyck (2000) also compared self-reported chronic conditions and self-rated health among Canadian immigrants aged 20 and older who had been in the country

for less than ten years versus ten or more years using 1994/95 National Population Health Survey (NPHS) data. Similar to this study, Dunn and Dyck found that having a chronic condition was associated with longer residence duration, after controlling for other key variables. They report chronic condition rates of 36% among persons in Canada less than ten years and 63.7% among those who arrived ten or more years ago. This gap reported by Dunn and Dyck of almost 30% between persons with shorter and longer duration of residence is, interestingly, nearly 10% higher than that found in the present study where only mid-life and older immigrants were considered. Also, contrary to this study, these authors report a statistically significant bivariate correlation between length of residence and self-rated health. Rates of fair or poor self-rated health increased from 6.5% to 17% when comparing those in Canada less than ten years to those with ten or more years in the country. Since the main difference between these two studies is the age range of the sample, it appears as though the effect of duration of residence on both chronic conditions and self-rated health may be stronger when a broader age range is included than it is when only the latter ages are considered.

5.1.1.2 Health Conditions by Duration of Residence, Controlling for Age

Even when controlling for age, many of the associations observed in the bivariate analysis remained. Thus, age is not solely responsible for the increase of chronic conditions with duration of residence within the foreign-born population aged 45 and older. However, with the addition of an age control, several changes in this relationship are noted. First, a general pattern of correlation strength decrease with older age was observed. Furthermore, the association with any chronic condition, high blood pressure,

and diabetes, within one or more of the older age categories (i.e., 65-74, 75+), became not statistically significant. Finally, an inverse association between duration of residence and fair/poor self-rated health emerged for the 75 plus age category. This is the single instance in which poorer health was associated with a shorter length of stay in Canada.

5.1.1.3 Health Conditions by Duration of Residence, Controlling for Visible Minority Status

A replication of the duration of residence by health conditions crosstabulation was also conducted while controlling for visible minority status. This was done in order to explore whether the change in country of origin of Canadian immigrants from European to non-European countries over recent decades may partially explain the inverse relationship between acculturation and health. With the visible minority status control, a few of the original associations were altered but most maintained statistical significance for both groups. However, an interaction effect was observed in the case of any chronic condition and high blood pressure in which a slightly stronger correlation with duration of residence was observed for visible minority immigrants when compared to White immigrants. In addition, a significant association with diabetes emerged only among visible minority immigrants and the strength of the statistic doubled from that observed without the control. Therefore, it appears as though the duration of residence effect occurs within the entire foreign-born population, but may be slightly stronger among non-White immigrants.

White immigrants who have lived in Canada for fewer than ten years have modestly higher rates of any chronic condition and arthritis or rheumatism than their

visible minority immigrant counterparts. Specific rates of having a chronic condition are 56.4% for White and 54.5% for visible minority immigrants. These rates rise to 78.9% and 72%, respectively, for those in Canada for 10+ years. Arthritis rates for White immigrants residing in the country for less than ten years are 15% and jump almost 20% to 34.1% for those residing here for ten or more years. In contrast, 10.8% of visible minority immigrants living in Canada for less than ten years have arthritis and these rates increase less than 10% to 19.1% among those of longer residence duration. The association between length of residence and heart disease did not reach the minimum correlation cut off. However, a similar pattern is observed, where White immigrants who immigrated less than ten years ago also have higher rates of heart disease than their non-White counterparts (6.6% versus 5.7%). Further, this condition is elevated with duration of residence to a greater degree among White immigrants than non-White immigrants (corresponding rates for 10+ years = 11.7% and 5.9%).

In contrast, a different pattern is observed for the other health conditions. Both high blood pressure and diabetes are more prevalent among visible minority immigrants than White immigrants who have lived in Canada for less than ten years. Rates of high blood pressure for recently-arrived visible minority immigrants are 19.5% and rates of diabetes are 5.0% whereas corresponding rates for White immigrants with a similar duration of residence are 13.6% and 3.1%. After nine years in Canada, rates of high blood pressure and diabetes shift upwards among visible minority immigrants to 26.7% and 12.1% and among White immigrants to 27.4% and 8.2%. However, although the association between diabetes and duration of residence was statistically significant for White immigrants, it was just below the minimum correlation cut off. This was also true

for the duration of residence and fair/poor self-rated health association for both cultural/racial groups.

Therefore, with the exception of diabetes, acculturation as measured by duration of residence has a similar positive effect on the health conditions of White and non-White foreign-born individuals. However, recently-arrived (less than ten years ago) White immigrants have a greater prevalence of any chronic condition and arthritis or rheumatism. In addition, visible minority immigrants of a similar length of residence have a higher prevalence of high blood pressure and diabetes.

In a comparison of the age-adjusted prevalence of health conditions among European and non-European Canadian immigrants (comparable to White and visible minority immigrants in the present study) using 1994/95 NPHS data, Chen, Ng and Wilkins (1996) also report an increase in rates of having a chronic condition with longer duration of residence within both groups. Further, lower rates of having a chronic condition were observed for non-European immigrants (37.2%) when compared to European immigrants (46.7%) who had been in Canada for ten or fewer years. These rates rose over ten per cent within both groups with over ten years residence in the country to 51.2% for non-European immigrants and 57.7% for their European counterparts. It is interesting to note that the gap between the chronic condition rates reported for European and non-European foreign-born individuals with ten or fewer years in Canada is five times larger than that found in the current study between visible minority and non-visible minority immigrants with a similar duration of residence. The gap within the Chen, Ng and Wilkins study was almost ten per cent compared to a gap of only two per cent in the present study. Since the study by Chen, Ng and Wilkins

included persons aged 18 and older whereas the present study included only those aged 45 and older, it is likely that the difference in chronic conditions at younger ages among European versus non-European immigrants account for this observation. Also, the current research uses CCHS data whereas Chen, Ng and Wilkins analyzed data from the NPHS. Finally, recent changes toward Western patterns of diet and physical activity reported within non-European countries such as China and India (Popkin et al., 2001) may mean that immigrants from non-Western nations have more chronic conditions upon arrival in Canada now than they did just 10 or 20 years ago. In support of this explanation, Kalbach and Kalbach (1999b) argue that among immigrants who are applying for Canadian citizenship based on the personal points system, those who are more 'westernized' in terms of their language, education, and occupational characteristics are favoured. We will now turn to consider how the effect of acculturation on health changes within this sample while controlling for multiple variables.

5.1.1.4 Duration of Residence Effect Within the Logistic Regression Analysis

Within the multivariate logistic regression analysis it is observed that after controlling for several key variables (including: demographics, visible minority status, language ability, lifestyle behaviours, doctor visits, perceived stress and socio-economic status variables), duration of residence is associated with self-report of any chronic condition, arthritis/rheumatism, high blood pressure, diabetes and fair/poor self-rated health. Examination of the final odds ratios reveals that the impact of duration of residence on any chronic condition (odds ratio = 1.98), arthritis/rheumatism (odds ratio = 1.90) and diabetes (odds ratio = 2.16) appears stronger than on high blood pressure (odds

ratio = 1.31) and fair/poor self-rated health (odds ratio = 1.24). After controlling for all other variables in the model, the likelihood of having any chronic condition, arthritis/rheumatism or diabetes is close to two times greater among immigrants who have been in Canada less than ten years compared to those who have resided in the country for longer. In contrast, the likelihood of having high blood pressure or fair/poor self-rated health is less than one and a half times greater.

The association between longer duration of residence and more health conditions found in this study is somewhat different than results reported by Pérez (2002b) in a similar study using CCHS data with unrestricted variables (i.e., categories were not grouped as they are in the PUMF for the purpose of maintaining confidentiality). Using Canadian-born persons as the reference category, he compared the odds of having a chronic condition, heart disease, diabetes, high blood pressure, and cancer for immigrants aged 12 and older who had been in Canada for 0 to 9 years, 10 to 19 years, 20 to 29 years and 30+ years. After controlling for demographic, socio-economic status, and health behaviour variables, none of the specific health conditions displayed a gradient of increasing odds ratios with time since immigration. The dependent variable encompassing all chronic conditions was the only one that was positively associated with duration of residence.

In contrast to Pérez's research, the present study found a positive association between duration of residence and both diabetes and high blood pressure. In order to account for this variation in results for the same dataset, it is important to consider the methodological differences between the two studies. First, in the Pérez (2002b) study, the reference group within the duration of residence variable was Canadian-born persons.

This allowed comparison of odds ratios related to each of the health conditions between foreign- and native-born persons, as well as between immigrants with different lengths of stay in the country. In contrast, this study included only immigrants and used those who had been in Canada for ten years or less as the reference. Second, Pérez had access to additional categories in the duration of residence variable (0-4, 5-9 10-14, 15-19, 20-24, 25-29 and 30+ years), whereas the current study only had a more limited dichotomous variable (0-9 and 10+ years) available in the PUMF files. Third, Pérez controlled for age, education, household income, smoking, heavy drinking, BMI, physical inactivity and fruit and vegetable consumption, whereas this study did not control for heavy drinking but added sex, marital status, visible minority status, language ability, doctor visits, perceived stress, and employment status. Finally, the current study included only persons from age 45 and older whereas the Pérez study included ages 12 and older. Since high blood pressure and diabetes are more prevalent among persons in middle and older adulthood, it is this latter difference that is likely responsible for the lack of association observed by Pérez between time since immigration and these two chronic conditions. On this note, we will turn to age-related differences observed in the effect of duration of residence on the health of mid-life and older immigrants.

5.1.1.5 Sub-analysis: Duration of Residence Effect within Logistic Regression for Restricted Age Groups

In order to further explore how the relationship between duration of residence and health changes with age, the six regression equations were repeated after limiting the sample to the following age categories: 45 to 54, 55 to 64, 65 to 74, and 75 and older.

This analysis resulted in several interesting findings, making it clear that immigrants' length of stay in Canada affects health in a different manner for various age groups, thus demonstrating important interaction effects. Although the duration of residence effect has received a great deal of research attention, previous studies have not investigated differences in this effect with age. The exploratory findings presented in this study are, therefore, unique and important.

First, after controlling for all other variables in the model, foreign-born adults aged 45 to 54 and those aged 55 to 64 with ten or more years of residence are more likely to have a chronic condition, arthritis or rheumatism and diabetes than their counterparts with shorter residence. Second, after controlling for all other variables in the model, the positive association between length of residence and self-reported arthritis/rheumatism and diabetes is twice as strong for 55 to 64 year olds as it is for 45 to 54 year olds. In contrast, it is striking that a shorter time spent in Canada is not associated with lower likelihood of these health conditions for foreign-born adults who are 65 years and older. Similarly, Singh and Siahpush (2002) found that while foreign-born persons in the United States had lower mortality and morbidity rates than their native-born counterparts, the mortality differentials between these two groups were greater for those aged 25 to 64 than for those 65 or older. Hence, these findings suggest that increased homogeneity occurs within the older immigrant population and that the influence of age on health is stronger than that of duration of residence within older age groups.

Finally, it appears that self-perceived health is only influenced by duration of residence among older immigrants. Foreign-born persons aged 75 and older who have lived in Canada for ten or more years have lower odds of rating their health as fair or

poor than their counterparts who have lived in the country for less time. This is the only instance where a longer time since immigration is related to a decreased likelihood of a health condition.

What might explain the decrease in the duration of residence effect on health with older age? This phenomenon can not be attributed to differences between midlife and older immigrants on any of the control variables, including sex, marital status, visible minority status, language ability, tobacco use, physical activity level, fruit and vegetable consumption, body mass index, doctor visits, perceived stress, household income, education or employment status. It is possible that this finding is related to a loss, due to death, of the least healthy elderly. However, since residence duration was found to have minimal influence on the health of 65-74 year olds as well as those 75 and older, it is unlikely that this fully explains the described age effect.

One possible explanation is related to a difference in the degree of acculturation that mid-life and older newcomers undergo while residing Canada. As explained, foreign-born individuals who are involved in the institutions of the host country are prone to acculturate quicker and to a greater degree than those who are not. Thus, the fact that mid-life immigrants are more likely to be employed within the workforce indicates that they may become more acculturated to Canadian society than their older counterparts. This adaptation may contribute to more health problems over time.

Another potential explanation focuses on the different reasons why mid-life and older persons immigrate to Canada. For instance, many older persons enter Canada as a family class immigrant, perhaps motivated to immigrate by emerging health issues and the desire to join younger family members who already live in Canada. Mid-life

newcomers, on the other hand, may be less likely to arrive in Canada under these circumstances and more likely to immigrate as a business class immigrant, based largely on personal income, education and employment skills. Thus, the selection effect, describing the phenomenon where the most robust persons are more likely to immigrate, would be less applicable to older individuals. Consequently, if older immigrants do not arrive in Canada with the superior health that their younger counterparts do, the effect of duration of residence on the health of older immigrants would not be as great.

Therefore, while acculturation appears to have little influence on the physical health of older foreign-born persons, it does affect the health of those in mid-life. Specifically, longer length of residence in Canada equates to an earlier development of chronic conditions for mid-life immigrants. Although the likelihood of developing one or more health conditions may increase inevitably as these persons reach older age, it appears as though living for ten or more years in the country leads to the occurrence of these conditions prematurely. Thus, quality of life for foreign-born individuals in mid-life is threatened by longer residence in Canada.

Yet, it appears as though something about the experience of living in Canada reduces the likelihood of poor subjective health for older adults. Self-rated health incorporates many facets of well-being including both physical and emotional components, and therefore it is not clear what is causing this perception of poor health among recent elder immigrants. However, since physical health is not significantly related to length of residence within this group, the higher rates of fair/poor health for those who have lived in the country for less than ten years cannot be attributed to physical health problems. A study by Angel, Buckley & Sakamoto (2001) reports that

emotional distress declines with longer duration of residence among mid-life and older immigrants in the United States, suggesting that emotional factors may help to explain this phenomenon. Although Ali (2002) found conflicting results, whereby depression was lowest among recently-arrived Canadian immigrants, her study included immigrants aged 12 and older and therefore did not focus on the latter life stages. Finally, given that health service utilization is positively related to duration of residence, perhaps something about a lack of contact with the health care system prompts the perception of poorer health within the recently-arrived older foreign-born population. Clearly, this is an area in need of further research attention.

5.1.2 Hypothesis II

Foreign-born persons with a longer duration of residence (10+ years) will have more unhealthy lifestyle behaviours than foreign-born persons with a shorter duration of residence (0 to 9 years).

Limited support was found for Hypothesis II. The only statistically significant lifestyle behaviour associated with duration of residence was body mass index ($r=.08$, $p\leq.001$). However, as a higher BMI was associated with five of the health conditions, this relationship is important in understanding the health of the foreign-born population. Moreover, this positive relationship has been observed in many other research studies among immigrant groups (Bennett, 1993; Cairney & Ostbye, 1999; Freimer, Echenberg & Kretchmer, 1983; Singh & Siahpush, 2002).

The lack of relationship between time since immigration and smoking status was unexpected. Other studies have found that a higher prevalence of smoking among foreign-born persons is associated with greater acculturation in North American countries (King, Poledknak, Bendel & Hovey, 1999; Singh & Siahpush, 2002; Swallen, 1997). Statistics Canada researchers Chen, Ng and Wilkins (1996) report a lower rate of having 'never smoked' among immigrants in Canada greater than ten years compared to their more recently-arrived counterparts based on the NPHS. Since these previous studies included individuals from young to older adulthood, it is probable that the focus on the middle and latter life stages in the present study is responsible for the observed lack of association. Smoking rates may wane with age as older adults attempt to halt deterioration of health status. Since the current study only includes persons 45 and older, tobacco use may have declined substantially among immigrant groups before their arrival in Canada. Thus, no association with residence duration would emerge.

The absence of an association between lower fruit and vegetable consumption and longer residence in Canada is also surprising. Previous research clearly indicates that greater acculturation to Canadian or similar Western societies is correlated with poorer nutritional habits within immigrant populations (Brock et al., 2001; Satia et al., 2001). However, these studies report a higher intake of dietary fat, greater consumption of food from take-out/fast food sources and habits such as snacking between meals and do not specifically consider fruit and vegetable intake. It is interesting to note that the study using CCHS data conducted by Pérez (2002b) reports low levels of fruit and vegetable consumption that were similar to those found for Canadian-born persons for certain groups of immigrants who had been in Canada for an extended period of time (men, 20-

29 years in Canada; women, 15 to 29 years in Canada). Also, immigrants who had been in the country for a shorter period ate more servings from this food group than Canadian-born persons and their foreign-born counterparts with longer residence. Pérez, however, created a continuous fruit and vegetable index, whereas the present study utilized the variable provided in the PUMF which separated consumption into less than five servings and greater or equal to five servings per day. Thus, it appears as though the loss of detail resulting from this dichotomous conversion may have affected the association between this variable and duration of residence.

Finally, length of residence and leisure-time physical activity also produced an association that was not statistically significant. However, the lack of association in this case was less surprising. In fact, many studies have reported similar results and have also reported an inverse relationship where greater physical activity during leisure is associated with a longer time since immigration (Chen, Ng & Wilkins, 1996; Pérez, 2002b). As discussed, immigrants may be less likely to engage in physically active leisure due to a cultural expectation that exercise is obtained during work and not leisure. Also, as this measure of activity does not include energy expended during work, it may not adequately reflect the activity patterns within this immigrant sample.

5.1.3 Hypothesis III

The association between duration of residence and chronic illness among immigrants will be partly explained by the inclusion of lifestyle variables (smoking, BMI, diet, physical activity).

It was hypothesized that acculturation in the lifestyle areas of smoking, physical activity, fruit and vegetable consumption and body mass index would at least partially explain the relationship between duration of residence and the six health conditions. Thus, a decrease in the odds ratio associated with residence status was anticipated with the addition of the lifestyle behaviour variable block. A correspondence rule was utilized to evaluate the importance of the reduction in the duration of residence odds ratio with the inclusion of each variable context. A standard difference of 10% or greater was considered substantively significant.

The logistic regression results did not support Hypothesis III. Although each of these lifestyle variables emerged as predictors of at least two of the six health conditions, the duration of residence odds ratio changed minimally (i.e., less than 10% difference, with no loss of statistical significance) with the inclusion of the lifestyle context in each regression analysis. Only in the case of 'has fair/poor self-rated health' did duration of residence become not statistically significant with the addition of the health care utilization context represented by the number of physician visits the respondent had in the past year. Therefore, even in the one case in which duration of residence was explained, this was not with the health behaviour variables. Thus, these results suggest that acculturation in these lifestyle areas does not account for the health status decline of foreign-born Canadian residents who are in mid-life or older adulthood as they spend more time in the country.

Pérez (2002b) reached a similar conclusion in his study focusing on the health convergence effect among immigrants aged 12 and older utilizing CCHS data. In general, he found that smoking, overweight and obesity, heavy drinking, physical

inactivity and fruit and vegetable consumption explained little of the difference in health outcomes between native- and foreign-born Canadians and between immigrants with different lengths of residence in the country. Nonetheless, this author did report that the health advantage of recent immigrants over Canadian-born persons in terms of heart disease and diabetes between men, and high blood pressure and diabetes among women, disappeared with the adjustment for health behaviours. However, the loss of statistical significance for diabetes was attributed to a small n size, and thus a lack of statistical power. Again, perhaps it is the inclusion of younger adults in the Pérez study that led to the difference observed in the ability of lifestyle behaviours to explain the rise in these chronic conditions with longer residence duration.

5.2 Theoretical Linkages

The results both provide support for, and identify limitations of, acculturation theory. First, this study reveals that acculturation may have both beneficial and detrimental effects for foreign-born persons. For instance, longer duration of residence was found to be associated with elevated rates of chronic illness for those 45 years and older while also correlated with better self-rated health among those over 75 years of age. However, the fact that greater adaptation to the host society may lead to lower physical health for immigrants runs contrary to the theoretical assumption that acculturation leads to favourable outcomes for foreign-born persons (Gordon, 1964). Other researchers have also found fault with this assumption and have criticized it as an inaccurate and ethnocentric aspect of acculturation theory (Alba & Nee, 1997, Rumbaut, 1997).

Also, it was expected that acculturation of lifestyle practices to Western norms would be observed with longer residence because of immigrants' ongoing interaction with the native-born population (Gordon, 1964). The observed rise in body mass index with extended residence in Canada is indication of such change. However, this pattern was not found for the three other lifestyle practices: smoking, fruit and vegetable consumption, and physical activity. Thus, it appears that acculturation may involve lifestyle behaviour transformation in some areas, but not others. Notably, acculturation theory does not explain why immigrants may selectively adopt only certain norms or practices of the host culture. Berry (1998) has proposed a number of factors that could possibly play a role in a foreign-born individual's level of adaptation to the prevalent behavioural patterns in the host society, including: gender, socio-economic status, religious affiliation, social support, language ability and age.

In fact, the sub-analysis conducted in the present study clearly demonstrates the presence of age effects occurring in the acculturation process where the negative impact on health is greater for middle-aged foreign-born adults than it is for their older counterparts. Furthermore, the unexpected lack of observed lifestyle change in this immigrant sample over time was previously discussed in relation to their older age since most other studies that report an elevation in smoking and poor dietary habits with longer residence duration include younger age groups. According to Alba and Nee (1997), acculturation occurs more rapidly, and to a greater extent, among foreign-born persons who have more contact with societal institutions than their counterparts with less involvement. In this vein, a low level of lifestyle acculturation may be observed in this older sample due to their relatively minimal involvement in educational and occupational

institutions after immigration. However, the influence of age receives very little attention in acculturation theory. Therefore, the findings of this study suggest that addressing the influence of age-related factors in the process of immigrant's cultural adaptation could add depth to acculturation theory.

5.3 Predictors of Health Among Mid-Life and Older Immigrants

Although the hierarchical model used in the regression analyses was not successful in explaining the relationship between duration of residence and health, several variables emerged as consistent predictors of chronic health conditions among mid-life and older immigrants. First, a strong positive association with each of the six dependent variables and age was evident. In fact, the age contrast with the oldest age category produced the strongest odds ratios observed within all six of the regression equations. Only with the addition of the final model representing socio-economic variables in the fair/poor self-rated health regression analysis did the age association disappear for two of the contrasts. An association between sex and having any chronic condition, arthritis or rheumatism and high blood pressure also emerged where females were more likely to report these than males. Diabetes and heart disease were more common among males. The relationship between fair/poor self-rated health and sex is interesting in that an initial higher likelihood among females was reversed with the addition of the socio-economic status context when the higher likelihood is reverted to male gender. Marital status is a less consistent demographic predictor of immigrant health than age or sex. Being part of a married or common-law relationship is weakly associated with lower odds of having arthritis or rheumatism and heart disease.

The other variables related to immigrant acculturation besides duration of residence, visible minority status and language, are two additional predictors of health status in this group. Non-visible minority immigrants are more likely to have a chronic condition, arthritis or rheumatism, heart disease and fair/poor self rated health, although the association with having a chronic condition is explained with the addition of the

socio-economic variables and the association with fair/poor self rated health is explained with the health behaviour context. The odds of having high blood pressure and diabetes are greater for visible minority immigrants than for their White counterparts. This is not surprising since these two chronic illnesses are risk factors for ischemic heart disease, a condition that is more prevalent among south Asians, an ethnic group that comprises a substantial proportion of Canada's non-White population (Sheth et al., 1999).

The inability to speak English or French is related to a lower likelihood of reporting a chronic condition, high blood pressure, diabetes, and heart disease. Notably, this alternative measure of acculturation acts in a manner that is similar to duration of residence: the category indicating a lower acculturated status is associated with superior health. Thus, an inability to speak one of the country's national languages may be protective in the case of physical chronic illness, perhaps because it encourages immigrants to maintain their ethno-cultural identity and traditions. Alternatively, foreign-born persons who do not speak English or French may report fewer health problems because they misunderstand the survey questions and/or the physician's diagnosis of their condition. It is interesting that while a lack of English or French-speaking ability may be beneficial in the case of physical chronic illness, it affects subjective health in a negative manner. This latter association is the only instance within the multivariate analyses conducted on the entire sample of persons aged 45 and older where an indicator of lower acculturation is associated with the presence of poorer health. Since English or French language ability may be lower among recently-arrived older immigrants who did not attend school or work in Canada, perhaps this association is

related to the finding that fair or poor self-rated health is higher among immigrants aged 75 and older with fewer years of residence in the country.

Although the health behaviour variable context was not successful in explaining the association between duration of residence and the six dependent variables, several predictors of health conditions emerge from this group. Smoking is related to a higher likelihood of having a chronic condition, arthritis or rheumatism, and fair or poor self-rated health. An unexpected relationship emerged between smoking status and high blood pressure in which not smoking is associated with greater odds of having this condition. Since these data are cross-sectional, it is possible that persons with hypertension or heart disease have reduced their smoking.

Fruit and vegetable consumption is a less consistent predictor of health status among immigrants. Several problems with this nutrition-related measure are noted in the limitations section that perhaps could have reduced the validity of this variable. Nevertheless, a lower likelihood of arthritis or rheumatism was found for persons who eat more than five servings per day compared to those who eat fewer servings. This weak association becomes not statistically significant with the addition of the socio-economic context. In contrast, the likelihood of heart disease is higher among those eating more fruits and vegetables. This weak association remains significant after controlling for all other variables and is surprising given that a diet high in fibre and low in saturated fat lowers risk of heart disease (Arntzenius, Kromhout, Barth, Reiber, Bruschke, Buis, van Gent, Kempen-Voogd, Strikwerda & van der Velde, 1985). Perhaps the knowledge of their condition has prompted these individuals to improve their nutritional intake in order to prevent future complications.

Physical activity is inversely associated with high blood pressure, heart disease, and self-rated health although the association with high blood pressure was very weak and became not statistically significant when the number of doctor visits in the past year was added to the equation. Nonetheless, it appears as though higher levels of leisure activity facilitate better health status among immigrants in mid-life and older adulthood. Dunn and Dyck (2000) also found that greater levels of physical activity were correlated with lower likelihood of reporting a chronic condition and fair/poor self-rated health among Canadian immigrants aged 20 and older.

Body mass index, reflecting weight management success, is positively related to each of the health conditions within the foreign-born population and is affected very little by the addition of the other variable contexts. Moreover, as described, this variable increases with duration of residence among immigrants in middle and older adulthood. High blood pressure and diabetes are the two conditions most strongly related to BMI. When controlling for all other variables, a unit increase in BMI is associated with a 1.08 odds increase in having hypertension and a 1.10 odds increase in having diabetes. The association with heart disease, on the other hand, is very weak and disappears when controlling for health care utilization.

In fact, health care utilization was associated with each of the dependent variables and was the variable block with the highest Model Chi Square increase for four of the logistic regressions: any chronic condition, arthritis or rheumatism, heart disease, and fair/poor self-rated health. After controlling for all other variables in the model, the odds of having a chronic condition and fair/poor self-rated health were 1.27 times and 1.12 times greater, respectively, for each additional visit to a doctor within the past year. The

corresponding odds ratios for the other four conditions ranged from 1.05 to 1.07. The consistent connection between this factor and poorer health status among mid-life and older immigrants is likely due to the association between visiting one's physician and diagnosis of health problems. An increase in health care utilization is associated with greater acculturation among immigrant groups in the literature (LeClere, Jensen & Biddlecom, 1994). However, although greater contact with physicians parallels longer residence in Canada within the multivariate analyses, it does not explain the connection between length of stay and poorer physical health. Interestingly, the number of doctor visits in the past year explains the duration of residence association with subjective health.

Perceived stress is another variable that is predictive of chronic health conditions among foreign-born residents of Canada. Within this study, rating one's days as 'a bit stressful' or 'quite a bit/extremely stressful' in comparison to 'not at all/not very stressful' is associated with a higher likelihood of: a chronic condition, arthritis or rheumatism, high blood pressure, and fair/poor self-perceived health. This association between stress and poor health among immigrants is cited in a body of literature that attributes health problems among immigrants to the stress that accompanies immigration and acculturation experiences (Berry, 1998; Kliewer, 1992). While this is one interpretation of the observed relationship, it is also possible that health problems lead to greater stress. Unfortunately, it is not possible to clarify the causal direction of the relationship using cross-sectional data.

Socio-economic status indicators also contribute to the prediction of mid-life and older immigrants' health. It is interesting to note that the relationship observed between

income and education and immigrant health parallels the inconsistent pattern observed within the literature (Dunn & Dyck, 2000). Instead of the clear gradient between higher socio-economic status and better health that occurs among the Canadian-born population, a couple of intruiging results were found. First, income and education were not consistently associated with the health conditions. Surprisingly, no association was found between education and any chronic condition or between income or education and high blood pressure. Second, the gradient pattern was not evident for most health conditions. Within the chronic condition logistic regression analysis, the annual household income category of $50,000 to $79,999 was associated with a lower likelihood of this health outcome compared to the reference category $80,000 plus and the other income and education contrasts were not statistically significant. A similar positive relationship was found between income and heart disease, where lower income levels were associated with a lower likelihood of reporting this condition. In fact, the odds of heart disease for the lowest category of less than $15,000 per year are one-half those for the reference category of $80,000 or more. This is similar to the Dunn and Dyck (2000) study which reported a weak positive relationship between educational attainment and likelihood of reporting a chronic condition.

Interestingly, the other associations that emerged between income and education and health conditions were in the expected direction. When compared to the highest education and income categories, the lowest categories were associated with a slightly higher likelihood of having arthritis or rheumatism. There is a greater odds of having diabetes among three of the lower income categories ($30,000-$49,999, $15,000-$29,999, and <$15,000) when compared to the highest reference category (≥$80,000).

Also, when compared to post-secondary graduates, those without a high school degree were slightly more likely to have diabetes. Although income was positively associated with heart disease, an inverse association was observed with education. Compared to those who have completed university or college, persons who only have a high school degree are 1.34 times more likely to have this condition. Finally, fair/poor self-rated health displays a relationship with these two socio-economic status variables that is stronger and in the expected direction. An annual income of $50,000 to $79,999, $30,000 to $49,999 and <$15,000 are associated with progressively greater odds of rating one's health as fair or poor (odds ratios = 1.47, 1.58 and 2.11, respectively) when compared to the reference category of greater or equal to $80,000. Similarly, secondary school graduates and persons who did not graduate from high school have a higher likelihood of this subjective health outcome (odds ratios = 1.39 and 1.72, respectively) than post-secondary graduates. Obviously, the influence of socio-economic status on the health of the foreign-born population in Canada is not straightforward. Although not considered in this thesis, interactions between age and socio-economic status may help to explain the complexity of this relationship. Further research is clearly needed to uncover how income and education affects the health and well-being of immigrant groups.

The final socio-economic related variable, employment status, was a more consistent predictor of health conditions. As unemployment is more prevalent among foreign-born persons than native-born Canadians, this is an important relationship to note (Boyd & Vickers, 2000). Except for diabetes, a greater likelihood of every other health condition was found for persons who did not work during the past year (i.e., unemployed, retired or other) compared to those who worked all or part of the year. The

corresponding odds ratios were: 1.47 for any chronic condition, 1.70 for arthritis or rheumatism, 1.16 for high blood pressure and 1.66 for heart disease. Also, employment status is strongly related to fair/poor self-rated health among mid-life and older immigrants whereby those who did not work during the past 12 months are three times more likely to rate their health accordingly.

5.4 Limitations

Several limitations to this research study must be acknowledged. First, the cross-sectional nature of the data set means that age and cohort effects may impact the results. Therefore, an observed greater number of health conditions among immigrants who have lived in Canada for a longer period of time may be due to the fact that increased duration of residence is associated with older age (age effect) or, alternatively, with changes in immigration policy in both Canada and countries of origin that shape the health-related characteristics of immigrant streams at different points in time (cohort effect). The age control within the regression equations and the additional sub-analysis were attempts to limit the effect of age on the associations. Also, as discussed previously, immigration policy changes over the past several decades suggest that recent groups of immigrants to Canada are not simply healthier than earlier cohorts of arrivals. Indeed, the increased emphasis on accepting newcomers based on family reunification and humanitarian grounds, as well as a decreased emphasis on the points system based on socio-economic status, age, and health factors, would indicate that present-day immigrants may in fact have health disadvantages. Further, the visible minority status control helped limit a cohort effect since country of origin has shifted dramatically from European countries to

largely Asian nations over recent years. Nonetheless, investigation of the predictors of decreased health with increased residence in Canada among immigrants using panel data would eliminate the possibility of these confounders.

The use of duration of residence as an indicator of acculturation may be viewed as another limitation of the present study and the body of research upon which it is based. The assumption made in this and other research studies using length of residence as a measure of acculturation is that the more time spent by foreign-born individuals in a new country, the more they will adapt to the societal norms. In fact, this premise is consistent with acculturation theory (Arcia, Skinner, Bailey, & Correa, 2001). However, recent research suggests that rates of acculturation among Canadian immigrants may differ widely due to factors such as previous exposure to Western culture in one's country of origin, age at immigration, living in a rural versus urban environment, availability of support from and socialization with one's ethno-cultural community, employment and socio-economic status, English- or French-speaking ability, and gender (Arcia et al., 2001). Thus, a particular duration of residence (e.g., ten years) does not correspond to an equivalent degree of acculturation.

It is also important to recognize the limitations inherent in the measure of self-reported health conditions. Due to language or communication difficulties, immigrants new to the country may be less accurate than long-term immigrants in reporting diagnosed chronic conditions. Every attempt was made, however, to obtain accurate information for the CCHS by interviewing respondents who did not speak one of Canada's national languages in their native tongue. Thus, almost 5% of immigrants were interviewed in a language other than English or French (Ali, 2002). Nevertheless,

foreign-born patients may not fully understand their own diagnoses if their physician is unable to speak their language. This would obviously affect the accuracy of their responses to health-related questions. Therefore, it must be acknowledged that a degree of under-reporting of chronic illness among newcomers may account for some of the difference observed in health conditions with duration of residence.

This thesis was also limited by certain aspects of the Canadian Community Health Survey's Public Use Microdata File. Firstly, the survey did not ask foreign-born persons about the circumstances surrounding their immigration into the country. Therefore, it was not possible to control for variability among immigrants who entered in different categories (e.g., refugee, independent, family reunification). Secondly, since the questionnaire did not distinguish between type I or type II diabetes, all diabetics in the sample were treated as if they had type II, or non-insulin dependent diabetes. However, while the development of type II diabetes is clearly related to lifestyle factors such as inactivity, overweight or obese BMI, and an unbalanced diet high in simple carbohydrates and saturated fat, the etiology of type I diabetes is genetic. Nonetheless, the amount of error should be small considering that approximately 90% of those with this condition have type II or 'adult-onset' diabetes whereas only 10% have type 1 (Canadian Diabetes Association, 2000).

Thirdly, many of the variables provided in the PUMF were restricted to ensure the confidentiality of respondents. For instance, age was grouped into five-year age categories, placing limits on the ability to control for age in multivariate analysis. Additionally, duration of residence information was restricted to less than ten years and ten or more years in Canada. This greatly reduces the ability to detect the nuances of

health status changes occurring over time. Finally, information on cultural/racial origin was also restricted within the PUMF. Although respondents were asked to identify themselves as belonging to one of twelve ethno-cultural groups within the survey, cases were separated into two groups (i.e., 'White' or 'visible minority') in the public dataset. Thus, non-white immigrants were analyzed as a single group despite vast health-related differences that exist between different ethnicities and cultures (Frisbie, Cho & Hummer, 2001; Kopec, Williams, To & Austin, 2001).

Another limitation of the dataset related to culture is the fact that some of the questions comprising the CCHS may be interpreted differently across cultural groups. Although the survey was translated and conducted in several different languages, it is important to realize that cultural differences may have led to various understandings and responses to certain questions. As an example, 'stress' may not be perceived exactly the same across cultures and therefore the measure of perceived stress may be less valid for some ethno-cultural groups. Thus, differing cultural interpretations of survey questions may have affected the accuracy of responses.

Several issues related to the fruit and vegetable consumption questions must also be considered in relation to the limitations of this thesis. First, some research assessing the accuracy of self-reported dietary intake measures suggests that these should be interpreted with caution due to questions of validity (Schoeller, 1995), especially among obese individuals (Heitmann, Lissner & Osler, 2000) and ethnic sub-groups (Serdule, Coates, Byers, Mokdad, Jewell, Chavez, Pares-Perlman, Newcomb, Ritenbaugh, Treiber & Block, 1993). These measures are particularly problematic for use within ethno-cultural groups when they enquire about foods that are not reflective of those commonly

consumed within the population (Serdule et al., 1993). For instance, the specific types of fruit and vegetables mentioned in the CCHS (e.g., carrots, green salad, potatoes, fruit juice) are typical of a Western diet but perhaps less common in the traditional diets of certain ethnic populations. Further, one of the most common reporting errors is an underestimation of 'bad' or unhealthy foods (e.g., high fat or high sugar items) and an overestimation of 'good' or healthy foods (e.g., fruits and vegetables) (Schoeller, 1995). Second, consideration of the set of questions measuring fruit and vegetable intake in the CCHS brings their accuracy into question since examples of serving sizes were not given to inform answers. Finally, the question asked of respondents was how many servings per day or times per day they ate certain produce items. As individuals may eat one or more servings each time they eat items from this food group, this question can only provide a very crude estimate of fruit and vegetable intake.

Lastly, the measurement of physical activity within the CCHS is almost entirely limited to leisure-related exercise. Although one question addresses the amount of physical activity a respondent does through "usual daily activities or work habits", this item is not incorporated into the variables summarizing energy expenditure within the PUMF. As discussed previously, active leisure pursuits may be less common among immigrant groups who were more accustomed to work-related than leisure-related exercise in their country of origin. If activity through physical labour type of jobs continues to be their main form of exercise in Canada, these individuals would be falsely labelled 'inactive' within this survey.

5.5 Summary, Conclusion and Directions for Future Research

This thesis adds to an existing body of research investigating how acculturation influences the health of immigrants in Canada. As our country faces the challenges posed by an aging society, the health of the substantial foreign-born population is of tremendous relevance. Furthermore, since the number of older immigrants is growing due to a recent emphasis on family reunification policy, the health status of this group is especially important, yet under-researched.

The pattern of increased health conditions among foreign-born persons with longer duration of residence in Canada was replicated in the present study within the mid-life and older population. Nonetheless, although several possible explanations for this phenomenon were explored, none was successful in fully explaining this effect. Furthermore, the lifestyle behaviour variables that were the focus of these analyses did not significantly alter the effect of acculturation on immigrants' health. It may be concluded, therefore, that factors beyond demographics, visible minority status, language ability, health care utilization, stress, socio-economic status, and lifestyle behaviour acculturation are responsible for the decline in health within immigrants aged 45 and older as they spend more years in Canada. However, as these variables emerge as predictors of the six health outcomes considered in this study, they are still clearly important pieces of the immigrant health picture. One health behaviour in particular, body mass index, is clearly associated with longer duration of residence. Since higher BMI is also consistently related to a higher likelihood of chronic conditions within this group of mid-life and older immigrants, reasons for acculturation in this area should be explored.

This research study also clearly demonstrated that the relationship between acculturation and health differs with age. While foreign-born persons aged 45 to 64 experience higher rates of a chronic condition, arthritis/rheumatism, and diabetes with longer residence in Canada, this does not occur for their counterparts aged 65 and older. Moreover, this analysis revealed a unique relationship between self-rated health and duration of residence for older immigrants aged 75 and older. Within this group, shorter length of residence is associated with a greater likelihood of reporting one's health as fair or poor. Interestingly, an inability to speak English or French also emerged as positively related to lower self-rated health. Therefore, language ability and other factors that may vary among immigrants in different life stages (e.g., circumstances around immigrating; attachment to one's country of origin, educational experience in origin or host country) could help to explain the patterns observed for immigrants' health within certain age groups. Since most studies in this area have included immigrants from a broad age spectrum, these are novel and important findings.

Several directions for future research may be identified from this study. First, studies seeking to understand the causal elements behind the rise in chronic health conditions with longer residence in Canada within the foreign-born population are essential. Although it appears as though BMI may be a relevant factor, the mechanisms and outcomes of weight gain within acculturating foreign-born persons require further exploration. Also, since the physical activity and nutrition lifestyle variables tested in this hypothesis had limitations, it would be worthwhile to re-explore the lifestyle acculturation hypothesis with more detailed and valid measures.

Furthermore, a longitudinal study that compares the health and lifestyle behaviours of immigrants before and after immigrating would be ideal to test whether it is lifestyle acculturation in the host country that is a causal factor in declining health. An understanding of the variables behind the decrease in health status with longer residence may inform mid-life immigrants how to maintain their superior health status while living in their new environment. Furthermore, this information would be valuable to health promotion efforts aimed at the general population.

Also, the collection of qualitative data, through methods such as focus groups and personal interviews, would provide valuable insight into health-related changes experienced by foreign-born persons as they acculturate to a new environment. Moreover, this type of research could be useful in clarifying how various ethno-cultural groups define 'health' and identifying the factors that these populations believe influence their health and well-being. Qualitative studies might also increase understanding about how foreign-born persons' health is influenced by different motivations for emigrating from one's country of origin, as well as the immigration process itself. Also, this research could explore the health implications of creating a place to belong and encountering discrimination in the host society.

This study replicated previous research reporting an inconsistent and complex association between socio-economic status and immigrant health and revealed that this unique relationship also exists within the midlife and older foreign-born population in Canada. Thus, another area of future research centres around the influence of socio-economic factors, especially income and education, on the health of immigrant groups. For instance, further exploration is needed to uncover the mechanisms contributing to

chronic illnesses such as heart disease within higher-income, mid-life and older foreign-born individuals. Studies should also consider how changes in socio-economic status occurring from the country of origin to the host country might affect the health of foreign-born persons. Exploration of this nature is important given that the poverty rate of foreign-born individuals (especially recent, visible minority immigrants) in Canada is higher than the national rate and that for the native-born population (Kazemipur & Halli, 2000).

Finally, it is important that the relationship between increased acculturation and poorer health, as well as other phenomena related to immigrants' health (e.g., the healthy immigrant effect and the convergence effect), are explored within specific age and ethno-cultural groups. This type of knowledge would inform the development of relevant health promotion initiatives targeting these populations. From this study, it is evident that programs proposing to benefit the health of newcomers in mid-life and older adulthood should be different. For instance, a focus for recently-arrived individuals who are between the ages of 45 to 64 should be prevention of chronic health conditions.

Alternatively, an appropriate focus for their counterparts aged 65 and older would be to link these individuals with physicians of the same ethnic or cultural background in order to facilitate the identification of existing health issues and education around coping with these conditions. These findings also suggest a need for policy mandating greater cultural competency of health professionals so that they may sensitively and effectively address the health needs of older newcomers of differing ethnic and cultural backgrounds. Further, given that recently-arrived older immigrants are more likely to perceive their health negatively, programs that identify and explore physical, mental,

emotional and spiritual factors contributing to this self-assessment would also be valuable. A discussion group bringing together foreign-born persons of short- and long-term residence, and led by a facilitator with appropriate training (e.g., a psychologist), may be an ideal setting for this type of dialogue.

Ongoing research into the patterns of health and well-being within immigrant groups in Canada is imperative as the characteristics of newcomers, including socio-economic status, ethnic background and age, vary over time in response to policy changes. Since immigration is an important contributor to the Canadian population, an understanding of the health of the foreign-born is essential to the health of the nation.

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