A COMPARISON OF THE PREDICTORS OF HEART HEALTH AMONG IMMIGRANTS AND NATIVE-BORN CANADIANS

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By

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A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfillment of the Requirements

for the Degree

Master of Arts

McMaster University

MASTER OF ARTS (2004) McMaster University
(Geography) Hamilton, Ontario

TITLE: A Comparison of the Predictors of Heart Health Among Immigrants and Native-Born Canadians.

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SUPERVISOR: Professor K.B. Newbold

NUMBER OF PAGES: ix, 128

ABSTRACT

With over 18% of the Canadian population born outside of Canada, the health of immigrants is an important concern. Heart health is of particular importance because heart disease is the leading cause of death among men and women in Canada. Using data from the National Population Health Survey (NPHS), the purpose of this thesis is to first establish whether immigrants to Canada have lower rates of coronary heart disease (CHD), and high blood pressure (HBP) than native-born Canadians, and second to determine the lifestyle and psychosocial factors that predict heart health and compare them between immigrants and native-born Canadians.

Regression and survival analyses of the NPHS data indicate that lifestyle and psychosocial risk factors such as smoking status, body mass index, alcohol consumption and depression affect immigrants and native-born Canadians similarly. Immigration variables such as length of time in the host country and country of origin are significant risk factors for HBP, however, not in the incidence of CHD. Immigrants were more likely to have HBP than native-born Canadians. However, immigrants have a significantly lower incidence of CHD than native-born Canadians. Native-born Canadians are at a higher risk of heart disease at a younger age than immigrants. These results suggest that there must be other factors relating to immigration affecting the heart health of immigrants.

Due to the complexity and high incidence of heart disease in Canada, it may never be possible to ascertain all of the risk factors for heart disease. However, this study has identified several key risk factors and has excluded other variables as possible risk

factors. The risk factors identified in this study can form the basis for the development of heart health programs to target all Canadians—both native- and foreign-born.

ACKNOWLEDGEMENTS

This thesis would not have been completed without the contributions of several individuals. Firstly, I would like to offer my most sincere thanks to my supervisor, Dr. K. Bruce Newbold, who not only supported me when I applied to the graduate program, despite my limited background in geography, but also continually offered his support, constructive feedback and guidance throughout my time in the program.

I would also like to thank the departmental staff, who provided me assistance with the administrative process as a McMaster employee and a part-time student. Thanks to the staff in the Research Data Centre for their assistance with the National Population Health Survey data.

Thanks to my friends and work colleagues, in particular Susan, who was always willing to share her experience and offer support and guidance. Thanks to family for their support, curiosity and encouragement. Finally, thanks to Mike, whose never-ending understanding, sense of humour and friendship mean the world to me.

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CHAPTER ONE

INTRODUCTION

1.1 The Research Problem

In 2001, the Canadian population was estimated to be 29.6 million, of which 5.4 million (18%) were not born in Canada (Statistics Canada 2003). A report published in early 2003 by Statistics Canada revealed that in 2001, there were more foreign-born citizens in Canada than there had ever been in the past 70 years and that there were over 200 ethnic origins represented in Canada (Statistics Canada 2003). Undeniably, Canada is becoming progressively more diverse, corresponding to shifts in the country of origin over time from European countries to Asian and African countries. In the early 1900s to the middle of the century, most immigrants to Canada came from Europe. In the first half of the twentieth century, immigration of Chinese people was prohibited under the Chinese Immigration Act of 1923. The Act was repealed in 1947, and Chinese immigrants living in Canada were able to sponsor family members to immigrate to Canada (Dench 2004). Canadian policy makers have adjusted their immigration policies over time responding to political, social and economical issues throughout the world, causing a shift in the country of origin of immigrants over time. Slowly, throughout the later half of the twentieth century immigration shifted from predominantly European countries to Asia, Africa and South/Central America, partially due to the liberalization of immigration laws (Dench 2004). In 1921, 97% of all immigrants to Canada were born in European countries (Dench 2004), by 1996 the proportion of European-born immigrants

to Canada had dropped to 47% (Statistics Canada 1997), a proportion that has continued to decline given the most recent statistics from Citizenship and Immigration Canada.

Immigrants come to Canada with their own culture, traditions, religion and language. However, immigrants also come to Canada with differing lifestyle habits and health statuses than native-born Canadians. Immigrants have different health needs than native-born Canadians (Fowler 1998). Immigrants may be young and in good health when they arrive in Canada (Statistics Canada 1999), however, inevitably they will age and develop health concerns as they live in Canada. The "healthy immigrant effect" refers to the trend where immigrants are healthier at arrival in their host country than the average person in either the host or origin country (Chen et al 1996; McDonald and Kennedy 2004). This "effect" has been documented in several host countries, including Canada (Parakulam et al 1992; Chen et al 1996; Friis et al 1998). Over time the "healthy immigrant effect" seems to decrease, and immigrant health status decreases, converging downward toward the health status of the native-born. One possible explanation for this decrease includes the adoption of poor lifestyle habits of the host country (Matuk 1996; Wong and Wong 2003; Newbold and Danforth 2003; Mooteri et al 2004). Alternatively, a less frequently investigated explanation for the decrease in health status is the stress of immigration itself (Janes and Pawson 1986). Immigration has the potential to be stressful given language barriers, cultural differences, acculturation, employment difficulty, health care service differences, and lack of social support (Statistics Canada 1999).

Another possible explanation for the decline in health status among immigrants is the structure of the health care system. Birch et al (1999), for example, argue that the

restructuring of the Canadian health care system over the 1990s has meant that an increasing proportion of care is non-insured. In an era of cost-containment, the impacts within the Canadian health system are not equal across the population (Eyles et al 1995), with low-income groups and the poorly educated less able to deal with system restructuring, even within the publicly financed system (Birch et al 1999). By extension, the immigrant population may be particularly disadvantaged. Unease or distrust of the medical system, or a medical system that does not provide culturally sensitive and appropriate care may create additional barriers (Deinard and Dunnigan 1987; Anderson et al 1993; Bentham et al 1995).

Declines in health status may also reflect a broader set of health determinants that are magnified within the immigrant population. Articulated by the determinants of health framework, health is influenced by a broad range of factors and interrelationships between factors, with demonstrated associations between health status and social, demographic, economic, and environmental variables (Jones and Moon 1987; Evans and Stoddart 1990; Evans 1994; Dunn 1996). Consequently, declining relative health within the immigrant population may represent a combination of issues including their social, political, economic, and cultural position within the host society. Conversely, loss of socioeconomic status, social networks, poor working conditions, and language barriers may contribute to declines in health (Anderson 1987; Saldov and Chow 1994; Chen et al 1996; Elliott and Gillie 1998; Grossi et al 1999). Access to health services may be especially limited among immigrant women whose family, job, or cultural expectations and roles may make it difficult to access and use resources (Anderson et al 1993; Dyck

1995; MacKinnon and Howard 2000; Oxman-Martinez et al 2000; Weerasinghe et al 2000). Poor access and service use may lead to a worsening of health status over time owing to the relative under-use of preventative health screening and under-diagnosis and treatment of health problems. However, it is also likely that if health status continues to decline over time, barriers to care must also persist over time, while existing evidence suggests that utilization of health care services actually increases with increasing duration of residence (Newbold and Danforth 2003). Improved access and use of health services, therefore, likely leads to increased recognition and reporting of conditions, and consequently, poorer self-assessed health.

Immigrants may also embody different perceptions of health relative to the broader population in general, and health professionals in particular, hindering understanding of health and illness. Indo-Canadian women, for example, perceive loneliness and depression as matters that do not warrant medical attention, but instead view them as personal problems (Anderson 1987). If, on the other hand, health status is correlated with these effects, it is logical to assume that as acculturation progresses, language skills improve, and knowledge of and opportunities to access health services increase, health status should, at a minimum, stabilize. However, it is ultimately unclear from the literature what role acculturation has upon health outcomes, although acculturation, measured through (for example) community participation, social contacts, income adequacy, housing, etc., may be associated with improved health (Hunt et al 2004).

1.2 Research Context

Rapoport et al (2004) published a report of the economic burden of chronic diseases in Canada. They used the National Population Health Survey data from 1999 to measure the utilization of physicians and hospitals for the management of chronic conditions. There were seven chronic conditions with a prevalence of over 10% in the respondents over 60 years: arthritis (46%), high blood pressure (35%), back problems (18%), heart disease (16%), cataracts (15%), diabetes (11%), and thyroid disorder (10%). Among the younger respondents (<60 years) the most prevalent conditions were arthritis (12%), back problems (15%), and migraines (10%). Even though these chronic conditions were the most prevalent, it was the management of heart disease, cancer and bowel disorders that utilized significant physician and hospital resources (this is true for respondents older than and younger than 60 years).

Currently, the leading cause of death in Canada is coronary heart disease. In 2001, 74,824 deaths were attributed to heart disease in Canada (Heart & Stroke Foundation 2004). Thirty-three percent of all male deaths and 35% of all female deaths in 2001 were attributed to heart disease or stroke. Both men and women suffer relatively equally from heart conditions, however, men suffer from heart disease on average 10 years younger than women (55 years versus 65 years) (Heart & Stroke Foundation 2004).

Immigrants to Canada seem to have lower rates of heart disease than native-born Canadians (Sheth et al 1999). Sheth et al (1999) reported that there were 1,093 heart related deaths per 100,000 native-born Canadian males compared to 758 heart related deaths per 100,000 South Asian immigrants and 599 heart related deaths per 100,000

Chinese male immigrants. Similarly, there were 567 heart related deaths per 100,000 native-born Canadian females compared to 494 heart related deaths per 100,000 South Asian immigrant females and 360 heart related deaths per 100,000 Chinese immigrant females. What can explain the variances in the incidence of heart conditions? Can the difference be explained by the differing lifestyle factors of immigrants versus native-born Canadians? Measuring the incidence of coronary heart disease among immigrants provides researchers an opportunity to try and explain for the differences in the incidence of coronary heart disease across countries (Yusuf et al 2004).

1.3 Research Objectives

The purpose of this thesis is to establish the relationship between heart health and immigration using the data from the National Population Health Survey. Specifically, the objectives of this research are three-fold:

- To establish whether immigrants to Canada have lower rates of heart related diseases (coronary heart disease, stroke, high blood pressure) than native-born Canadians.
- To determine the role of lifestyle (smoking, alcohol use, physical activity) and psychosocial factors (social support, stress, depression) on the incidence of heart related conditions for immigrants and relative to the native-born population, if differences in heart health exist.
- To determine if the incidence of heart related diseases among immigrants increases the longer they live in Canada, regardless of age. For instance, does a

55 year old who has lived in Canada for less than 10 years have a lower risk of heart disease than a 55 year old who has lived in Canada more than 10 years?

1.4 Contributions of this Research

The purpose of this research is to contribute to the current breadth of literature regarding immigration and health, in particular, heart health. The methodology and theory behind this research are consistent with other studies investigating immigration and health (Dunn and Dyck 2000; Wong and Wong 2003). However, this study is the first of its kind (as far as the author can tell) to specifically address the heart health of immigrants in comparison to native-born Canadians. Also, this research is one of the few immigration studies to address the risk factors for heart health separately for men and women. Evidence suggests that women and men suffer from heart disease differently and at different ages (Heart & Stroke Foundation 2004), yet gender differences have only recently been fully accounted for in the literature, or it has focused on one gender only. By comparing the heart health of immigrants with native-born Canadians, it is possible to establish the differences in the incidence of heart diseases, as well as, the differences in lifestyle behaviours that impact health between the two populations. Also, the outcomes of this research will hopefully identify at what point after immigration, immigrants increase their risk of heart health problems. It is anticipated that the conclusions that are made from this research will impact policy decisions regarding the health care and health promotion for immigrants, not only when they first arrive in Canada, but throughout their lives in Canada.

1.5 Chapter Outline

The next chapter provides an overview of the literature of immigration and heart health. The chapter also describes other studies which have used the National Population Health Survey (NPHS) in their analyses of immigrants to Canada. The NPHS provides the data for this study; an outline of the NPHS and the questions used for this thesis are described in chapter three. In addition, chapter three also outlines the methodology for this study.

The purpose of chapters four and five is to present the results of this thesis. Chapter four describes the descriptive results and the correlations identified between heart health and immigration. The results of the logistic regression for overall heart health, coronary heart disease and high blood pressure are detailed in chapter five. In addition, the results of the survival analysis are presented in chapter five.

Finally, chapter six reviews the major findings of this research, followed by a discussion of the contributions of this research in terms of its methodology, theory and policy implications. As a final point, there is some discussion regarding possible future research in the area of immigration and heart health stemming from this research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Canada has experienced a large influx of immigrants over the twentieth century. In the early part of the century the majority of the immigrants were from Europe, but by the end of the twentieth century most of the immigrants were from Asian countries (Dench 2004). Recent immigrants are generally healthy when they arrive, a phenomenon called the "healthy immigrant effect". Immigrants, on average, are healthier than the population in their native country and healthier than the general population in the host country, given self-selection, their relatively young age, and health screening before arrival. Eventually, however, immigrant health declines and converges toward that of the general population within the host country. There have been several studies describing the health changes of immigrants the longer they reside in the host country. This chapter will critically review the studies that were identified which described the health of immigrants in the host countries, with a specific emphasis on the studies that investigated heart health.

Several adverse lifestyle factors are associated with the increased risk of coronary heart disease (CHD), including smoking, diabetes, obesity, poor diet and physical inactivity (Health Protection Branch 1998; Yusuf et al 2004). Yusuf et al demonstrated that these risk factors could account for most of the risk of CHD worldwide across all ages and both genders. There is also emerging evidence from Yusuf et al's study and

Elliott's study (1995) that suggests psychosocial variables, such as social support and stress also play also role in the incidence of heart disease. Psychosocial stress is a difficult variable to measure. Elliott and Dean's ecology analysis (1998) attempted to assess the relationship between psychosocial stress and heart disease by correlating stress indicators data (education, marital status, etc.) from the Canada Health Promotion Survey with self-reported stress levels. Then a multivariate analysis was conducted to measure the relationship between stress and heart disease.

Many industrialized countries have implemented heart health programs to provide education regarding heart health (Luepker et al 1996; Holmes et al 2001; Garcia-Palmieri et al 2002; Assaf et al 2002). In Canada, the Canadian Heart Health Initiative (CHHI) (Canadian Heart Health Initiative 2003) links national, provincial and local health departments and combines research with community-based heart health programs. The purpose of CHHI is to address the major risk factors of heart disease that are preventable or controllable. Generally, heart health programs up until this point have addressed the well-known, modifiable risk factors for heart disease, such as smoking, physical inactivity and diet. Elliott and Dean (1998) suggest that programs should also be targeting the emerging psychosocial risk factors (stress) as well.

In 1997, Sellers et al (1997) conducted a meta-analysis to measure the effectiveness of heart health programs, concluding that the effectiveness of heart health programs was variable, with a portion of this heterogeneity partially explained by the evaluation tools used to measure the effectiveness of the program, as well as, by the intervention (to reduce risk factor) itself. It is important to identify the risk factors for

heart disease so that they can be effectively targeted and measured through the heart health programs throughout the world.

As previously mentioned, almost 20% of Canada's population is foreign-born, meaning that it is important that the needs of this group be met when designing heart health programs in Canada. However, in order to effectively design a heart health program that targets immigrants, it is first important to establish the risk factors of heart disease in an immigrant population. A literature review was conducted to identify studies that addressed the risk factors of heart disease among immigrants. However, it is important to first describe a few of the methodological concerns with immigration research in general.

2.2 Methodological Concerns with Immigration Research

The research of immigration and immigrant heart health poses several methodological challenges. One of the greatest obstacles regarding immigration research is attempting to manage the large number of contextual variables. There are several challenges associated with trying to control for this magnitude of variables (Friis et al 1998). A few examples of the contextual variables include language barriers, income, education, skills, and cultural and religious beliefs. It is often difficult to control for variables without discriminating or making assumptions about the immigrant group. For instance, when considering the health of immigrants it is important to recognize that disclosing personal information about oneself, even to a health practitioner, is not as culturally accepted in some cultures as it is in others (Liao et al 2004). For this reason,

when measuring illness in a population, researchers must recognize that not all immigrants will be diagnosed by a health practitioner, despite suffering from the researched illness.

Another important factor to recognize when considering immigration research is that all immigrants do not have the same motivations for immigrating. Some immigrate voluntarily and others immigrate non-voluntarily (e.g. refugees) (Friis et al 1998). Similarly, immigrants have different skills, thus their employability in the host country is quite variable—some migrants are very highly educated, while others have practically no education or skills. Therefore, it is difficult to make common assumptions about all types of immigrants.

A third methodological challenge encountered is the limited data available specifically for immigration alone. Researchers must often use other databases and survey information to derive immigration information; census data or their equivalent are commonly used. This poses a problem because these data sources were not specifically designed for use with an immigrant population, therefore, they may not include or account for the variables that are important to immigration.

Finally, another common concern is the "healthy immigrant effect", making it difficult to define a comparable control group. Using native-born people in the host country as a control group would be a methodological flaw because immigrants and natives have different cultures, backgrounds and genetics, thus they are not comparable groups (Parakulam et al 1992). However, to compare immigrants to citizens from their country of origin would also be a methodological flaw because immigrants tend to be

younger and healthier, therefore, more able to migrate than the general population. Thus, they cannot be compared to the general population in their country of origin because it would produce biased results.

Friis et al (1998) outlined these and other methodological concerns in their study. They also proposed a study design that could control for some of the flaws mentioned above. The ideal study design would involve using three study cohorts (migrants-to-be, non-migrants from origin country and residents of host country) and it would include repeated prospective measures (i.e. longitudinal study). While the study design is good, it is also difficult to implement, with few studies able to achieve the ideal design.

2.3 Immigrants and the Risk Factors for Heart Disease

A literature search was conducted using MEDLINE (1966 through September 2004), EMBASE (1980 through 2004 week 35) and PSYCHLit (1984 through June 2004) databases to identify studies that examined the health of immigrants. Table 2.1 outlines the studies identified in this search.

Twenty-three cohort studies (Marmot and Syme 1976; Alfredsson et al 1982; Carter et al 1984; Silman et al 1985; Nair et al 1990; Parakulam et al 1992; Matuk 1996; Chen et al 1996; Enas et al 1996; Porsch-Oezcueruemez et al 1999; Dunn and Dyck 2000; Anand et al 2000; Dotevall et al 2000; Dallo and James 2000; Frisbie et al 2001; Hoogeveen et al 2001; Diwan and Jonnalagadda 2001; Perez 2002; Kaplan et al 2002; Wong and Wong 2003; Newbold and Danforth 2003; Gadd et al 2003; Mooteri et al 2004) and two reviews (McKeigue et al 1989; Daly et al 2002) were identified that

examined risk factors for heart disease or high blood pressure (hypertension) in relation to immigration. Several risk factors were investigated among the studies including demographic variables, such as age, gender, income, marital status and education; lifestyle factors, such as body mass index (BMI), physical activity, smoking, alcohol consumption, lipid measures (cholesterol); psychosocial factors, such as stress, perceived health, social support; and immigration factors, such as country of birth and length of time in host country.

Marmot et al (1976) were the first group to publish a study on incidence of CHD in an immigrant population. For this reason, their work is often cited in other publications (Carter et al 1984; McKeigue et al 1989; Dunn and Dyck 2000). Marmot et al studied the acculturation of Japanese Americans in California, comparing the incidence of heart disease between men of Japanese descent in California, men of Japanese descent in Hawaii and Japanese men in Japan. They also studied incidence of heart disease between Japanese Americans who had become more 'Westernized' compared to the incidence of heart disease in Japanese Americans who retained more of their Japanese culture. Marmot et al (1976) found that Japanese Americans (especially those in California) had the highest rates of heart disease, and Japanese who still lived in Japan had the lowest rates of heart disease. Marmot et al (1976) tested to see if Japanese Americans who had become mostly 'Westernized' displayed more risk factors for heart disease than their Japanese American counterparts who had retained their culture. They found that when they controlled for typical risk factors for heart disease (cholesterol,

smoking, blood pressure) the 'Westernized' Japanese Americans still had higher rates of heart disease.

Marmot et al (1976) proposed that the higher rate of heart disease among 'Westernized' Japanese Americans may be a result of other non-biological factors of acculturation, hypothesizing that Japanese culture emphasizes group cohesion, group achievement and social stability. 'Westernized' American culture, on the other hand, emphasizes social and geographic mobility and individualized striving ambition. American culture encourages more Type A behaviour [1], which is a proven risk factor for heart disease (Haynes et al 1980). Unfortunately, the authors did not provide evidence to support this hypothesis.

In a continuation of Marmot et al's research, Carter et al (1984) used the data from the Hawaiian cohort of Japanese men from Marmot et al's (1976) original study. Carter et al (1984) separated the Hawaiian cohort into two groups: men with Okinawan ancestry or men with mainland Japan ancestry. The sample of 11,000 Japanese men included first- and second-generation immigrants; however, there is no indication in the study how many men were in each category. In Japan, Okinawan men had lower rates of all causes of death, including CHD than men from mainland Japan. Carter et al (1984) wanted to measure if these differences in heart disease incidence could be seen in Hawaii as well. Interestingly, the Okinawan men were found to be heavier (more overweight), they consumed more caffeine and saturated fat, and were less educated than the mainland Japanese immigrants. In Hawaii, there was not a significant difference in mortality due

[1] Type A behaviour refers to the characteristic of having a personality that is marked by impatience, aggressiveness, and competitiveness. This is in comparison to Type B behaviour which is characterized by having a personality that is marked by a lack of excessive aggressiveness and tension.

to CHD (or any other cause of death) between the two groups of Japanese immigrants. These findings suggest that Okinawan immigrants have integrated or acculturated to another culture and in doing so, have altered their incidence of heart disease.

Alfredsson et al (1982) conducted a case-control study to examine the incidence of heart attacks among Finnish male immigrants to Sweden in relation to their length of stay in Sweden. From a registry of heart attacks in Sweden, 393 heart attacks occurred between 1974 and 1976 in men born between 1911 and 1935. There were 985 age-matched controls selected from the general population. In the heart attack group there were 32 Finnish immigrants and in the general population group there were 55 Finnish immigrants. They found that Finnish men who had lived in Sweden 10 to 19 years had a 2.7 times greater risk of having a heart attack than native-born Swedish men. However, men who had lived in Sweden less than 10 years or more than 20 years only had a 1.3 times greater risk of having a heart attack compared to native-born Swedish men ($p=0.007$). These results were age-standardized, which eliminates the possibility that younger Finnish men were more likely to have lived in Sweden less than 10 years and therefore had a lower incidence of heart attacks due to their age.

The purpose of the Scandinavian cohort study by Dotevall et al (2000) was to determine if the decrease in the incidence in CHD in Sweden could be attributed to the influx of immigrants to Sweden. Dotevall et al recruited 1618 men and women in Sweden to complete a screening procedure for CHD including completing a questionnaire and undergoing physical and laboratory examinations. Then, they collected data regarding heart attacks from a registry of heart attacks in Sweden. A limitation of

the methodology used by Dotevall et al (2000) was that they established immigrant status using the last name of the heart attack patient in the registry. This posed a problem because a person's last name does not necessarily indicate his or her ethnic heritage. Dotevall et al (2000) justified this procedure stating that until the 1950s Sweden was a homogeneous country, and, therefore, any people with non-Swedish names must have immigrated since the 1950s. Another limitation of this study is the lack of immigration data, with the authors neglecting to report the length of time that the immigrants had resided in Sweden, meaning that it was not possible to establish whether or not recent immigrants displayed the same risk factors as their long-term immigrant counterparts. Despite the study's shortcomings, Dotevall et al (2000) concluded that immigrants in Sweden seem to demonstrate more risk factors for CHD than native Swedes. The immigrants had higher rates of smoking, high blood pressure and higher indices of obesity (body mass index, waist-to-hip ratio). These findings contradict Dotevall et al's hypothesis that the declining incidence of heart disease is correlated to the increase in immigration to Sweden.

Another Scandinavian study compared immigrants from various countries to native-born Swedes (Gadd et al 2003). They found that the incidence of heart disease was consistently higher for males than females, and that immigrants (regardless of country of origin) had significantly higher incidences of heart disease than native-born Swedes. They controlled for age, education and employment status and still found the same results.

The Giessen Study surveyed 480 Turkish immigrants living in Germany (Porsch-Oezcueruemez et al 1999). They found that the greatest predictors of heart disease among the Turkish males were stress and hypertension, however, the greatest predictor of heart disease among the Turkish females was obesity.

The purpose of the cross-sectional study by Silman et al (1985) was to determine if the lifestyle habits of Bangledeshi male immigrants to England could explain their 30% higher incidence of CHD than native-born English males. Through a series of questionnaires and interviews Silman et al (1985) compared smoking and dietary habits of the Bangledeshi immigrants to native-born English males. They concluded that Bangledeshi male immigrants were 50% more likely to smoke than native-born English males and that Bangledeshis seemed to have high fat diets. Silman et al (1985) did not report any information regarding length of time that the immigrants lived in England. They reported that they controlled for age and social status, but did not indicate how these measurements of social status were identified and tabulated.

Daly et al (2002) reviewed literature specifically regarding CHD in Chinese-Australians. Despite the limited availability of data, they concluded that Chinese-Australians seek health care differently than native-born Australians. Chinese immigrants have different perceptions of illness and health. Daly et al defined Chinese health-seeking behaviour as a passive behaviour, while the Australian health-seeking behaviour is an active behaviour. Also, Chinese immigrants in Australia display a greater reliance on family members for jobs typically provided by nursing services in Australia than native-born Australians. This is an interesting finding because they were able to

demonstrate that relying on hospital admission records or data from health care services was inadequate in measuring the health of Chinese immigrants in Australia.

The other review identified in the literature search examined the incidence of CHD in South Asian immigrants living in the United Kingdom (McKeigue et al 1989). The purpose of the study was to try to explain why South Asian immigrants have increased rates of CHD even when the known risk factors for CHD (smoking, cholesterol, hypertension) are controlled. While they were unable to explain the increased risk due to a lack of high quality data, they did, however, hypothesize that the increased risk was due to a biologic difference regarding insulin resistance. This is interesting in terms of immigration because it demonstrates that people can only assimilate and integrate to a certain extent—immigrants from South Asia have different genetics, and thus have different health care needs, which policy makers need to take into account.

Diwan and Jannalagadda (2001) conducted a study to try and identify a link between acculturation and risk factors for CHD. They surveyed 226 Asian Indians (over 50 years old) living in the southwestern United States to examine the relationship between social integration and health status. The authors reported that better health was associated with greater perceived social support and relatives nearby.

In another study of acculturation and heart disease, Dallo and James (2000) examined the blood pressure in Chaldean-American women in a cross-sectional study. The study measured the blood pressure of the 130 participants, in addition, to administering a questionnaire regarding acculturation. Women were eligible to

participate if they were between 35 and 45 years of age and of Chaldean descent. Dallo and James took into account length of time in the United States, English language proficiency and other acculturation factors such as involvement in children's school and ethnic identification. Dallo and James (2000) found that the strongest predictors of blood pressure were body mass indices and waist-to-hip ratios. These weight-related factors were inversely correlated with age, education, employment outside the home and involvement in children's school. There were several limitations of this study, including a relatively small sample size and a lack of additional information on risk factors for CHD such as smoking, exercise and diet. From an immigration perspective, the greatest limitation of this study was the difficulty in measuring acculturation. While the weight-related measurements were objective, consistent and reliable measurements, the measures of acculturation were more difficult to measure objectively, which could lead to the misinterpretation of results. However, to take this limitation into account, Dallo and James statistically demonstrated that the scales for the acculturation measures were acceptable using Cronback alpha coefficients (Dallo and James 2000).

Hoogeveen et al (2001) conducted a prospective cohort study in which they examined plasma levels of lipoprotein [a] in Asian Indians in India compared to Asian Indian immigrants in the United States. High levels of plasma lipoprotein [a] are a risk for CHD. Hoogeveen et al tried to replicate the ideal study design outlined by Friis et al (1998) by incorporating three study arms: 57 Asian Indians living in India and diagnosed with CHD; 46 Asian Indians living in India without signs or symptoms of CHD (control group); and 206 Asian Indians living in the United States (but were born in India).

Hoogeveen et al (2001) did not report the length of time that the Asian Indians were in the United States. They detected that the levels of lipoprotein [a] were similar among the Asian Indians in India with CHD and the Asian Indian immigrants to the United States. This finding is interesting because it indicates that there are other variables interacting in the United States increasing the plasma levels that are not present in India, or else the plasma levels of the immigrants would be similar to the control group in India. Hoogeveen et al (2001) propose that this increased risk of CHD among Asian Indians in the United States could be attributed to the Westernized lifestyle of increased consumption of calories and fat, higher stress levels and low levels of physical activity.

The study by Frisbie et al (2001) compared native-born Americans to immigrants from Asia (Japan, China, Philippines, Korea, India, Vietnam). They looked at several demographic variables including marital status, education, income, employment status, age and gender. They reported that the native-born population was significantly more likely to have an activity limitation, to report more days in bed than immigrants, and to report poorer self-reported health than immigrants to the United States.

Another study of Asian Indian immigrants to the United States was reported by Enas et al (1996). They surveyed 1688 Asian Indian immigrants (physicians and their families) regarding several risk factors for heart disease including hypertension, body mass index (BMI), diabetes, smoking and lipid measures. They compared the results to the Framingham Study (a large study of the incidence of heart disease in the U.S.), and determined that Asian Indian immigrant males had three times the risk of heart disease than the general population ($p<0.0001$). This trend was not observed among the females

in the study. When immigrant males without heart disease were compared to the immigrant males with heart disease, they reported that the males with heart disease were significantly more likely to smoke, have a family member with heart disease, and to have diabetes and hypertension. Interestingly, there were no significant differences between the immigrant males in terms of BMI, length of time in the United States or vegetarianism.

A recent study by Mooteri et al (2004) surveyed 527 first generation immigrants from India to the United States (The Konkani Heart Study) to identify their risk for heart disease. They investigated several possible risk factors including age, hypertension, cholesterol, diabetes, smoking and length of time in the United States. They found that the significant predictors of heart disease among this group of immigrants were age, gender, smoking and length of time in the United States.

2.4 Canadian Studies

Ten studies were identified that compared the risk factors for heart disease between immigrants and native-born Canadians. The study by Anand et al (2000) surveyed 985 immigrants from South Asia, China and Europe. Anand et al (2000) detected a significantly higher prevalence of CHD among South Asians (11%) than among Chinese (2%) and Europeans (5%) ($p=0.0004$). Anand et al reported that, not surprisingly, the European immigrants had lived in Canada longer than the South Asians and the Chinese (mean 44.5 years versus 19.5 years and 20.5 years, respectively). The most interesting result identified by Anand et al (2000) was that lifestyle factors,

associated with Westernization (smoking, obesity) were both significantly higher among the European immigrants, however, the incidence of CHD was still highest among the South Asians.

Nair et al (1990) examined the incidence of CHD in immigrants to Canada during two separate time periods (1969 to 1973 and 1984 to 1988), using data from the census and the Canadian Mortality Data Base. They found that the incidence of heart disease was lowest among immigrants from Latin America, China and South Asia and highest among immigrants from Scandinavia and Africa. Overall, there was a decrease in mortality due to heart disease between 1969 and 1984, except in immigrants from Africa, in which case there was an increase in the incidence of CHD. This study by Nair et al (1990) was one of the few to report data regarding immigrants from a variety of origins. This study was able to capture a very large sample size, however, limitations remain. For example, not all of the data in the study is weighted for appropriate comparisons between groups. They did control for age, however, they did not report the length of time that the immigrants had been in Canada.

Matuk et al (1996) surveyed the health status of immigrants to Canada who had immigrated within the three years prior to the administration of the Newcomers' Health Survey. Immigrants of all ages completed the questionnaire (548 respondents completed the survey, 408 were over 12 years old). This study looked at demographic variables (income, education, age, gender, etc.), and self-perceived (self-rated) measures of health and stress (234 respondents answered the questions on the survey regarding perceived measures). Self-perceived health was rated as excellent or good in 90% of the

respondents, although 84% of the newcomers indicated that their lives were very or fairly stressful. Women reported more life stress than men, and stress overall increased with age. When immigrants were asked what made their lives stressful, the most common responses were unemployment, language barriers and securing affordable housing. Only 8% of the respondents owned their homes, in 80% of the families the income was less than $30,000 per annum. Eighteen percent were unemployed and seeking employment.

Parakulam et al (1992) investigated the health status of immigrants compared to native-born Canadians using a healthfulness index based on factors such as presence of chronic illness, use of health care facility and degree of activity limitation (disability). Their study found that immigrants were generally healthier than native-born Canadians. However, when the results were divided according to age group and immigration status it was the men and women who were over 60 years old who immigrated to Canada since 1970 that had the lowest healthfulness scores. Women appeared to be slightly less healthy than men (both native-born and immigrant), however, this may be influenced by the factors used to calculate 'healthfulness'—in particular 'use of a health care facility'.

2.5 Studies Reporting Results from the National Population Health Survey (NPHS)

The study by Wong and Wong (2003) used the 1996/97 NPHS data to investigate the relationship between heart health and immigrant women. They looked at risk factors for CHD including hypertension, obesity, diabetes, physical activity, smoking and the use of hormone replacement therapy. They also looked at immigration factors such as country of origin and length of time in Canada. They found that age, diabetes, income,

physical activity and length of time in Canada were significant predictors of hypertension among immigrant women. A limitation of this study was that it included all immigrant women over 20 years of age, while there is significant research to indicate that males are most likely to develop heart disease in their fifties, and women are most likely to develop heart disease in their sixties (2004a). Thus, it is questionable why this study would include such young women, when they have very little risk of developing heart disease.

Kaplan et al (2002) published a short report of data regarding hypertension among Asian immigrants to Canada using the 1996/97 NPHS. They described the characteristics of 1,971 Asian immigrants who completed the survey. Essentially, the study concluded that the prevalence of hypertension among Asian immigrants increased as Asian immigrants' period of residence in Canada increased. However, it is important to interpret the findings with caution. The factor used to establish hypertension was one question on the survey that asked "Have you been diagnosed with high blood pressure by a health professional?" Hypertension is a disease that often is undiagnosed because the symptoms are often not severe enough to seek medical treatment. This may be especially true among a foreign, non-English (or French) speaking population that may have difficulty seeking health care. As immigrants integrate or assimilate into Canadian culture they may be more likely to see a health professional, and at that time be diagnosed with hypertension. Therefore, it could be that the incidence of hypertension does not increase as the time that the immigrant resides in Canada increases, it could be that as the time that the immigrant resides in Canada increases, the immigrant is more likely to see a health professional. Another limitation of Kaplan et al's study is that the

incidence of hypertension is not compared with the general population. Perhaps this trend is consistent among Canadians, in which case it is not an immigration issue, but rather a population health issue.

The study by Dunn and Dyck (2000) examined the social determinants of health among immigrants to Canada using the 1994/95 NPHS, investigating variables such as country of origin (European versus Non-European), length of time in Canada (0-9 years, 10 or more years), and demographic variables (age, gender, marital status, education, income, etc.). When immigrants were compared to native-born Canadians in terms of chronic illness, there was not a significant difference in the rate of chronic illness. However, when the immigrants from Europe, United States and Australia (European) were compared to the immigrants from Asia, Africa and South America (Non-European), there were significantly more chronic conditions reported among the immigrants from Europe than the immigrants form the Non-European countries ($p<0.001$). Also, the immigrants who had lived in Canada less than ten years were significantly less likely to report chronic conditions than immigrants who had lived in Canada ten or more years ($p<0.001$).

The study by Chen et al (1996) used the NPHS survey from 1994/95 to generate a comparison between the health status of immigrants and native-born Canadians in Canada. They reported a slightly higher incidence of heart disease among native-born Canadians than immigrants (5.0% versus 4.6%). When they divided the immigrants into categories according to country of origin, they found that 5.2% of the immigrants from Europe and 3.3% of the immigrants from Non-European countries had heart disease.

The study by Newbold and Danforth (2003) used the 1998/99 NPHS data to examine the overall health of immigrants in Canada. This study looked at self-assessed health scores and compared them to health status. Immigrants reported through the self-assessed health measure that they had poorer health than native-born Canadians; a trend that was also apparent among the health status of immigrants and native-born Canadians. They also found that as length of time in Canada increases, health decreases among immigrants to Canada. When Newbold and Danforth looked specifically at heart disease and high blood pressure they found that overall immigrants reported less incidences of heart disease than native-born Canadians (3.8% versus 4.3%), however, immigrants who had lived in Canada more than 10 years reported slightly more incidences of heart disease than native-born Canadians (4.6% versus 4.3%). Immigrants reported more incidences of high blood pressure than native-born Canadians (13.0% versus 10.4%), and the rate was even higher for immigrants who had lived in Canada more than 10 years (16.0%).

The study by Perez (2002) used the Canadian Community Health Survey (CCHS) from 2000/01 to measure the health of immigrants in Canada. The CCHS is similar to the NPHS in terms of the health variables measured. The sample includes 131,535 respondents over 12 years old in Canada. They reported that when the results were adjusted for age, education, and income, immigrant males who had lived in Canada for less than 20 years were significantly less likely to develop heart disease than native-born Canadian males ($p<0.05$). However, immigrant males who had resided in Canada for more than 20 years had comparable incidence of heart disease. This trend was not observed among immigrant females. Interestingly, when lifestyle factors (obesity,

smoking, alcohol consumption) were controlled for in addition to age, education, and income, the trends in heart disease still remained the same between the immigrants and the native-born Canadians. Perez et al argue that there is little evidence to support that the declining health of immigrants is due to the adoption of poor health behaviours.

Table 2.1. Description of studies included in the literature review.

Study	Origin	Host	Number of Participants	Risk Factors Studied
Mooteri, 2004	India	USA	527 immigrants	Age, gender, smoking, obesity, hypertension, diabetes, length of time, alcohol, physical activity
Gadd, 2003	Various	Sweden	3.5 million (550,000 immigrants)	Gender, country of origin
Newbold, 2003	Various	Canada	2058 immigrants	Age, gender, country of origin, income, education, race, marital status, smoking, alcohol, physical activity, length of time in Canada, self-assessed health
Wong, 2003	Various	Canada	6024 immigrant women	Age, country of birth, marital status, length of time in Canada, income, language spoken, diabetes, hypertension, obesity, physical activity, smoking
Kaplan, 2002	Asia	Canada	1972 immigrants	Gender, age, education, length of time in Canada, smoking, alcohol, physical activity, self-assessed health, BMI, chronic conditions, psychological distress
Perez, 2002	Various	Canada	131,535 respondents	Age, gender, length of time in Canada, smoking, obesity, alcohol, physical activity, dietary habits, country of origin, diabetes
Diwan, 2001	Asia/ India	USA	226 immigrants	Age, gender, social support, diabetes, hypertension, BMI, length of time
Frisbie, 2001	Asia, Pacific Islands	USA	Approx. 217,000 respondents	Age, gender, marital status, number in household, education, income, occupation, access to health care
Hoogeveen 2001	Asia/ India	USA	309 immigrants	Gender, smoking, hypertension, diabetes, obesity, family history of CHD, age
Anand, 2000	South Asia, Europe, China	Canada	985 immigrants	Smoking, hypertension, diabetes, lipid measures, degree of atherosclerosis, BMI
Dallo, 2000	Iraq	USA	130 Chaldean women	Age, education, employed outside home, marital status, BMI, BP, language spoken, length of time

Table 2.1 continued. Description of studies included in the literature review.

Study	Origin	Host	Number of Participants	Risk Factors Studied
Dotevall, 2000	Various	Sweden	1618 participants	Smoking, psychological stress, physical activity, BMI, lipid measures
Dunn, 2000	Various	Canada	17626 respondents	Age, gender, marital status, income, education, occupation, number in household, alcohol, smoking, social support
Giessen Study, 1999	Turkey	Germany	480 Turkish immigrants	Age, gender, length of time in Germany, BMI, hypertension, stress, family history of CHD, physical activity, lipid measures
Chen, 1996	Various	Canada	6379 immigrants	Age, gender, length of time in Canada, income, education
Enas, 1996	Asia/ India	USA	1688 Asian Indian immigrants	Age, gender, hypertension, BMI, diabetes, smoking, lipid measures
Matuk, 1996	Various	Canada	548 newcomers	Self-rated health, self-perceived stress, social support, education, occupation, income
Parakulam, 1992	Various	Canada	13295 respondents	Age, region of residence in Canada, gender
Nair, 1990	Various	Canada	Canadian census (>8 million)	Age, gender, smoking, BP
Silman, 1985	Banglad esh	UK	327 males	Dietary fat intake, smoking
Carter, 1984	Japan	USA (Hawaii)	8006 men of Japanese descent [a]	BMI, number of years lived in Japan, number of children, physical activity, lipid measures, alcohol, caffeine
Alfredsson, 1982	Finland	Sweden	356 male cases 887 male controls	Length of stay in Sweden
Marmot, 1976	Japan	USA	Approx. 10,000 men [a]	Blood pressure, weight, acculturation, diet, smoking

Note: BMI, body mass index; BP, blood pressure; CHD, coronary heart disease; HBP, high blood pressure; NPHS, National Population Health Survey; NR, not reported; UK, United Kingdom; USA, United States of America

[a] Not all men included in the study were first generation immigrants from Japan.

2.6 Summary and Critique of Literature

The identified studies focused on various risk factors for heart disease from an immigration perspective. The countries that have published the most studies on heart disease and immigration are Canada, Sweden and the United States. The majority of the studies identified regarding heart health and immigration to the United States involved immigrants from India. The Swedish studies focused primarily on immigrants from other European countries, predominantly Finland.

Even though the studies all included immigrants, they did not necessarily include specific immigration risk factors, such as country of origin and length of time in the host country. Recently, two studies have indicated that length of time in the host country is a significant predictor of heart disease (Newbold and Danforth 2003; Mooteri et al 2004). Country of origin is an important variable to establish, since immigrants from different origins appear to face varying challenges. For instance, culture, religion and/or language may or may not be a barrier, depending on the country of origin. Immigrants who arrived in Canada in the early twentieth century are older and more likely to reflect predominately European sources. With changes to Canadian immigration policy in 1962, major source countries shifted, such that by 1998, Asia represented the largest origin region (48%). Europe was the second largest origin (22%), and Africa and the Middle East combined the third-largest origin (18%) (Dench 2004) (Statistics Canada 1997). Immigration policy has also shifted over recent years, with the Federal government placing increased emphasis on economic immigrants. Controlling for period of arrival also highlights the "healthy immigrant effect", with cohort effects serving to proxy

exposure to economic, social and fiscal conditions, greater awareness of health care opportunities, and increasing need for care with increasing age.

Stress is a proven risk factor for heart disease (Barnes et al 1997). A systematic review of the relationship between stress and heart disease investigated the following components of stress: depression, social isolation (lack of social support), adverse life events, psychosocial work characteristics and Type A behaviour (Bunker et al 2003). The review concluded that depression and social isolation were risk factors for heart disease independent of conventional risk factors, such as smoking and hypertension (Bunker et al 2003). Psychosocial work characteristics and Type A behaviour were not associated with increased risk of heart disease. There are several reasons why an immigrant would feel more stress than the average native-born Canadian: immigrants are faced with the stress of assimilation, homesickness, social acceptance and language barriers (Matuk 1996).

Another limitation of some of the studies was that they reported results for males and females together. It is becoming apparent that CHD affects women differently than it does men. For instance, women have different signs and symptoms of CHD and they tend to develop the disease later in life (7-10 years later than men) (2004b). The Giessen Study reported their results separately for males and females and found that predictors of heart disease among the Turkish males were stress and hypertension, however, the greatest predictor of heart disease among the Turkish females was obesity (Porsch-Oezcueruemez et al 1999).

In 1970, Keys published a study that tracked heart disease across seven countries (Keys 1970). The study by Keys was the first of its kind to study populations and explore variances in diet, risk and disease. Keys' hypothesis was that countries with high levels of CHD also engage in more adverse lifestyle factors. If Keys' hypothesis is true then as immigrants assimilate or integrate into their new environment in the host country they will adopt the lifestyle factors of the country, and therefore, also converge to the have the same risk of CHD as the host country. This hypothesis is supported by early immigrant heart health studies such as Marmot et al.'s. However, in 2004, Yusuf et al demonstrated that nine risk factors could account for most of the risk of CHD worldwide across all ages and both genders. The recent study by Perez (2002) also disagrees with Keys' hypothesis, stating that immigrant health does decline over time in the host country, however, it is not due to adopting the adverse lifestyle habits of the host country. Perez suggested that the decline of immigrant health overtime may be partially explained by the fact that the healthiest immigrants emigrate from Canada (Kilewer and Jones 1997), leaving behind the cohort of less healthy immigrants.

In summary, there are a number issues that need to be clarified in the current literature. First, it is important to establish a relationship between heart health and immigration. Second, males and females need to be studied separately because they seem to have different risk factors for the same disease. Third, specific lifestyle factors, such as physical activity, smoking status and alcohol use, need to be examined to see if they are predictors of heart health. Fourth, if lifestyle factors are not predictors of heart health, then can psychosocial factors (social support, stress, depression) explain for the

difference in the incidence of heart disease and high blood pressure between immigrants and native-born Canadians? Finally, what role does arrival period or duration of residence play? That is, does the health status of immigrants change (i.e. decline) the longer they live in Canada?

CHAPTER THREE

DATA AND METHODS

3.1 Introduction

This chapter describes the methodology used to address the research objectives for this study. The first research objective was to establish whether immigrants to Canada have lower rates of heart related diseases (coronary heart disease, stroke, high blood pressure) than native-born Canadians. Coronary heart disease (CHD) was chosen as the chronic condition to compare immigrants to native-born Canadians because of its prevalence within Canada, and because it is a disease that affects both men and women. Next, if the difference in heart related conditions exists between immigrants and native-born Canadians, then it is important to determine why the difference exists. Can lifestyle factors such as smoking, alcohol use and physical activity explain differences in the incidence of heart related conditions between immigrants and native-born Canadians? Finally, if lifestyle factors are not predictors of heart health, then can psychosocial factors (social support, stress, depression) explain the differences in the incidence of heart disease and high blood pressure between immigrants and native-born Canadians?

3.2 Overview of National Population Health Survey

Data utilized in this analysis were drawn from the National Population Health Survey (NPHS), and utilized in both the cross-sectional and longitudinal components. Residents in all provinces in Canada are surveyed for the NPHS, except those living on

Aboriginal reserves, Canadian Forces Bases, and those in some remote locations. The first cycle of the survey was run in 1994/95, with subsequent cycles in 1996/97, 1998/99 and 2000/01. The results of the first three cycles of the survey generated both 'public' and 'private' data. Public data is data that is readily available to the public because it is impossible from this data set to identify individual respondents. Answers in the public data set are typically grouped into more restrictive categories to prevent identification of individuals (i.e. age is reported in groupings: 40-44 years, 45-49 years, etc.). The private data set on the other hand, includes longitudinal identifiers and individual variables include greater detail. As such, there are greater confidentiality issues associated with the data, and its use is restricted. Following the 1998/99 cycle, the decision was made to drop the public component and focus the NPHS upon the gathering of longitudinal data only.

In addition to public and private data, there were also 'general' and 'health' components conducted in each of the survey years. The general component included questions regarding mostly demographic variables, while the health component included many more questions regarding the health of the respondents, including self-assessed health status, use of health care facilities, perceptions of health, chronic conditions and lifestyle factors, such as physical activity, smoking status, and alcohol use. Since the purpose of this paper is to examine the heart health of immigrants, the health component was used. In addition, the health component also includes data on sociodemographic, socioeconomic variables.

The cross-sectional, publicly available, data from the second cycle of the NPHS (1996/97) was used for the first part of the analysis, because this cycle included the most respondents. The 1994/95 and 1998/99 cycles included less than 20,000 respondents over 40 years, while the 1996/97 cycle included almost 80,000 respondents over 40 years. The results of the 1996/97 NPHS public data file form the bulk of the results of this thesis.

In addition, the longitudinal components of the 1994/95, 1996/97, 1998/99 and 2000/01 NPHS were analyzed, utilizing the full longitudinal nature of the data and allowing the heart health of individuals to be followed over the 1994/95 – 2000/01 period. Following the first (1994/95) cycle, 17,276 individuals (immigrants and native-born) were eligible for re-interview in subsequent cycles.

3.3 Variables Analyzed

Several variables were used in the analysis, with covariates hypothesized to be associated with heart health grouped into five broad categories: sociodemographic, socioeconomic, heart health, immigration status, and lifestyle/psychosocial factors (Table 3.1).

The sociodemographic variables included age, gender, marital status, and region of residence. The sample was analyzed for all respondents and all immigrants alone, however, it was also analyzed for males and females separately because of the potential for varying predictors of heart health between genders. The 1996/97 NPHS sample was modified to include only respondents over the age of 40 years because the risk of heart

conditions increases with age, and respondents under the age of 40 are much less likely to suffer from heart conditions than respondents over 40 years. Age was analyzed as a continuous variable.

The socioeconomic variables analyzed include education and household income. Education was divided into three categories: less than high school education, high school education; or post-secondary education (including completion of partial degrees and diplomas). Measuring annual household income and accounting for household size, income adequacy was divided into three categories: high income, mid income and low income. Respondents in the high income category earned more than $50,000 per annum; respondents in the mid income category earned between $30,000 and $49,999 per annum; and respondents in the low income category earned less than $30,000 per annum.

Heart health variables included heart disease, high blood pressure, and 'any' heart condition, with the latter capturing individuals reporting either heart disease, high blood pressure, or stroke[2]. The three variables were combined to increase the number of "events" improving the reliability of the statistical analysis. In other words, with more events it is more likely to identify a consistent pattern of factors among respondents with a heart condition.

The immigration variables included length of time in Canada, country of origin and immigrant status. Length of time in Canada was broken down into three categories: immigrants who had lived in Canada less than four years, immigrants who had lived in Canada for five to nine years and immigrants who had lived in Canada for 10 or more

[2] The variable regarding stroke was not analyzed separately because there were too few incidences of stroke among the respondents to generate accurate results. That is, there were too few incidences of stroke to identify consistent patterns among the respondents who had suffered from the effects of a stroke.

years. The variable for country of origin had two categories: immigrants from Europe, the United States of America or Australia or immigrants from Asia or other any other country. A variable for immigrant status was derived from other variables (country of origin and length of time in Canada). Respondents were categorized as immigrants or native-born Canadians based on their responses to the other questions.

Finally, lifestyle and psychosocial variables included physical activity, alcohol use, smoking status, social support, body mass index (BMI), diabetes, chronic stress and depression. The physical activity variable was a derived variable from a variable for energy expenditure, and derived from a series of questions regarding types of physical activity and the number of times the respondent participated in the activity within the last three months. Activities ranged from gardening to walking to dancing to cycling.

Smoking status was derived from the variable for number of years smoked. Respondents who indicated that the question was not applicable or responded that they did not smoke were categorized as never smokers. The remaining respondents were divided into two additional categories, distinguishing between those who smoked for more than (or less than) 25 years.

The variable for social support had two categories: high social support and low social support. These categories were based on the respondents' social support index. Respondents who scored between zero and two for social support were placed in the low social support category and respondents who scored three or four for social support were placed in the high social support category. The social support index was based on a

series of questions regarding the closeness of relationships between friends and family members.

Respondents were divided into two categories for BMI, using a BMI of 27 as the cut point. A BMI of 18 to 25 is considered normal, BMI values between 26 and 30 are considered overweight, and BMI values over 30 are considered obese. Respondents with BMI values between 25 and 27 are considered overweight, but the adverse conditions associated with weight are more likely to occur in respondents with a BMI 27 or over (Douketis et al 1999). Thus, for the purposes of the analyses reported in this thesis, respondents were divided into two categories: BMI less than 27 or BMI more than or equal to 27. BMI was only reported for those aged 65 years or less. Consequently, separate analyses were conducted for populations aged 40-65, and all respondents over 40 years.

Table 3.1. Description of covariates included in the analysis of heart health

Variable	Variable Categories
Sociodemographic variables	
Gender	Male or Female
Marital status	Married (common-law) or Single (widow,divorced)
Region of residence	Atlantic provinces, Quebec, Ontario, Prairies or B.C.
Socioeconomic variables	
Education	Less than high school, High school graduate, or Post-secondary education
Household income	Low, Mid or High income
Heart health variables	
Has heart disease diagnosed by a practitioner?	Yes or No
Has high blood pressure diagnosed by a practitioner?	Yes or No
Has a heart condition	Yes or No
Immigration variables	
Length of time in Canada	0-4 years, 5-9 years, or more than 10 years
Country of origin	European (Europe/USA/Australia) or Non-European (Asia/other)
Immigration status	Immigrant or Canadian-born
Lifestyle and Psychosocial variables	
Physical activity	Active, Moderately active, Inactive
Alcohol consumption	Consumes alcohol or Abstains from alcohol
Smoking status	Never smoker, Smoked less than 25 years or Smoked more than 25 years
Social support	High or Low social support
Body Mass Index (BMI)	BMI <27 or BMI >27
Has diabetes diagnosed by a practitioner?	Yes or No
Chronic stress	Less stress than usual, Same stress as usual or More stress than usual
Depression	Likely not depressed or Likely depressed

3.4 Methodology

Individual respondents included in this study were defined as those aged 40 and over in 1996/97, and analyzed using SPSS (version 11.5), using both descriptive and multivariate techniques. Frequencies were run for all variables included in the analysis for all respondents, immigrants alone, and by gender. Crosstabulations were run comparing immigrants to native-born Canadians in terms of heart health. Also, crosstabulations were run for immigrants alone regarding length of time in Canada and country of origin. Crosstabulations were run for any heart condition, heart disease alone and high blood pressure alone, for males and females separately. The crosstabulations for stroke were not run alone because there was such a small incidence of stroke among the respondents that it was not possible to generate accurate results. Pearson Chi-square tests were calculated for the crosstabulations with a two-sided significance level of 0.05.

Following the analysis of the crosstabulated results, logistic regression was utilized to examine the concurrent influence of a series of variables on heart health. Given the binomial nature of the dependent variable (has heart disease (or high blood pressure) or does not), correlates of heart health are evaluated using a binomial logistic model, defined as:

$$P_i = 1/(1+e^{\alpha+\beta X_i})$$

where X is a vector of explanatory variables. For the estimation of the model based upon the 1996/97 survey, forward stepwise regression was used to construct models with statistically significant relationships. A forward stepwise regression model was used, with the significance level set at 0.05 for both entry and retention. The benefit of using

the stepwise model was that only variables that were significant were entered and/or remained in the model. It was ideal for this analysis, especially considering the psychosocial variables, because there is limited evidence to support the hypothesis that immigrants are more likely to suffer from a heart condition due to a psychosocial factor, like stress or depression. The analysis was run for heart disease, high blood pressure, and any heart condition in a pooled model (native-born and immigrants), as well as, in a model the included immigrants only. Again, the analysis was not run for stroke alone because there were not enough incidences of stroke to generate accurate results. All of the variables are categorical, with the categorical representations based upon a priori assumptions or the nature of the data. The exception is age, which was analyzed as a continuous variable. Since BMI was calculated only for those respondents less than 65 years old, additional regressions were run, with one including BMI but restricting the age to 40 – 64 years, and the other without BMI, but using all respondents aged 40 years or older.

In addition to the regression analysis, a survival analysis was also run (using SAS), utilizing the full longitudinal nature of the NPHS. Survival analysis is concerned with studying the time between entry to a study and a subsequent event. Originally the analysis was concerned with time from treatment until death, hence the name, but survival analysis is applicable to many areas as well as mortality, including the onset of heart conditions, with the model defined as;

$$\log h_i(t) = \alpha(t) + \beta_1 x_{i1} + \ldots + \beta_k x_{ik}$$

where $\alpha(t) = \log \lambda_0(t)$ (the baseline hazard function), and x represent the set of k covariates, selected using forward stepwise regression. The survival analysis included all respondents who were 40 years or over in 1994/95, with the population allowed to 'age' forward with each subsequent survey. The 1994/95 survey was used as baseline data, and all respondents who reported that they did not have a heart condition were included in the survival analysis to see if they developed a heart condition over the subsequent three cycles. The same variables were included in the survival analysis as were included in the regression analysis. There are, however, some differences between the variables included in the regression and survival analyses, because the regression analysis was generated with cross-sectional data and the survival analysis was generated with longitudinal data. Table 3.2 highlights the similarities and differences between the data. Generally, the demographic, lifestyle and heart health variables are similar in both data sets. However, the immigration variables represent the most substantial differences between the two, since the longitudinal component provides more categories for the country of origin variable than the cross-sectional component.

Table 3.2. Comparison of cross-sectional versus longitudinal NPHS variables

Variable	Cross-sectional Categories		LongitudinalCategories	
Gender	Male/Female		Male/Female	
Age	40-44 yrs	65-69 yrs	40-44 yrs	65-69 yrs
	45-49 yrs	70-74 yrs	45-49 yrs	70-74 yrs
	50-54 yrs	75-79 yrs	50-54 yrs	75-79 yrs
	55-59 yrs	≥80 yrs	55-59 yrs	≥80 yrs
	60-64 yrs		60-64 yrs	
Marital status	Married, common-law, partner		Now married	
	Single		Common-law	
	Widowed, separated, divorced		Living with partner	
			Single (never married)	
			Widowed	
			Separated	
			Divorced	
Highest level of education	No schooling		No schooling	
	Sec. school graduation		Sec. school graduation	
	Dipl./Cert. College, Trade		Dipl./Cert. College, Trade	
	Some university		Some university	
	Bachelor degree		Bachelor degree	
	Master, PhD, MD		Master, PhD, MD	
Income adequacy	Lowest income quintile		Lowest income quintile	
	Lower middle income quintile		Lower middle income quintile	
	Middle income quintile		Middle income quintile	
	Upper middle income quintile		Upper middle income quintile	
	Highest income quintile		Highest income quintile	
High blood pressure	Yes/No		Yes/No	
Heart disease	Yes/No		Yes/No	
Length of time in Canada	0-4 years/ 5-9 years/ 10 or more years		0-92 years	
Arrival cohort	N/A		Before 1970/ 1970-1979/ 1980-1989/ 1990-1994	
Country of birth	Canada		Canada	
	U.S., Europe,Australia		Other North America	
	Asia		South, Central America and Caribbean	
	Other		Europe	
			Africa	
			Asia	
			Oceania	

Table 3.2 continued. Comparison of cross-sectional versus longitudinal NPHS variables

Variable	Cross-sectional Categories	LongitudinalCategories
Immigrant status	Yes/No	Yes/No
Race	White	White
	Other	Black
		Korean
		Filipino
		Japanese
		Chinese
		Aboriginal Peoples of North America
		South Asian
		South East Asian
		West East Asian and North African
Physical activity index	Active/Moderate/Inactive	Active/Moderate/Inactive
Type of drinker	Regular drinker	Regular drinker
	Occasional drinker	Occasional drinker
	Former drinker	Former drinker
	Abstainer	Abstainer
Number of years smoked	0-79	0-79
Body Mass Index	14.1-94.0	14.1-94.0
Diabetes	Yes/No	Yes/No
Social support index	0-4	0-4
Chronic stress	A lot more than usual	A lot more than usual
	Somewhat more than usual	Somewhat more than usual
	A little more than usual	A little more than usual
	About the same as usual	About the same as usual
	A little less than usual	A little less than usual
	Somewhat less than usual	Somewhat less than usual
	A lot less than usual	A lot less than usual
	Never had any	Never had any
Depression scale	0-8	0-8

CHAPTER FOUR

A DESCRIPTIVE ANALYSIS OF HEART HEALTH

4.1 Introduction

The purpose of this chapter is the present the results of the descriptive analyses. The analyses describe the characteristics, demographics, lifestyle, and psychosocial risk factors of immigrants and native-born Canadians. In addition, crosstabulations are presented which compare the lifestyle and psychosocial risk factors of immigrants to native-born Canadians. Crosstabulations are also presented describing the changes in the heart health, lifestyle habits of immigrants based upon their duration of residence in Canada. The descriptive analyses provide a basis for understanding the data, which will be useful when interpreting the results of the regression and survival analyses, which are presented in the next chapter.

4.2 What are the characteristics/demographics of immigrants in Canada?

Several variables regarding demographics and the characteristics of respondents of the 1996/97 NPHS are available. The variables included in the analysis are listed in Table 4.1. There were 5,446 (20.3%) immigrants included in the sample of respondents. This ratio of immigrants to native-born Canadians is consistent with the literature (Heart & Stroke Foundation 2004).

4.2.1 Demographic variables

There were almost as many female immigrants as there were male immigrants (49.4% versus 50.6%, respectively), and there were more native-born females than native-born males (52.0% versus 48.0%, respectively). The largest age category was 40 to 49 years. The number of respondents per age category decreased as age increased. The mode age for the whole sample was 50 to 54 years compared to 55 to 59 years for the immigrants [3].

Slightly more immigrants reported being married or in common-law relationships than the native-born Canadians (76.1% versus 71.4%). More immigrant males reported being married than females (83.4% versus 68.8%). It is important to note that this study includes all respondents over 40 years, since women tend to live longer than men, there is a high probability that more women than men are widows.

More immigrants reported having post-secondary education than the native-born Canadians (57.5% versus 52.6%). Immigrant males were the most educated of the sample, with 59.5% having post-secondary education, and only 23.3% with less than high school education. Despite being more educated, more immigrants were in the low income category than native-born Canadians. More immigrant females were in the low income category than any other cohort of respondents (20%).

[3] The mode age was calculated rather than median or mean age because in the public data set of the 1996/97 NPHS individual respondents' ages are not provided, thus it is not possible to generate the median or mean age for the sample.

4.2.2 Heart health variables

The incidence of heart disease ranged from 5.9% to 7.6% for subgroups of respondents. Overall, immigrants reported fewer incidences of heart disease than the native-born Canadians (6.0% versus 7.0%), even though the immigrant sample was slightly older than the native-born Canadians. Immigrant males reported a slightly higher incidence of heart disease than females (6.2% versus 5.9% for immigrants). The incidence of high blood pressure ranged from 16.2% to 22.5%. Unlike the incidence of heart disease, high blood pressure was more frequently reported among immigrants than native-born Canadians, and it was also more frequently reported among females than males. Immigrant females reported the highest incidence of high blood pressure (22.5%).

4.2.3 Immigration variables

Approximately 89% of the immigrants who participated in the survey had been in Canada for at least 10 years. Four percent of the immigrants had lived in Canada for less than four years, and 6% had lived in Canada five to nine years. There were slightly more immigrant males who had lived in Canada for less than four years than immigrant females (4.6% versus 3.5%). The majority of immigrants in Canada are from Europe, the United States of America or Australia (69%). Slightly more female immigrants are from these regions than the immigrant males (70.0% versus 67.3%).

4.2.4 Lifestyle and psychosocial variables

The respondents' degree of physical activity was separated into three categories: active, moderately active and inactive. Immigrant males were more active than immigrant females (21.3% versus 13.8%). Approximately 26% of the immigrant females and 34% of immigrant males had BMI values over 27. Immigrants had lower BMI values than the native-born Canadians (70% of immigrants <27 BMI versus 63% native-born Canadians <27 BMI).

Almost 40% of immigrant females reported abstaining from drinking alcohol, and immigrant females were also the least likely to have ever smoked among this sample, with almost 70% of female immigrants reporting that they had never smoked. Immigrants were generally less likely to have smoked than native-born Canadians. Overall, 36% of native-born Canadians reported smoking for 25 years or more compared to only 23% of immigrants.

In terms of psychosocial variables, more immigrant females reported having slightly higher social support (93.0%) than immigrant males (89.4%). However, immigrant females reported more stress and depression than immigrant males (5.1% versus 2.1%, respectively).

These results provide some description of the sample of immigrants and native-born Canadians. In the next section, the results of crosstabulations comparing lifestyle behaviours of immigrants and native-born Canadians are reported. Then, in the following chapter, the results of the regression analyses are presented to identify which risk factors are significant predictors of heart health.

Table 4.1. Demographics for the NPHS 1996/97 (weighted %).

Variable		NB	NB male	NB female	Imm	Imm male	Imm Female
Gender	Male	48.0	N/A	N/A	50.6	N/A	N/A
	Female	52.0	N/A	N/A	49.4	N/A	N/A
Age	40-49	39.0	42.3	36.0	35.9	34.5	37.3
	50-59	26.1	26.2	26.2	16.2	17.4	24.9
	60-69	18.0	17.0	18.8	19.7	20.8	18.6
	70-79	12.7	10.8	14.4	13.5	13.4	13.5
	≥80	4.2	3.7	4.6	4.8	3.9	5.7
Marital status	Married	71.4	78.5	64.8	76.1	83.4	68.8
	Single	28.6	21.5	35.2	23.9	16.6	31.2
Education	Less than H.S.	31.8	31.5	32.1	24.6	23.3	25.9
	H.S. graduate	15.6	14.4	16.7	17.9	17.2	18.6
	Post-secondary	52.6	54.1	51.1	57.5	59.5	55.5
Household income	Low income	15.1	11.7	18.3	15.9	12.3	19.6
	Mid income	29.9	28.3	31.5	29.9	30.0	29.8
	High income	54.9	60.1	50.2	54.2	57.7	50.6
Region of residence	Atlantic	11.8	11.7	11.8	2.3	2.1	2.4
	Quebec	32.5	32.0	33.0	15.4	16.8	14.0
	Ontario	26.5	26.4	26.5	48.1	47.2	49.1
	Prairies	15.3	15.5	15.1	11.9	11.8	12.0
	B.C.	13.9	14.4	13.5	22.3	22.1	22.4
Has CHD	Yes	7.0	7.6	6.5	6.0	6.2	5.9
	No	93.0	92.4	93.5	94.0	93.8	94.1
Has HBP	Yes	18.2	15.6	20.7	20.5	18.5	22.5
	No	81.8	84.4	79.3	79.5	81.5	77.5
Has heart condition	Yes	22.6	21.0	24.1	24.4	23.3	25.6
	No	77.4	79.0	75.9	75.6	76.7	74.4
Years in Canada	0-4 years	N/A	N/A	N/A	4.1	4.6	3.5
	5-9 years	N/A	N/A	N/A	6.4	5.8	7.0
	≥10 years	N/A	N/A	N/A	89.5	89.6	89.5
	Canadian-born	100	100	100	N/A	N/A	N/A

Table 4.1 continued. Demographics for the NPHS 1996/97 (weighted %).

Variable		NB	NB male	NB female	Imm	Imm male	Imm Female
Country of origin	Europe	N/A	N/A	N/A	68.6	67.3	70.0
	Asia/ Other	N/A	N/A	N/A	31.4	32.7	30.0
	Canada	100	100	100	N/A	N/A	N/A
Physical activity	Active	16.3	18.5	14.2	17.6	21.3	13.8
	Mod. Active	23.0	23.3	22.7	20.3	20.3	20.3
	Inactive	60.7	58.2	63.0	62.1	58.4	65.9
Alcohol	Drinks alcohol	77.3	82.7	72.3	69.2	77.0	38.8
	Abstainer	22.7	17.3	27.7	30.8	23.0	61.2
Smoking	Never smoked	41.2	30.0	51.5	56.8	44.1	69.9
	Smoke <25 yrs	23.0	26.5	19.7	20.4	26.9	13.7
	Smoke ≥25 yrs	35.8	43.5	28.8	22.8	29.0	16.4
Social support	High	93.3	91.8	94.8	91.2	89.4	93.0
	Low	6.7	8.2	5.2	8.8	10.6	7.0
BMI[a]	BMI <27	62.5	56.8	68.3	69.7	65.6	74.0
	BMI ≥27	37.5	43.2	31.7	30.3	34.4	26.0
Has diabetes	No	99.9	99.9	99.9	100	100	100
	Yes	0.1	0.1	0.1	0	0	0
Chronic stress	Less stress	44.0	47.3	41.0	46.6	52.6	40.3
	Same stress	45.8	44.8	46.8	44.2	40.9	47.7
	More stress	10.2	8.0	12.2	9.2	6.5	12.0
Depression	Not depressed	94.7	95.6	93.8	96.1	97.3	94.9
	Depressed	5.3	4.4	6.2	3.9	2.7	5.1
Weighted N		21403	10280	11123	5446	2756	2690
Unweighted N		21897	10512	11385	4952	2324	2628

Note: BMI, body mass index; H.S., high school; Imm, immigrant; Mod., moderately; N/A, not applicable; NB, native-born

[a] Only respondents between 40 years and 65 years were included in the analysis for BMI. The NPHS did not calculate BMI values for respondents over 65 years.

4.3 Comparison of demographics and lifestyle behaviours of immigrants and native-born Canadians.

Crosstabulations were run comparing the demographics and lifestyle behaviours of immigrants and native-born Canadians (Table 4.2). The results indicate that there were several significant differences between immigrants and native-born Canadians in terms of demographics and their lifestyle behaviours. One of the most notable differences between the two populations was the region of residence of the respondents. Native-born Canadians were widely distributed throughout the country, whereas the immigrants lived predominantly in Ontario, with approximately 48% of immigrant respondents living in Ontario, compared with 26.5% of the native-born Canadians. Other notable differences between immigrants and native-born Canadians are alcohol consumption and smoking status. Native-born Canadians were more likely to smoke and consume alcohol (58.8% and 77.3%, respectively) than immigrants (43.2% and 69.2%, respectively). Almost 70% of immigrant females reported having never smoked, compared to 51.5% native-born Canadian females.

Table 4.2. Crosstabulations of demographics and lifestyle variables according to immigration status.

Variable		All (%)		Males (%)		Females (%)	
		Imm	NB	Imm	NB	Imm	NB
Gender	Male	50.6[a]	48.0[a]	N/A	N/A	N/A	N/A
Marital	Married	76.1[a]	71.4[a]	83.3[a]	78.5[a]	68.7[a]	64.8[a]
Education	Less than H.S.	24.6[a]	31.8[a]	23.3[a]	31.5[a]	25.9[a]	32.1[a]
	H.S. grad	17.9[a]	15.6[a]	17.2[a]	14.4[a]	18.6[a]	16.7[a]
	Post-secondary	57.5[a]	52.6[a]	59.5[a]	54.1[a]	55.5[a]	51.2[a]
Income	High	54.2	54.9	57.7	60.1	50.6	50.2
	Middle	29.9	29.9	30.0	28.3	29.8	31.5
	Low	15.9	15.1	12.3	11.7	19.6	18.3
Region of residence	Atlantic	2.3[a]	11.8[a]	2.1[a]	11.7[a]	2.4[a]	11.8[a]
	Quebec	15.4[a]	32.5[a]	16.8[a]	32.0[a]	14.1[a]	33.0[a]
	Ontario	48.1[a]	26.5[a]	47.2[a]	26.4[a]	49.1[a]	26.5[a]
	Prairies	11.9[a]	15.3[a]	11.8[a]	15.5[a]	12.0[a]	15.1[a]
	B.C.	22.3[a]	13.9[a]	22.1[a]	14.3[a]	22.5[a]	13.5[a]
Physical activity	Active	17.6[a]	16.3[a]	21.3[a]	18.5[a]	13.8[a]	14.2[a]
	Mod. active	20.3[a]	23.0[a]	20.3[a]	23.3[a]	20.3[a]	22.7[a]
	Inactive	62.1[a]	60.7[a]	58.4[a]	58.2[a]	65.9[a]	63.0[a]
Alcohol	Drinks alcohol	69.2[a]	77.3[a]	77.0[a]	82.7[a]	61.2[a]	72.2[a]
Smoking	Never	56.8[a]	41.2[a]	44.1[a]	30.0[a]	69.9[a]	51.5[a]
	Smoked <25 years	20.4[a]	23.0[a]	26.9[a]	26.5[a]	13.7[a]	19.7[a]
	Smoked ≥25 years	22.8[a]	35.8[a]	29.0[a]	43.5[a]	16.4[a]	28.8[a]
Social support	High	91.2[a]	93.3[a]	89.4[a]	91.8[a]	93.0[a]	94.7[a]
Chronic stress	Less stress than usual	46.6[a]	44.0[a]	52.6[a]	47.3[a]	40.3	41.0
	Same stress as usual	44.2[a]	45.8[a]	40.9[a]	44.8[a]	47.7	46.8
	More stress than usual	9.2[a]	10.2[a]	6.5[a]	8.0[a]	12.0	12.2
Depression	Likely not depressed	96.1[a]	94.7[a]	97.4[a]	95.6[a]	94.9[a]	93.9[a]

Note: H.S., high school; Imm, immigrant; Mod, moderately; NB, native-born

[a] significant difference ($p<0.05$)

4.4 Do the lifestyle/psychosocial factors of the immigrants change over time?

Crosstabulations were run to identify if the lifestyle and psychosocial factors of the immigrants changed the longer they lived in Canada. It is important to recognize that these crosstabulations do not take country of origin into effect. Table 4.3 lists the crosstabulations according to three age subgroups: 40-49 years; 50-59 years and 60 years or over. Immigrant males do not seem to change their level of physical activity the longer they live in Canada. However, females aged greater than 50 years seem to increase their level of physical activity. For instance, 22.2% of immigrant females 50-59 years old who had lived in Canada for less than 10 years reported being physically inactive, compared to only 11.2% of immigrant females in the same age bracket who had lived in Canada more than 10 years. Alcohol consumption also significantly increases for immigrants in all age subgroups the longer they live in Canada. Across all ages, both males and females, there is at least a 10% increase in the number of immigrants who consume alcohol who have lived in Canada more than 10 years compared to those who have lived in Canada less than 10 years. Interestingly, immigrants younger than 50 years or older than 60 years are significantly more likely to smoke if they have lived in Canada for more than 10 years—this trend was not observed among the immigrants between 50 and 59 years. Not surprisingly, social support increases significantly in immigrants who have lived in Canada more than 10 years. Stress seems to increase for female immigrants the longer they live in Canada, a trend that is also observed in males aged 40 to 49 years, but not in the other age subgroups. Finally, depression does not seem to be affected by length of time in Canada, regardless of age or gender, although it does appear to decrease

as age increases. For instance, approximately 7.0% of immigrant females 40-49 years report being depressed, compared to less than three percent of immigrant females over the age of 60.

Table 4.3. Crosstabulations comparing lifestyle and psychosocial variables to the length of time immigrants have lived in Canada.

Variable	Age (yrs)	All Immigrants (%)		Males (%)		Females (%)	
		<10 years	≥10 years	<10 years	≥10 years	<10 years	≥10 years
Physically inactive	40-49	11.6	11.7	13.1	8.8	9.5	14.5
	50-59	14.6	13.8	10.0	16.2	22.2[a]	11.2[a]
	≥60	26.8[a]	15.2[a]	13.6	13.6	31.7[a]	16.8[a]
Consumes alcohol	40-49	61.0[a]	77.2[a]	69.1[a]	85.1[a]	52.7[a]	69.9[a]
	50-59	53.8[a]	73.8[a]	60.4[a]	76.1[a]	42.6[a]	71.5[a]
	≥60	17.1[a]	64.3[a]	30.4[a]	75.0[a]	13.3[a]	52.7[a]
Smokes cigarettes	40-49	29.1[a]	40.7[a]	38.2[a]	51.5[a]	20.0[a]	30.7[a]
	50-59	46.1	44.3	51.6	54.9	38.9	32.8
	≥60	7.3[a]	48.1[a]	18.0[a]	64.2[a]	3.4[a]	30.7[a]
Low social support	40-49	16.0[a]	8.7[a]	16.0[a]	10.1[a]	16.0[a]	7.4[a]
	50-59	18.6[a]	6.3[a]	20.0[a]	9.0[a]	14.8[a]	3.4[a]
	≥60	14.6	8.3	13.6	10.1	15.0[a]	6.4[a]
More stress than usual	40-49	7.6	10.8	1.7[a]	8.8[a]	13.6	12.7
	50-59	9.0	12.0	12.1	9.3	5.6[a]	14.9[a]
	≥60	2.4	6.7	4.5	3.3	1.7[a]	10.3[a]
Likely depressed	40-49	4.7	5.8	2.2	4.4	7.0	7.2
	50-59	1.4	3.5	0	1.5	3.8	5.7
	≥60	1.2	2.5	0	2.3	1.7	2.8

[a] significant difference in disease rate ($p<0.05$)

4.5 Prevalence of any heart condition, CHD and HBP

The presence heart conditions was compared with the immigrants' length of time in Canada, and country of origin. Each set of crosstabulations were run according to age and gender.

There was only one comparison where there was a statistically significant difference between the incidence of a heart condition and length of time in Canada (Table 4.4). In females between the ages of 40 and 49 years, immigrants who had lived in Canada for less than 10 years were significantly less likely to have HBP than female immigrants who had lived in Canada for more than 10 years (1.7% versus 6.1%, $p<0.05$). Even though none of the other comparisons reached statistical significance, there were some notable differences in the comparisons. Immigrants who had lived in Canada for more than 10 years were more likely to have a heart condition than immigrants who had lived in Canada for less than 10 years, although this is not necessarily surprising given that age and duration of residence are linked. Immigrant males who had lived in Canada for less than 10 years were slightly more likely to have HBP if they were between 40 and 49 years (8.7% versus 6.4%) or over 60 years (31.8% versus 27.8%), but not if they were between 50 and 59 years (9.1% versus 18.8%).

Table 4.4. Crosstabulations of immigrants' length of time in Canada and heart health.

Heart condition	Age (yrs)	All immigrants (%)		Males (%)		Females (%)	
		<10 years	≥10 years	<10 years	≥10 years	<10 years	≥10 years
Any heart condition	40-49	6.3	7.3	9.8	6.9	3.5	7.8
	50-59	14.9	22.8	13.6	24.2	16.7	21.6
	≥60	48.1	42.4	40.9	37.5	53.3	46.0
CHD	40-49	1.4	1.4	1.1	0.8	1.7	2.0
	50-59	4.1	5.1	2.3	6.4	6.7	3.8
	≥60	15.4	14.8	9.1	14.5	20.0	15.1
HBP	40-49	4.8	6.3	8.7	6.4	1.7[a]	6.1[a]
	50-59	10.8	18.8	9.1	18.8	13.3	18.8
	≥60	40.4	33.3	31.8	27.8	46.7	37.5

Note: CHD, coronary heart disease; HBP, high blood pressure
[a] significant difference in disease rate ($p<0.05$)

A few comparisons reached statistical significance in the crosstabulations between heart health and country of origin (Europe/USA/Australia versus Asia/other) (Table 4.5). Among the comparisons for country of origin and any heart condition, immigrants aged 40 to 49 years from Non-European countries were more likely to have a heart condition than European immigrants (9.0% versus 6.2%, $p<0.05$). Non-Europeans had significantly higher rates of HBP compared to Europeans, especially females. For both male and female immigrants combined (aged 40 to 49 years) the rate of HBP among the Europeans was 4.8% compared to 8.4% for the Non-Europeans ($p<0.05$). Immigrant females (40 to 49 years) from Europe had a 3.9% incidence rate of HBP compared to 8.0% for Non-Europeans ($p<0.05$).

Alternatively, it was the Europeans (aged 50 to 59 years) that had significantly higher incidences of CHD compared to Non-Europeans in the same age group (5.7% versus 2.5%, $p<0.05$). The same situation existed when the comparison was made for females alone(50 to 59 years) (4.6% versus 0.8%). Again, this conclusion is expected, since European immigrants have resided in Canada longer than other origin groups.

Table 4.5. Crosstabulations of country of origin and heart health.

Heart condition	Age (yrs)	All immigrants (%)		Males (%)		Females (%)	
		Europe	Non-Europe	Europe	Non-Europe	Europe	Non-Europe
Any heart condition	40-49	6.2[a]	9.0[a]	6.5	8.8	5.9	9.2
	50-59	22.3	22.8	23.3	23.7	21.3	21.7
	≥60	42.7	39.4	37.8	35.5	46.5	43.0
CHD	40-49	1.7	0.8	1.1	0.4	2.4	1.2
	50-59	5.7[a]	2.5[a]	6.9	3.8	4.6[a]	0.8[a]
	≥60	15.0	13.4	14.3	14.5	15.5	12.4
HBP	40-49	4.8[a]	8.4[a]	5.6	8.8	3.9[a]	8.0[a]
	50-59	17.8	20.3	17.5	19.9	18.0	20.8
	≥60	33.6	31.6	28.3	24.5	37.7	38.0

Note: CHD, coronary heart disease; HBP, high blood pressure
[a] significant difference in disease rate ($p<0.05$)

Among respondents aged 40 to 49 years, native-born Canadians had statistically significant higher incidence rates of any heart condition compared to the immigrants in the same age category (9.6% versus 7.2%, $p<0.05$) (Table 4.6). This statistical significance was also observed when males and females were analyzed separately, with native-born Canadians consistently having higher incidences of any heart condition. As the respondents aged, this difference in heart health was diminished, with no statistically significant differences observed with respect to any heart condition and immigrant status

in respondents aged 50 to 59 years and over 60 years. A possible reason why there is a significant difference in heart conditions between the younger respondents, and not among the older respondents is that perhaps there is a difference in the health of immigrants compared to the health of the native-born population in the younger respondents, but not in the older respondents. In other words, as people age health, inevitably, deteriorates regardless of healthy lifestyle habits or the possible benefits of being an immigrant (i.e. healthy immigrant effect).

Native-born Canadian males, 40 to 49 years and over 60 years were significantly more likely to have heart disease than immigrant males of the same age. The incidence of heart disease among females was fairly consistent between immigrants and native-born Canadians, regardless of age. Native-born Canadians aged 40 to 49 years (overall and females alone) were more likely than immigrants to have HBP. This trend was only observed among the respondents aged 40 to 49 years, and was not apparent in the older age categories. For the respondents aged 50-59 years, the incidence of HBP ranged from 17.5% to 18.6% among the native-born Canadians. The incidence of HBP was slightly higher for immigrants compared to the native-born Canadians, except when females were compared alone. Native-born females had the highest incidence of HBP, and immigrant females had the lowest incidence of HBP for the 50-59 age category. As for the respondents over 60 years, males, both native-born and immigrant (26.1% and 27.9%, respectively), had substantially lower incidences of HBP than the females, both native-born and immigrant (35.7% and 37.7%, respectively).

Table 4.6. Crosstabulations comparing immigrant status to heart health.

Heart condition	Age (yrs)	All respondents (%)		Males (%)		Females (%)	
		NB	Imm	NB	Imm	NB	Imm
Any heart condition	40-49	9.6[a]	7.2[a]	9.7[a]	7.3[a]	9.6[a]	7.1[a]
	50-59	21.4	22.4	23.1	23.4	19.9	21.4
	≥60	41.4	42.4	38.0	37.5	43.7	46.2
CHD	40-49	2.0	1.4	2.1[a]	0.9[a]	1.9	2.0
	50-59	5.8	5.0	7.8	6.1	4.1	3.9
	≥60	15.8	14.8	17.1[a]	14.3[a]	14.9	15.2
HBP	40-49	8.1[a]	6.0[a]	8.1	6.7	8.1[a]	5.4[a]
	50-59	17.5	18.3	17.9	18.1	18.6	17.1
	≥60	31.8	33.4	26.1	27.9	35.7	37.7

Note: CHD, coronary heart disease; HBP, high blood pressure; Imm, immigrant; NB, native-born

[a] significant difference in disease rate ($p<0.05$)

4.6 Summary and Discussion

Approximately 20% of the sample of respondents to the 1996/97 NPHS were immigrants, a proportion that is generally consistent with the literature regarding the proportion of immigrants living in Canada (Statistics Canada 1997). Overall, there were slightly more female respondents than male respondents. This would be expected because females have a longer lifespan than males, thus there are more likely to be more females than males especially in the older age categories. However, there were slightly more immigrant males than immigrant females who responded to the survey, which is somewhat surprising because there are generally more immigrant females than males (Migration Information Source 2004), although historical immigration streams were male dominated. More males also reported being married or in common-law relationships than females, this would follow the same logic regarding the fact that females live longer than males, thus more females are more likely to be widowed than males.

Immigrants were more likely to be educated than the whole sample of respondents. There are a few ways that immigrants can migrate to Canada, and one way to gain entry into the country is to be a skilled worker where level of education is a key factor in establishing eligibility (Government of Canada 2004). Immigrants, depending on their country of origin, tend to be more educated than the native-born (Betts and Lofstrom 1998; Hirschman 2001). This is most likely due to the fact that, in many cases, it is the only way for an immigrant to enter Canada. Despite the higher level of education, more immigrants were in the low income category than the whole group of respondents. There were more female immigrants in the lowest income group than any other cohort of respondents. There are several reasons why immigrants could potentially earn less than native-born Canadians, including language barriers, having fewer social connections than native-born Canadians to gain employment or inability to transfer credentials to the Canadian system. The Ontario Ministry of Health and Long-Term Care has recently implemented a system to 'fast track' foreign-trained physicians through the Ontario medical school system because, historically, physicians trained in most foreign countries were not able to practice in Canada without completing a medical degree in Canada (Ministry of Health and Long-term Care 2004). Developing the 'fast-track' system has addressed two issues: employment of immigrants and the shortage of practicing physicians in Ontario.

In terms of CHD, immigrants reported a lower incidence of CHD than the overall group of respondents; despite having a mode age that was greater than that found in the native-born group (55-59 and 50-54 years, respectively). Thus, even though the

immigrants were somewhat older than the overall group, they still had slightly fewer incidences of CHD (6.0% versus 6.8%). Males reported a marginally higher incidence of CHD than females (7.3% versus 6.4%). In 2001, 33% of deaths among Canadian males were attributed to heart disease compared to 35% of deaths of Canadian females (Heart & Stroke Foundation 2004).

The incidence of HBP was higher among the sample of immigrants than the overall group (20.5% versus 18.7%), with immigrant females reporting the highest incidence of HBP (22.5%). This is relatively consistent with results from the NHANES IV survey in the United States that indicated that a higher percentage of men than women have HBP until age 50, however, from ages 50 to 74 a much higher percentage of women than men have HBP (American Heart Association 2004). Postmenopausal females are at an increased risk of hypertension than pre-menopausal females, thus, it follows that older females are more likely to have hypertension (Staessen et al 1998; Rappelli 2002).

Approximately 89% of the immigrants who responded to the survey had lived in Canada for 10 or more years. This high proportion of immigrants needs to be taken into consideration when looking at the regression analysis and crosstabulation results. Since there is not an even distribution of immigrants who arrived in Canada less than 10 years ago and more than 10 years ago, the results may be skewed. This concern will be described more thoroughly later with the discussion regarding the regression analysis. Also, the majority of the immigrants were from Europe, the United States or Australia (69%) compared to immigrants from Asia or other Non-European countries.

Immigrants and the overall group of respondents reported similar levels of physical inactivity (62.1% and 61.0%, respectively). Males (both immigrants and overall) were more active than females, however, males also had higher body mass indices (BMI) than the females. This is peculiar because the higher the BMI, the more overweight a person is, and logic would suggest that people who are more active are less likely to be overweight. However, there are other factors that contribute to a person's weight other than activity, including diet (which is not addressed in this paper). It is also important to note that the physical activity variable measured leisure physical activity, as opposed to physical exertion at work. Only 26% of immigrant females reported BMI's greater than 27, yet 66% of the immigrant females reported being inactive. Immigrant females may consume fewer calories, or they may be more likely to work in labour-intensive jobs. Also, there are cultural differences regarding leisure physical activity, which could explain for the difference in leisure physical activity (Lindstrom and Sundquist 2001). Westernized cultures place more emphasis on leisure physical activity than non-Westernized countries (Lindstrom and Sundquist 2001). Gym memberships, playing with organized sports teams and participating in non-work physical activity is a cultural difference between Western and non-Western countries. When immigrant females who had lived in Canada less than 10 years were compared to immigrant females who had lived in Canada more than 10 years, the rate of physical inactivity dropped by 11% in females aged 50 to 59 years (22% versus 11%, respectively), and the rate dropped by 15% in females over 60 years (32% versus 17%). This suggests that immigrant females alter their leisure physical activity behaviour upon immigration to Canada.

Another substantial difference between immigrants and the overall sample of respondents was alcohol consumption. Immigrants were much less likely to report consuming alcohol than the overall group of respondents. Although the cross-sectional data limit interpretation, it would appear that regardless of age group, there was a significant increase in the proportion of immigrants who reported consuming alcohol after living in Canada more than 10 years. The trend was also observed when males and females were analyzed separately. In Canada, alcohol is readily available and its consumption is, generally, a socially acceptable behaviour. Similar to the increase in alcohol consumption, the longer that immigrants live in Canada the more likely they are to smoke cigarettes, with the most dramatic differences seen in immigrants who are over 60 years old. Approximately 7% of immigrants over 60 years who have lived in Canada for less than 10 years reported smoking compared to 48% of the immigrants over 60 years who have lived in Canada more than 10 years. This difference can potentially be explained according to the country of origin of the immigrants, with immigrants with a longer duration in Canada sourcing from European countries, (Dench 2004). In these countries, the culture of cigarette smoking has been a socially accepted behaviour, although this is not necessarily the case elsewhere. The culture of cigarette smoking is changing as it becomes less socially acceptable in Westernized countries, and cigarettes become more widely marketed in developing countries (Mackay 1994; Richmond 1997). Thus, there may be a shift in the proportion of new immigrants who smoke in the next few decades.

Immigrants reported lower social support than the overall group of respondents. This is not surprising because immigrants are much less likely to have the social network of native-born Canadians. When social support was compared between immigrants who had lived in Canada for less than 10 years and immigrants who had lived in Canada more than 10 years, social support was significantly higher in immigrants who had lived in Canada longer. The longer immigrants live in Canada, the more time they have to make new social networks (ceteris paribus), thus, having more people to rely on and greater social support.

The rate of chronic stress and depression was higher for females than males. This is consistent with the literature which indicates that females experience more mental health issues than males (Canadian Mental Health Association 2004). The rate of depression did not significantly change between immigrants who had lived in Canada more or less than 10 years. Chronic stress increased for females the longer they lived in Canada. The reasoning for this could be that females may be faced with different expectations in Canada than in their country of origin. In some circumstances, females may have more difficulty with acculturation than males resulting in greater stress and fewer social networks, if, for instance, they choose not to work outside the home they will most likely not learn English or French as well as if they were working outside the home.

When the incidence of heart conditions was compared to the length of time immigrants had lived in Canada, the only significant difference was among HBP in females. There were no other significant differences between length of time in Canada

and heart conditions. This is consistent with the research by Perez (2002). Almost 2% of immigrant females between 40 and 49 years who had lived in Canada for less than 10 years had high blood pressure compared to 6% in immigrant females between 40 and 49 years who had lived in Canada more than 10 years. The difference in the incidence in HBP was not significant among immigrant females in the older age categories. As mentioned previously, it is important to recognize that there is not an equal distribution between the number of immigrants who have lived in Canada for less than 10 years and immigrants who have lived in Canada for more than 10 years. Almost 90% of immigrants who responded to the survey had lived in Canada for more than 10 years. Also, this comparison did not analyze immigrants according to specific country of origin, thus, it is not possible to tell if immigrants from different countries of origin have variable incidences of heart conditions depending on their length of time in Canada. Country of origin was compared to any heart condition and the crosstabulations revealed no differences in the incidence of any heart condition and country of origin in the oldest group of immigrants (60 years or older), however, there were some differences in the younger immigrants. The Non-European immigrants between the ages of 40 and 49 were significantly more likely to have HBP than European immigrants in the same age category. Interestingly, European immigrants between the ages of 50 and 59 were significantly more likely to have CHD than Non-European immigrants in the same age category. This suggests that despite the Non-European immigrants' higher incidence of HBP, they are at less risk of CHD than European immigrants. HBP is a risk factor for CHD, however, it does not seem to be the predominant risk factor among Non-European

immigrants, or else there would be a higher incidence of CHD among the Non-European immigrants. Immigrant status and heart conditions seem to be most significant in the younger age cohort. Native-born Canadians between the ages of 40 and 49 are significantly more likely to have heart conditions than immigrants in the same age group. This significant difference is not observed in the older age categories. Thus, perhaps the effects of age overpower the effect of immigration status in the older respondents. That is, being an immigrant may reduce the risk of heart disease in younger respondents. However, at some point the effects of age on the deterioration of the body balance out the difference in immigration status and eventually all respondents have an equal risk of developing heart conditions, regardless of immigration status.

These descriptive results derived from a series of crosstabulations comparing demographic, lifestyle and psychosocial variables in immigrants and native-born Canadians according to heart health provide a basis for the results of the regression analyses which are presented in the next chapter.

CHAPTER FIVE

IMMIGRANT HEART HEALTH: REGRESSION AND SURVIVAL ANALYSES

5.1 Introduction

It is clear from the previous chapter that differences in heart health exist between the immigrant and non-immigrant populations. While easy to interpret, the results presented so far provide only a partial picture, with the extent and significance of the differences between immigrant and non-immigrant groups difficult to untangle given the host of potential effects that confound health status in general, and heart health in particular. This chapter, therefore, describes the results of the regression and survival analyses. Regression analyses were run for all respondents (immigrants and native-born in a 'pooled' model) and immigrants alone. The regression was also run according to gender. In addition, since body mass index (BMI) was only calculated in respondents up to 65 years old, the same series of logistic regressions were also run for the respondents between 40 and 64 years old. The logistic regression assessed the significant predictors of any heart condition (HBP, CHD or stroke), CHD alone and HBP alone. The results of the survival analysis are also presented. The survival analysis established the new cases of heart conditions since the 1994/95 cycle. The results of the survival analysis help to predict which risk factors influence the development of heart conditions once immigrants have arrived in Canada.

5.2 Regression Analysis

5.2.1 Any Heart Condition

As mentioned previously, logistic regression analyses were run for all respondents, immigrants alone, including and excluding BMI as a variable, and according to gender. Comparing the logistic regression models for all respondents and immigrants alone, the rho-squared for the model of all respondents is 0.109 and 0.134 for the immigrant model. These results suggest that the immigrant model is slightly better than the model for all respondents at explaining the incidence of heart conditions, although the fit of both models is somewhat less than what is generally considered to be a good fit (rho-squared = 0.2) (Wrigley 1985). Table 5.1 details the results of the regression analysis for all respondents examining the risk factors for any heart condition. This regression model can explain approximately 77% of the cases of heart conditions, based on a cut point of 0.5. When a more conservative cut point of 0.15 was applied, the model was able to correctly classify 57% of the cases. The cut point determines the cutoff value for classifying cases. As the cut point is shifted from 0.99 to 0.01, the probability of correctly predicting heart conditions increases. Thus, in this case, a cut point of 0.15 is more accurate at correctly predicting heart conditions than a cut point of 0.5. Both 0.15 and 0.5 were calculated in the analysis because 0.5 is the generally accepted standard cut point used in logistic regression analyses, and 0.15 was also calculated to compare a more conservative cut point to the generally accepted standard. Even when the more conservative cut point of 0.15 was used, the probability of correctly predicting heart conditions was greater than 55%.

Table 5.2 details the results of the immigrant model for any heart condition. The model for all immigrants was able to correctly classify 76% of cases at a cut point of 0.5.

The regression analysis for all respondents and any heart conditions provided a good source of baseline data to ensure reliability of the regression model. The variables, which were expected to be significant predictors of heart conditions, were significant: increasing age, physical inactivity, smoking, high BMI, low income, chronic stress and depression. These results offer some reliability in the regression analysis models for immigrants alone, and the individual heart conditions when analyzed separately. Gender, marital status, immigration status and diabetes are not predictors of heart conditions.

As for lifestyle factors, respondents who reported being moderately physically active were significantly less likely to report heart conditions than respondents who reported that they were inactive, in line with results found elsewhere in the literature. Respondents who abstained from drinking alcohol reported more incidences of heart conditions than respondents who reported consuming alcohol, which is again in broad agreement with the existing literature that supports moderate drinking as a component of a healthy lifestyle (Canadian Cardiovascular Society, 1998). This trend was also observed among the females alone, but not among the males when analyzed separately. Respondents who never smoked were significantly less likely to report heart conditions than respondents who smoked more than 25 years. High social support also seemed to have a protective effect against heart conditions among the respondents. Respondents who reported that they were experiencing less stress than usual had significantly fewer incidences of heart conditions than respondents experiencing more stress than usual.

Finally, respondents who were likely not depressed reported fewer incidences of heart conditions than respondents who were likely depressed.

Among all respondents, income was a predictor of heart conditions: those with high or middle income reported fewer incidences of heart conditions than respondents in the low income category. There are several reasons for this, including that low income earners may not be educated regarding physical activity and optimal food choices, and/or have more limited access to food choices. Low income earners may also not have access to leisure physical activities. This could lead to weight problems, which ultimately results in morbid conditions such as HBP, CHD, diabetes and a host of other chronic conditions (Nelson et al 2002; Keles et al 2003; Osler et al 2003; Andersen et al 2003). Correspondingly, respondents from the Atlantic provinces reported significantly more heart conditions than respondents from B.C. When the proportion of low income earners in Atlantic provinces was compared to low income earners in B.C., 21% of respondents in the Atlantic provinces were in the low income category compared to almost 12% of the respondents from B.C. This difference in income status could explain the difference in heart conditions between regions.

Interestingly, the disparity between income in the Atlantic provinces and B.C. does not exist among the immigrants. Thirteen percent of immigrants reported low income in the Atlantic provinces compared to 14% in B.C. There is, however, a difference in country of origin of immigrants between these two regions. In the Atlantic provinces, 91% of the immigrants are of European descent, and in B.C. 67% of the immigrants are of European descent. This, however, complicates the reasoning because

immigrants from Europe have a significantly lower incidence of heart conditions than immigrants from other countries; however, in the Atlantic provinces where almost all of the immigrants are of European descent there is a higher incidence of heart conditions than in B.C., where there are substantially fewer immigrants of European descent.

All respondents and immigrants alone from Quebec reported significantly fewer incidences of heart conditions than respondents from B.C. One theory was that since the respondents who reported consuming alcohol also had fewer incidences of heart conditions compared to abstainers, then it may follow that respondents from Quebec may be more likely to consume alcohol than respondents from B.C. When the proportion of respondents who consumed alcohol in Quebec was compared to respondents from B.C., 77% of respondents from Quebec reported consuming alcohol compared to 80% of respondents from B.C. Thus, it is not simply alcohol that can explain difference in heart conditions. However, it may be possible that the type of alcohol consumed may have an impact on heart conditions (Nanji 1985; Truelsen et al 1998). Respondents from Quebec may be more likely to consume wine than respondents from B.C., thus gaining more of a benefit from alcohol consumption than B.C. residents. Unfortunately, the NPHS survey does not distinguish the type of alcohol consumed or the amount of alcohol consumed.

Perhaps the explanation for the difference in heart conditions among immigrants can be explained by the length of time the immigrants have lived in Canada. In the Atlantic provinces, 98% of the immigrants have lived in Canada more than 10 years compared to 89% of the immigrants in B.C. Immigrants who had lived in Canada for less than 10 years were significantly less likely to report heart conditions than immigrants

who had lived in Canada for more than 10 years. This could be a result of the 'healthy immigrant effect', which suggests that immigrants are healthier than the native-born residents of the host country and they are also healthier than the general population in their country of origin. Heart conditions are chronic conditions that take several years to develop, and since immigrants who are new to Canada had to demonstrate healthiness, and had to be well enough to immigrate less than 10 years ago, there has not been a chance for a heart condition to manifest.

Turning to lifestyle variables, immigrant males who were moderately active were less likely to have a heart condition than inactive males, while immigrant females who were moderately active were more likely to have a heart condition than inactive females. Similarly, immigrant males who never smoked were less likely to have a heart condition than immigrant males who smoked for more than 25 years, but immigrant females who never smoked were more likely to have a heart condition than immigrant females who had smoked more than 25 years. Immigrants with high social support were less likely to report a heart condition than immigrants with low social support. Similarly, immigrants who reported less stress than usual reported fewer incidences of heart conditions than immigrants with more stress than usual. Finally, immigrants who were likely not depressed reported fewer incidences of heart conditions than immigrants who were likely depressed.

Table 5.1. Logistic regression for all respondents for any heart condition (aged 40+, BMI excluded).

Variable		All respondents (n=26849)				Males (n=13035)				Females (n=13814)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.316	.007	1.37	.000	.319	.010	1.38	.000	.314	.010	1.37	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---	---	---
	H.S graduate	.115	.045	1.12	.010	.163	.066	1.18	.013	---	---	---	---
Income	High income	-.182	.046	.834	.000	-.170	.071	.844	.017	-.248	.059	.780	.000
	Middle income	-.221	.046	.802	.000	-.355	.074	.701	.000	-.138	.059	.871	.019
Province	Atlantic	.307	.062	1.36	.000	.191	.090	1.21	.035	.420	.084	1.52	.000
	Quebec	-.132	.050	.877	.009	-.216	.073	.806	.003	---	---	---	---
	Ontario	.096	.048	1.10	.047	---	---	---	---	---	---	---	---
	Prairies	---	---	---	---	---	---	---	---	---	---	---	---
Immigration status	Immigrant	---	---	---	---	---	---	---	---	---	---	---	---
Physical activity	Active	-.176	.045	.839	.000	---	---	---	---	-301	.069	.740	.000
	Moderately active	-.158	.039	.854	.000	-.182	.058	.833	.002	-.135	.054	.873	.012
Alcohol	Abstainer	.142	.036	1.15	.000	---	---	---	---	.178	.047	1.19	.000
Smoking status	Never smoker	---	---	---	---	-.220	.055	.802	.000	---	---	---	---
	Smoked < 25 years	-.121	.045	.886	.007	---	---	---	---	-.218	.071	.804	.002
Social support	High social support	-.116	.058	.891	.047	-.172	.077	.842	.026	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.256	.056	.774	.000	-.227	.088	.797	.010	-.302	.073	.739	.000
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.408	.071	.665	.000	-.608	.108	.544	.000	-.288	.094	.750	.002
Constant		-4.94	.141	.007	.000	-4.61	.209	.010	.000	-5.14	.178	.006	.000
ρ^2				0.109				0.100				0.120	
Correctly classified (cut point 0.15)				56.5%				58.0%				56.2%	
Correctly classified (cut point 0.5)				77.4%				78.6%				76.4%	
Likelihood ratio statistic				3154.35				1451.95				1839.61	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.2. Logistic regression for immigrants for any heart condition (aged 40+, BMI excluded).

Variable		All Immigrants (n=5446)				Male Immigrants (n=2756)				Female Immigrants (n=2690)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.333	.016	1.40	.000	.313	.024	1.37	.000	.354	.022	1.43	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	.344	.082	1.41	.000	.523	.114	1.69	.000	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	---	---	---	---
Income	High income	---	---	---	---	---	---	---	---	-.365	.138	.694	.008
	Middle income	---	---	---	---	---	---	---	---	---	---	---	---
Province	Atlantic	---	---	---	---	.685	.312	1.99	.028	---	---	---	---
	Quebec	-.559	.121	.572	.000	-.716	.165	.489	.000	-.419	.180	.657	.020
	Ontario	---	---	---	---	---	---	---	---	---	---	---	---
	Prairies	-.317	.124	.728	.010	---	---	---	---	---	---	---	---
Years in Canada	0-4 years	-.895	.259	.408	.001	---	---	---	---	-1.737	.531	.176	.001
	5-9 years	-.621	.175	.537	.000	-.764	.287	.466	.008	-.476	.221	.621	.031
Country of origin	Europe/USA	-.242	.083	.785	.004	-.486	.114	.615	.000	---	---	---	---
Physical activity	Active	---	---	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	-.364	.128	.695	.004	.347	.126	1.42	.006
Alcohol	Abstainer	.330	.076	1.39	.000	---	---	---	---	.415	.105	1.51	.000
Smoking status	Never smoker	---	---	---	---	-.332	.121	.717	.006	.304	.135	1.36	.025
	Smoked < 25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.282	.118	.755	.017	---	---	---	---	-.576	.190	.562	.002
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.359	.126	.699	.004	---	---	---	---	-.424	.170	.654	.013
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.794	.171	.452	.000	-1.128	.272	.324	.000	-.651	.230	.521	.005
Constant		-4.50	.292	.011	.000	-3.94	.437	.019	.000	-4.92	.437	.007	.000
ρ^2				0.134				0.120				0.169	
Correctly classified (cut point 0.15)				56.8%				55.6%				61.2%	
Correctly classified (cut point 0.5)				75.6%				76.6%				76.1%	
Likelihood ratio statistic				809.99				359.60				518.61	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

The Role of BMI

Inclusion of BMI within the models restricted the analysis to those aged 40 to 65 years, since BMI data was not collected for the older population (65+). Generally, the models that included BMI were better able to correctly classify more of the cases than the models without the BMI variable. For instance, for all respondents, the model with BMI included was able to correctly classify 84% of the cases (cut point of 0.5), compared to 77% for the model that excluded BMI. It is interesting to note, however, that the rho-squared values are slightly lower for the model for all respondents with BMI included than the model with BMI excluded (all respondents BMI included 0.094 versus all respondents BMI excluded 0.109). For the immigrant alone models, both the percentages correctly classified and rho-squared values were higher for the models that included BMI.

There are two possible explanations for the improvement in the models with BMI included: firstly, by adding an additional variable there was more data available to explain for the variance. Secondly, as people age, their health undoubtedly deteriorates, thus, respondents over the age of 65 are likely to have some type of morbidity regardless of lifestyle habits, stress or demographics. This inevitable deterioration in health in respondents over 65 may contribute additional 'noise' to the model, which is eliminated when respondents over 65 are excluded. Table 5.3 and 5.4 outline the models for all respondents and immigrants alone, respectively, with the BMI variable included and respondents over 65 years excluded.

There are some notable differences between the models that include BMI and those that do not, in addition to the better fit of the models which include BMI and

exclude respondents over 65 years. In the model including BMI with females alone identified being married as a protective factor against heart conditions, however, this was not found in the model excluding BMI of females alone. The reason for this could be due to the fact that there are most likely more widows who are over 65 years who have a heart condition that are not being represented in this analysis. For the immigrant model including BMI, both income and smoking are significant variables in this model, but they are not significant in the model that excludes BMI and includes respondents over 65 years. This difference may not be significant in the model that includes immigrants over 65 years because there may be too many incidences of heart conditions based on age alone.

Table 5.3. Logistic regression for all respondents for any heart condition (aged 40-65, BMI included).

Variable		All respondents (n=18200)				Males (n=8933)				Females (n=9267)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.468	.015	1.59	.000	.483	.022	1.62	.000	.449	.021	1.57	.000
Marital status	Married	---	---	---	---	---	---	---	---	-.184	.069	.832	.008
Education	Less than H.S.	---	---	---	---	-.071	.072	.931	.319	---	---	---	---
	H.S graduate	---	---	---	---	.217	.080	1.24	.007	---	---	---	---
Income	High income	-.282	.060	.755	.000	-.358	.091	.699	.000	---	---	---	---
	Middle income	-.383	.066	.682	.000	-.504	.102	.604	.000	-.240	.091	.787	.009
Province	Atlantic	.207	.080	1.23	.009	.298	.114	1.35	.009	---	---	---	---
	Quebec	-.139	.065	.871	.032	---	---	---	---	-.184	.090	.832	.041
	Ontario	---	---	---	---	---	---	---	---	-.180	.090	.835	.046
	Prairies	-.147	.075	.863	.051	---	---	---	---	-.293	.108	.746	.007
Immigration status	Immigrant	---	---	---	---	---	---	---	---	---	---	---	---
Physical activity	Active	-.173	.058	.841	.003	---	---	---	---	---	---	---	---
	Moderately active	-.133	.051	.875	.009	---	---	---	---	-.214	.072	.807	.003
Alcohol	Abstainer	.179	.049	1.19	.000	---	---	---	---	---	---	---	---
Smoking status	Never smoker	---	---	---	---	-.183	.072	.833	.011	---	---	---	---
	Smoked < 25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.208	.077	.812	.007	-.229	.098	.795	.029	-.255	.129	.775	.048
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.248	.070	.780	.000	---	---	---	---	-.351	.091	.704	.000
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.582	.080	.559	.000	-.840	.123	.432	.000	-.393	.105	.675	.000
BMI	BMI <27	-.752	.041	.471	.000	-.790	.059	.454	.000	-.729	.059	.482	.000
Constant		-6.04	.227	.002	.000	-6.09	.325	.002	.000	-5.79	.322	.003	.000
ρ^2				0.094				0.098				0.096	
Correctly classified (cut point 0.15)				63.3%				63.9%				63.4%	
Correctly classified (cut point 0.5)				83.7%				83.9%				83.8%	
Likelihood ratio statistic				1649.28				856.30				841.46	

Note: BMI, body mass index; H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.4. Logistic regression for immigrants for any heart condition (aged 40-65, BMI included).

Variable		All Immigrants (n=3154)				Male Immigrants (n=1572)				Female Immigrants (n=1582)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.565	.038	1.76	.000	.606	.053	1.82	.000	.556	.057	1.74	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	---	---	---	---
Income	High income	-.416	.142	.660	.003	-.534	.209	.586	.011	---	---	---	---
	Middle income	-.473	.158	.623	.003	-.943	.241	.390	.000	---	---	---	---
Province	Atlantic	---	---	---	---	---	---	---	---	---	---	---	---
	Quebec	-1.44	.187	.237	.000	-1.06	.239	.346	.000	-2.22	.335	.109	.000
	Ontario	-.578	.113	.561	.000	-.470	.162	.625	.004	-.766	.165	.465	.000
	Prairies	-.753	.172	.471	.000	-.622	.238	.537	.009	-1.03	.257	.357	.000
Years in Canada	0-4 years	-1.08	.306	.340	.000	---	---	---	---	-2.22	.793	.109	.005
	5-9 years	-1.16	.252	.313	.000	-.665	.328	.514	.042	-1.58	.411	.206	.000
Country of origin	Europe/USA	-.748	.112	.473	.000	-.885	.150	.413	.000	-.489	.164	.613	.003
Physical activity	Active	---	---	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	.410	.109	1.51	.000	---	---	---	---	.775	.152	2.17	.000
Smoking status	Never smoker	-.363	.129	.695	.005	-.733	.169	.481	.000	---	---	---	---
	Smoked < 25 years	---	---	---	---	-.364	.175	.695	.038	---	---	---	---
Social support	High social support	---	---	---	---	---	---	---	---	-.654	.267	.520	.014
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.434	.163	.648	.008	---	---	---	---	-.575	.220	.563	.009
	Same stress as usual	---	---	---	---	---	---	---	---	-.512	.209	.599	.014
Depression	Likely not depressed	-.601	.232	.548	.010	-1.04	.381	.352	.006	---	---	---	---
BMI	BMI <27	-.895	.100	.409	.000	-.757	.140	.469	.000	-1.15	.150	.316	.000
Constant		-5.93	.561	.003	.000	-6.05	.805	.002	.000	-6.17	.743	.002	.000
ρ^2				0.160				0.156				0.196	
Correctly classified (cut point 0.15)				68.3%				67.3%				73.5%	
Correctly classified (cut point 0.5)				84.7%				83.0%				86.9%	
Likelihood ratio statistic				551.77				281.83				322.46	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

5.2.2 Coronary heart disease

The regression models for all respondents and immigrants alone were able to explain for more variance than the models for any heart condition or HBP. The model for all respondents was able to correctly classify 93% of the cases at a cut point of 0.5, and 86% of the cases at a cut point of 0.15. Similarly, the model for immigrants alone was able to correctly classify 94% of the cases at a cut point of 0.5, and almost 88% of cases at a cut point of 0.15. The rho-squared values were slightly higher for the immigrant models than for the models of all respondents. The range for immigrant models (all immigrants, males only, females only) was 0.154-0.177, compared to 0.129-0.137 for the models for all respondents (all respondents, males only, females only). Tables 5.5 and 5.6 outline the models for CHD for all respondents and immigrants alone, respectively.

For the regression analyses examining the risk factors for CHD among all respondents, increasing age, being male, having low income, lower levels of education, living in the Atlantic provinces or Ontario, being a native-born Canadian, being physically inactive, abstaining from alcohol, smoking, having more stress than usual and being depressed were found to be predictors of CHD (Table 5.5). Marital status, social support and diabetes were not predictors of CHD in the general population.

Among the overall sample of respondents, immigration status was found to be a predictor of heart disease. In other words, native-born Canadians were significantly more likely to suffer from CHD than immigrants. When immigrants were analyzed separately, the immigration variables (country of origin and length of time in Canada) were not

significant predictors of CHD in any the regression analyses (all immigrants, immigrant males, immigrant females). Immigration status was not a significant predictor in the regression model of any heart condition, nor was it observed among the regression model for HBP. Another trend unique to the heart disease regression analysis was that males were significantly more likely to have heart disease than females. This is most likely due to the fact that more than one third of respondents were between 40 and 49 years, and approximately two-thirds of respondents were less than 60 years. Males and females suffer from heart disease equally, however, men suffer from heart disease on average 10 years younger than women (55 years versus 65 years) (Heart & Stroke Foundation 2004). Since the majority of the respondents are less than 60 years old, it is not surprising that more males than females have reported heart disease.

Ontario has a higher proportion of immigrants than any other region in Canada. Since immigrants have significantly fewer incidences of heart disease, one might expect a lower incidence of heart disease in Ontario because of Ontario's immigrant population. However, respondents from Ontario reported significantly higher incidences of heart disease than respondents from B.C. When the risk factors were compared between Ontario and B.C., they were very similar, which makes it difficult to explain for the difference in heart disease. The proportion of respondents who smoke cigarettes, who are physically inactive, who are depressed, who report chronic stress, and who consume alcohol is consistent between Ontario and B.C. This suggests that there are other variables involved. This study does not take into account environmental variables such as air quality, which may impact heart health (Glantz 2002; Zanobetti et al 2003).

Similar to the incidence of any heart condition, the higher incidence of heart disease in the Atlantic provinces than B.C. can most likely to be explained largely to the income disparity between the Atlantic provinces and B.C.

Unlike the results for males in the regression analysis of CHD for all respondents, immigrant males were not significantly more likely than immigrant females to develop CHD. The differences in the incidence of CHD were detected among the regions of residence within Canada. Immigrants from the Atlantic provinces and Ontario were significantly more likely than immigrants from B.C. to report CHD.

The country of origin and length of time immigrants had lived in Canada was very similar between immigrants who live in Ontario and those who live in B.C. Approximately 69% of the immigrants in Ontario are of European descent compared to 67% of immigrants from European descent in B.C. In terms of length of time in Canada, 88% of immigrants in Ontario had lived in Canada more than 10 years compared to 89% of immigrants from B.C.

One difference between the residents of Ontario and B.C. was that the immigrants in B.C. were less likely to have smoked for more than 25 years compared to the immigrants from Ontario (17% versus 24%). Immigrants who had never smoked were significantly less likely to have CHD than immigrants who had smoked for more than 25 years.

With respect to sociodemographic variables, increasing age, lower level of education, lower income and living in the Atlantic provinces or Ontario were significant predictors of CHD among immigrants (Table 5.6). Gender, marital status, country of

origin, physical activity and diabetes were not predictors of CHD. The incidence of CHD significantly increased with age. High school graduates were significantly less likely to report CHD than immigrants with post-secondary education. Among the female immigrants, those with less than high school education were significantly more likely to have CHD than immigrant females with post-secondary education. Income was only a significant predictor of CHD among the immigrant females—high and middle income females were significantly less likely to report CHD than low income females.

Immigrants who abstained from drinking alcohol were significantly more likely to report CHD than immigrants who consume alcohol. Immigrants who have never smoked reported significantly fewer incidences of CHD than immigrants who had smoked more than 25 years. Immigrants with high social support reported fewer incidence of CHD than immigrants with low social support. Also, immigrants who reported less stress than usual had fewer incidences of CHD than immigrants with more stress than usual. Finally, immigrants who were likely not depressed had significantly fewer incidences of CHD than immigrants who were likely depressed.

Table 5.5. Logistic regression for all respondents for CHD (aged 40+, BMI excluded).

Variable		All Respondents (n=26849)				Males (n=13035)				Females (n=13814)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	.288	.054	.785	.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.361	.011	1.43	.000	.356	.015	1.43	.000	.346	.017	1.41	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	-.267	.121	.765	.027
Income	High income	-.273	.069	.761	.000	---	---	---	---	-.390	.100	.677	.000
	Middle income	-.313	.068	.732	.000	---	---	---	---	-.368	.091	.692	.000
Region of residence	Atlantic	.459	.101	1.58	.000	.750	.139	2.12	.000	---	---	---	---
	Quebec	---	---	---	---	---	---	---	---	---	---	---	---
	Ontario	.468	.082	1.60	.000	.643	.115	.190	.000	.275	.118	1.32	.020
	Prairies	---	---	---	---	---	---	---	---	---	---	---	---
Immigration status	Immigrant	-.242	.068	.785	.000	-.310	.094	.733	.000	---	---	---	---
Physical activity	Active	---	---	---	---	---	---	---	---	-.463	.133	.630	.001
	Moderately active	---	---	---	---	---	---	---	---	-.265	.099	.767	.008
Alcohol	Abstainer	.394	.056	1.48	.000	.316	.082	1.37	.000	.401	.079	1.49	.000
Smoking status	Never smoker	-.531	.059	.588	.000	-.663	.089	.515	.000	-.429	.083	.651	.000
	Smoked <25 years	-.282	.074	.754	.000	.316	.094	.729	.001	---	---	---	---
Social support	High social support	---	---	---	---	---	---	---	---	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.229	.093	.795	.014	---	---	---	---	---	---	---	---
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.709	.106	.492	.000	-.577	.161	.561	.000	-.861	.141	.423	.000
Constant		-7.18	.221	.001	.000	-7.21	.305	.001	.000	-6.72	.309	.001	.000
ρ^2				0.129				0.130				0.137	
Correctly classified (cut point 0.15)				85.8%				84.6%				87.2%	
Correctly classified (cut point 0.5)				93.2%				92.7%				93.6%	
Likelihood ratio statistic				1731.25				887.10				901.89	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.6. Logistic regression for immigrants for CHD (40+, BMI excluded).

Variable		All Immigrants (n=5446)				Male Immigrants (n=2756)				Female Immigrants (n=2690)			
		β	SE (β)	OR	p-value	B	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.419	.028	1.52	.000	.392	.040	1.48	.000	.442	.043	1.56	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	-.608	.219	.544	.005
	H.S. graduate	-.713	.186	.490	.000	-1.008	.300	.365	.001	---	---	---	---
Income	High income	---	---	---	---	---	---	---	---	-.714	.234	.490	.002
	Middle income	---	---	---	---	---	---	---	---	-.611	.213	.543	.004
Region of residence	Atlantic	1.002	.335	2.72	.003	1.839	.405	6.29	.000	---	---	---	---
	Quebec	---	---	---	---	---	---	---	---	1.288	.329	3.63	.000
	Ontario	.837	.175	2.31	.000	.637	.231	1.89	.006	.994	.277	2.70	.000
	Prairies	---	---	---	---	---	---	---	---	.945	.338	2.57	.005
Years in Canada	0-4 years	---	---	---	---	---	---	---	---	---	---	---	---
	5-9 years	---	---	---	---	---	---	---	---	1.111	.297	3.04	.000
Country of origin	Europe/USA	---	---	---	---	---	---	---	---	---	---	---	---
Physical activity	Active	---	---	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	.563	.127	1.76	.000	.509	.195	1.66	.009	.491	.043	1.56	.008
Smoking status	Never smoker	-.630	.137	.533	.000	-.923	.213	.397	.000	---	---	---	---
	Smoked <25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.410	.185	.664	.026	---	---	---	---	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.505	.208	.603	.015	-.934	.316	.393	.003	---	---	---	---
	Same stress as usual	---	---	---	---	-.704	.319	.495	.028	---	---	---	---
Depression	Likely not depressed	-1.183	.242	.306	.000	-1.162	.377	.313	.002	-1.336	.325	.263	.000
Constant		-7.42	.519	.001	.000	-6.63	.736	.001	.000	-8.64	.773	.000	.000
ρ^2				0.154				0.177				0.169	
Correctly classified (cut point 0.15)				87.6%				87.9%				89.1%	
Correctly classified (cut point 0.5)				94.0%				94.1%				94.3%	
Likelihood ratio statistic				383.16				226.03				236.26	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

The Role of BMI

When the regression analyses were run for all respondents and immigrants alone for CHD and including the BMI variable, the models were able to correctly classify more cases. Tables 5.7 and 5.8 detail the regression models for CHD for all respondents and immigrants alone, respectively, including the BMI variable and limiting age to 40-64 years. These models were able to correctly classify approximately 96% of the cases in the model for all respondents, and 97% of the cases for the immigrant model. The rho-squared values are mostly consistent between the models with and without the BMI variable. For example, the rho-squared value for all respondents in the model excluding BMI is 0.129 and the rho-squared value for all respondents in the model including BMI is 0.109.

As with the comparison of the models with and without the BMI in the models for any heart condition, there are some differences between the models with and without the BMI variable worth mentioning. In the model for males alone, being an immigrant had a protective effect against CHD in the model that excluded BMI, however, this significant difference was not observed in the model that included BMI. The model for immigrant females alone was able to correctly classify almost 98% (cut point 0.5) of the cases when BMI was included. There were more variables included in the model without BMI, however, the percentage correctly classified was slightly less at 94% (cut point 0.5). By excluding patients over 65 years and including the additional variable, the model for immigrant females was able to eliminate some of the 'noise' and correctly classify almost all of the respondents.

Table 5.7. Logistic regression for all respondents for CHD (aged 40-65, BMI included).

Variable		All Respondents (n=18200)				Males (n=8933)				Females (n=9267)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	.352	.081	1.42	.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.507	.030	1.66	.000	.538	.039	1.71	.000	.439	.045	1.55	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	.260	.133	1.29	.050
	H.S. graduate	---	---	---	---	---	---	---	---	---	---	---	---
Income	High income	-.283	.107	.754	.008	---	---	---	---	---	---	---	---
	Middle income	-.306	.117	.736	.009	---	---	---	---	---	---	---	---
Region of residence	Atlantic	.935	.175	2.55	.000	1.97	.288	7.18	.000	---	---	---	---
	Quebec	.776	.156	2.17	.000	1.57	.272	4.81	.000	---	---	---	---
	Ontario	.905	.154	2.47	.000	1.76	.269	5.83	.000	---	---	---	---
	Prairies	.580	.175	1.79	.001	1.41	.291	4.12	.000	---	---	---	---
Immigration status	Immigrant	-.242	.113	.785	.033	---	---	---	---	---	---	---	---
Physical activity	Active	---	---	---	---	.401	.131	1.49	.002	---	---	---	---
	Moderately active	---	---	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	.532	.088	1.70	.000	.430	.122	1.54	.000	.661	.124	1.94	.000
Smoking status	Never smoker	-.852	.096	.427	.000	-1.03	.142	.356	.000	-.785	.133	.456	.000
	Smoked <25 years	-.300	.096	.741	.002	-.333	.121	.717	.006	-.450	.169	.638	.008
Social support	High social support	---	---	---	---	-.377	.153	.686	.014	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.277	.138	.758	.045	-.803	.184	.448	.000	---	---	---	---
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.835	.133	.434	.000	---	---	---	---	-1.14	.159	.319	.000
BMI	BMI <27	-.326	.078	.722	.000	-.512	.103	.599	.000	---	---	---	---
Constant		-9.24	.451	.000	.000	-10.4	.626	.000	.000	-7.96	.612	.000	.000
ρ^2				0.109				0.131				0.091	
Correctly classified (cut point 0.15)				94.6%				92.5%				96.0%	
Correctly classified (cut point 0.5)				96.2%				95.7%				96.9%	
Likelihood ratio statistic				685.76				466.39				249.67	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.8. Logistic regression for immigrants for CHD (aged 40-65, BMI included).

Variable		All Immigrants (n=3154)				Male Immigrants (n=1572)				Female Immigrants (n=1582)			
		β	SE (β)	OR	p-value	B	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.652	.084	1.92	.000	.775	.113	2.17	.000	.461	.127	1.59	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	-.834	.307	.434	.007	-1.00	.386	.368	.010	---	---	---	---
	H.S. graduate	-.927	.313	.396	.003	-1.49	.552	.225	.007	---	---	---	---
Income	High income	---	---	---	---	---	---	---	---	---	---	---	---
	Middle income	-.902	.327	.406	.006	---	---	---	---	---	---	---	---
Region of residence	Atlantic	1.51	.678	4.52	.026	3.37	.880	29.0	.000	---	---	---	---
	Quebec	1.12	.458	3.07	.014	2.22	.685	9.19	.001	---	---	---	---
	Ontario	1.51	.374	4.51	.000	2.27	.635	9.69	.000	---	---	---	---
	Prairies	1.27	.445	3.55	.004	1.58	.727	4.88	.029	---	---	---	---
Years in Canada	0-4 years	---	---	---	---	---	---	---	---	---	---	---	---
	5-9 years	---	---	---	---	---	---	---	---	---	---	---	---
Country of origin	Europe/USA	---	---	---	---	---	---	---	---	---	---	---	---
Physical activity	Active	---	---	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	-.998	.419	.369	.017	---	---	---	---
Alcohol	Abstainer	.703	.221	2.02	.001	---	---	---	---	1.02	.344	2.76	.003
Smoking status	Never smoker	-1.22	.252	.297	.000	-1.15	.346	.317	.001	-1.30	.401	.271	.001
	Smoked <25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.576	.294	.562	.051	-.816	.3490	.442	.019	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	---	---	---	---	---	---	---	---	---	---	---	---
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-1.08	.347	.340	.002	-1.39	.603	.247	.021	-1.04	.446	.354	.020
BMI	BMI <27	-.433	.209	.648	.038	---	---	---	---	-.661	.335	.516	.048
Constant		-10.4	1.25	.000	.000	-12.7	1.68	.000	.000	-7.99	1.77	.000	.000
ρ^2				0.167				0.197				0.129	
Correctly classified (cut point 0.15)				96.0%				94.6%				97.1%	
Correctly classified (cut point 0.5)				97.2%				96.6%				97.8%	
Likelihood ratio statistic				164.81				115.32				50.73	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

5.2.3 High Blood Pressure

The regression analysis models for HBP for all respondents and immigrants alone are described in Tables 5.9 and 5.10, respectively. The rho-squared values for these models are lower than the rho-squared values for the models for any heart condition and CHD. The rho-squared values range from 0.056 to 0.095 for the models for all respondents, and from 0.089 to 0.143 for the immigrant models. Thus, the immigrant models have a slightly better fit. The correctness of classification is similar between the models for all respondents and the models for immigrants alone. For instance, the model of all respondents correctly classified 81% (cut point 0.5) of cases, and the immigrant model correctly classified 79% (cut point 0.5) of cases.

Increasing age, being female, being less educated, having lower income, living in Atlantic Canada, being an immigrant, being physically inactive, abstaining from alcohol, smoking, having low social support and being depressed were all significant predictors of HBP among all respondents. The variables that were not significant predictors of HBP were marital status and diabetes. Unlike the regression analysis for CHD, males were significantly less likely to have HBP than females, after controlling for other effects. Increasing age was a significant predictor of HBP. Respondents with a high school education or less were significantly more likely to report HBP than respondents with a post-secondary education. This trend was not observed among the males and females when analyzed separately. Males in the middle income category were significantly less likely than males in the low income category to report HBP. There were no other significant comparisons among the income category and HBP.

With respect to the lifestyle variables, respondents who were at least moderately active were significantly less likely to report HBP than inactive respondents. Respondents with high social support were less likely to report HBP than respondents with low social support. Respondents reporting less stress than usual were less likely to report HBP than respondents reporting more stress than usual. Finally, respondents who were likely not depressed reported significantly fewer incidences of HBP.

In terms of region of residence, residents of the Atlantic provinces were significantly more likely to report HBP compared to B.C. Again, the difference between the Atlantic provinces and B.C. is most likely income related.

Opposite to the results of the regression analyses for CHD, females that had a significantly higher incidence of HBP than the males. As explained previously, this is consistent throughout the literature because HBP is a side effect of menopause (Staessen et al 1998; Rappelli 2002).

For the regression analysis examining the risk factors for HBP among immigrants, being female, increasing age, being married, being less educated, living in B.C., living in Canada more than 10 years, being from a Non-European country, abstaining from alcohol, smoking, having low social support and being depressed were all significant predictors of HBP (Table 5.10). Income, diabetes and chronic stress were not predictors of HBP among immigrants. Immigrants who were married reported a higher incidence of HBP than immigrants who were not married. Immigrants with less than high school education had significantly more incidences of HBP than immigrants with post-secondary education.

Immigrant females who were active were more likely to have HBP than inactive immigrant females. This finding is somewhat surprising, as physical activity is generally associated with improved health. It is important to note, however, that the physical activity variable in the NPHS measured 'leisure physical activity', and not overall physical activity. Thus, it is possible that the immigrant females who report not being physically active in their leisure time, may be physically active otherwise (i.e. physically active at work). Physical activity was not a significant predictor among the whole group of immigrants or males alone. Also, immigrant females who never smoked reported significantly higher incidences of HBP than immigrant females who smoked for more than 25 years. As with physical activity, one would expect improved health among the females who had never smoked compared to those who had smoked for more than 25 years. One possible explanation for this outcome may have to do with the wording of the survey question for HBP, the question was "[h]ave you been diagnosed with high blood pressure by a physician"? Perhaps the immigrant females who smoked for 25 years were less likely to see a physician than immigrant females who never smoked, thus never had HBP diagnosed by a physician. Smoking status was not a significant predictor among the whole group of immigrants or males alone. Immigrants who abstained from alcohol were more likely to have HBP than immigrants who drank alcohol. Immigrants with high social support reported fewer incidences of HBP than immigrants who reported low social support. Finally, immigrants who were likely not depressed reported significantly fewer incidences of HBP than immigrants who were likely depressed.

Immigrant females were also significantly more likely to report HBP than immigrant males. Country of origin and length of time in Canada played a significant role in the regression analysis for HBP. Immigrants who had lived in Canada for less than 10 years were significantly less likely to report HBP than immigrants who had lived in Canada more than 10 years. The reasoning behind this, as explained previously, is most likely a result of the 'healthy immigrant effect' and the long latent period of heart conditions. Also, immigrants of European descent were significantly less likely to report HBP than immigrants of Asian descent.

As for region of residence, immigrants from Quebec, Ontario and the Prairies were less likely to have HBP than immigrants from B.C. This result is peculiar because one would expect that the immigrants living in Quebec would have a higher incidence of HBP compared to immigrants in B.C., because they are more likely to smoke (27% versus 17%), more likely to be inactive (69 % versus 60%) and more likely to have a low income (25% versus 14%). The proportion of immigrants living in Quebec who consume alcohol compared to the immigrants living in B.C. is 70% and 71 %, respectively. As mentioned previously, perhaps the type of alcoholic beverage is an important factor in this case. Perhaps more immigrants living in Quebec drink wine than immigrants in B.C., thus gaining the beneficial effects of alcohol. The NPHS survey does not break down alcohol consumption according to type of beverage consumed.

Table 5.9. Logistic regression for all respondents for HBP (aged 40+, BMI excluded).

Variable		All Respondents (n=26849)				Males (n=13035)				Females (n=13814)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	-.190	.034	.827	.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.265	.007	1.30	.000	.243	.010	1.28	.000	.281	.009	1.33	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	.078	.039	1.08	.042	---	---	---	---	---	---	---	---
	H.S. graduate	.125	.047	1.13	.008	---	---	---	---	---	---	---	---
Income	High income	---	---	---	---	---	---	---	---	---	---	---	---
	Middle income	---	---	---	---	-.209	.081	.811	.010	---	---	---	---
Region of residence	Atlantic	.311	.065	1.37	.000	---	---	---	---	.449	.086	1.57	.000
	Quebec	---	---	---	---	-.194	.077	.824	.012	---	---	---	---
	Ontario	---	---	---	---	---	---	---	---	---	---	---	---
	Prairies	---	---	---	---	---	---	---	---	---	---	---	---
Immigration status	Immigrant	.118	.041	1.12	.004	---	---	---	---	---	---	---	---
Physical activity	Active	-.179	.048	.836	.000	---	---	---	---	-.206	.071	.814	.004
	Moderately active	-.126	.041	.882	.002	-.144	.062	.866	.020	---	---	---	---
Alcohol	Abstainer	---	---	---	---	---	---	---	---	.167	.048	1.18	.000
Smoking status	Never smoker	.117	.038	1.12	.002	---	---	---	---	.124	.052	1.13	.016
	Smoked <25 years	---	---	---	---	---	---	---	---	-.275	.075	.759	.000
Social support	High social support	-.125	.061	.883	.041	-.206	.082	.814	.012	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.202	.059	.817	.001	---	---	---	---	-.271	.076	.763	.000
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.396	.074	.673	.000	-.700	.109	.497	.000	-.220	.099	.802	.027
Constant		-4.66	.143	.009	.000	-4.05	.208	.017	.000	-5.18	.173	.006	.000
ρ^2				0.077				0.056				0.095	
Correctly classified (cut point 0.15)				59.5%				63.2%				57.4%	
Correctly classified (cut point 0.5)				81.1%				83.6%				78.8%	
Likelihood ratio statistic				2008.90				647.83				1353.85	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.10. Logistic regression for immigrants for HBP (aged 40+, BMI excluded).

Variable		All Immigrants (n=5446)				Male Immigrants (n=2756)				Female Immigrants (n=2690)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	-.248	.075	.780	.001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.291	.017	1.34	.000	.237	.024	1.27	.000	.316	.023	1.37	.000
Marital status	Married	.184	.087	1.20	.035	---	---	---	---	---	---	---	---
Education	Less than H.S.	.415	.085	1.51	.000	.694	.119	2.00	.000	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	---	---	---	---
Income	High income	---	---	---	---	---	---	---	---	---	---	---	---
	Middle income	---	---	---	---	---	---	---	---	---	---	---	---
Region of residence	Atlantic	---	---	---	---	---	---	---	---	---	---	---	---
	Quebec	-.556	.123	.573	.000	-.636	.171	.529	.000	-.375	.177	.687	.035
	Ontario	-.277	.089	.758	.002	---	---	---	---	-.263	.126	.769	.037
	Prairies	-.467	.129	.627	.000	---	---	---	---	-.603	.185	.547	.001
Years in Canada	0-4 years	-1.440	.333	.237	.000	-.942	.392	.390	.016	-2.039	.645	.130	.002
	5-9 years	-.551	.179	.576	.002	-.601	.290	.548	.038	-.456	.225	.634	.043
Country of origin	Europe/USA	-.325	.087	.722	.000	-.518	.119	.596	.000	---	---	---	---
Physical activity	Active	---	---	---	---	---	---	---	---	.326	.148	1.39	.028
	Moderately active	---	---	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	.249	.080	1.28	.002	---	---	---	---	.348	.106	.001	.001
Smoking status	Never smoker	---	---	---	---	---	---	---	---	.455	.142	1.58	.001
	Smoked <25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.393	.123	.675	.001	---	---	---	---	-.681	.189	.506	.000
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	---	---	---	---	---	---	---	---	---	---	---	---
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.584	.178	.558	.001	-.836	.283	.434	.003	---	---	---	---
Constant		-4.31	.317	.013	.000	-3.598	.461	.027	.000	-5.437	.420	.004	.000
ρ^2				0.107				0.089				0.143	
Correctly classified (cut point 0.15)				59.5%				57.9%				63.0%	
Correctly classified (cut point 0.5)				78.8%				81.5%				76.9%	
Likelihood ratio statistic				591.88				235.36				410.39	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

The Role of BMI

When the BMI variable was added to the HBP analyses for all respondents and immigrants alone, the models were slightly improved (Tables 5.11 and 5.12). The model for all respondents was able to correctly classify 86% (cut point 0.5) of cases and the model for immigrants was able to correctly classify 87% (cut point 0.5) of cases. The rho-squared values were also slightly improved. For example, the rho-squared value for all respondents including the BMI variable was 0.091 compared to 0.077 for the model for all respondents excluding the BMI variable.

When the models including and excluding the BMI variable were compared, low income and region of residence were significant predictors of HBP among all respondents in the model including BMI, however, these were not significant predictors of HBP in the model excluding BMI. Interestingly, the immigration variables (country of origin and length of time in Canada) were consistent across the models with and without the BMI variable. This consistency offers some strength to the impact that these immigration variables have on HBP.

Table 5.11. Logistic regression for all respondents for HBP (aged 40-65, BMI included).

Variable		All Respondents (n=18200)				Males (n=8933)				Females (n=9267)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	-.134	.046	.875	.003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.447	.016	1.56	.000	.441	.023	1.55	.000	.451	.023	1.57	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---	---	---
	H.S. graduate	.150	.059	1.16	.012	.253	.085	1.29	.003	---	---	---	---
Income	High income	-.161	.066	.852	.015	---	---	---	---	-.210	.084	.811	.013
	Middle income	-.282	.072	.754	.000	---	---	---	---	-.360	.092	.698	.000
Region of residence	Atlantic	---	---	---	---	---	---	---	---	---	---	---	---
	Quebec	-.230	.068	.794	.001	-.353	.099	.703	.000	---	---	---	---
	Ontario	-.210	.067	.810	.002	---	---	---	---	-.264	.094	.768	.005
	Prairies	-.286	.080	.752	.000	---	---	---	---	-.373	.113	.688	.001
Immigration status	Immigrant	---	---	---	---	---	---	---	---	---	---	---	---
Physical activity	Active	-.233	.064	.793	.000	-.359	.089	.699	.000	---	---	---	---
	Moderately active	-.164	.054	.849	.003	---	---	---	---	-.234	.076	.791	.002
Alcohol	Abstainer	.109	.053	1.12	.040	---	---	---	---	.242	.068	1.27	.000
Smoking status	Never smoker	---	---	---	---	---	---	---	---	---	---	---	---
	Smoked <25 years	---	---	---	---	---	---	---	---	---	---	---	---
Social support	High social support	-.216	.083	-.806	.009	-.242	.105	.785	.021	---	---	---	---
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.235	.075	.791	.002	---	---	---	---	-.326	.095	.722	.001
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.582	.085	.559	.000	-1.035	.125	.355	.000	-.312	.112	.732	.005
BMI	BMI <27	-.847	.044	.429	.000	-.861	.063	.423	.000	-.816	.061	.442	.000
Constant		-5.85	.249	.003	.000	-5.71	.332	.003	.000	-6.28	.325	.002	.000
ρ^2				0.091				0.088				0.097	
Correctly classified (cut point 0.15)				68.9%				71.6%				66.6%	
Correctly classified (cut point 0.5)				86.3%				87.1%				85.7%	
Likelihood ratio statistic				1439.33				672.76				792.36	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

Table 5.12. Logistic regression for immigrants for HBP (aged 40-65, BMI included).

Variable		All Immigrants (n=3154)				Male Immigrants (n=1572)				Female Immigrants (n=1582)			
		β	SE (β)	OR	p-value	β	SE (β)	OR	p-value	β	SE (β)	OR	p-value
Gender	Male	---	---	---	---	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Age	Age	.532	.040	1.70	.000	.522	.057	1.69	.000	.550	.060	1.73	.000
Marital status	Married	---	---	---	---	---	---	---	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	---	---	---	---
Income	High income	-.398	.152	.672	.009	-.620	.226	.538	.006	---	---	---	---
	Middle income	---	---	---	---	-.709	.255	.492	.006	---	---	---	---
Region of residence	Atlantic	-.817	.395	.442	.039	---	---	---	---	---	---	---	---
	Quebec	-1.75	.207	.173	.000	-1.62	.274	.198	.000	-2.36	.335	.095	.000
	Ontario	-.785	.116	.456	.000	-.801	.168	.449	.000	-1.01	.170	.364	.000
	Prairies	-1.03	.184	.356	.000	-.991	.255	.371	.000	-1.37	.281	.253	.000
Years in Canada	0-4 years	-1.72	.407	.180	.000	-1.48	.488	.228	.002	-2.21	.796	.109	.005
	5-9 years	-1.26	.273	.284	.000	-.672	.336	.511	.046	-2.14	.525	.118	.000
Country of origin	Europe/USA	-.775	.116	.461	.000	-.940	.160	.391	.000	-.596	.171	.551	.000
Physical activity	Active	---	---	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	.305	.113	1.36	.007	---	---	---	---	.720	.156	2.06	.000
Smoking status	Never smoker	---	---	---	---	-.719	.179	.487	.000	---	---	---	---
	Smoked <25 years	---	---	---	---	-.529	.190	.589	.005	---	---	---	---
Social support	High social support	---	---	---	---	---	---	---	---	-.799	.277	.450	.004
Diabetes	Not diabetic	---	---	---	---	---	---	---	---	---	---	---	---
Chronic stress	Less stress than usual	-.385	.173	.680	.026	---	---	---	---	---	---	---	---
	Same stress as usual	---	---	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-.684	.242	.505	.005	-1.09	.390	.336	.005	---	---	---	---
BMI	BMI <27	-.950	.105	.387	.000	-.793	.150	.452	.000	-1.26	.158	.284	.000
Constant		-5.72	.576	.003	.000	-4.74	.852	.009	.000	-6.25	.766	.002	.000
ρ^2				0.160				0.150				0.204	
Correctly classified (cut point 0.15)				72.2%				72.2%				73.4%	
Correctly classified (cut point 0.5)				86.9%				87.0%				88.4%	
Likelihood ratio statistic				503.07				241.09				314.18	

Note: H.S., high school; N/A, not applicable; OR, odds ratio; SE, standard error

5.3 Collinearity Diagnostics

Tests were conducted to measure the relationship between the independent variables (multicollinearity) included in the regression analyses. This thesis uses tolerance as a measure of collinearity. Tolerance was calculated using the following formula: $1 - R^2_k$, where R^2_k is the coefficient of determination for the prediction of variable *k* by the other predictor variables. Thus, as the value for tolerance decreases, the independent variable is more similar to other variables. According to Menard (1995), a tolerance value less than 0.1 indicates a serious collinearity concern. Table 5.13 outlines the tolerance values for the whole sample of respondents and immigrants alone, reported for the final step of each regression analyses. From the table it is evident that multicollinearity is not a problem for this data set, as all values are greater than 0.8.

Table 5.13. Collinearity diagnostics for the independent variables included in the regression analyses

Heart condition	Sample	Independent variable	Tolerance (final step of each model)[a]
Any heart condition	All respondents	Age	.845
		Chronic stress	.963
		Alcohol consumption	.943
		Depression	.957
		Physical activity	.978
		Marital status	.952
		Education	.877
		Region of residence	.971
CHD	Immigrants	Age	.883
		Depression	.962
		Alcohol consumption	.929
		Smoking status	.926
		Region of residence	.974
		Chronic stress	.957
		Education	.897
		Social support	.988
HBP	All respondents	Age	.942
		Gender	.923
		Chronic stress	.955
		Physical activity	.977
		Depression	.958
		Smoking status	.921
		Alcohol consumption	.930
		Region of residence	.958
		Immigrant status	.948

[a] The tolerance values are based on linear regression models, thus the final step of the models presented in this table may not be exact to the models presented of the logistic regression analyses earlier in this chapter.

5.4 The Risk of Heart Disease: Survival Analysis

Prior to running the survival analysis for any heart condition, crosstabulations were run for each of the four NPHS cycles (1994/1995, 1996/97, 1998/99 and 2000/01) in order to gain a general sense of the data for each cycle, including to determine how heart health changes over time as a particular cohort of individuals age. Table 5.14

outlines the incidence of heart conditions across the four NPHS cycles. In all cycles, the native-born Canadians had a higher incidence of heart conditions than immigrants. However, the incidence for both native-born Canadians and immigrants seemed to be increasing over time. The incidence of heart conditions in the 1994/95 cycle for native-born Canadians was 14.9% compared to 4.5% in the immigrant population, and the incidence of heart conditions in the 2000/01 cycle was 24.0% for native-born Canadians and 7.5% for immigrants.

Table 5.14. Incidence of heart conditions according to NPHS cycle, native- and foreign-born aged 40+ in 1994/95.

NPHS Cycle	% of Native-born Canadians with Heart Condition	% of Immigrants with Heart Condition
1994/95	14.9%	4.5%
1996/97	18.4%	5.9%
1998/99	21.4%	6.1%
2000/01	24.0%	7.5%

When the incidence of heart conditions was compared across arrival cohorts (i.e. decade in which the immigrants migrated to Canada), those who immigrated the longest time ago (pre-1970) had the highest incidence of heart conditions (Table 5.15). This is not surprising because this cohort also represents the oldest cohort of immigrants. Consistent with the results of the incidence of heart conditions according to NPHS cycle presented in Table 5.13, the incidence of heart conditions increases over time, regardless of arrival cohort. That is, in the 1994/95 cycle, 13.1% of the immigrants who reported arriving in Canada before 1970 had a heart condition, compared to 21.2% of immigrants who reported arriving in Canada before 1970 in the 2000/01 cycle. The most dramatic

increase in the incidence of heart conditions according to arrival cohort occurred in the immigrants arriving before 1970 across the four cycles, with the incidence rising from 13.1 percent in 1994/95 to 21.2% by 2000/01. In contrast, the difference in the incidence of heart conditions between the 1994/95 cycle and the 2000/01 cycle for those immigrants who arrived between 1990 and 1994 was less than 1%. Similarly, the difference in the incidence of heart conditions between the 1994/95 cycle and 2000/01 cycle was 1.5% for the immigrants arriving between 1980 and 1989, and 2% for immigrants arriving between 1970 and 1979.

Table 5.15. Incidence of heart conditions among immigrants according to arrival cohort and NPHS cycle.

NPHS Cycle	Arrived 1990-1994	Arrived 1980-1989	Arrived 1970-1979	Arrived Before 1970
1994/95	<1%	1.4%	3.9%	13.1%
1996/97	2.2%	1.8%	4.1%	17.0%
1998/99	1.6%	1.9%	4.8%	17.6%
2000/01	1.8%	2.9%	5.9%	21.2%

A survival analysis was run over four cycles of the NPHS. For the analysis, all respondents who were over 40 years in 1994/95 and reported that they *did not* suffer from a heart condition in 1994/95 were included. The analysis was also run for immigrants separately. By including all respondents who did not have a heart condition in 1994/95, the analysis can measure the risk of developing a heart condition over the next three cycles of the survey. The same variables were used in the logistic regression as were used in the survival analysis.

The hazard ratio (HR) is a form of relative risk that provides the summary of the difference between two curves, representing the risk of developing a heart condition for various risk factors (age, gender, region of residence, lifestyle factors, etc.). For instance, in the survival analysis for all respondents, the HR for marital status was 1.6, which means that those who were married had 1.6 times the risk of developing a heart condition compared to those who were not married. This trend was not observed among the immigrant respondents.

The survival analysis indicated that there were several similarities between immigrants and all respondents in terms of the risk of heart conditions. When the analysis was run for all respondents the significant predictors of any heart condition were age, income, region of residence, race, immigration status, smoking status and diabetes (Table 5.15). The survival analysis indicated that native-born Canadians were at significantly greater risk for developing a heart condition relative to immigrants (HR=1.83), consistent with results noted in the logistic regressions presented earlier. Older age, low income (compared to middle income), smoking for more than 25 years (compared to never smoking) and having diabetes also increased the risk of developing heart disease in both the pooled (immigrants and native-born) and immigrants only model. Among the sample of all respondents, being married, living in the Atlantic provinces, Quebec or Ontario, being depressed and being a race other than white are significant predictors of having a heart condition. However, these were not found to be significant predictors of heart conditions among the sample of immigrants alone.

Among the whole sample of respondents, those who were classified as 'white' for race were significantly less likely to have a heart condition, although race was not statistically significant in the immigrant only model. Amongst immigrants, country of origin did have an effect on the risk of heart disease, with Non-Europeans significantly more likely to have a heart condition than immigrants from European countries. This is puzzling because logic would suggest that since significantly more immigrants from Non-European countries reported having developed a heart condition than European immigrants, being 'white' would significantly lower the chances of developing a heart condition. When a crosstabulation was run comparing race and heart condition for immigrants only in the 1996/97 NPHS survey, 24.6% of 'white' immigrants had a heart condition compared to 24.1% of 'non-white' immigrants. Thus, a similar proportion of 'white' immigrants and 'non-white' immigrants have a heart condition, however, the 'white' immigrants may have been diagnosed prior to 1994. It is important to recall that the respondents with a heart condition in 1994 were excluded from the analysis. Perhaps the increased incidence of Non-European immigrants who developed heart conditions since 1994 can be explained by the fact that more Non-European immigrants have immigrated in recent years than European immigrants. According to the results of the 1996/97 NPHS survey, 4.6% of the immigrants from European countries immigrated since 1986 compared to 23.4% of the immigrants from Non-European countries.

Another significant predictor of developing a heart condition was arrival cohort. Immigrants who arrived in Canada between 1980 and 1989 were significantly less likely than immigrants who arrived in Canada prior to 1970 to develop a heart condition. This

can most likely be explained by the likely difference in age of the respondents. It is more likely that the immigrants will generally be older in the sample of immigrants who have lived in Canada the longest.

Diabetes was a significant predictor of heart conditions in the whole sample of respondents and immigrants alone. The importance of diabetes as a significant predictor of heart conditions needs to be interpreted cautiously because there were very few incidences of diabetes reported, thus making statistical calculations more difficult, and more likely to be biased. For instance, the survival analysis for the immigrant sample indicated that the hazard ratio for the diabetes variable was 30.0, with a 95% confidence interval of 1.8 to 487.9. This suggests that an immigrant with diabetes has 1.8 to 487.9 times the risk of developing a heart condition compared to an immigrant without diabetes.

Table 5.15. Survival analysis of any heart condition. Data from 1994, 1996 and 1998 NPHS.

Variable		All Respondents (N=2815)					All Immigrants (N=421)				
		β	SE (β)	HR	95% CI	p-value	β	SE (β)	HR	95% CI	p-value
Gender	Male	---	---	---	---	---	---	---	---	---	---
Age	Age	0.06	0.01	1.06	1.05-1.07	<.0001	0.06	0.02	1.06	1.03-1.10	.0003
Marital status	Married	0.46	0.17	1.60	1.14-2.24	.006	---	---	---	---	---
Education	Less than H.S.	---	---	---	---	---	---	---	---	---	---
	H.S. graduate	---	---	---	---	---	---	---	---	---	---
Household income	High income	---	---	---	---	---	---	---	---	---	---
	Middle income	-0.36	0.14	0.70	0.53-0.91	.008	-2.47	0.78	0.09	0.02-0.39	.0015
Region of residence	Atlantic	1.49	0.60	4.47	1.37-14.6	.013	---	---	---	---	---
	Quebec	0.43	0.17	1.54	1.09-2.16	.013	---	---	---	---	---
	Ontario	0.61	0.17	1.85	1.33-2.56	.0002	---	---	---	---	---
	Prairies	---	---	---	---	---	---	---	---	---	---
Arrival cohort	1970-1979	N/A	N/A	N/A	N/A	N/A	---	---	---	---	---
	1980-1989	N/A	N/A	N/A	N/A	N/A	-2.25	1.05	0.11	0.01-0.83	.0323
	1990-1994	N/A	N/A	N/A	N/A	N/A	---	---	---	---	---
Country of origin	Asia/other	N/A	N/A	N/A	N/A	N/A	1.50	0.37	4.49	2.17-9.29	<.0001
Race	White	-1.01	0.25	0.36	0.22-0.60	<.0001	---	---	---	---	---
Immigration status	Native-born Canadian	0.61	0.19	1.83	1.27-2.65	.001	N/A	N/A	N/A	N/A	N/A
Physical activity	Active	---	---	---	---	---	---	---	---	---	---
	Moderately active	---	---	---	---	---	---	---	---	---	---
Alcohol	Abstainer	---	---	---	---	---	---	---	---	---	---
Smoking status	Smoked less than 25 years	---	---	---	---	---	---	---	---	---	---
	Smoked more than 25 years	0.56	0.12	1.75	1.39-2.22	<.0001	1.00	0.39	2.72	1.28-5.79	.009
Social support	High social support	---	---	---	---	---	---	---	---	---	---
Diabetes	Diabetic	0.65	0.27	1.91	1.12-3.26	.017	3.40	1.42	30.0	1.85-487.8	0.017
Chronic stress	Same stress as usual	---	---	---	---	---	---	---	---	---	---
	More stress than usual	---	---	---	---	---	---	---	---	---	---
Depression	Likely not depressed	-0.50	0.22	0.61	0.39-0.93	.022	---	---	---	---	---
ρ^2				0.0771					0.243		

Note: CI, confidence interval; HR, hazard ratio; H.S., high school; N/A, not applicable; SE, standard error

5.5 Summary

There were several consistencies across the regression analyses for any heart condition, CHD and HBP. As expected, increasing age was a consistent and significant predictor in all three sets of analyses. Another consistency across all analyses was diabetes, although it was never a significant predictor of heart health in any of the analyses, a somewhat contradictory finding given the literature linking it to heart disease (Aronow and Ahn 1999; Gillum et al 2000; Arteagoitia et al 2003). However, there were very few incidences of diabetes reported in the sample, thus, this analysis most likely did not achieve an accurate picture of the role of diabetes on heart health. Among the cohort of immigrants there were only four cases of diabetes reported which makes establishing trends difficult. Marital status was also not a predictor for heart health in any of the analyses, while social support was a predictor of any heart condition and HBP. This would suggest that the social support that one gets from having a spouse is not necessarily the most important source of social support in terms of heart health. It is important to note, that a test for multicollinearity indicated that the independent variables included in the analyses were not affected by collinearity. The fourth variable which was consistent across all the analyses was depression. Respondents who were likely depressed were also more likely to report poor heart health. This is consistent among the literature as well, which also offers strength and credibility to the rest of the analyses (Thomas et al 2003).

The regression analysis was run for all respondents over 40 years, and then it was run again for respondents between the ages of 40 and 65 years so that the BMI variable

could be captured in the regression models. BMI greater than 27 was a significant predictor of any heart condition, CHD and HBP. This second set of analyses also served an additional function: it allowed for the affects of many risk factors on a younger population to be identified. That is, as people age, their health inevitably deteriorates. Once people are over 65 years they are much more likely to suffer from a chronic condition than respondents less than 65 years, regardless of how many healthy lifestyle habits one has.

There were some notable differences between the models for all respondents and immigrants alone. For instance, in the models for any heart condition, low income and physical inactivity were significant predictors of any heart condition among all respondents, however, neither income and nor activity level were significant predictors of heart conditions among immigrants alone. In the immigrant model, the immigration variables, country of origin and length of time in Canada, were both significant predictors of heart conditions. That is, immigrants were more likely to report a heart condition if they had lived in Canada for more than 10 years and if they were from a Non-European country.

There are a few interesting differences between the models for all respondents and immigrants alone for CHD. Firstly, the overall sample of males seems to be at a higher risk of developing CHD, however, immigrant males do not seem to be at an increased risk of CHD compared to immigrant females. Also, income is a significant predictor of CHD among all respondents, but not immigrants alone. Finally, the immigration

variables, country of origin and length of time in Canada, are not significant predictors of CHD among immigrants.

Comparing the model for all respondents to the immigrant model for HBP, physical activity was a significant predictor of HBP among all respondents, but not among immigrants alone. Similar to the results of the models for any heart condition, the immigration variables, country of origin and length of time in Canada, were both significant predictors of HBP among immigrants.

In the sample of respondents it is important to acknowledge a few differences between the immigrant sample and the whole sample of respondents. Since there are fewer immigrants than respondents in the whole sample, the results may be slightly less accurate because there are fewer incidences in the smaller sample. For instance, there were only four cases of diabetes reported in the sample of immigrants. Also, the results for immigrant females smoking may not be entirely accurate because 70% of immigrant females never smoked, which skews the distribution of smoking status for immigrant females.

CHAPTER SIX

CONCLUSIONS

6.1 Introduction

This thesis presents the results of the analysis of the NPHS data comparing the heart health of immigrants to that of native-born Canadians. The thesis set out to achieve the following objectives:

- To establish whether immigrants to Canada have lower rates of heart related diseases (coronary heart disease, stroke, high blood pressure) than native-born Canadians.
- To provide an explanation for the difference in heart related conditions if differences exist between immigrants and native-born Canadians, by analyzing lifestyle factors (smoking, alcohol use, physical activity) and psychosocial factors (social support, stress, depression).
- To determine if the incidence of heart related diseases among immigrants increases the longer they live in Canada, regardless of age.

The objectives were met by conducting descriptive analyses and regression analyses of the public data of the 1996/97 NPHS, and survival analyses of the 1994/95, 1996/97, 1998/99 and 2000/01 NPHS private data. This final chapter provides a summary of the results and describes the contributions of this research, and offers suggestions for future research stemming from the conclusions of this research.

6.2 Summary of Findings

Approximately 20% of the respondents of the 1996/97 NPHS were immigrants. Immigrants reported a lower incidence of CHD than the overall group of respondents, even though the immigrants were somewhat older than the overall group. Alternately, the incidence of HBP was higher among the sample of immigrants than the overall group (20.5% versus 18.7%), with immigrant females reporting the highest incidence of HBP (22.5%). Demographic risk factors for heart conditions, such as age and income, affect both immigrants and native-born Canadians, and lifestyle and psychosocial risk factors, such as smoking status, BMI, alcohol consumption and depression, also affect immigrants and native-born Canadians similarly.

When the incidence of heart conditions was compared to the length of time immigrants had lived in Canada, the only significant difference was among HBP in females. The Non-European immigrants between the ages of 40 and 49 were significantly more likely to have HBP than European immigrants in the same age category. Interestingly, European immigrants between the ages of 50 and 59 were significantly more likely to have CHD than Non-European immigrants in the same age category. This suggests that despite the Non-European immigrants' higher incidence of HBP, they are at less risk of CHD compared to European immigrants. HBP is a risk factor for CHD, however, it does not seem to be the predominant risk factor among Non-European immigrants, or else there would be a higher incidence of CHD among the Non-European immigrants.

Native-born Canadians between the ages of 40 and 49 were significantly more likely to have reported having heart conditions than immigrants in the same age group. This significant difference was not observed in the older age categories. Thus, perhaps the effects of age overpower the effect of immigration status in the older respondents. That is, immigration status may be a risk factor for heart conditions in younger respondents. For instance, immigration may be a risk factor for respondents less than 55 years, but it may not be a factor in respondents over 55 years. The specific point at which immigration is no longer a risk factor is unknown. Nonetheless, at some point, the effects of age on the deterioration of the body balance out the difference in immigration status and eventually all respondents have an equal risk of developing heart conditions, regardless of immigration status.

The results of the regression analyses indicated that immigration status was a predictor of heart disease. In other words, native-born Canadians were significantly more likely to suffer from CHD than immigrants. This trend was not observed in the regression model of any heart condition, nor was it observed among the regression model for HBP. Another trend unique to the heart disease regression analysis was that males were significantly more likely to have heart disease than females. Unlike the results for males in the regression analysis of CHD for all respondents, immigrant males were not significantly more likely than immigrant females to develop CHD. All respondents and immigrants alone from the Atlantic provinces and Ontario were significantly more likely than immigrants from B.C. to report CHD.

Similar to the results of the regression analyses for CHD, individuals living in the Atlantic provinces were significantly more likely to report HBP than residents in B.C. Possible explanations for the difference in the incidence of HBP between regions could be due to income disparities. Generally, residents of the Atlantic provinces have lower incomes than residents of B.C. The regression analyses indicated that immigrants who had lived in Canada longer were more likely to have HBP. Opposite to the results of the regression analyses for CHD, females had a significantly higher incidence of HBP than males. Females and immigrant females alone were significantly more likely to report HBP than males and immigrant males, respectively. Immigrants who had lived in Canada for less than 10 years were significantly less likely to report HBP than immigrants who had lived in Canada more than 10 years.

The survival analysis indicated that there were several similarities between immigrants and all respondents in terms of the risk of heart conditions. As would be expected, increasing age, low income and smoking for more than 25 years were significant predictors of heart conditions in both populations. Among the whole sample of respondents, 'whites' were significantly less likely to have a heart condition, although this was not the case amongst 'white' immigrants. In the survival analysis of immigrants, those from Non-European countries were significantly more likely to have a heart condition than immigrants from European countries. Another significant predictor of developing a heart condition was arrival cohort. Immigrants who arrived in Canada between 1980 and 1989 were significantly less likely than immigrants who arrived in Canada prior to 1970 to have developed a heart condition.

Chapter one of this thesis describes the 'healthy immigrant effect' which refers to the phenomenon in which immigrants are healthier upon arrival in their host country than the average person in either the host or origin country. The results of the logistic regression analyses for CHD do not support this phenomenon because the results have not indicated a convergence in the incidence of CHD among the immigrants to the incidence of CHD among the native-born Canadians. The results of this research indicate that immigrants have a significantly lower incidence of CHD than native-born Canadians, and that length of time in Canada is not a significant risk factor for CHD. The results for HBP do indicate that length of time in Canada is a significant predictor of HBP among immigrants. This result needs to be interpreted cautiously because more immigrants may be diagnosed with HBP the longer they live in Canada because the longer immigrants live in Canada the more likely they are to visit a physician who will diagnose them with HBP. It is important to recall that the NPHS question for HBP was "[h]ave you been diagnosed with high blood pressure by a physician?". High blood pressure is usually asymptomatic, and people are often diagnosed with high blood pressure when they are having a regular blood pressure check by their health provider (Chobanian et al 2003), thus without visiting a healthcare provider many people are unaware whether or not they have HBP. Therefore, these results comparing the incidence of heart conditions between immigrants and native-born Canadians do not support the "healthy immigrant effect".

Even though almost 20 variables were analyzed and included in the regression model as possible risk factors for CHD and HBP, there are still many variables that are not accounted for. There are unexplainable differences between immigrants and native-

born Canadians, and between respondents from one region of Canada compared to another. Due to the complexity and high incidence of heart disease in Canada, it may never be possible to ascertain all of the risk factors for heart disease, however, this study has identified several key risk factors and has excluded other variables as possible risk factors. The risk factors identified in this study can form the basis for the development of heart health programs to target all Canadians—both native and foreign born.

6.3 Limitations of the Research

The NPHS was used as the data set for this research because it is a large Canadian survey of a variety of health and demographic variables. However, there are some limitations of the NPHS which need to be acknowledged. One limitation of the NPHS public data is the inability to determine specifically the country of origin of immigrants. The NPHS public data groups immigrants into three categories: European/Australian/American; Asian; or Other. The NPHS does not include any questions regarding diet and eating habits, which undoubtedly affects one's health. However, it is very difficult to ask accurate questions regarding diet, because studies have shown that self-reported eating habits are frequently reported inaccurately (Heitmann 1996).

Approximately 89% of the immigrants who responded to the survey had lived in Canada for 10 or more years. This high proportion of immigrants needs to be taken into consideration when looking at the regression analysis and crosstabulation results. Since

there is not an even distribution of immigrants who arrived in Canada less than 10 years ago and more than 10 years ago, the results may be skewed.

In the survival analysis, diabetes was a significant predictor of heart conditions in the whole sample of respondents and immigrants alone. The importance of diabetes as a significant predictor of heart conditions needs to be interpreted cautiously because there were very few incidences of diabetes reported, thus making statistical calculations more difficult, and more likely to be biased. For instance, the survival analysis for the immigrant sample indicated that the hazard ratio for the diabetes variable was 30.0, with a 95% confidence interval of 1.8 to 487.9. This suggests that an immigrant with diabetes has 1.8 to 487.9 times the risk of developing a heart condition compared to an immigrant without diabetes.

Therefore, there are some limitations of the NPHS data, however, this data set provides more information regarding immigrants to Canada than any other survey currently available. The ideal dataset for this type of analysis investigating the relationship between heart health and immigration would include an accurate variable to assess diet, also a better variable to measure stress or the ability to manage stress would be useful in this analysis. In terms of immigration variables, the country of origin variable would be better if it was more delinated (i.e. including more specific countries of origin, rather than grouping all immigrants into very broad categories). Finally, the ideal dataset would include a variable to measure why the immigrant has chosen to immigrate. In other words, a survey question establishing whether the immigrant whether moved to

Canada voluntarily through a work visa or family sponsorship, or has the immigrant moved to Canada involuntarily (i.e. refugee status).

6.4 Research Contributions

This research is the first of its kind to specifically address the heart health of immigrants in comparison to native-born Canadians using the data from the NPHS. This thesis identified over 20 variables that were possible risk factors for developing heart conditions and incorporated them into a regression analysis. All heart conditions (heart disease, stroke, high blood pressure) combined were analyzed, and then heart disease and high blood pressure were analyzed separately. Separate risk factors for heart disease and high blood pressure were also identified. For instance, native-born Canadians were at a higher risk of developing CHD than immigrants, however, immigrants were at a higher risk of developing HBP. This research also compared heart health for men and women separately, and reported separate results for men and women. Women were more likely to have HBP than men, however, men were more likely to report CHD. Physical activity was a predictor of CHD among women, however, it was not a significant predictor of CHD among men.

6.5 Policy Implications and future Research Directions

This research will help policy makers and program developers create heart health programs for immigrants and native-born Canadians. Heart health promotion programs need to provide education regarding healthy lifestyle choices, such as physical activity, healthy body weight, and smoking.

Overall, this analysis is consistent with other literature that suggests that income is a strong predictor of heart conditions. The results of this research indicate that there were more immigrant females in the low income category than any other cohort of respondents, therefore, heart health promotion programs should specifically target immigrant women.

For heart health programs specifically targeting immigrants, it is very important to engage all immigrants. However, it is the Non-European immigrants and the immigrants who have lived in Canada more than 10 years that are at greatest risk of having HBP. For this reason, heart health programs need to be tailored to meet the needs of communities. In other words, in a community with a large proportion of Non-European immigrants, heart health programs should address the risk factors of high blood pressure. These heart health initiatives must be able to engage Non-European immigrants in order to be effective. One way to engage Non-European immigrants might be to offer programs in a variety of languages.

As mentioned previously, this research has made a variety of contributions. One area that this research has identified as important is the difference between men and women in terms of the incidence of heart disease and high blood pressure. Women are more likely to suffer from HBP, while men are more likely to suffer from CHD. It would be interesting to investigate why this difference exists, and develop policies and programs to address these differences between men and women.

Also, future research should specifically focus on the differences in heart health across regions in Canada—investigating both immigrants and native-born Canadians.

Respondents from the Atlantic provinces had high incidences of CHD and HBP, as hypothesized earlier in this thesis, this could be due to income differences across the country, however, there could be other variables interacting affecting the incidences of heart conditions in the Atlantic provinces. Another area of potential research is to identify what type of alcoholic beverage is consumed by respondents to see if that has an impact of heart health. It would be worthwhile to investigate if any type of alcohol decreases the risk of heart conditions and whether there are differences across Canada and among immigrants in terms of type of beverage chosen. This data is not available in the current NPHS questionnaire; however, it would be useful to incorporate this data into future administrations of the survey.

This thesis has, therefore, provided a basis for a wide variety of other possible research initiatives, which would allow researchers to learn more about the heart health of immigrants and native-born Canadians.

BIBLIOGRAPHY

Alfredsson, L., Ahlbom, A., and Theorell, T. Incidence of myocardial infarction among male Finnish immigrants in relation to length of stay in Sweden. *International Journal of Epidemiology.* 1982:11;225-228.

American Heart Association. High Blood Pressure Statistics. American Heart Association. 2004.

Anand, S. S., Yusuf, S., Vuksan, V., Devanesen, S., Teo, K. K., Montague, P. A., Kelemen, L., Yi, C., Lonn, E., Gerstein, H., Hegele, R. A., and McQueen, M. Differences in risk factors, atherosclerosis, and cardiovascular disease between ethnic groups in Canada: the Study of Health Assessment and Risk in Ethnic groups (SHARE). *Lancet.* 2000:356;279-284.

Andersen, I., Osler, M., Petersen, L., Gronbaek, M., and Prescott, E. Income and risk of ischaemic heart disease in men and women in a Nordic welfare country. *International Journal of Epidemiology.* 2003:32;367-374.

Anderson, J. M. Migration and health: perspectives on immigrant women. *Sociology of Health & Illness.* 1987:9;410-438.

Anderson, J. M., Blue, C., Holbrook, A., and Ng, M. On chronic illness: immigrant women in Canada's work force--a feminist perspective. *Canadian Journal of Nursing Research.* 1993:25;7-22.

Aronow, W. S. and Ahn, C. Incidence of heart failure in 2,737 older persons with and without diabetes mellitus. *Chest.* 1999:115;867-868.

Arteagoitia, J. M., Larranaga, M. I., Rodriguez, J. L., Fernandez, I., and Pinies, J. A. Incidence, prevalence and coronary heart disease risk level in known Type 2 diabetes: a sentinel practice network study in the Basque Country, Spain. *Diabetologia.* 2003:46;899-909.

Assaf, A. R., Parker, D., Lapane, K. L., McKenney, J. L., and Carleton, R. A. Are there gender differences in self-reported smoking practices? Correlation with thiocyanate and cotinine levels in smokers and nonsmokers from the Pawtucket Heart Health Program. *Journal of Women's Health.* 2002:11;899-906.

Barnes, V., Schneider, R., Alexander, C., and Staggers, F. Stress, stress reduction, and hypertension in African Americans: an updated review. [Review] [139 refs]. *Journal of the National Medical Association.* 1997:89;464-476.

Bentham, G., Hinton, J., Haynes, R., Lovett, A., and Bestwick, C. Factors affecting non-response to cervical cytology screening in Norfolk, England. *Social Science & Medicine.* 1995:40;131-135.

Betts, J. R. and Lofstrom, M. The educational attainment of immigrants: trends and implications. *NBER Working Paper Series.* 1998:45.

Birch, S., Gafni, A., and O'Brien, B. Willingness to pay and the valuation of programmes for the prevention and control of influenza. [Review] [29 refs]. *Pharmacoeconomics.* 1999:16;Suppl-61.

Bunker, S. J., Colquhoun, D. M., Esler, M. D., Hickie, I. B., Hunt, D., Jelinek, V. M., Oldenburg, B. F., Peach, H. G., and Ruth, D. "Stress" and coronary heart disease: psychosocial risk factors. National Heart Foundation of Australia position statement update. *Medical Journal of Australia.* 2003:178;272-276.

Canadian Heart Health Initiative. Canadian Heart Health Initiative. Canadian Heart Health Initiative . 2003.

Canadian Mental Health Association. Lifetime incidences of mental disorders by gender, 1999. Canadian Mental Health Association Statistical Sourcebook . 2004. 6-19-2004.

Carter, C., McGee, D., and Yano, K. Morbidity and mortality rates in Okinawan Japanese vs. Mainland Japanese: The Honolulu Heart Program. *Human Biology.* 1984:56;339-353.

Chen, J., Ng, E., and Wilkins, R. The health of Canada's immigrants in 1994-95. *Health Reports, Statistics Canada.* 1996:7;33-45.

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., Jr., Jones, D. W., Materson, B. J., Oparil, S., Wright, J. T., Jr., Roccella, E. J., Joint National Committee on Prevention, D. E. a. T. o. H. B. P. N. H. L. a. B. I., and National High Blood Pressure Education Program Coordinating Committee Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.[see comment]. *Hypertension. 42(6):1206-52.* 2003.

Dallo, F. J. and James, S. A. Acculturation and blood pressure in a community-based smaple of Chaldean-American women. *Journal of Immigrant Health.* 2000:2;145-153.

Daly, J., Davidson, P., Chang, E., Hancock, K., Rees, D., and Thompson, D. R. Cultural aspects of adjustment to coronary heart disease in Chinese-Australians: A review of the literature. *Journal of Advanced Nursing.* 2002:39;391-399.

Deinard, A. and Dunnigan, T. Hmong health care-reflections on a six-year experience. International Migration Review 21, 857-865. 1987.

Dench, J. A hundred years of immigration to Canada: 1900-1999. Canadian Council of Refugees . 2004.

Diwan, S. and Jonnalagadda, S. S. Social intergration and health among Asian Indian immigrants in the United States. *Journal of Gerontological Social Work.*2001:36;45-62.

Dotevall, A., Rosengren, A., Lappas, G., and Wilhelmsen, L. Does immigration contribute to decreasing CHD incidence? Coronary risk factors among immigrants in Goteborg, Sweden. *Journal of Internal Medicine.*2000:247;331-339.

Douketis, J. D., Feightner, J. W., Attia, J., Feldman, W. F., and the Canadian Task Force on Preventive Health Care Periodic health examination, 1999 update: 1. Detection, prevention and treatment of obesity. *Canadian Medical Association Journal.*1999:160;513-525.

Dunn, J. R. Patient swallows removable partial denture: a clinical report. *Journal of Prosthetic Dentistry.*1996:76;571-572.

Dunn, J. R. and Dyck, I. Social determinants of health in Canada's immigrant population: Results from the National Population Health Survey. *Social Science & Medicine.*2000:51;1573-1593.

Dyck, I. Hidden geographies: the changing lifeworlds of women with multiple sclerosis. *Social Science & Medicine.*1995:40;307-320.

Elliott, S. J. Psychosocial stress, women and heart health: a critical review. *Social Science & Medicine.*1995:40;105-115.

Elliott, S. J. and Dean, A. An ecologic analysis of psychosocial stress and heart disease in British Columbia. *Canadian Journal of Public Health.*1998:89;137-141.

Elliott, S. J. and Gillie, J. Moving experiences: a qualitative analysis of health and migration. *Health & Place.*1998:4;327-339.

Enas, E. A., Garg, A., Davidson, M. A., Nair, V. M., Huet, B. A., and Yusuf, S. Coronary heart disease and its risk factors in first generation immigrant Asian Indians to the United States of America. *Indian Heart Journal.*1996:48;343-353.

Evans, R. G. (1994). Introduction. In Aldine DeGruyter (Ed.), *Why Are Some People Healthy and Others Not?* New York.

Evans, R. G. and Stoddart, G. L. Producing health, consuming health care. *Social Science & Medicine.* 1990:31;1347-1363.

Eyles, J., Birch, S., and Newbold, K. B. Delivering the goods? Access to family physician services in Canada: a comparison of 1985 and 1991. *Journal of Health & Social Behavior.* 1995:36;322-332.

Fowler, N. Providing primary health care to immigrants and refugees: the North Hamilton experience. *Canadian Medical Association Journal.* 1998:159;388-391.

Friis, R., Yngve, A., and Persson, V. Review of social epidemiologic research on migrants' health: Findings, methodologic cautions, and theoretical perspectives. *Scandinavian Journal of Social Medicine.* 1998:26;173-180.

Frisbie, W. P., Cho, Y., and Hummer, R. A. Immigration and the health of Asian and Pacific Islander adults in the United States. *American Journal of Epidemiology.* 2001:153;372-380.

Gadd, M., Johansson, S. E., Sundquist, J., and Wandell, P. Morbidity in cardiovascular diseases in immigrants in Sweden. *Journal of Internal Medicine.* 2003:254;236-243.

Garcia-Palmieri, M. R., Feliberti, M., Costas, R., Jr., Colon, A. A., Cruz-Vidal, M., Cortes-Alicea, M., Ayala, A. M., Sobrino, R., and Torres, R. An epidemiological study on coronary heart disease in PR. The Puerto Rico Heart Health Program. 1969. *Boletin - Asociacion Medica de Puerto Rico.* 2002:94;61-67.

Gillum, R. F., Mussolino, M. E., and Madans, J. H. Diabetes mellitus, coronary heart disease incidence, and death from all causes in African American and European American women: The NHANES I epidemiologic follow-up study. *Journal of Clinical Epidemiology.* 2000:53;511-518.

Glantz, S. A. Air pollution as a cause of heart disease. Time for action.[comment]. *Journal of the American College of Cardiology.* 2002:39;943-945.

Government of Canada. Immigration entry requirements for Canada. Government of Canada . 2004. 6-19-2004.

Grossi, G., Soares, J. J. F., Angesleva, J., and Perski, A. Psychosocial correlates of long-term sick-leave among patients with musculoskeletal pain. *Pain.* 1999:80;607-620.

Haynes, S. G., Feinleib, M., and Kannel, W. B. The relationship of psychosocial factors to coronary heart disease in the Framingham Study. Eight-year incidence of coronary heart disease. *American Journal of Epidemiology.* 1980:111;37-58.

Health Protection Branch. Cancer in Canada: Estimated Number of Cases, 1998. 1998.

Heart & Stroke Foundation. Heart and Stroke Foundation of Canada. Heart & Stroke . 2004.

Heitmann, B. L. Social desirability bias in dietary self-report may compromise the validity of dietary intake measures. Implications for diet disease relationships.[comment]. *International Journal of Epidemiology.*1996:25;222-225.

Hirschman, C. The educational enrollment of immigrant youth: a test of the segmented-assimilation hypothesis. [Review] [44 refs]. *Demography.*2001:38;317-336.

Holmes, P., Neville, D., Donovan, C., and MacDonald, C. A. The Newfoundland and Labrador Heart Health Program dissemination story: the formation and functioning of effective coalitions. *Promotion et Education.*2001:Suppl;1-12.

Hoogeveen, R. C., Gambhir, J. K., Gambhir, D. S., Kimball, K. T., Ghazzaly, K., Gaubatz, J. W., Vaduganathan, M., Rao, R. S., Koschinsky, M., and Morrisett, J. D. Evaluation of Lp[a] and other independent risk factors for CHD in Asian indians and their USA counterparts. *Journal of Lipid Research.*2001:42;631-638.

Hunt, L. M., Schneider, S., and Comer, B. Should "acculturation" be a variable in health research? A critical review of research on US Hispanics. *Social Science & Medicine.*2004:59;973-986.

Janes, C. R. and Pawson, I. G. Migration and biocultural adaptation: Samoans in California. *Social Science & Medicine.*1986:22;821-834.

Jones, K. and Moon, G. (1987). Health Disease and Society. In RKP (Ed.), *Health Disease and Society* London.

Kaplan, M. S., Chang, C., Neweson, J. T., and McFarland, B. H. Acculturation status and hypertension among Asian immigrants in Canada. *Journal of Epidemiology and Community Health.*2002:56;455-456.

Keles, I., Onat, A., Toprak, S., Avci, G. S., and Sansoy, V. Family income a strong predictor of coronary heart disease events but not of overall deaths among Turkish adults: a 12-year prospective study. *Preventive Medicine.*2003:37;171-176.

Keys, A. Coronary heart disease in seven countries. *Nutrition.*1970:13;250-252.

Kilewer, E. V. and Jones, R. Immigrant health and use of medical services: Results from the longitudinal survey of immigrants to Australia. 1997. Canberra, Australia, Department of Immigration and Multicultural Affairs.

Liao, L., Whellan, D. J., Tabuchi, K., and Schulman, K. A. Differences in care-seeking behaviour for acute chest pain in teh United States and Japan. *American Heart Journal.*2004:147;630-635.

Lindstrom, M. and Sundquist, J. Immigration and leisure-time physical inactivity: A population-based study. *Ethnicity & Health.*2001:6;77-85.

Luepker, R. V., Rastam, L., Hannan, P. J., Murray, D. M., Gray, C., Baker, W. L., Crow, R., Jacobs, D. R., Jr., Pirie, P. L., Mascioli, S. R., Mittelmark, M. B., and Blackburn, H. Community education for cardiovascular disease prevention. Morbidity and mortality results from the Minnesota Heart Health Program. *American Journal of Epidemiology.*1996:144;351-362.

Mackay, J. The tobacco problem: commercial profit versus health--the conflict of interests in developing countries. *Preventive Medicine.*1994:23;535-538.

MacKinnon, M. and Howard, L. L. Affirming immigrant women's health: Building inclusive health policy. 2000. Halifax, Maritime Centre of Excellence for Women's Health.

Marmot, M. G. and Syme, L. Acculturation and coronary heart disease in Japanese-Americans. *American Journal of Epidemiology.*1976:104;225-247.

Matuk, L. C. Health status of newcomers. *Canadian Journal of Public Health.*1996:87;52-55.

McDonald, J. T. and Kennedy, S. Insights in the 'healthy immigrant effect': Health status and health service use of immigrants to Canada. *Social Science & Medicine.*2004:59;1613-1627.

McKeigue, P. M., Miller, G. J., and Marmot, M. G. Coronary heart disease in South Asians overseas: A review. *Journal of Clinical Epidemiology.*1989:42;597-609.

Menard, S. Applied logistic regression analysis. Sage university paper series on quantitative applications in the social sciences, 7-106. 1995. Thousand Oaks, CA, Sage.

Migration Information Source. Stock of foreign-born population by country of birth, various years, 1991 to 2001 . Migration Information Source . 2004. 6-19-2004.

Ministry of Health and Long-term Care. International Medical Graduates. Government of Ontario . 2004. 6-19-2004.

Mooteri, S. N., Petersen, F., Dagubati, R., and Pai, R. G. Duration of residence in the United States as a new risk factor for coronary artery disease (The Konkani Heart Study). *American Journal of Cardiology.*2004:93;359-360.

Nair, C., Nargundkar, M., Johansen, H., and Strachan, J. Canadian cardiovascular disease mortality: First generation immigrants versus Canadian born. *Health Reports, Statistics Canada.*1990:2;203-228.

Nanji, A. A. Alcohol and ischemic heart disease: wine, beer or both? *International Journal of Cardiology.*1985:8;487-489.

Nelson, T. L., Hunt, K. J., Rosamond, W. D., Ammerman, A. S., Keyserling, T. C., Mokdad, A. H., and Will, J. C. Obesity and associated coronary heart disease risk factors in a population of low-income African-American and white women: the North Carolina WISEWOMAN project. *Preventive Medicine.*2002:35;1-6.

Newbold, K. B. and Danforth, J. Health status and Canada's immigrant population. *Social Science & Medicine.*2003:57;1981-1995.

Osler, M., Christensen, U., Due, P., Lund, R., Andersen, I., Diderichsen, F., and Prescott, E. Income inequality and ischaemic heart disease in Danish men and women. *International Journal of Epidemiology.*2003:32;375-380.

Oxman-Martinez, J., Abdool, S. N., and Loiselle-Leonard, M. Immigration, women and health in Canada. *Canadian Journal of Public Health. Revue Canadienne de Sante Publique.*2000:91;394-395.

Parakulam, G., Krishnan, V., and Odynak, D. Health status of Canadian-born and foreign-born residents. *Canadian Journal of Public Health.*1992:83;311-314.

Perez, C. E. Health status and health behaviour among immigrants. *Health Reports, Statistics Canada.*2002:13;1-12.

Porsch-Oezcueruemez, M., Bilgin, Y., Wollny, M., Gediz, A., Arat, A., Karatay, E., Akinci, A., Sinterhauf, K., Koch, H., Siegfried, I., von Goergi, R., Brenner, G., and Kloer, H. U. Prevalence of risk factors of coronary heart disease in Turks living in Germany: The Giessen Study. *Atherosclerosis.*1999:144;185-198.

Rapoport, J., Jacobs, P., Bell, N. R., and Klarenbach, S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Diseases in Canada.*2004:25.

Rappelli, A. Hypertension and obesity after the menopause. *Journal of Hypertension.*2002:20;Suppl-8.

Richmond, R. Ethical dilemmas in providing tobacco to developing countries: the case of China. *Addiction.* 1997:92;1137-1141.

Saldov, M. and Chow, P. The ethnic elderly in Metro Toronto Hospitals, nursing homes, and homes for the aged: communication and health care. *International Journal of Aging & Human Development.* 1994:38;117-135.

Sellers, D. E., Crawford, S. L., Bullock, K., and McKinlay, J. B. Understanding the variability in the effectiveness of community heart health programs: a meta-analysis. *Social Science & Medicine.* 1997:44;1325-1339.

Sheth, T., Nair, C., Nargundkar, M., Anand, S. S., and Yusuf, S. Cardiovascular and cancer mortality among Canadians of European, South Asian and Chinese origin from 1979 to 1993: An analysis of 1.2 million deaths. *Canadian Medical Association Journal.* 1999:161;132-138.

Silman, A., Loysen, E., De Graaf, W., and Sramek, M. High dietary fat intake and cigarette smoking as risk factors for ischaemic heart disease in Bangladeshi male immigrants in East London. *Journal of Epidemiology and Community Health.* 1985:39;301-303.

Staessen, J. A., Celis, H., and Fagard, R. The epidemiology of the association between hypertension and menopause. [Review] [56 refs]. *Journal of Human Hypertension.* 1998:12;587-592.

Statistics Canada. 1996 Census: Immigration and citizenship. The Daily, Statistics Canada . 1997. 5-16-2004.

Statistics Canada. Immigration and health. Applied Research and Analysis Directorate . 1999. 5-16-2004.

Statistics Canada. Canada's ethnocultural portrait: The changing mosaic. 1-61. 2003. Ottawa, Statistics Canada. 2001 Census: Analysis series.

Thomas, S. A., Friedmann, E., Khatta, M., Cook, L. K., and Lann, A. L. Depression in patients with heart failure: physiologic effects, incidence, and relation to mortality. [Review] [44 refs]. *AACN Clinical Issues.* 2003:14;3-12.

Truelsen, T., Gronbaek, M., Schnohr, P., and Boysen, G. Intake of beer, wine, and spirits and risk of stroke : the copenhagen city heart study. *Stroke.* 1998:29;2467-2472.

Weerasinghe, S., Mitchell, T., Hamilton, L., and Ragheb, M. Equitable access to healthcare, health promotion, and disease prevention for recent immigrant women living in Nova Scotia, Canada. 2000. Halifax, Maritime Centre of Excellence for Women's Health.

Wong, J. and Wong, S. Cardiovascular health of immigrant women: Implications for evidence-based practice. *Clinical Governance.*2003:8;112-122.

Wrigley, N. (1985). *Categorical Data Analysis*. Longman, London, U.K.

Yusuf, S., Hawken, S., Ounpuu, S., Dans, T., Avezum, A., Lanas, F., McQueen, M., Budaj, A., Pais, P., Varigos, J., and Lisheng, L. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet.* 2004. 9-15-2004.

Zanobetti, A., Schwartz, J., Samoli, E., Gryparis, A., Touloumi, G., Peacock, J., Anderson, R. H., Le Tertre, A., Bobros, J., Celko, M., Goren, A., Forsberg, B., Michelozzi, P., Rabczenko, D., Hoyos, S. P., Wichmann, H. E., and Katsouyanni, K. The temporal pattern of respiratory and heart disease mortality in response to air pollution. *Environmental Health Perspectives.*2003:111;1188-1193.