# Health Literacy and immigrants in Canada: Determinants and effects on health outcomes

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## 1.0 Introduction

Health literacy is the ability to access and use health information to make appropriate health decisions and maintain basic health (Canadian Council on Learning, 2007). It is an emerging concept that links levels of literacy with the ability to act upon health information and to take control of health (Nutbeam, 2000; Wilson, 2004; Rootman and Ronson, 2005). It is also considered as one critical pathway linking education to health and a contributor to health disparities (Canadian Council on Learning, 2007). The overall average level of health literacy in Canada is low (Canadian Council on Learning, 2008). About 60% of adult Canadians (ages 16 and older) lack the capacity to obtain, understand, and act upon health information and services and to make appropriate health decisions on their own. While low levels of health literacy are partly due to Canada's aging population and the shrinking youth cohort, an important contributor is the growing immigrant population.

Immigrants currently represent virtually one-fifth of the Canadian population, the highest proportion in 75 years according to the 2006 census (Chui, Maheux and Tran, 2007). As well, Canada now receives approximately 230,000 new immigrants each year (Citizenship and Immigration Canada, 2007). Initial results from the 2003 International Adult Literacy and Skills Survey (IALSS) found that immigrants in general scored significantly below the national average in health literacy (Canadian Council on Learning, 2008). However, the reasons for these differences and the potential effects on health at the population level are largely unknown. Because immigrants are a heterogeneous group differing by such factors as place of birth, and recency of arrival to Canada, it is of interest to examine the association of these factors with health literacy, and the role of health literacy on health outcomes among immigrant subgroups. While our interest is on the immigrant population, we also examine issues related to health literacy and its role on health among the local-born by generation in this report. This study has two overall objectives. First, it seeks to examine the determinants of health literacy among immigrants and non-immigrants, as well as among sub-groups of immigrants defined by their

country of origin and recency of arrival in Canada, as well as sub-groups of non-immigrants defined by generation. Second, this study examines the relationship between health literacy and selected health outcomes among both immigrants and non-immigrants, and among the sub-groups of immigrants and non-immigrants.

In the following background section, we will briefly review recent immigration trends in Canada to set the stage for a brief review of immigrant health research, with an emphasis on factors associated with health literacy and its relationship to health outcomes. We will also discuss the emergence of research on "generations" in the immigration context. Following the background we describe the data and methods, results, and then a discussion of the results and conclusions.

## 2.0. Background

### 2.1 Health literacy in the immigration context

While health literacy was originally the focus of clinical studies, it has been adapted to community based population studies of health (Nutbeam, 2008). In clinical settings, low literacy skills have been identified as an important risk factor for poor health, and assessment tools have been developed to identify patients with low literacy skills to help clinicians individualise patient education (Davis et al., 1993; Parker et al., 1995; Bass et al., 2002; Passche-Orlow et al., 2005; Chew et al., 2008). For example, clinical researchers have developed and used various quick assessment tools to predict limited health literacy, such as Test of Functional Health Literacy in Adults (TOFHLA). Among the factors deemed to be important correlates of limited health literacy are educational attainment, self-rated reading ability, sex, race, school-leaving age, employment status, whether a job involves reading, and the frequency of book reading (Ibrahim et al., 2008; Jeppesen, Coyle, and Miser, 2009). Note that most of these measures tend to ignore oral and aural literacy and thus have their limitations (Rootman and Ronson, 2005).

In the community setting, which includes the public health and health promotion areas, the focus is on the potential asset of skill and capacity development to enable people to take control of their own health (Ontario Public Health Association and Frontier College, 1989). Literacy skills have been shown to be important over and above socioeconomic factors such as education and income for health. Together with the need to improve our understanding of the role of literacy as a determinant of health (Butler-Jones, 2006), health literacy assessments scales have been included in population based studies. For example, the Health Activities Literacy Scale (HALS) was first developed from items in the US National Literacy Survey (Rudd, Kirsch and Yamamoto, 2004). This scale was later adopted for the IALSS in Canada and the Adult Literacy and Life Skills Survey in Australia. This effort expanded the utility of the concept of health literacy beyond the clinical setting into various population health contexts, such as homes, workplaces, and communities. Using the HALS scale on population based data; one study was able to identify population groups in the US vulnerable to low health literacy, as well as the socio-economic and health impacts of low health literacy (Rudd et al., 2004). In relation to immigration, they found that non-native-born adults in the US had significantly lower health literacy scores than did the native adult population and raised the issue of how to improve literacy among the US immigrant population. In Australia, an analysis of the Adult Literacy and Life Skills Survey found similar results, yet presented differences for sub-groups of immigrants. Only 26% of immigrants from non-English speaking countries had an adequate level of health literacy compared to 44% of those born in Australia. However, immigrants from English speaking countries had comparable levels of health literacy to Australian born (46%) (Australian Bureau of Statistics, 2008).

Although differences in health literacy between immigrant and non-immigrant populations have been observed in international studies and in population based studies, few Canadian studies have examined the factors associated with health literacy and its effects on health outcomes, and even fewer have focused on immigrants. In a review of literature on asthma and health literacy in a cultural/ethnic

perspective, Poureslami and his colleagues (2007) concluded that most of the Canadian studies in this area are qualitative. The paucity of quantitative research in this area is not surprising because Canadian population-based surveys that include the concept of health literacy such as the 2003 IALSS are relatively recent. The availability of the health literacy scores included in IALSS is the first opportunity to examine the correlates and the impact of health literacy on health outcomes in the Canadian context.

Initial findings from the IALSS showed that seniors, people with low levels of education, those with learning disabilities, some ethno-cultural groups, Aboriginal, and Francophone Canadians have low literacy rates (Statistics Canada and Human Resources and Social Development Canada (HRSDC), 2005). In the relationship between health literacy and health, the initial IALSS study found that document literacy proficiency was associated with self-rated health (Statistics Canada and HRSDC, 2005). Also an analysis by Canadian Council on Learning (2008) found that daily reading habits, educational attainment, parental education, concordance between respondent's mother tongue and language of survey interview, and place of birth were the most important predictors of health literacy. On the latter the analysis revealed that there was a large gap in average health literacy between immigrants and non-immigrants. All these are important factors to consider in any study of health literacy.

Two recent reviews report on health literacy among immigrants. First, an article examining health literacy in the context of culture and linguistic diversity concluded that factors associated with low health literacy of new immigrants include low levels of education, language, culture, beliefs, and institutional factors related to healthcare requirements, services, and programs (Zanchetta and Poureslami, 2006). Linguistic and cultural barriers, community and institutional discrimination, income disparity, and low health literacy were factors identified as influencing immigrants' access to health services as well as health outcomes. Second, a policy brief submitted to the Public Health Agency of Canada and Citizen and Immigration Canada on health literacy and health, drew on various studies to

conclude that sex, language proficiency, prior education about health issues in the country of origin, cultural beliefs about illness, familiarity with the healthcare system in Canada, and the perceptions of cultural awareness among health service providers and institutions are important factors for health literacy (Simich, 2009). Nonetheless, a systematic empirical analysis of the factors responsible for low health literacy among the immigrant population in Canada has not been undertaken. This study responds to this research gap.

In reviewing the present state of health literacy research in Canada, the Canadian Public Health Association (CPHA) expert panel concluded that there is indeed a lack of systematic information on levels of health literacy in certain sub-populations, such as newcomers to Canada (CPHA, 2008). Investigating health literacy of immigrants in Canada is particularly important as many recent immigrants are from countries with languages and/or cultures different from Canadian ones. Country of birth is therefore an important factor to consider in immigrant research. A related factor is recency of arrival in Canada. While recency of arrival partly determines the extent of adaptation and integration in the host society, the degree of difficulty in adjusting to the new environment likely depends on the country that the immigrant is arriving from, thus necessitating an examination of both of these factors (country of origin and recency of arrival).

## 2.2 Immigration trends and immigrant health

Immigration has played and will continue to play an important role in Canada. The 2006 census enumerated more than 6 million foreign-born people, representing close to 20% of the total Canadian population. This is the highest proportion in the past 70 years. Only Australia with 22% of the population consisting of immigrants is ahead of Canada in the proportion of the immigrant population. By comparison, the corresponding proportion in the United States was 13% (Chui et al., 2007). In recent years, Canada has admitted more than 230,000 immigrants annually. Overall, Canada's total

population increased by 1.1 million between 2001 and 2006, a growth rate of 5.4%, and these immigrants contributed 69% of the population growth. Immigration is becoming the predominant source of population growth in Canada, as well as a central dynamic in both population and labour market growth in Canada (Martel et al., 2007; Beach et al.., 2003).

Immigration is a disruptive process that interferes with immigrants' way of life. Further, depending on the extent of differences between the place of origin and Canada, there may be issues that have to be considered to ensure smooth adaptation and settlement. It is well-known that the main immigrant source region has changed in Canada over the past 40 years. Recent immigrants mainly came from Asia (58%), followed by Europe (16%). The corresponding figures were drastically different in 1971, at 11% and 61% respectively (Chui et al., 2007). Immigrants from countries such as Asia and Africa, come from countries with cultures and languages very different from those of Canada, and likely face adjustment challenges in the host country. Not surprisingly, Citizenship and Immigration Canada has identified low official language literacy as one of three areas of concern for immigrants (Ruddick, 2008). Lower official language literacy hinders immigrants' ability to function in the Canadian society and likely translates to translate to lower health literacy.

While economic studies have examined the role of literacy on earnings and labour outcomes for immigrants (e.g., Grant, 1999; Picot and Hou, 2003; Ferrer, Green and Ridell, 2004; Picot, Hou and Coulombe, 2008; Bonikowska, Green and Ridell, 2008), to our knowledge no studies have examined the impact of low literacy on immigrant health. The dominant idea in immigrant health research is the observation that new immigrants usually come to Canada with better health compared to non-immigrants, but their health advantage disappears over time (e.g., Ng et al., 2005; Newbold, 2005; Hyman, 2007). The loss in the health advantage for immigrants to Canada is observed when assessed by several standard health measures including self-reported health (Chen, Ng and Wilkins, 1996a; Newbold and Danforth, 2003; Ng et al., 2005), self-reported chronic disease (Pérez, 2002; McDonald

and Kennedy, 2004), self-reported disability (Chen et al., 1996a; Chen et al., 1996b), and self-reported mental health (Ali, 2002; Lou and Beaujot, 2005). While the "healthy immigrant effect" was not observed for infectious diseases such as Tuberculosis (Wilkins, 1996; Cowie and Sharpe, 1998), analyses using mortality data show that immigrants tend to have lower age-standardized mortality rates than their non-immigrant counterparts, but this mortality advantage is inversely related to year of arrival in Canada (Trovato, 2003; DesMeules et al., 2005; Wilkins et al., 2008). Immigrants who have been in Canada longer look more similar to those who are Canadian born.

The maintenance of good health is critically important for successful immigrant settlement and integration into Canadian society so much so that Health Canada, the Public Health Agency of Canada, and the Metropolis project within Citizen and Immigration Canada commissioned various policy briefs and review reports on immigrant health (Health Canada, 1998; Health Canada, 1999; Hyman, 2001; Hyman, 2007; 2009; Simich, 2009; Khanlou, 2009). Admittedly, the relationship between immigration and health is complex as it involves factors from both pre-migration and post-migration contexts. Thus, comparing the health of immigrants to that of non-immigrants is methodologically challenging. Nevertheless, the initial health advantage of new immigrants can be partly explained by selection factors. That is, individuals generally need to be healthy, motivated, and physically and financially able to leave their country of birth to immigrate. In addition, most major immigrant receiving countries such as Canada have screening criteria and procedures that select immigrants based on health as well as other factors such as education, job skills, and language ability factors considered important for successful adaptation and settlement. Some reasons put forth to explain subsequent health declines include difficulties and stressor associated with the settlement, adjustment, and integration process in the host country (Ng et al., 2005), poor access to care (Vissandjée et al., 2001), limited knowledge of services (Steele et al., 2002), low income (Dunn and Dyck, 2000), and/or limited social supports

(Stewart et al., 2008). However, to date there has been no examination of the impact of these factors on health literacy and no examination of the impact of health literacy as mediating these effects on health.

In recent years, because the source of immigration has shifted from English and French speaking countries (Europe and USA) to countries where English and French are not the native language (Africa, Asia, Latin America and the Caribbean), an important policy concern is the risk for poor health posed by an inability to communicate, access, and use health information effectively and to engage in reasonable and meaningful health communication (Zanchetta and Poureslami; 2006; Poureslami et al., 2007; Pottie et al., 2008). Following a long tradition of research in the area of language skills and immigrant adjustment (e.g., Chiswick and Miller, 2004), Pottie et al. (2008) found that poor official language proficiency in Canada was associated with poor self-rated health for immigrant women, while Ng and his colleagues (2008) found that the lack of improvement in official language proficiency over time is also associated with poor self-rated health for both immigrant men and women. Understanding immigrant health from the angle of literacy, and health literacy in particular, may therefore enable us to gain further understanding of the factors associated with the loss of the "healthy immigrant effect" over time for immigrants and also provide information that can be used to design appropriate interventions to ameliorate immigrant health.

Previous clinical studies have found that limited health literacy is related to increased difficulties in accessing health information, using medical services, and having worse health outcomes (e.g., Von Wagner et al., 2009; Tokuda et al., 2009). For example, an American longitudinal study found that low health literacy was associated with more depressive symptoms, which was measured using the Mental Component Summary scale and the Addiction Severity Index (Lincoln et al., 2006). In the immigration context, an American study found that immigrant women with limited health literacy were more than twice as likely to have depressive symptoms compared to those with adequate health literacy (Bennett et al., 2007). Another study focusing on Latino patients' needs for medical

visits concluded that some Latin American immigrants in the US are burdened with cultural and linguistic barriers, low health literacy, and minimal education (Sarfaty, Turner, and Damotta, 2005). The findings of this study were in concordance with the Institute of Medicine's (2004) report that highlighted the importance of setting up health education programs with an emphasis on cultural and language appropriateness.

### 2.3 Emerging research by generation

Research on immigrants has begun to examine the short- and long-term consequences of immigration, and thus generational status has been highlighted as a marker of integration into Canadian society. Most of the initial research on generational status is American (Borjas, 1993; 1995; Zhou and Bankston, 1996; Portes and Hao, 2002). In Canada, the availability of data such as the General Social Surveys, Survey of Labour Income Dynamics, and most recently the Census (see, e.g., Boyd and Greico, 1998; Jantzen, 2008; Miroslav, 2008) has encouraged research on generation effects. These Canadian studies have generally found evidence to support a "success" model in which the second generation tends to over-achieve relative to the first and third-plus generation in educational attainment and/or labour market characteristics such as earnings (Boyd and Creico, 2008; Corak, 2008; Miroslav, 2008). However, other non-Canadian studies have found wide variations exist within the second generation regarding socioeconomic achievement. For example, in Germany and the Netherlands, second generation immigrants have been found to be more disadvantaged than their non-immigrant counterparts in educational attainment (Riphahn, 2003; Van Ours and Veenman, 2003). To our knowledge there are no studies that have examined the effect of health literacy by generational status. However, there are several studies that have compared the health of immigrants to non-immigrants and between generations of immigrants.

The classical study on immigrant health conducted by Marmot and Syme (1976), found a higher prevalence of heart disease among male Japanese migrants to California and Hawaii than among non-immigrant counterparts in Japan. First generation Japanese immigrants in Hawaii had less cardiovascular disease than the second generation, whose health profiles were found to be closer to those of non-immigrant Hawaiians. In Sweden, second-generation immigrants were at greater risk for suicide than their first-generation parents (Hjern et al., 2002). In Canada, a gap exists for studies examining health by generational status (see Hyman, 2007). In light of these, there is a need to understand whether health literacy differs by generational status.

Another closely related issue in generational status studies is the age at immigration among the first generation immigrants (e.g., Friedberg, 1993; Borjas, 1995; Schaafsma and Sweetman, 2001; Corak, 2008). The age of immigration reflects the importance of early socialization on socioeconomic and other outcomes including health. This relates to the concept of one and half (1.5) generation. It is argued that immigrating at a young age provides the immigrants opportunities to be raised, educated, socialized, and to gain work experience and life-skills in a similar fashion as those born in the host society. The socioeconomic outcomes for this group are thus likely to resemble those of the non-immigrant population. For example, in Canada, Shaafema and Sweetman (2001) found that those who migrated at younger ages (under 13) had higher earnings than those who immigrated at older ages. Thus, there is a need to investigate whether age at immigration impacts health literacy as well as health outcomes.

## 2.4 Research questions

The preceding sub-sections have presented a review of health literacy among immigrants, immigration trends, immigrant health, and migrant adaptation in the host country as viewed through studies on generations. In general, health literacy among immigrants, as evidenced by studies in other

countries, is low. However, despite theoretical expectation that this could also apply here, no empirical analysis specifically focused on health literacy among immigrants is available for Canada. Second, the source countries for immigrants to Canada have changed over the recent decades and majority of recent immigrants come from countries with very dissimilar cultures to Canada. This poses potential adaptation challenges for the immigrants. Third, immigrants usually arrive with good health due largely to selection factors. This initial advantage, however, disappears over time because of different factors such as difficulties and stressors associated with settlement in the host country, poor access to health care, limited knowledge of services, and poor social supports, among others. An examination of specific factors such as health literacy could offer a possible explanation for the decline in the health of immigrants over time. Lastly, although studies elsewhere have shown that there are health differences by generation status, there is a data gap for such research in Canada. The potential research questions from this review relate to the reciprocal relationships between immigrants and their host society. For example, one way to determine the impact of immigration on immigrants is to examine different long-term life outcomes of second generation immigrants, that is, children of immigrants.

This study examines the factors associated with health literacy among immigrants and its relationship with selected health outcomes. The study pays special attention to immigrant factors namely, place of birth and recency of arrival to Canada among the immigrant populations. Further, generation status will be examined to establish whether the second generation differ from the third-plus generation. Unlike previous studies, the second-generation is not considered an immigrant group since they are Canadian born..

The specific questions of the study are as follows:

1. Are there differences between non-immigrants (local born) and immigrants (foreign born) in health literacy and health outcomes (Self-rated health , disability-free status, and health related quality of life (HRQoL))?

2. For immigrants, are there differences in health literacy and health outcomes by country of origin, recency of arrival in Canada, and age at immigration?

3. How is generational status (second and third-plus generation) associated with health literacy and health outcomes among non-immigrants?

4. What factors are associated with health literacy for immigrants as compared to non-immigrants and for subgroups of immigrants defined by country of origin and recency of arrival in Canada, as well as for subgroups of non-immigrants defined by generation?

5. What is the effect of health literacy on selected health outcomes (SRH, disability-free status, and HRQoL) for immigrants and non-immigrants and their respective sub-groups?

6. What is the effect of socio-demographic variables, literacy related, and socioeconomic factors on the selected health outcomes for immigrants and non-immigrants and their respective sub-groups?

Thus, there are three study groups covered by the six research questions. The first is a general comparison between immigrants and non-immigrants (questions 1, 4, 5, and 6). The second and the third are specific comparisons within immigrant sub-groups by country of origin and recency of arrival in Canada (questions 2, 4, 5, and 6), and among the local-born by generational status (questions 3, 4, 5, and 6) respectively.

## 3.0 Data and Methods

### 3.1 Data

The data used in this analysis comes from the 2003 International Adult Literacy and Skills Survey (IALSS) undertaken by Statistics Canada (Statistics Canada and HRSDC, 2005). The IALSS is the Canadian component of a seven-country initiative conducted for the 2003 Adult Literacy and Life Skills Survey (ALL). The main purpose of the survey was to establish how well adults used printed information to function in society. More specifically, this is a sample survey with a cross-sectional

design representing Canadian adults aged 16 and over not residing in institutions or on Aboriginal reserves. In addition to provincial and territorial estimates, the survey was designed to provide reliable estimates for a variety of special target populations such as recent and established immigrants. A base sample of 16,000 dwellings was selected to cover the general population. An additional 24,000 dwellings were selected in supplementary samples targeting subpopulations such as immigrants in Québec, Ontario, Alberta, and British Columbia. As well, unlike most other participating countries in this international survey, Canada extended this survey to cover respondents over age 65. A total of 23,038 people were interviewed in the IALSS. However, this analysis excluded 220 respondents on student, work, and visitor's visas, refugee claimants, or those whose immigration status in Canada could not be determined. The effective sample on which the analysis is based comprises 22, 818 people.[1]

The survey dataset includes background information such as demographic measures, education, language, labour force, training, literacy uses, information and communication technology, and income. The Background Questionnaire also collected information on ethnicity, immigrant status (immigration status, year of immigration, refugee status upon arrival, place of birth), education (extensive section, including highest level attained by immigrants outside of Canada), self-assessment of reading and writing in mother tongue, parental education and occupation, work status and history, occupation, industry, workplace literacy, numeracy and problem-solving practices, wages, adult education and learning (extensive section), literacy and numeracy practices at home, civic engagement, mental and physical health, information and communication technology use and familiarity, household information, and income. Also, the data includes a measure of health literacy, which was constructed from selected survey items by the Education Testing Service in the United States of America (Rudd et al., 2004). The survey also asks respondents for linguistic information such as mother tongue, and this

enables us to construct another variable on concordance of test language with mother tongue, which has been reported as important in doing analysis on health literacy (Desjardins, 2003).

### 3.2.0 Description of variables

### 3.2.1 Outcome variables

#### 3.2.1.1 Health literacy

Health literacy is one's ability to access and use health information to make appropriate health decisions and maintain basic health. The IALSS collected information of respondents' proficiency on four skills domains: prose and document literacy, numeracy, and problem-solving. Of the 350 literacy items in the IALSS, 191 were judged to measure health-related activities covering five dimensions of health (Rudd et al., 2004). These dimensions include health promotion (e.g., health benefit of physical activity), health protection (e.g., learning about product safety issue), disease prevention (e.g., screening and use of sun screen), healthcare (e.g., consulting with care providers, learning about disease management), and system navigation (e.g., dealing with insurance and informed consent). The selected 191 items were used to develop a Health Activities Literacy Scale with scores ranging from 0 to 500. This scale was further broken down into five levels as follows:

Level 1 (0-225): reflects one's ability to read relatively short text.

Level 2 (226-275): reflects one's ability to sorting through distractions.

Level 3 (275-325): reflects one's ability to integrate information from dense text.

Level 4 (326-375): reflects one's ability to handle multiple steps to find solution to abstract problems.

Level 5 (376-50): reflects one's ability to search for information in dense text with distractions, making inferences etc.

For ease of interpretation of the results and because individuals require a minimum of level 3 health literacy to maintain their health (Rudd et al., 2004; Statistics Canada, 2005), respondents are grouped into either of these two categories: Low health literacy (person scoring <= 275 or <=level 2) or high health literacy (person scoring >275 or >= level 3). In addition to examining the predictors of health literacy, we also examine its association with selected health outcomes.

*Health outcomes*

#### 3.2.1.2 Self-rated health (SRH)

Despite its subjective nature, SRH has been shown to be strongly related to one's morbidity, mortality, and utilization of health services (Burström and Fredlund, 2001; Kaplan et al., 2007). Self-rated health consisted of five categories: excellent, very good, good, fair, and poor. Based on previous research we dichotomize self-rated health into good (excellent, very good, or good health) and poor (fair or poor) with the latter as the base category (e.g., Shields, 2008; Perruccio, Power, and Badley, 2007).

#### 3.2.1.3 Disability-free status

Respondents' disability-free status is derived from five questions on current disability and activity limitation related to vision, hearing problems, speech, learning, or any other disability or health problem lasting six months or more. Respondents who replied affirmatively to any of the listed conditions were considered as having a disability; all others were defined as disability-free. As in the other health outcomes, we model good health and therefore having a disability is the base category.

#### 3.2.1.4 Health related quality of life (HRQoL)

HRQoL is derived from the Medical Outcomes Study Short Form (SF)-12 (Ware, Kosinski & Keller, 1995). The SF-12 is an internationally accepted generic measure of health status and consists of 12 questions covering eight dimensions of health significantly affected by medical conditions: social functioning, role-emotional, mental health, physical functioning, role-physical, bodily pain, general

health, and vitality (Ware, Kosinski, and Keller, 1996). Two widely used summary scores of HRQoL are derived from this eight-scale profile: a mental component summary (MCS-12) and a physical component summary (PCS-12). Higher scores on both components correspond to better health. Based on the sample's MCS-12 and PCS-12 distribution and as others have reported (e.g., Johnson and Coons 1998; Stuff et al., 2004; Piotrowicz et al., 2007; Lucca et al., 2008) we dichotomise both variables: respondents with MCS or PCS scores at or above the sample's median are defined to have good HRQoL. Those with scores below the median are considered to have poor HRQoL and make up the base category.[2]

### 3.2.2 Independent variables

#### 3.2.2.1 Immigration status and generational status

The key independent variables in this analysis are immigration status and generational status. There are three variables associated with *immigration status*. First, the local born (non-immigrants) are compared to foreign born (immigrants). The former group is the reference category in the multivariate context. This corresponds to our comparison group (i).

Second, we look at country of origin and recency of arrival in Canada. Immigrants are sub-divided into four categories based on country of birth and year of arrival in Canada. Immigrants in the IALSS came from about 28 countries and were divided into two groups: those who came from Europe or US versus those who came from all the other countries (termed as non-European for simplicity).[3] Year of arrival in Canada ranged from 1900 to 2003. Due to sample size consideration, immigrants are categorised for the purpose of this study as either "recent" immigrants (arrived between 1994 and 2003) or "established" immigrants (arrived between 1900 and 1993). The country of origin and year of arrival are combined to create the immigration variable that includes recent immigrants from Europe or USA, recent immigrants from other countries, established immigrants from Europe or USA, and

established immigrants from other countries. Established immigrants from Europe or USA are the reference category. This reflects our comparison group (ii).

Lastly, the non-immigrant sample was also further subdivided into two groups designated by generational status: the second and third-plus generation. Using information on parental place of birth, the third-plus generation are non-immigrant people whose parents are both locally born, while the second generation are those with at least one foreign-born parent. The third-plus generation is the reference category. This corresponds to our comparison group (iii).

#### 3.2.2.2 Socio-demographic variables

*Age at immigration*

Using year of birth and year of arrival in Canada we distinguish between people who arrived in Canada when they younger than 12 years of age and those who arrived when they were 12 years of age or older. We used age 12 as the cut-point because immigrants who arrive young are expected to undergo most of their education and socialization in Canada. It is assumed that people who arrive after age 12 have most of their socialization completed (Corak, 2008). People who arrived in Canada when they were younger than 12 years are the reference category.

*Age*

This is the current age of the respondent divided into the following categories: 16-25, 26-35, 36-45, 46-55, 56-65, or over 65 years of age. Over 65 years, is the base category.

*Sex*

This is a binary variable coded female or male. Males are used as the reference category.

#### 3.2.2.3 Literacy and education variables

The choice of variables here was guided by the work of Desjardins (2003) in accordance to the life-long and life-wide perspective in the determinants of literacy proficiency. Simply put, this perspective argues that current literacy is a result of one's own past education, training and current

literacy practices by the respondents in different settings as well as the educational level of the mother. These are the reasons the following variables are included.

*Literacy practices at home*

Literacy practices at home is a dichotomous composite variable: People who responded that they used the library weekly or monthly, or read or used information from newspapers, magazines, books, and letters, notes, or emails at least once weekly are considered to engage in literacy practices. People who do not engage in literacy practices at home are the reference category.

*Literacy practices at work*

This is also a composite variable based on frequency of reading or using information from letters, memos, and e-mails; reports, articles, magazines, or journals; manuals, or reference books including catalogues as part of the respondent's main job. It also includes frequency of writing or filling out letters, memos, or e-mails; and reports, articles, magazines, or journals at work. People who performed any of these activities at least once weekly are considered to be involved in literacy practices at work, whereas the rest are not. An additional category, 'not applicable', defined people who were not working. People who do not engage in literacy practices at work are the reference category.

*Respondent education*

Education is derived from the highest reported level of education attained by the respondent. A distinction is made between people with less than high school and those with at least a high school level of education. The latter category includes those who had completed high school, people with some post-secondary education, and those who had completed post-secondary education. Less than high school education is the base category.

*Maternal education*

Similarly, maternal education is derived from the reported highest level of education attained by the respondent's mother. A distinction is made between mothers with less than high school and those with at least high school education. Less than high school education is the base category.

*Adult education training*

This refers to participation in adult education or training in the 12 months preceding the survey. It has two categories: Participated, or did not participate in adult education or training. The former category is the reference category.

*Concordance of mother tongue with language of test*

This variable is derived from the questions on respondents' mother tongue and language of interview in the survey. Although the language of survey administration was either English or French, there were many options for mother tongue. Past research has found that having a mother tongue different than the language of the literacy assessment has a strong negative effect on literacy proficiency in many countries (Desjardins, 2003). By including this variable in our analysis, we also take into consideration the lack of official language proficiency on health literacy test scores, an effect which is expected to be more prevalent among immigrants. Respondents whose mother tongue was the same as the test language are considered Concordant and the others Discordant. The concordant group is used as the reference group.

#### 3.2.2.4 Socioeconomic variables

*Employment*

The employment status of the respondent has the following categories: Employed or self employed, not working and looking for work, retired, student (including work programs), and 'other'. The employed are used as the base category.

*Census Metropolitan Area (CMA) of residence*

Recent immigrants usually settle in Canada's major metropolitan areas (Beshiri and He, 2009). It is therefore important to include an indicator of place of residence in immigrant studies. The CMA of residence had the following categories: Toronto, Montreal, Vancouver, other CMA, and areas outside of CMA. People residing in the Toronto CMA are the reference category.

*Household income*

Following Statistics Canada (2005), total household income (from all sources in the preceding 12 months of the survey) adjusted for household size is used to define two levels of income: the low income level includes incomes of less than $30,000 for families of 2, less than $40,000 for families of 3 and 4, and less than $60,000 for families of 5 or more. Families earning more than the cut-off point for a given size are considered high income families. People in households with low income are the base category.

### 3.3 Analytic strategy

In this study, we first examine whether there are differences between non-immigrants (local born) and immigrants (foreign born) in health literacy and health outcomes (SRH, disability-free status, HRQoL) in the overall sample (N=22, 818). Then, we examine differences in health literacy and health outcomes by country of origin, recency of arrival in Canada, and age at immigration among immigrants (n=3, 861). Lastly, we examined how generational status (third-plus generation versus second generation) is associated with health literacy and health outcomes among non-immigrants (n=18, 957). These are our study groups.

For each of the outcomes, we start with a descriptive analysis comparing (i) immigrants versus non-immigrants, (ii) established immigrants from Europe or USA versus other immigrant groups, and (iii) second generation versus third-plus generation non-immigrants (Table 1). We also present in Table 2 the distribution of predictor variables for the overall population, as well as for immigrants and

non-immigrants. Further, three logistic regression models are estimated for each of the five outcomes (health literacy plus four health outcomes) for the same study groups (Tables 3 to 17).

For the factors associated with health literacy, we examine differences in health literacy comparing immigrants versus non-immigrants first by including basic demographic controls (age and sex), then adding the factors most proximal to health literacy (literacy practices at home and work, own and maternal education, concordance between mother tongue and test language, and participation in adult education and training) in Model 2. Model 3 adds socioeconomic factors (employment status, household income, and CMA) (Table 3). A similar strategy was followed in the analysis of factors associated with health literacy for the immigrant sub-groups defined by country of origin and recency of arrival in Canada, and the non-immigrants defined by generational status respectively (see Tables 4 and 5). However, for the immigrant population, the first model includes the indicator of country of origin, year of arrival, and age at immigration. One the other hand, for the non-immigrant population the first model includes an indicator of generational status.

For each of the four health outcomes analysed, a similar strategy was followed in the regression models for each of the three study groups (Tables 6 to 17). We started with age, sex (basis socio-demographic controls), and the immigration status variables. Then, by adding health literacy, we examined if health literacy plays a significant role in influencing that particular health outcome. Finally, a third model which included all the control variables examined the effect of literacy, education related, and socioeconomic factors on health outcomes.

This modelling approach enables us to examine the mediation effect of health literacy and the other independent variables on the differences for the three sets of study groups, namely, between immigrants and non-immigrants, and between sub-groups of immigrants and non-immigrants in the four health outcomes. Specifically, we were interested in establishing whether certain variables had a mediator effect on any observed effect of other variables. For instance, we sought to establish the

extent to which the some of the effect of generation on self rated health operated through health literacy. A test of the intervening variable effect was used to assess the presence and extent of mediation (Baron and Kenny, 1986). The amount the variable explained by other variables was quantified as:

$$\text{the percentage change in estimated effects} = 100[(OR_{M-} - OR_{M+}) / OR_{M-} - 1)]$$

where $OR_{M-}$ is the odds ratio for the predictor of interest from a model without a control for the hypothesised mediator, while $OR_{M+}$ is the odds ratio for the same predictor from a model including a control for the hypothesised mediator (Anashensel, 2002).

As all the outcome variables (health literacy, SRH, disability-free status, HRQoL) are defined as binary, binary logistic regression is used for the analysis. However, because health literacy was derived using item response theory (e.g., Rudd et al., 2004), it could not be analysed using the routines in standard statistical software. We used Stattool, a SAS macro developed at Statistics Canada to do the estimation. This macro allows for the use of jackknife weights to adjust for complex survey design. The individual variables are assessed for their significance using the *t* statistic, while model significance is assessed using log-likelihood ratio tests. Statistical significance of the estimates was set at $p<0.05$ level.

## 4.0 Results

### 4.1 Descriptive results

Table 1 presents the distribution of the outcome variables comparing (i) non-immigrants to immigrants, (ii) established European or American immigrants to other groups of immigrants, and (iii) the third-plus generation to second generation. The mean level of health literacy in Canada is (256), but non-immigrants scored higher than immigrants, 264 versus 228. Further, about 40% of Canadians have the requisite literacy level to maintain health (>=275), but only 25% of immigrants compared to 45%

of non-immigrants possess this level. The differences in means were statistically significant. The results also show that 25.3% of established immigrants from Europe or USA, 23.7% established immigrants from other countries, 45.9% of recent immigrants from Europe or USA, and 25.3% of recent immigrants from other countries have the requisite literacy skills to maintain health. Except for recent immigrants from Europe or America, there were no differences in the mean health literacy scores between established European or American immigrants and the other immigrant sub-groups of immigrants. The results also show that the mean health scores are 263 and 266 for third-plus and second generation Canadians respectively. Forty-three percent and 50.4% of the third-plus generation and second generation respectively have the requisite literacy skills to maintain health. There was no difference between the generations in the mean health literacy scores.

Turning to the distribution of health outcome measures, a majority of Canadians (86.1%) reported their overall health was good. This was also true regardless of immigrant status although slightly more non-immigrants (86.7%) than immigrants (84%) report good self-rated health; these differences were statistically significant. Turning to immigrants groups defined by country of origin and recency of arrival in Canada, more recent immigrants from countries other than European or the USA (92.4%) and recent immigrants from Europe or USA (90.2%) rated their overall health as good compared to 83.5% of established immigrants not from countries other than Europe and America 78.9% for established immigrants from Europe or USA. Among non-immigrants, slightly fewer second generation Canadians (83%) than third-plus generation Canadians reported their health as good (88%). As evident in Table 1, the differences between immigrants and non-immigrants, and the sub-groups of immigrants and non-immigrants in self-rated health are statistically significant.

Regarding disability-free status, a majority of Canadians (73%) reported being disability free. This was also true regardless of whether one was non-immigrant (72%) or immigrant (76.1%); the differences in the proportions of people who are disability-free are statistically significant. Among

immigrants only, 65.2% of the established immigrants from Europe or USA, 77.8% of the established ones from other countries, 78.1% of the recent ones from Europe or USA, and 91.7% of recent immigrants from other source countries reported not being disabled. The differences between immigrant sub-groups with the European or American reference group in disability-free status are statistically significant. As for the non-immigrant population, 69.9% and 72.1% of the second and third-plus generation respectively reported being disability free. The difference between third-plus and second generation in disability-free status is not statistically significant.

In mental health, the results show that 49.7% of non-immigrants and 51% of immigrants had SF-12 mental components scores above the median (60.1) of the overall population. The differences between immigrants and non-immigrants are not statistically significant. Among immigrants, 49.8% of established immigrants from Europe or USA, 48.6% of established immigrants from other countries, 60.1% of recent immigrants from Europe of USA, and 51.2% of recent immigrants from other countries had SF-12 mental components scores above the median (60.3) for this population. Among non-immigrants 48.8 % and 50.5 % second and third-plus generation respectively had SF-12 mental components scores above the median (60.1) for this population. Except for recent immigrants from other source countries, there are no statistically significant differences in the proportions of people scoring above the median in mental health between the study sub-groups.

Turning to physical health, the results show that 50.6% of non-immigrants and 48% of immigrants had SF-12 physical components scores above the median (41.8) of the overall population. In the immigrant population, 45.5% of established European or American immigrants, 49.8% of established immigrants from other countries, 58.2% of recent European or American immigrants, and 56.5% of recent immigrants from other countries had SF-12 physical components summary scores above the median (41.5) for this population. Except for recent immigrants from other origins, there were no differences between the other immigrant groups and established European or American

immigrants in the proportions of people scoring above the median in physical health. Among the non-immigrants, 49% and 51% of the second and third-plus generation Canadians respectively had an SF-12 physical component summary score above the median (41.8) for this population. There was no statistically significant difference between the second and third-plus generations in the proportions of people scoring above the median in physical health.

Table 2 contains descriptive statistics of the independent variables for the overall sample, and for the sub-samples of immigrants and non-immigrants. We did not show these distributions further by their subgroups either because of sample size (in the case of immigrants) or because of the lack of significant differences in the outcomes studied (in the case of non-immigrants by generation; see Table 1). Fewer immigrants compared to non-immigrants reported engaging in literacy practices at home and work, being employed, and living in high income households. As would be expected based on recent trends on country of origin of immigrants, the majority (73%) of immigrants compared to only 9% of the non-immigrants report having a discordant language (different mother tongue from either English or French) from the languages used in the survey. Consistent with immigrant settlement trends, 40% of immigrants resided in Toronto. Yet, the percentage of people with high school or more education was similar. Larger difference was reported for maternal level of education with only 36.5% of immigrants having mothers with high school or more education compared to 49% of non-immigrants.

## 4.2 Multivariate results

### 4.2.1 Determinants of health Literacy

This sub-section presents the results of the regression models looking at the determinants of health literacy comparing (i) immigrants and non-immigrants, (ii) different immigrant groups, and (iii) generations of the local born population.

#### 4.2.1.1 Comparing immigrants versus non-immigrants

The purpose of this analysis is to examine the association of immigrant status with health literacy and to examine the associations over and above other literacy and education related factors as well as socio-demographic and socioeconomic factors. The results show that there are differences in health literacy between immigrants and non-immigrants (see Table 3, Model 1); immigrants are less likely to obtain a high score in health literacy (OR=0.43). These differences persist even after controlling for literacy and education related factors in Model 2 as well as all socioeconomic factors in Model 3 with these additional factors accounting for only 7.5% of the differences between immigrants and non-immigrants in health literacy (see methods section for explanation on how this was done). Of the factors we included as controls, being <65 years of age, engaging in literacy practices at home and work, being a student, having high school level of education or above, having a mother who completed high school or more, participating in adult education and training, and living in a high income household were all significantly associated with scoring high in health literacy.

The likelihood ratio statistics describing the goodness of fit of the models showed that most of the models are significant and each subsequent model increased the explanatory power of the preceding one. Each of the tables reporting the regression results includes the measure of the proportion of the variation in the outcome variable explained by the variables in each model, the $R^2$. Because our interest is in the relationship between the outcome and independent variables and changes in these across the models, we do not describe the $R^2$ results to keep this section within reasonable length.

#### 4.2.1.2 Comparing immigrants by country of origin and recency of arrival in Canada

The purpose of this analysis is to examine differences in health literacy among immigrants as indicated by country of origin and recency of arrival in Canada. Table 4 presents the logistic regression results of the associations between health literacy and immigrant groups, other socio-demographic factors, literacy and education related, and socioeconomic factors. The results of Model 1 show that

there are differences in health literacy among immigrants net of age and gender for all groups except recent immigrants from Europe or USA. Relative to established immigrants from Europe or USA, both recent and established immigrants from non-European countries are less likely to score high in health literacy. Further, immigrants who came to Canada when they were 12 or more years of age are less likely to score high in health literacy compared to those who came before age 12. In a separate model (not shown) that omitted age at immigration, recent immigrants from Europe or USA are significantly less likely to score high in health literacy (OR=0.96) suggesting that age at immigration is particularly important. In this same analysis, the magnitude of effect of the other immigrant categories was also large, established non-European and non-American immigrants (OR=0.58) and recent ones from the same countries (OR=0.44), suggesting that some of the effect of country of origin and recency of arrival in Canada is accounted for by age at immigration with those arriving when they are younger than age 12 years being more likely to have high health literacy scores.

In the subsequent model that examined literacy and education related factors, the association between immigrant group and health literacy attenuates and becomes statistically non-significant. The literacy and education related factors account for 14% and 39% of the differences in health literacy of established and recent immigrants from sources other than Europe or USA respectively (comparing Models 1 and 2). In particular, the results show that the differences in health literacy among immigrant groups are largely attributable to literacy practices at home and work; personal and maternal educational, participation in adult education or training, and household income, with literacy practices at home having the largest effect. For example, in Model 3 which includes all the control factors of interest, people who engage in literacy practices at home are more likely to score high in health literacy compared to those who do not (OR=5.10).

#### 4.2.1.3 Comparing second generation versus third-plus generation non-immigrants

The objective of this analysis is to establish whether there are differences in health literacy among non-immigrant Canadians by generational status. Table 5 presents the results of the logistic regression analysis of the association between health literacy and generational status, other socio-demographic factors, literacy and education related, and socioeconomic factors. The results show that relative to the third-plus generation, second generation Canadians are more likely to have high health literacy net of age and gender (OR=1.38 in Model 1). Just as in the analysis for immigrants only, this association is reduced and is not statistically significant in Model 2 with the addition of literacy and education related factors. Further, the results of this model show that about 40% of the differences in health literacy among non-immigrant Canadians are attributable to literacy practices at home and work, own and maternal education, and participation in adult education and training.

In addition to literacy practices at home and work, own and maternal education, and participation in adult education, the other significant predictors of health literacy among non-immigrant Canadians are age and household income (Model 3). For example, compared to people living in low income households, those who live in high income ones are more likely to have high health literacy (OR=1.57).

### 4.2.2 Relationship between health literacy and health outcomes

In this section, we examine the relationship between health literacy and health outcomes for our three study groups, namely, the overall population, and separately for immigrant and non-immigrant populations. The overall objective is to examine whether there are differences in health outcomes by immigrant status, immigrant group, and generational status, and what role health literacy plays in these relationships.

#### 4.2.2.1 Self-rated health

The objective of this analysis is to examine whether there are differences in self-rated health between immigrants and non-immigrants, immigrant groups defined by country of origin and recency of arrival in Canada, and between the second and third-plus generation. Further, the analysis seeks to establish the extent to which health literacy and other factors account for any observed differences between these groups.

The results of the multivariate logistic regression analyses on the relationship between immigrant status, other socio-demographic factors, and literacy and education related and socioeconomic factors are presented in Table 6. The results of Models 1 and 2 show that there are no differences between immigrants and non-immigrants in self-rated health. However, controlling for all the selected variables in Model 3, immigrants are more likely to rate their overall health as good compared to non-immigrants (OR=1.40). The results also show that health literacy is significantly associated with overall self-rated health (OR=1.94 in Model 2). As would be expected, all of its effects are accounted for by literacy and education related and socioeconomic factors (Model 3). Further, the results of the final model show that being 45 years of age or younger, engaging in literacy practices at home, having high school or more education, living in the Montreal CMA or outside a CMA, and living in a high income household are positively associated with good self-rated health. On the other hand, people whose mother tongue is not the same as the test languages (English and French) and those who are looking for work, are less likely to report good self-rated health.

Table 7 presents the multivariate logistic regression results of the relationship between immigrant group as defined by country of origin and recency of arrival in Canada, other socio-demographic factors, and literacy and education related and socioeconomic factors and self-rated health. The results of Model 1 show that there are no differences in self-rated health among immigrant groups after adjustment for age, gender, and age at immigration. However, controlling for the other

factors boosts the effect of immigration: recent immigrants from other countries (not-Europe or USA) are more likely to report their health as good compared to established immigrants from Europe or USA (OR=1.85 in Model 3). Further, Model 2 shows that there is difference in self-rated health by level of health literacy; however, the difference is no longer significant when additional factors especially own education and employment status are considered (model 3).

The multivariate logistic regression results of the association between generational status, other socio-demographic factors, literacy and education related and socioeconomic factors, and self-rated health are reported in Table 8. The results of the three models show that relative to third-plus generation Canadians, second generation Canadians are less likely to report their health as good (OR=0.76). These differences are not accounted for by the control factors and remain unchanged and significant in the final model. Just as in the immigrants' population analysis, there are differences in self-rated health in the non-immigrant population by health literacy level (Model 2); people with high health literacy are likely to report their health as good compared to those with low health literacy (OR=2.05). As would be expected, all these differences are accounted by the control factors. The most important of the latter are literacy practices at home, own education, whether the mother tongue is similar to the survey language, CMA of residence, and household income.

#### 4.2.2.2 Disability-free status

The purpose of this analysis is to determine whether there are differences in disability-free status between immigrants and non-immigrants, between immigrant groups defined by place of birth and recency of arrival in Canada, and between the second and third-plus generation Canadians. Further, the analysis seeks to establish whether the differences in disability-free status in these groups are accounted for by health literacy.

Table 9 reports the multivariate logistic regression results of the relationship between immigrant status, other socio-demographic factors, and literacy and education related and

socioeconomic factors, and disability-free status. The results of Model 1 show that immigrants are more likely to report being disability-free compared to non-immigrants (OR=1.55). Controlling for health literacy, however, boosted the effect of immigration status. Comparing Models 2 and 3, the results of the latter show that about 40% of the effect of immigration status on being disability-free operates through education, employment status, CMA of residence, and income. Further, the results show that there are differences in disability-free status by health literacy (Model 2). However, these differences are accounted for by the control factors especially own education, employment status, and CMA of residence, and household income (Model 3).

The multivariate logistic regression results of the relationship between immigrant group, other socio-demographic factors, and literacy and education related and socioeconomic factors and disability-free status are presented in Table 10. The results show that after controlling for all the selected predictors, recent immigrants not from Europe or USA are more likely to be disability-free compared to established immigrants from Europe or USA (OR=2.26 in model 3). There are no significant differences, however, between established immigrants from other countries and recent immigrants from Europe or USA on the one hand and established immigrants from Europe or USA in the odds of being disability-free. Further, the results show that health literacy was not significantly associated with being disability-free and had little effect on the differences between immigrant groups. The other significant predictors of disability-free status in the immigrant population are age, employment, and CMA of residence. For instance, not living in a CMA or living in a CMA other than Montreal or Vancouver was associated with a higher likelihood of being disabled compared to living in the Toronto CMA.

Table 11 presents the results of the multivariate logistic regression on the relationship between generation status, other socio-demographic variables, and literacy related and socioeconomic factors, and disability-free status. The results indicate that there are no differences in disability-free status

between second and third-plus generation Canadians. The results also underscore the importance of health literacy in being disability-free for the non-immigrant population; even after controlling for all the factors of interest, people with high health literacy are more likely to report being disability-free (OR=1.21 in Model 3). These results suggest that 52% of the effect of health literacy operates through own education, income and CMA of residence, yet health literacy remains significant. The other significant predictors of not being disabled in the non-immigrant population are age and gender.

#### 4.2.2.3 Health related quality of life

The purpose of this analysis is to examine whether there are differences in health related quality of life between immigrants and non-immigrants, immigrant groups defined by country of origin and recency of arrival in Canada, and between non-immigrant groups defined by generational status. We also seek to establish what role, if any, is played by health literacy in these differences.

##### 4.2.2.3.1 SF-12 mental component summary

Table 12 presents the results of the multivariate logistic regression of the relationship between immigration status and socio-demographic factors and SF-12 mental component. The results of Models 1 and 2, which include controls for age, gender, and health literacy show that there are no differences in good mental health between immigrants and non-immigrants in Canada. Controlling for all the variables of interest in Model 3, however, boosts the effect of immigrant status: compared to non-immigrant Canadians, immigrants are more likely to report good mental health (OR=1.20). Further, the effect of health literacy on mental health is not statistically significant across all models. Other variables that have a statistically significant independent effect on mental health in the overall population are age, gender, literacy practices at home, own education, employment status, CMA of residence and household income. For instance, people who are looking for work are less likely to report good mental health (OR=0.76). On the other hand, having at least high school education is associated with good mental health (OR=1.32). Females were significantly less likely to have good mental health than males (OR=0.69).

The multivariate results on the relationship between immigrant groups, other socio-demographic factors, and literacy and education related and socioeconomic factors and mental health are reported in Table 13. The results of all the three models show that there are no differences in mental health by country of origin and recency of arrival in Canada and by health literacy. However, immigrants who arrived in Canada aged 12 years or older were more likely to report their mental health as good with the results strengthening as more controls were introduced in the models. In addition to age at immigration, the other significant predictors of mental health among immigrants are gender, literacy practices at home, employment status, and residence in non-CMA. For example, in Model 3, relative to people who did not engage in literacy practices at home, those who did were more likely to report good mental health (OR=1.42). Similarly, those who resided in non-CMA were more likely to report good mental health (OR=1.79). On the other hand, the unemployed looking for work (OR=0.51), students (OR=0.44), and females (OR=0.77) were less likely to report good mental health.

Table 14 presents the results of the multivariate logistic regression of mental health on generation status, other socio-demographic factors, and literacy and education related and socioeconomic factors. The results of all the models show that both generational status and health literacy do not have a significant effect on mental health. The only factors with a statistically independent effect on mental health in the non-immigrant population are gender, literacy practices at home, employment status, and household income (Model 3). The results show that females (OR=0.67) and people who were not looking for work, retired or students (OR=0.61) were less likely to report their mental health as good. On the other hand, relative to the comparison group, people who engaged in literacy practices at home (OR=1.29) and those living in high income households (OR=1.26) were more likely to report their mental health as good.

#### 4.2.2.3.2 SF-12 physical component summary

Table 15 presents the results of the multivariate logistic regression of the SF-12 physical component summary on immigrant status, other socio-demographic factors, literacy and education related, and socioeconomic factors. Across all models, there are no differences between immigrants and non-immigrants in physical health. The results of Model 2 indicate that relative to people with low health literacy those with high health literacy are more likely to report good physical health (OR=1.26). However, this effect is accounted for by the control factors (Model 3). Specifically, compared to Model 2, the results suggest that the factors introduced in Model 3 account for about 80% of the effect of health literacy on physical health. The most important of these factors are own education, employment status, CMA of residence, and household income. The results show that relative to people with less than high school education, and those living in low income households, those with at least high school level of education (OR=1.21) and those living in a high income household (OR=1.28) are more likely to report their physical health as good. Further, compared to people who live in the Toronto CMA, those who live in Montreal CMA are more likely to report their physical health as good (OR=1.30).

Table 16 presents the multivariate logistic regression results of the logistic regression of SF-12 physical component summary on immigrant groups, other socio-demographic factors, and literacy and education related and socioeconomic factors. In all models, there were no differences between immigrant groups in physical health. However, high health literacy is associated with an increase in the odds of reporting good physical health (OR=1.35 in Model 2). The relationship was, however, rendered statistically insignificant in the model with all controls in Model 3. The results of this final model suggest that 79% of the effect of health literacy operates through the other factors included in this analysis. Surprisingly, only the age of the respondent had a significant effect on physical health in the full model. Compared to people aged >65, those aged 16-25 (OR=2.41), 26-35 (OR=1.99), and 36-45 (OR=1.75) are more likely to report good physical health.

Table 17 presents the results of the multivariate logistic regression for SF-12 physical component summary comparing second and third-plus generation Canadians while controlling for other socio-demographic factors, literacy and education related and socioeconomic factors. Across all models, there is no evidence that the second generation differ in their physical health from third-plus generation Canadians. Again, just as in the overall and immigrant populations (see Tables 15 and 16), health literacy is significantly associated with physical health, but the other control factors reduce its effect by 77% rendering it statistically insignificant (Model 3). Education, employment status, CMA of residence, and household income were significant predictors of physical health status among non-immigrant Canadians in the final model. Relative to people with less than high school education, those with at least high school education are more likely to report their physical health as good (OR=1.23). Retirees are less likely to report their physical health as good compared to the employed (OR=0.67). Compared to residents of the Toronto CMA, those who live in the Montreal CMA are more likely to report their physical health as good (OR=1.42). Finally, relative to people living in low income households, those in high income households are more likely to report their physical health as good (OR=1.32).

### 4.3 Summary of results

The first overall objective of this analysis was to examine differences in health literacy and to understand factors influencing health literacy in the context of immigration. Although 60% of Canadians overall do not possess the requisite literacy skills to maintain health, immigrants fair much more poorly; 75% of immigrants compared to 55% of non-immigrants lack these skills. Immigrants were more likely to have low health literacy compared to non-immigrants, even after adjusting for numerous factors including age, sex, literacy practices at home and work, own and maternal education, concordance between mother tongue and test language, employment status, household income,

participation in adult education and training, and CMA in the multivariate regression analysis. Further, the results showed that engaging in literacy practices at home, followed by age and educational attainment had the strongest effect on health literacy in the analysis comparing immigrants versus non-immigrants.

Among immigrants, slightly more recent European or American immigrants compared to the general population scored at least 275 in the health literacy scale, 46% versus 40%. The results of the logistic regression showed that established and recent immigrants from other source countries were less likely to score high on health literacy compared to established immigrants from Europe or USA. The results of the multivariate analysis showed that differences in health literacy between immigrant groups were explained by the selected factors with engaging in literacy practices at home having the largest effect. It was followed by own educational attainment, maternal educational attainment, engaging in literacy practices at home, income, and participation in adult learning in that order.

Overall, 49% and 57% of second and third-plus generation Canadians lacked the requisite literacy skills to maintain health. Just as among immigrants, the differences in health literacy in the non-immigrant population were explained by the selected literacy and education related, socio-demographic and socioeconomic factors. Further, the results showed that age (being younger than age 65) had the single strongest effect on health literacy followed by own educational attainment and literacy practices at home.

The second overall objective of this analysis was to examine differences in health outcomes between immigrants and non-immigrants, immigrant groups defined by country of origin and recency of arrival in Canada, and between second and third-generation non-immigrant, and to examine the role of health literacy in any observed differences. There were no apparent differences in the proportions of people reporting good self-rated health between immigrants and non-immigrants. However, controlling for all the selected factors boosted the effect of immigrant status and immigrant group on self-rated

health pointing to a modest suppression effect (Tables 6 and 7). On the other hand, there were significant differences in self-rated health between the second and third-plus generation Canadians with the latter more likely to report poor health compared to the former over and above literacy and education related, socio-demographic, socio-economic controls. Further, health literacy was significantly associated with self-rated health in the study sub-groups. As would be expected, all of its effects were accounted for by the selected literacy-related factors especially literacy practices at home and educational attainment.

Slightly more immigrants (76%) than non-immigrants (72%) reported being disability-free. Unlike self-rated health, there were differences between immigrants and non-immigrants and between immigrant groups in self-reported disability-free status. Immigrants were more likely to report being disability-free and these differences remained even with adjustment for the other factors (Table 9). Also, compared to established European or American immigrants, established and recent non-European or non-American immigrants were more likely to report being disability-free. There were no differences, however, in disability-free status between second and third-plus generation Canadians. Controlling for health literacy boosted the differences between immigrants and non-immigrants and among immigrants groups pointing to a suppressor effect. Further, health literacy had a significant positive effect on disability-free status only in the analysis comparing first between immigrants and non-immigrants and that comparing the second with third-plus generations. However, all of its effects were explained by the control factors in the former analysis (between immigrants and non-immigrants), but not in the latter analysis (non-immigrants by generation). Age and CMA of residence were the only factors with an independent effect on disability-free status across the study sub-groups; sex, education, and income had an independent effect only in the overall and non-immigrant populations; employment had an independent effect only in the overall and immigrant populations; whereas health literacy had an independent effect only in the non-immigrant population (Model 3 in Tables 9, 10, and 11).

There were no differences between immigrants and non-immigrants in the median scores for SF12 mental and physical components summaries. We found that after adjusting for all the selected factors, immigrants were more likely to report good mental health, but not good physical health compared to non-immigrants. No differences in mental or physical health were observed for immigrant groups and generations.

Among immigrants those who arrived at age 12 years or older were more likely to report good mental health, but not good physical health as compared to those who arrived at less than12 years. Health literacy was not significantly associated with mental health, but was significantly associated with physical health. However, all of health literacy's effects were explained by the control variables.

## 5.0 Discussion and Conclusions

This study has attempted to increase our understanding of the determinants of health literacy in Canada in the context of immigrants. We compared differences in health literacy between immigrants and non-immigrants, among immigrants by country of origin and recency of arrival in Canada, and among the non-immigrant population by generational status. The study also examined the relationship between immigration status and health outcomes as measured by self-rated health, disability-free status, and health related quality of life and the effect of health literacy in these relationships.

The results on the determinants of health literacy show that immigrants were less likely to report high health literacy compared to non-immigrants. This holds true even after adjusting for all the selected factors of interest in the study. Given that an increasing number of recent immigrants are from non-English and non-French speaking countries, the results comparing immigrants to non-immigrants are not surprising. Not only are these immigrants from cultures that are very dissimilar to those of Canadians, but their low proficiency in English or French is likely to hinder their ability to obtain and use health information to maintain good health (Pottie et al., 2008). In addition, the aging of the

established immigrant population (Turcotte and Schellenberg, 2006) likely contributes to the low level of health literacy among immigrants as a whole as it is associated with an overall decline in mental ability which impacts the reading and comprehension of information (Carlson et al., 2008; McGinnis, 2009).

This study also found that there were no differences in health literacy among immigrant and generation groups after controlling for all the selected factors. Although there are differences within these groups, they largely attributable to the selected literacy-related factors especially own and maternal education, literacy practices at work and home, participation in adult education, and household income. These factors were also consistently significant across all study sub-groups in predicting health literacy. Literacy practices at home, however, was the most important of these with its effect being largest among immigrants (OR=5.64, Model 2, Table 3). These results are consistent with previous research on the influence of reading habits on general literacy and health literacy (e.g., Scarborough, Dobrich, and Hager, 1991; Corbeil 2006; Jeppesen et al., 2009). The results also suggest that it is not merely having a job that is important for health literacy, but rather engaging in literacy practices at work. Although we did not examine the effect of type of work, it is possible that controlling for it would account for some of the effect of literacy practices at work.

On the relationship between health literacy and health outcomes, our results for the three study groups show that there were differences by immigration and generation status. First, we found that compared to non-immigrants, immigrants were more likely to report good overall (self-rated) and mental health, and being disability-free even after adjusting for all the selected factors. Second, among immigrant subgroups, there were differences only in self-rated health and disability-free status; recent immigrants from other source countries were more likely report having good self-rated health and being disability-free compared to established immigrants from Europe or USA. Finally, among non-immigrants the differences were only in self-rated health; second generation Canadians were less likely

to report having good self-rated health compared to third-plus generation Canadians. The differences in self-rated health between immigrants and non-immigrants and between sub-groups of immigrants were only observed after controlling for all the selected factors. This suggested a strong suppression effect: Controlling for factors that could be more positively distributed among immigrants, particularly education, revealed a positive association between being a migrant and rating one's health as good. Engaging in literacy practices at home seems to have a similar effect albeit to a smaller extent.

The results of better health among immigrants are consistent with our expectation and previous studies (e.g., Chen, et al., 1996b; Perez, 2002; Landman and Cruickshank, 2001; Darmon and Khlat, 2001; DesMeules et al., 2005). One possible explanation for this is that immigrants have better health because they are selected for good health at the outset: good health is an enabling factor, allowing them to change their country of residence. Selection characteristics associated with both immigration and good health include having higher education, higher income, having high aspirations for social mobility, and adeptness in adapting to new environments. Nonetheless, it has been suggested, that this advantage disappears over time and the health profile of immigrants eventually resembles that of non-immigrants (e.g., Antecol and Bedard, 2006; Wilkins et al., 2008). An exploratory analysis studying the effect of migration and generations using a single variable found that recent immigrants not from Europe or USA were more likely to report good health. There were no differences, however, between the third plus generation and the other groups of immigrants.

This study also found that except for SF-12 mental component summary across all study sub-groups, and disability-free status among immigrants, health literacy is significantly associated with health. Our results are also consistent with previous research on the effect of health literacy on health (e.g., Baker et al., 2002; Sudore et al., 2006; Safeer et al., 2006). Adjusting for the selected control factors that include literacy-related factors, reduced the magnitude of the effect of health literacy and largely rendered it statistically insignificant. The results suggest that the effect of health literacy on

self-rated health, was largely mediated by literacy practices at home, own education, household income, discordance in mother tongue and language of test, and CMA of residence in the non-immigrant population, while own education was much more important among immigrants. This was confirmed by alternative models in which literacy practices at home and work, maternal education, discordance between mother tongue and language of test, and participation in adult education training were excluded from the final models (results not shown). In these results, health literacy was significantly associated with self-rated health in the analysis comparing immigrants to non-immigrants and the second to third-plus generation and disability-free status only in the analysis comparing the second to third-plus generation.

While we would expect health literacy to play an important role in the mental wellbeing of immigrants, our analysis did not support this expectation. On the one hand, although this result is puzzling, it suggests that we need to be more specific in the way we define health literacy in the mental health domain (see Simich, 2009). On the other hand, the result confirms previous Canadian research on the relationship between literacy and mental health. For example, a study using the Canadian Community Health Survey (CCHS) found that the lack of English or French speaking ability, which is one type of literacy measure, did not affect the risk of immigrants having depression (Ali, 2002).

An important finding of this analysis is the paradox of surprisingly low levels of health literacy with good self-rated health and being disability-free among recent immigrants who are not from Europe or USA. This low health literacy level could be attributed to the fact the IALSS survey was conducted in the two official languages only (English and French), and could have therefore underestimated the health literacy of immigrants. In particular, IALSS may have failed to capture the possibility higher health literacy among immigrants, which could have been observed if measurement was done in the context of their own culture and mother tongue. Besides difficulty in comprehension of survey items for immigrants who may not be proficient in English or French, conducting the survey in

only the official languages excluded all who speak neither English nor French. One way to increase the number of immigrants included in the surveys is to conduct the interviews in dominant languages in the immigrant population. For instance, the Longitudinal Survey of Immigrants to Canada (LSIC) was conducted in 15 languages to accommodate the diverse language profiles among recent immigrants. However, measuring immigrant health literacy in English or French in Canada is both practical and realistic because of the great language diversity among immigrants. In addition, it is also possible that there is a delayed effect of health literacy on health among immigrants. Low levels of health literacy could affect immigrant health over the long term. Although the impact of low health literacy (measured in English or French) among recent immigrants was not evident, it may have a long term impact, emerging in the future if their health literacy does not improve. This may be an important part of the explanation for the health of immigrants deteriorating with increasing duration of residence in Canada (Pottie et al., 2008).

The analysis of the effect of age at immigration and generations of the Canadian-born provided us the opportunity to understand the immigration process especially its long term effects on immigrants and their children. The age at immigration was significantly associated with health literacy and mental health, but in opposite directions; whereas the results for health literacy are in the expected direction, they are not for mental health. On the one hand, the results on the mental health advantage among those who immigrated at older ages (aged >=12) suggest that they are better prepared to handle the challenges of settling and living in a new country. It also points to the overarching influence of selection among older immigrants. On the other hand, younger immigrants grow in the Canadian culture and it is therefore not surprising that their mental health largely mirrors that of the non-immigrant population; and it is not better than that of people who came to Canada at older ages. This is despite the fact that growing up in Canada affords better and more life opportunities than may have been available in their country of origin. This result is in line with that of Wu and Schimmele (2005)

who reasoned that the pressures for young immigrants to 'fit' in at school and in the new social environment can potentially create stressful conflicts between the values and norms present in their homes and those learned in school and social life, and thus the lower mental health MCS scores. However, these results are tentative because the data in this study are cross-sectional and do not permit us to properly separate the effects of age, age at immigration, and period of immigration on health. Nonetheless, it is an issue that deserves further investigation. However, to properly understand the long term effects of immigration and to attribute associations to the observed relationships between health literacy and health outcomes would require longitudinal data.

This study found that although there are differences between second and third- plus generation Canadians in health literacy, they were all accounted for by the selected factors. Regarding health, second generation Canadians were only significantly different from third-plus generation in self-rated health. The results showed that even after controlling for all the selected factors, second generation Canadians were less likely to report good self-rated health compared to third-plus generation Canadians. The reasons for these differences are not clear and may point to unmeasured and unobservable factors. In particular, because it is not a health survey, the IALSS does not have information on health risk factors such as smoking, physical activity, alcohol consumption, and body mass index, nor health care utilization data such as physician visit, hospital stays, and unmet health needs. This information would be helpful in a detailed study of the relationship between health literacy, health outcomes, health risk behaviours, and healthcare use for both the non-immigrant and immigrant populations. In the meantime, it would be possible to examine the current data with healthcare utilization data at the geographical level to study the relationship between health literacy and healthcare utilization patterns.

Another related issue on generational status is whether children of immigrants enjoy better health or have higher health literacy than their parents. We did not specifically compare second

generation to first generation immigrants to determine whether children of immigrants do better than their parents, but the results of the analysis presented here, however, can provide a sense of the long term impact of immigration. First, immigrants perform worse in health literacy compared to non-immigrants overall. Second, the second generation does not perform any differently from the third-plus generation. Interpreted together, these two results suggest that children of immigrants (second generation) are likely to do better than their parents in health literacy. An exploratory analysis comparing the non-immigrant second generation and first generation immigrants found that the latter were significantly less likely to score high in health literacy (OR=0.44, and confidence intervals=0.29, 0.66) even after controlling for socio-demographic and socioeconomic factors. This is not surprising because these individuals are born and are raised largely according to Canadian norms, values and culture, and are educated in Canada. Their cultural practices and health behaviours are more likely to be closer to the Canadian norms compared to their foreign-born parents. Again, because the data analysed here are cross-sectional and do not necessarily match children of immigrants to their parents, these conclusions are tentative.

In addition to not having collected information on health risk factors and the data being cross-sectional, this study also had other limitations. First, because health literacy is significantly related to health outcomes (such as self-rated health), it would be of interest to establish how the various groups perform in the five dimensions of health literacy namely, health promotion, health protection, disease prevention, health care, system navigation. This information would form the basis for more targeted intervention strategies. However, in light of the way that health literacy information was derived (using the Item Response Theory method) it was not possible to delve into an analysis on the specific dimensions of health literacy for the current study. Second, while there is an increasing demand for more immigrant data, most population based surveys have not included large enough sample sizes for in-depth analyses on matters related to immigrants. Although the IALSS over-sampled the immigrant

population, there is still a need for a large enough samples that will enable us to undertake a detailed analysis on health literacy issues for different immigrant sub-groups that goes beyond the broad categories used here to include at least the different regions of the world. In addition, some European countries including Belgium, Norway, and Spain were not listed specifically in the data and therefore immigrants from these countries are classified under the non-European and non-USA group. However, the fact that these European countries are not listed possibly reflects the reality that their numbers are small. Overall, the effect of the error of misclassification of country of origin on our results would be small.

This study has underscored the importance of health literacy for good health. Although the levels of health literacy are relatively low in the overall Canadian population, the levels among immigrants deserve particular attention; only 25% of immigrants have the requisite health literacy skills to maintain health. Nonetheless, health literacy plays an important role as immigrants with high health literacy were more likely to report good self-rated health and to report good physical health even with controls for age, gender, immigration, and age at immigration. This relationship was rendered insignificant in the presence of socioeconomic factors and literacy practices at home and work suggesting that education and literacy practices at home are important. Although achieving higher health literacy is important for the general population, because of their low health literacy, immigrants would benefit most. Overall, our results suggest that engaging in literacy practices at home could provide large benefits to both health literacy and the health of all Canadians, but especially for immigrants.

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**Appendix A: Notes**

1. At the request of CCL, the information available from the International Survey of Reading Skills, clinical reading tests administered to a sample of adults from the IALSS, was examined to see if it could yield additional insights to our analyses in this project. However, consultation with the expert at the Centre of Education, Culture and Tourism Division revealed that this follow-up survey will not give us additional insights into why immigrants had lower health literacy.
2. Health related quality of life (MCS and PCS) medians: There are three populations analysed in this study; overall sample, local born, and immigrants. In the case of sub-sample analyses (local and immigrants), a population-specific median was used.
3. There is a miscellaneous category called 'Other' that was included in the non-European category. Due to limitations in data collection, we could not create further sub-divisions by immigrants' country of origin. Also, it is possible that there are misclassifications because the other 'Other' category includes both European and non-European countries. However, the impact of this on our estimates is minimal because the counts are small, about 5% of the total sample.

**Table 1: Descriptive statistics of the outcome variables (health literacy, self-rated health, SF-12 mental and physical health components, disability free), IALSS 2003[a]**

| | **Overall** | | **Immigrant groups** | | | | **Non-immigrant generations** | |
|---|---|---|---|---|---|---|---|---|
| | | | *Established* | | *Recent* | | | |
| **Outcome** | Non-immigrants | Immigrants | European or American | Other | European or American | Other | Third-plus | Second |
| High health literacy, mean (% scoring >=275) | 264 (45.0) | **228 (25.0)** | 229 (25.3) | 222 (23.7) | **256 (45.9)** | 234 (24.2) | 263 (43.3) | 266 (50.4) |
| Good SRH, % | 86.7 | **84.0** | 78.9 | **83.5** | **90.2** | **92.4** | 88.0 | **83.0** |
| Not disabled, % | 72.0 | **76.1** | 65.2 | **77.8** | **78.1** | **91.7** | 72.1 | 69.9 |
| Good MCS-12 , % [b] | 49.7 | 51.0 | 49.8 | 48.6 | 60.1 | 51.2 | 50.5 | 48.8 |
| Good PCS-12, % [b] | 50.6 | 48.0 | 45.5 | 49.8 | 58.2 | **56.5** | 51.0 | 49.0 |
| **N** | 18,957 | 3,861 | 1,196 | 1,431 | 211 | 1,023 | 16,145 | 2,812 |

Note: [a] Estimates in bold are statistically significant from the comparison group at $p<0.05$.

[b] The median scores for SF-12 mental and physical health components (MCS-12 and PCS-12) were only estimated for the overall population and separately for immigrants and non-immigrants, but not their sub-groups. The percentages represent the proportion of people whose score on these components was equal or higher than the median. The median MCS-12 scores are 60.1, 60.1, and 60.3 for the overall, non-immigrant and immigrant sample respectively. The median PCS-12 scores are 41.8, 41.9, and 41.5 for the overall, non-immigrant and immigrant sample respectively.

**Table 2: Descriptive statistics of the predictor variables for the overall, immigrants and non-immigrant populations, IALSS 2003**

| Characteristic | Overall | Immigrants | Non-immigrants |
|---|---|---|---|
| **Socio-demographic factors** | | | |
| *Age* | | | |
| 16-25 | 16.8 | 9.5 | 18.9 |
| 26-35 | 17.2 | 16.1 | 17.6 |
| 36-45 | 21.0 | 21.2 | 20.9 |
| 46-55 | 18.3 | 19.1 | 18.1 |
| 56-65 | 12.3 | 15.0 | 11.5 |
| Over 65 | 14.4 | 19.1 | 13.0 |
| *Females* | 51.0 | 51.7 | 50.8 |
| *Immigrants* | | | |
| Established European or American | | 33.1 | |
| Established other | | 42.6 | |
| Recent European or American | | 4.6 | |
| Recent other | | 19.7 | |
| *Age at immigration, <12* | | 18.9 | |
| *Second generation Canadians* | | | 14.8 |
| **Literacy and education factors** | | | |
| *Engages in literacy practices at home* | 91.3 | 87.6 | 92.3 |
| *Literacy practices at work* | | | |
| Practices | 58.2 | 49.3 | 60.8 |
| Does not practice | 14.5 | 16.3 | 14.0 |
| Not working | 27.3 | 34.5 | 25.3 |
| *Own education, >=High school* | 74.1 | 75.4 | 73.7 |
| *Maternal education* | | | |
| <High school | 46.5 | 57.2 | 43.4 |
| >=High school | 46.4 | 36.5 | 49.2 |
| Not stated | 7.2 | 6.3 | 7.4 |
| *Language of test and mother tongue discordant* | 23.1 | 73.0 | 9.1 |

**Table 2 continued**

| Characteristic | Overall | Immigrants | Non-immigrants |
|---|---|---|---|
| **Socioeconomic factors** | | | |
| *Employment status* | | | |
| Employed | 63.4 | 57.8 | 65.0 |
| Looking for work | 6.3 | 7.0 | 6.1 |
| Retired | 18.2 | 22.9 | 16.8 |
| Student | 5.7 | 4.8 | 5.9 |
| Other | 6.5 | 7.5 | 6.2 |
| *Census Metropolitan Area* | | | |
| Toronto | 15.9 | 40.1 | 9.1 |
| Montreal | 11.4 | 10.8 | 11.5 |
| Vancouver | 6.8 | 13.9 | 4.8 |
| Other CMA | 46.6 | 29.1 | 51.5 |
| Non-CMA | 19.4 | 6.1 | 23.1 |
| *Household income* | | | |
| Low | 32.3 | 39.4 | 30.3 |
| High | 59.2 | 52.3 | 61.2 |
| Not stated | 8.5 | 8.3 | 8.6 |
| **Total (N)** | **22,818** | **3,861** | **18,957** |

**Table 3: Multivariate logistic regression results of association of immigrant status, socio-demographic, education and literacy, and socioeconomic variables with high health literacy (N=22, 818)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **6.58 (4.87, 8.87)** | **2.27 (1.58, 3.25)** | **2.41 (1.43, 4.06)** |
| 26-35 | **7.98 (6.44, 9.89)** | **2.43 (1.86, 3.19)** | **2.75 (1.95, 3.89)** |
| 36-45 | **6.27 (4.46, 8.82)** | **2.35 (1.59, 3.49)** | **2.65 (1.80, 3.89)** |
| 46-55 | **5.25 (3.61, 7.63)** | **2.21 (1.41, 3.45)** | **2.38 (1.42, 3.99)** |
| 56-65 | **3.67 (2.74, 4.90)** | **2.39 (1.72, 3.32)** | **2.43 (1.70, 3.48)** |
| *Females* | 1.01 (0.86, 1.20) | 1.00 (0.84, 1.19) | 1.03 (0.87, 1.22) |
| *Immigrants* | **0.43 (0.35, 0.53)** | **0.45 (0.34, 0.61)** | **0.47 (0.34, 0.65)** |
| **Literacy and education variables** | | | |
| *Literacy practices at home* | | **2.91 (2.14, 3.94)** | **2.80 (2.06, 3.81)** |
| *Literacy practices at work* | | **1.76 1.28 2.40** | **1.68 (1.20, 2.34)** |
| *Own education (=>High school)* | | **2.77 1.93 3.98** | **2.68 (1.84, 3.91)** |
| *Maternal education (=>High school)* | | **2.24 1.90 2.65** | **2.18 (1.85, 2.57)** |
| *Test language and mother tongue discordant* | | 0.92 0.76 1.12 | 0.91 (0.75, 1.10) |
| *Participated in adult education* | | **1.69 (1.35, 2.13)** | **1.59 (1.28, 1.97)** |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 1.00 (0.62, 1.60) |
| Retired | | | 1.35 (0.81, 2.27) |
| Student | | | **1.67 (1.02, 2.75)** |
| Other | | | 1.15 (0.65, 2.04) |
| *Census Metropolitan Area* | | | |
| Montreal | | | 0.86 (0.62, 1.20) |
| Vancouver | | | 1.26 (0.85, 1.88) |
| Other CMA | | | 1.14 (0.87, 1.50) |
| Non-CMA | | | 1.05 (0.75, 1.46) |
| Household income | | | |
| *Household income (High)* | | | **1.61 (1.37, 1.90)** |
| –Log-likelihood | –15,365,169 | –13,520,483 | –13,335,369 |
| $R^2$ | 0.08 | 0.19 | 0.20 |

Note: The reference categories are: age >=65, male, non-immigrants, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates (–Log-likelihood (–LL) = -16,620,894). Subtracting from the $R^2$ of the preceding model indicates the additional amount of variation explained by the additional variables.

**Table 4: Multivariate logistic regression results of association of immigrant group, socio-demographic, education and literacy, and socioeconomic variables with high health literacy (n= 3, 861)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **3.66 (1.77, 7.58)** | 1.28 (0.46, 3.58) | 1.03 (0.20, 5.34) |
| 26-35 | **5.33 (3.02, 9.43)** | 1.40 (0.60, 3.29) | 1.30 (0.33, 5.07) |
| 36-45 | **4.30 (2.21, 8.35)** | 1.57 (0.54, 4.57) | 1.41 (0.30, 6.67) |
| 46-55 | **3.44 (1.43, 8.26)** | 1.53 (0.48, 4.89) | 1.35 (0.28, 6.51) |
| 56-65 | **2.80 (1.45 5.41)** | 1.57 (0.61, 4.02) | 1.40 (0.43, 4.51) |
| *Females* | 0.80 (0.56, 1.15) | 0.88 (0.59, 1.30) | 0.88 (0.61, 1.27) |
| *Immigration* | | | |
| Established other | **0.64 (0.44, 0.95)** | 0.69 (0.38, 1.23) | 0.76 (0.44, 1.31) |
| Recent European or American | 1.26 (0.56, 2.83) | 1.13 (0.45, 2.83) | 1.21 (0.46, 3.23) |
| Recent other | **0.59 (0.38, 0.92)** | 0.75 (0.45, 1.25) | 0.79 (0.43, 1.46) |
| *Age at immigration (=>12)* | **0.56 (0.32, 0.97)** | 0.61 (0.32, 1.18) | 0.63 (0.32, 1.24) |
| **Literacy and education variables** | | | |
| *Literacy practices at home* | | **5.24 (1.94, 14.14)** | **5.10 (1.88, 13.86)** |
| *Literacy practices at work* | | **2.60 (1.55, 4.38)** | **2.34 (1.39, 3.95)** |
| *Own education (=>High school)* | | **2.91 (1.67, 5.06)** | **3.02 (1.72, 5.27)** |
| *Maternal education (=>High school)* | | **2.58 (1.83, 3.63)** | **2.53 (1.80, 3.55)** |
| *Test language and mother tongue discordant* | | 0.95 (0.62, 1.45) | 0.96 (0.63, 1.45) |
| *Participated in adult education* | | **1.72 (1.27, 2.34)** | **1.58 (1.13, 2.22)** |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 1.14 (0.51, 2.54) |
| Retired | | | 0.99 (0.28, 3.52) |
| Student | | | 2.03 (0.64, 6.44) |
| Other | | | 1.24 (0.40, 3.81) |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.24 (0.69, 2.23) |
| Vancouver | | | 1.33 (0.67, 2.61) |
| Other CMA | | | 1.39 (0.89, 2.16) |
| Non-CMA | | | 1.51 (0.69, 3.29) |
| *Household income (High)* | | | **1.81 (1.17, 2.80)** |
| –Log-likelihood | –2,914,255 | –2,489,689 | –2,438,759 |
| $R^2$ | 0.05 | 0.19 | 0.20 |

Note: The reference categories are: age >=65, male, established immigrants from Europe or USA, immigrated at age <12, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL= –3,055,543.

**Table 5: Multivariate logistic regression results of association of Canadian-born generation group, socio-demographic, education and literacy, and socioeconomic variables with high health literacy (n= 18, 957)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **7.85 (5.59, 11.03)** | **2.67 (1.66, 4.28)** | **2.97 (1.56, 5.64)** |
| 26-35 | **9.60 (7.20, 12.79)** | **2.95 (1.96, 4.42)** | **3.45 (2.29, 5.18)** |
| 36-45 | **7.57 (4.58, 12.49)** | **2.78 (1.44, 5.39)** | **3.26 (1.78, 5.99)** |
| 46-55 | **6.38 (4.18, 9.73)** | **2.59 (1.45, 4.64)** | **2.92 (1.64, 5.21)** |
| 56-65 | **4.27 (2.81, 6.47)** | **2.81 (1.68, 4.70)** | **2.93 (1.81, 4.74)** |
| *Females* | 1.07 (0.86, 1.32) | 1.03 (0.83, 1.29) | 1.06 (0.85, 1.33) |
| *Second generation Canadians* | **1.38 (1.04, 1.84)** | 1.23 (0.89, 1.70) | 1.19 (0.85, 1.66) |
| **Literacy and education variables** | | | |
| *Literacy practices at home* | | **2.65 (1.81, 3.88)** | **2.55 (1.74, 3.75)** |
| *Literacy practices at work* | | **1.60 (1.11, 2.33)** | **1.55 (1.05, 2.29)** |
| *Own education (=>High school)* | | **2.74 (1.85, 4.07)** | **2.64 (1.73, 4.01)** |
| *Maternal education (=>High school)* | | **2.15 (1.83, 2.54)** | **2.09 (1.77, 2.46)** |
| *Test language and mother tongue discordant* | | 0.97 (0.77, 1.23) | 0.96 (0.76, 1.20) |
| *Participated in adult education* | | **1.67 (1.28, 2.17)** | **1.57 (1.22, 2.01)** |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.99 (0.62, 1.61) |
| Retired | | | 1.47 (0.75, 2.89) |
| Student | | | 1.61 (0.89, 2.88) |
| Other | | | 1.16 (0.65, 2.07) |
| *Census Metropolitan Area* | | | |
| Montreal | | | 0.75 (0.46, 1.22) |
| Vancouver | | | 1.22 (0.70, 2.13) |
| Other CMA | | | 1.03 (0.67, 1.57) |
| Non-CMA | | | 0.93 (0.56, 1.56) |
| *Household income (High)* | | | **1.53 (1.27, 1.84)** |
| –Log-likelihood | –12,291,465 | –10,903,883 | –10,768,964 |
| $R^2$ | 0.07 | 0.17 | 0.18 |

Note: The reference categories are: age >=65, male, third-plus generation, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –13,211,459.

**Table 6: Multivariate logistic regression results of association of immigrant status, socio-demographic, education and literacy, and socioeconomic variables with good-self-rated health (N=22, 818**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **4.81 (3.40, 6.80)** | **3.94 (2.78, 5.58)** | **2.00 (1.25, 3.20)** |
| 26-35 | **4.76 (3.46, 6.56)** | **3.80 (2.75, 5.26)** | **1.87 (1.20, 2.90)** |
| 36-45 | **4.09 (3.28, 5.10)** | **3.38 (2.67, 4.29)** | **1.67 (1.14, 2.46)** |
| 46-55 | **2.42 (1.99, 2.95)** | **2.05 (1.65, 2.54)** | 1.00 (0.76, 1.40) |
| 56-65 | **1.72 (1.40, 2.11)** | **1.53 (1.23, 1.89)** | 1.01 (0.78, 1.31) |
| *Females* | 0.91 (0.79, 1.05) | 0.91 (0.79, 1.05) | 1.08 (0.93, 1.26) |
| *Immigrants* | 0.93 (0.80, 1.08) | 1.02 (0.88, 1.19) | **1.40 (1.03, 1.91)** |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.94 (1.50, 2.52)** | 1.27 (0.97, 1.66) |
| *Literacy practices at home* | | | **1.66 (1.27, 2.17)** |
| *Literacy practices at work* | | | 1.06 (0.82, 1.37) |
| *Own education (=>High school)* | | | **1.44 (1.18, 1.75)** |
| *Maternal education (=>High school)* | | | 1.12 (0.71, 1.18) |
| *Test language and mother tongue discordant* | | | **0.79 (0.62, 0.99)** |
| *Participated in adult education* | | | 1.09 (0.94, 1.27) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | **0.63 (0.44, 0.91)** |
| Retired | | | 0.93 (0.57, 1.52) |
| Student | | | 1.06 (0.63, 1.80) |
| Other | | | **0.50 (0.33, 0.76)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | **1.65 (1.16, 2.36)** |
| Vancouver | | | 1.20 (0.89, 1.62) |
| Other CMA | | | 1.32 (0.90, 1.93) |
| Non-CMA | | | **1.56 (1.06, 2.28)** |
| *Household income (High)* | | | **1.49 (1.26, 1.78)** |
| –Log-likelihood | – 9,395,953 | – 9,248,570 | –8,664,804 |
| $R^2$ | 0.05 | 0.07 | 0.13 |

Note: The reference categories are: age >=65, male, non-immigrants, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = – 9,919,103.

**Table 7: Multivariate logistic regression results of association of immigrant group, socio-demographic, education and literacy, and socioeconomic variables with good self-rated health (n=3, 861)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **5.08 (2.76, 5.09)** | **4.60 (2.40,8.80)** | 2.20 (0.87, 5.61) |
| 26-35 | **9.87 (4.69, 20.80)** | **8.64 (4.04, 18.47)** | **3.62 (1.56, 8.40)** |
| 36-45 | **4.85 (3.31, 7.10)** | **4.35 (2.92, 6.47)** | 1.93 (0.91, 4.09) |
| 46-55 | **2.74 (1.94, 3.87)** | **2.51 (1.75, 3.60)** | 1.14 (0.56, 2.33) |
| 56-65 | **1.61 (1.15, 2.25)** | **1.50 (1.07, 2.10)** | 0.92 (0.54, 1.57) |
| *Females* | **0.75 (0.56, 0.99)** | 0.76 (0.57, 1.01) | 0.93 (0.68, 1.27) |
| *Immigration* | | | |
| Established other | 0.96 (0.71, 1.29) | 0.99 (0.72, 1.36) | 1.13 (0.79, 1.61) |
| Recent European or American | 0.83 (0.41, 1.69) | 0.81 (0.38, 1.72) | 0.88 (0.38, 2.03) |
| Recent other | 1.25 (0.80, 1.95) | 1.33 (0.85, 2.08) | **1.85 (1.15, 2.98)** |
| *Age at immigration (=>12)* | 1.15 (0.80, 1.66) | 1.22 (0.84, 1.77) | 1.26 (0.86, 1.84) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.91 (1.04, 3.50)** | 1.25 (0.64, 2.43) |
| *Literacy practices at home* | | | 1.38 (0.93, 2.04) |
| *Literacy practices at work* | | | 1.22 (0.73, 2.03) |
| *Own education (=>High school)* | | | **1.45 (1.08, 1.94)** |
| *Maternal education (=>High school)* | | | 1.11 (0.76, 1.60) |
| *Test language and mother tongue discordant* | | | 0.81 (0.54, 1.23) |
| *Participated in adult education* | | | 1.30 (0.82, 2.04) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | **0.46 (0.24, 0.88)** |
| Retired | | | 0.55 (0.23, 1.31) |
| Student | | | 0.64 (0.27, 1.52) |
| Other | | | **0.39 (0.17, 0.87)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.18 (0.70, 1.99) |
| Vancouver | | | 0.80 (0.56, 1.13) |
| Other CMA | | | 0.87 (0.60, 1.28) |
| Non-CMA | | | 1.16 (0.55, 2.43) |
| *Household income (High)* | | | 1.22 (0.91, 1.64) |
| –Log-likelihood | –2,164,828 | –2,126,433 | –2,023,916 |
| $R^2$ | 0.09 | 0.10 | 0.15 |

Note: The reference categories are: age >=65, male, established immigrants from Europe or USA, immigrated at age <12, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –2,370,449.

**Table 8: Multivariate logistic regression results of association of Canadian-born generation group, socio-demographic, education and literacy, and socioeconomic variables with good self-rated health (n=18, 957)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **4.52 (2.99, 6.82)** | **3.53 (2.33, 5.35)** | **1.81 (1.01, 3.23)** |
| 26-35 | **3.92 (2.73, 5.62)** | **2.94 (2.02, 4.28)** | 1.44 (0.86, 2.41) |
| 36-45 | **3.68 (2.77, 4.89)** | **2.88 (2.11, 3.94)** | 1.43 (0.89, 2.30) |
| 46-55 | **2.20 (1.71, 2.85)** | **1.77 (1.34, 2.34)** | 0.84 (0.54, 1.30) |
| 56-65 | **1.69 (1.32, 2.17)** | **1.44 (1.10, 1.89)** | 0.96 (0.69, 1.32) |
| *Females* | 0.97 (0.82, 1.14) | 0.96 (0.81, 1.13) | 1.12 (0.95, 1.33) |
| *Second generation Canadians* | **0.76 (0.59, 0.98)** | **0.72 (0.56, 0.93)** | **0.75 (0.58, 0.98)** |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **2.05 (1.52, 2.76)** | 1.32 (0.96, 1.81) |
| *Literacy practices at home* | | | **1.79 (1.26, 2.54)** |
| *Literacy practices at work* | | | 1.07 (0.79, 1.45) |
| *Own education (=>High school)* | | | **1.42 (1.12, 1.80)** |
| *Maternal education (=>High school)* | | | 1.14 (0.97, 1.35) |
| *Test language and mother tongue discordant* | | | **0.74 (0.57, 0.96)** |
| *Participated in adult education* | | | 1.08 (0.87, 1.33) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.67 (0.43, 1.04) |
| Retired | | | 1.15 (0.66, 2.00) |
| Student | | | 1.21 (0.64, 2.31) |
| Other | | | **0.55 (0.34, 0.90)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | **2.21 (1.41, 3.47)** |
| Vancouver | | | **1.84 (1.07, 3.16)** |
| Other CMA | | | **1.85 (1.17, 2.93)** |
| Non-CMA | | | **2.15 (1.33, 3.45)** |
| *Household income (High)* | | | **1.72 (1.43, 2.06)** |
| –Log-likelihood | – 7,190,318 | – 7,063,313 | – 6,523,493 |
| $R^2$ | 0.05 | 0.06 | 0.13 |

Note: The reference categories are: age >=65, male, third-plus generation, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = – 7,536,806.

**Table 9: Multivariate logistic regression results of association of immigrant status, socio-demographic, education and literacy, and socioeconomic variables with disability-free status (N=22, 818)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **5.95 (4.70, 7.53)** | **5.40 (4.23, 6.88)** | **3.35 (2.45, 4.57)** |
| 26-35 | **4.97 (3.94, 6.28)** | **4.44 (3.52, 5.61)** | **2.71 (2.02, 3.65)** |
| 36-45 | **3.92 (3.20, 4.81)** | **3.57 (2.95, 4.31)** | **2.19 (1.70, 2.81)** |
| 46-55 | **2.82 (2.28, 3.50)** | **2.60 (2.08, 3.25)** | **1.62 (1.24, 2.12)** |
| 56-65 | **1.82 (1.49, 2.23)** | **1.71 (1.39, 2.11)** | **1.29 (1.03, 1.62)** |
| *Females* | 1.10 (0.97, 1.25) | 1.10 (0.97, 1.24) | **1.18 (1.04, 1.35)** |
| *Immigrants* | **1.55 (1.36, 1.76)** | **1.62 (1.42, 1.85)** | **1.37 (1.13, 1.67)** |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.35 (1.15, 1.59)** | 1.17 (0.97, 1.40) |
| *Literacy practices at home* | | | 1.10 (0.91, 1.34) |
| *Literacy practices at work* | | | 0.90 (0.70, 1.17 ) |
| *Own education (=>High school)* | | | **1.32 (1.12, 1.56)** |
| *Maternal education (=>High school)* | | | 0.96 (0.86, 1.07) |
| *Test language and mother tongue discordant* | | | 1.15 (0.98, 1.36) |
| *Participated in adult education* | | | 0.95 (0.82, 1.11) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | **0.79 (0.64, 0.96)** |
| Retired | | | 0.99 (0.75, 1.32) |
| Student | | | 1.31 (0.94, 1.83) |
| Other | | | **0.71 (0.56, 0.90)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | **1.67 (1.26, 2.21)** |
| Vancouver | | | 0.90 (0.63, 1.28) |
| Other CMA | | | 0.83 (0.63, 1.09) |
| Non-CMA | | | 0.77 (0.57, 1.04) |
| *Household income (High)* | | | **1.19 (1.02, 1.38)** |
| –Log-likelihood | – 13,567,694 | –13,524,569 | –13,160,841 |
| $R^2$ | 0.06 | 0.06 | 0.09 |

Note: The reference categories are: age >=65, male, non-immigrants, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –14,440,316.

**Table 10: Multivariate logistic regression results of association of immigrant group, socio-demographic, education and literacy and socioeconomic variables with disability free status (n=3,861)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **6.90 (3.91, 12.17)** | **6.74 (3.79, 12.00)** | **3.84 (1.75, 8.42)** |
| 26-35 | **7.02 (4.07, 12.11)** | **6.79 (3.89, 11.85)** | **3.64 (1.88, 7.03)** |
| 36-45 | **5.29 (3.68, 7.59)** | **5.15 (3.53, 7.50)** | **3.05 (1.71, 5.41)** |
| 46-55 | **3.51 (2.38, 5.18)** | **3.43 (2.30, 5.12)** | **2.11 (1.27, 3.51)** |
| 56-65 | **1.82 (1.24, 2.66)** | **1.78 (1.22, 2.61)** | 1.32 (0.83, 2.11) |
| *Females* | 1.05 (0.84, 1.32) | 1.06 (0.84, 1.33) | 1.19 (0.93, 1.51) |
| *Immigration* | | | |
| Established other | **1.33 (1.05, 1.68)** | **1.34 (1.06, 1.70)** | 1.21 (0.92, 1.61) |
| Recent European or American | 0.70 (0.34, 1.46) | 0.70 (0.33, 1.47) | 0.62 (0.28, 1.37) |
| Recent other | **2.41 (1.62, 3.58)** | **2.44 (1.63, 3.66)** | **2.26 (1.54, 3.31)** |
| *Age at immigration (=>12)* | 1.23 (0.93, 1.62) | 1.25 (0.95, 1.64) | 1.14 (0.85, 1.53) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | 1.14 (0.76, 1.72) | 1.06 (0.63, 1.76) |
| *Literacy practices at home* | | | 1.03 (0.73, 1.46) |
| *Literacy practices at work* | | | 0.99 (0.55, 1.77) |
| *Own education (=>High school)* | | | 1.14 (0.85,1.53) |
| *Maternal education (=>High school)* | | | 1.39 (0.94, 2.05) |
| *Test language and mother tongue discordant* | | | 1.22 (0.86, 1.72) |
| *Participated in adult education* | | | 0.80 (0.60, 1.07) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.67 (0.41, 1.08) |
| Retired | | | 0.72 (0.41, 1.28) |
| Student | | | 0.89 (0.39, 2.06) |
| Other | | | **0.55 (0.31, 0.98)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.26(0.84, 1.91) |
| Vancouver | | | 0.86 (0.58, 1.28) |
| Other CMA | | | **0.66 (0.46, 0.96)** |
| Non-CMA | | | **0.59 (0.36, 0.98)** |
| *Household income (High)* | | | 0.85 (0.65, 1.11) |
| –Log-likelihood | –2,619,450 | –2,619,439 | –2,540,296 |
| $R^2$ | 0.11 | 0.11 | 0.14 |

Note: The reference categories are: age >=65, male, established immigrants from Europe or USA, immigrated at age <12, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –2,951,624.

**Table 11: Multivariate logistic regression results of association of Canadian-born generation group, socio-demographic, education and literacy, and socioeconomic variables with disability-free status (n= 18, 957)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **5.40 (4.13, 7.06)** | **4.71 (3.54, 6.26)** | **2.97 (2.01, 4.39)** |
| 26-35 | **4.33 (3.34, 5.61)** | **3.70 (2.83, 4.84)** | **2.28 (1.60, 3.26)** |
| 36-45 | **3.43 (2.70, 4.35)** | **2.99 (2.39, 3.74)** | **1.82 (1.37, 2.41)** |
| 46-55 | **2.54 (2.01, 3.20)** | **2.25 (1.77, 2.85)** | **1.36 (1.00, 1.83)** |
| 56-65 | **1.76 (1.38, 2.26)** | **1.61 (1.24, 2.11)** | **1.18 (0.89, 1.57)** |
| *Females* | 1.11 (0.95, 1.29) | 1.10 (0.95, 1.28) | **1.18 (1.01, 1.38)** |
| *Second generation Canadians* | 0.97 (0.83, 1.14) | 0.94 (0.81, 1.10) | 0.94 (0.80, 1.10) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.44 (1.23, 1.69)** | **1.21 (1.02, 1.44)** |
| *Literacy practices at home* | | | 1.16 (0.91, 1.48) |
| *Literacy practices at work* | | | 0.92 (0.69, 1.24) |
| *Own education (=>High school)* | | | **1.35 (1.11, 1.65)** |
| *Maternal education (=>High school)* | | | 0.91 (0.80, 1.03) |
| *Test language and mother tongue discordant* | | | 0.97 (0.77, 1.22) |
| *Participated in adult education* | | | 1.00 (0.85 1.18) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.81 (0.64, 1.02) |
| Retired | | | 1.10 (0.82, 1.48) |
| Student | | | 1.39 (0.97, 2.00) |
| Other | | | 0.75 (0.56, 1.01) |
| *Census Metropolitan Area* | | | |
| Montreal | | | **2.11 (1.35, 3.29)** |
| Vancouver | | | 0.95 (0.58, 1.55) |
| Other CMA | | | 1.04 (0.69, 1.57) |
| Non-CMA | | | 0.98 (0.62, 1.53) |
| *Household income (High)* | | | **1.36 (1.15, 1.61)** |
| –Log-likelihood | –10,887,219 | –10,824,940 | –10,486,062 |
| $R^2$ | 0.05 | 0.06 | 0.09 |

Note: The reference categories are: age >=65, male, third-plus generation, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –11,463,426.

**Table 12: Multivariate logistic regression results of association of immigrant status, socio-demographic, education and literacy, and socioeconomic variables with good mental health (N= 22, 818)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **1.30 (1.08, 1.57)** | **1.26 (1.04, 1.52)** | 1.18 (0.91, 1.54) |
| 26-35 | 1.13 (0.95, 1.35) | 1.09 (0.91, 1.31) | 0.96 (0.74, 1.26) |
| 36-45 | **1.27 (1.06, 1.52)** | **1.23 (1.02, 1.48)** | 1.09 (0.83, 1.44) |
| 46-55 | **1.27 (1.09, 1.49)** | **1.24 (1.05, 1.45)** | 1.09 (0.86, 1.40) |
| 56-65 | **1.45 (1.12, 1.86)** | **1.42 (1.10, 1.83)** | **1.32 (1.00, 1.75)** |
| *Females* | **0.66 (0.60, 0.72)** | **0.66 (0.60, 0.71)** | **0.69 (0.63, 0.76)** |
| *Immigrants* | 1.07 (0.96, 1.19) | 1.09 (0.97, 1.21) | **1.20 (1.00, 1.44)** |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | 1.10 (0.94, 1.29) | 0.95 (0.80, 1.13) |
| *Literacy practices at home* | | | **1.32 (1.12, 1.56)** |
| *Literacy practices at work* | | | 0.99 (0.83, 1.18) |
| *Own education (=>High school)* | | | **1.14 (1.00, 1.30)** |
| *Maternal education (=>High school)* | | | 1.12 (0.95, 1.31) |
| *Test language and mother tongue discordant* | | | 1.01 (0.89, 1.14) |
| *Participated in adult education* | | | 1.09 (0.94, 1.25) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | **0.76 (0.60, 0.96)** |
| Retired | | | 1.04 (0.80, 1.33) |
| Student | | | **0.75 (0.57, 0.99)** |
| Other | | | **0.61 (0.46, 0.80)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.04 (0.80, 1.36) |
| Vancouver | | | 0.90 (0.68, 1.19) |
| Other CMA | | | 1.07 (0.84, 1.36) |
| Non-CMA | | | **1.37 (1.04, 1.80)** |
| *Household income (High)* | | | **1.23 (1.06, 1.42)** |
| –Log-likelihood | –16,876,191 | –16,873,271 | –16,642,953 |
| $R^2$ | 0.01 | 0.01 | 0.02 |

Note: The reference categories are: age >=65, male, non-immigrants, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –17,050,352.

**Table 13: Multivariate logistic regression results of association of immigrant group, socio-demographic, education and literacy, and socioeconomic variables with good mental health (n= 3, 861)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **1.58 (1.11, 2.25)** | **1.55 (1.08, 2.22)** | 1.51 (0.88, 2.60) |
| 26-35 | 1.20 (0.86, 1.69) | 1.17 (0.82, 1.65) | 0.98 (0.61, 1.57) |
| 36-45 | **1.49 (1.09, 2.03)** | **1.45 (1.04, 2.01)** | 1.21 (0.80, 1.83) |
| 46-55 | **1.33 (1.00, 1.78)** | 1.31 (0.97, 1.76) | 1.10 (0.73, 1.67) |
| 56-65 | **1.52 (1.08, 2.14)** | **1.49 (1.05, 2.12)** | 1.34 (0.97, 1.86) |
| *Females* | **0.71 (0.58, 0.87)** | **0.71 (0.58, 0.87)** | **0.77 (0.63, 0.95)** |
| *Immigration* | | | |
| Established other | 0.89 (0.73, 1.09) | 0.90 (0.73, 1.11) | 1.03 (0.79, 1.33) |
| Recent European or American | 1.35 (0.88, 2.08) | 1.34 (0.86, 2.09) | 1.43 (0.88, 2.34) |
| Recent other | 0.92 (0.68, 1.25) | 0.93 (0.68, 1.28) | 1.11 (0.76, 1.61) |
| *Age at immigration (=>12)* | **1.25 (1.03, 1.51)** | **1.26 (1.04, 1.53)** | **1.33 (1.10, 1.62)** |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | 1.13 (0.84, 1.52) | 0.98 (0.69, 1.39) |
| *Literacy practices at home* | | | **1.42 (1.07, 1.88)** |
| *Literacy practices at work* | | | 0.86 (0.66, 1.13) |
| *Own education (=>High school)* | | | 1.03 (0.77, 1.38) |
| *Maternal education (=>High school)* | | | 1.17 (0.91, 1.51) |
| *Test language and mother tongue discordant* | | | 0.91 (0.69, 1.20) |
| *Participated in adult education* | | | 1.23 (0.93, 1.63) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | **0.51 (0.33, 0.80)** |
| Retired | | | 0.67 (0.42, 1.06) |
| Student | | | **0.44 (0.26, 0.73)** |
| Other | | | **0.51 (0.31, 0.84)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | 0.88 (0.62, 1.24) |
| Vancouver | | | 0.88 (0.63, 1.22) |
| Other CMA | | | 0.91 (0.69, 1.20) |
| Non-CMA | | | **1.79 (1.10, 2.91)** |
| *Household income (High)* | | | 1.13 (0.83, 1.56) |
| –Log-likelihood | –3,698,364 | –3,695,712 | –3,616,380 |
| $R^2$ | 0.01 | 0.01 | 0.03 |

Note: The reference categories are: age >=65, male, established immigrants from Europe or USA, immigrated at age <12, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –3,742,926.

**Table 14: Multivariate logistic regression results of association of Canadian-born generation group, socio-demographic, education and literacy, and socioeconomic variables with good mental health (n= 18, 957)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | 1.25 (0.99, 1.58) | 1.19 (0.93, 1.52) | 1.11 (0.78, 1.56) |
| 26-35 | 1.11( 0.92, 1.34) | 1.05 (0.85, 1.30) | 0.92 (0.66, 1.27) |
| 36-45 | 1.20 (0.97, 1.47) | 1.14 (0.92, 1.42) | 1.01 (0.72, 1.41) |
| 46-55 | **1.24 (1.01, 1.51)** | 1.19 (0.97, 1.46) | 1.04 (0.74, 1.45) |
| 56-65 | **1.39 (1.05, 1.85)** | **1.35 (1.02, 1.80)** | 1.26 (0.90, 1.76) |
| *Females* | **0.65 (0.58, 0.72)** | **0.65 (0.58, 0.72)** | **0.67 (0.60, 0.75)** |
| *Second generation Canadians* | 0.95 (0.80, 1.13) | 0.94 (0.79, 1.12) | 0.95 (0.80, 1.11) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | 1.13 (0.94, 1.35) | 0.97 (0.79, 1.19) |
| *Literacy practices at home* | | | **1.29 (1.05, 1.59)** |
| *Literacy practices at work* | | | 1.07 (0.87, 1.32) |
| *Own education (=>High school)* | | | 1.15 (0.99, 1.34) |
| *Maternal education (=>High school)* | | | 1.11 (0.94, 1.30) |
| *Test language and mother tongue discordant* | | | 1.04 (0.87, 1.26 ) |
| *Participated in adult education* | | | 1.05 (0.88, 1.26) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.84 (0.63, 1.12) |
| Retired | | | 1.13 (0.84, 1.53) |
| Student | | | 0.81 (0.58, 1.13) |
| Other | | | **0.61 (0.44, 0.84)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.09 (0.77, 1.52) |
| Vancouver | | | 0.91 (0.59, 1.40) |
| Other CMA | | | 1.12 (0.79, 1.58) |
| Non-CMA | | | 1.38 (0.96, 1.98) |
| *Household income (High)* | | | **1.26 (1.10, 1.44)** |
| –Log-likelihood | –13,170,150 | –13,166,765 | –12,982,013 |
| $R^2$ | 0.01 | 0.01 | 0.02 |

Note: The reference categories are: age >=65, male, third-plus generation, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –13,307,401.

**Table 15: Multivariate logistic regression results of association of immigrant status, socio-demographic, education and literacy, and socioeconomic variables with good physical health (N= 22, 818)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **2.69 (2.11, 3.42)** | **2.49 (1.97, 3.15)** | **1.40 (1.07, 1.84)** |
| 26-35 | **2.62 (2.11, 3.25)** | **2.40 (1.93, 2.98)** | **1.34 (1.05, 1.70)** |
| 36-45 | **2.29 (1.87, 2.80)** | **2.12 (1.73, 2.61)** | 1.21 (0.95, 1.54) |
| 46-55 | **1.93 (1.60, 2.33)** | **1.81 (1.48, 2.20)** | 1.04 (0.84, 1.30) |
| 56-65 | **1.43 (1.21, 1.69)** | **1.36 (1.15, 1.62)** | 0.99 (0.82, 1.19) |
| *Females* | 1.02 (0.92, 1.13) | 1.02 (0.92, 1.13) | 1.09 (0.97, 1.22) |
| *Immigrants* | 0.98 (0.85, 1.13) | 1.02 (0.89, 1.17) | 1.07 (0.90, 1.27) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.26 (1.14, 1.38)** | 1.05 (0.95, 1.16) |
| *Literacy practices at home* | | | 1.17 (0.97, 1.41) |
| *Literacy practices at work* | | | 1.16 (0.99, 1.37) |
| *Own education (=>High school)* | | | **1.21 (1.06, 1.37)** |
| *Maternal education (=>High school)* | | | 1.11 (0.99, 1.24) |
| *Test language and mother tongue discordant* | | | 0.95 (0.85, 1.07) |
| *Participated in adult education* | | | 0.94 (0.85, 1.05) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.85 (0.68, 1.06) |
| Retired | | | **0.71 (0.56, 0.91)** |
| Student | | | 1.26 (0.93, 1.71) |
| Other | | | **0.62 (0.47, 0.80)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | **1.30 (1.07, 1.58)** |
| Vancouver | | | 1.09 (0.89, 1.35) |
| Other CMA | | | 1.01 (0.86, 1.19) |
| Non-CMA | | | 1.02 (0.85, 1.23) |
| *Household income (High)* | | | **1.28 (1.14, 1.45)** |
| –Log-likelihood | –16,712,584 | –16,678,524 | –16,4035,73 |
| $R^2$ | 0.02 | 0.02 | 0.04 |

Note: The reference categories are: age >=65, male, non-immigrants, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –17,050,352.

**Table 16: Multivariate logistic regression results of association of immigrant group, socio-demographic, education and literacy, and socioeconomic variables with good physical health (n= 3, 861)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **3.71 (2.47, 5.57)** | **3.53 (2.31, 5.40)** | **2.41 (1.42, 4.08)** |
| 26-35 | **3.41 (2.22, 5.24)** | **3.17 (2.06, 4.89)** | **1.99 (1.22, 3.23)** |
| 36-45 | **2.78 (1.91, 4.04)** | **2.62 (1.79, 3.83)** | **1.75 (1.06, 2.88)** |
| 46-55 | **2.04 (1.43, 2.91)** | **1.94 (1.35, 2.79)** | 1.32 (0.80, 2.18) |
| 56-65 | 1.33 (0.91, 1.95) | 1.28 (0.87, 1.89) | 0.98 (0.66, 1.47) |
| *Females* | 0.93 (0.74, 1.19) | 0.95 (0.74, 1.20) | 1.06 (0.83, 1.35) |
| *Immigration* | | | |
| Established other | 0.93 (0.72, 1.19) | 0.95 (0.74, 1.21) | 1.03 (0.79, 1.35) |
| Recent European or American | 0.89 (0.49, 1.62) | 0.88 (0.47, 1.62) | 0.94 (0.54, 1.66) |
| Recent other | 0.86 (0.60, 1.23) | 0.88 (0.62, 1.27) | 1.05 (0.72, 1.54) |
| *Age at immigration (=>12)* | 1.07 (0.76, 1.50) | 1.10 (0.78, 1.56) | 1.16 (0.82, 1.63) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.35 (1.02, 1.80)** | 1.07 (0.79, 1.46) |
| *Literacy practices at home* | | | 1.11 (0.79, 1.56) |
| *Literacy practices at work* | | | 1.28 (0.92, 1.77) |
| *Own education (=>High school)* | | | 1.13 (0.79, 1.60) |
| *Maternal education (=>High school)* | | | 1.15 (0.85, 1.57) |
| *Test language and mother tongue discordant* | | | 0.92 (0.69, 1.24) |
| *Participated in adult education* | | | 1.08 (0.80, 1.46) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.88 (0.56, 1.38) |
| Retired | | | 0.85 (0.54, 1.33) |
| Student | | | 1.02 (0.64, 1.64) |
| Other | | | 0.62 (0.37, 1.05) |
| *Census Metropolitan Area* | | | |
| Montreal | | | 1.07 (0.77, 1.48) |
| Vancouver | | | 0.91 (0.62, 1.32) |
| Other CMA | | | 0.97 (0.76, 1.23) |
| Non-CMA | | | 1.50 (0.94, 2.38) |
| *Household income (High)* | | | 1.21 (0.93, 1.59) |
| –Log-likelihood | –3,614,798 | –3,603,428 | –3,538,504 |
| $R^2$ | 0.03 | 0.04 | 0.05 |

Note: The reference categories are: age >=65, male, established immigrants from Europe or USA, immigrated at age <12, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. The change in $R^2$ is assessed in relation to the model with no covariates, –LL = –3,742,920.

**Table 17: Multivariate logistic regression results of association of Canadian-born generation group, socio-demographic, education and literacy, and socioeconomic variables with good physical health (n= 18, 957)**

| Characteristic | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Socio-demographic variables** | **OR ( 95% confidence intervals)** | | |
| *Age* | | | |
| 16-25 | **2.58 (1.94, 3.42)** | **2.35 (1.78, 3.10)** | 1.23 (0.85, 1.80) |
| 26-35 | **2.49 (1.91, 3.25)** | **2.25 (1.73, 2.92)** | 1.17 (0.83, 1.66) |
| 36-45 | **2.17 (1.69, 2.79)** | **1.99 (1.54, 2.56)** | 1.05 (0.77, 1.43) |
| 46-55 | **1.89 (1.51, 2.37)** | **1.75 (1.38, 2.21)** | 0.93 (0.71, 1.22) |
| 56-65 | **1.47 (1.20, 1.81)** | **1.39 (1.14, 1.71)** | 0.98 (0.78, 1.23) |
| *Females* | 1.06 (0.93, 1.20) | 1.05 (0.92, 1.20) | 1.11 (0.97, 1.27) |
| *Second generation Canadians* | 0.96 (0.81, 1.14) | 0.94 (0.79, 1.12 ) | 0.92 (0.76, 1.11) |
| **Literacy and education variables** | | | |
| *Health literacy (High)* | | **1.26 (1.12, 1.41)** | 1.06 (0.93, 1.21) |
| *Literacy practices at home* | | | 1.17 (0.95, 1.44) |
| *Literacy practices at work* | | | 1.14 (0.94, 1.38) |
| *Own education (=>High school)* | | | **1.23 (1.08, 1.39)** |
| *Maternal education (=>High school)* | | | 1.09 (0.96, 1.24) |
| *Test language and mother tongue discordant* | | | 0.98 (0.82, 1.16) |
| *Participated in adult education* | | | 0.93 (0.81, 1.07) |
| **Socioeconomic variables** | | | |
| *Employment status* | | | |
| Looking for work | | | 0.83 (0.65, 1.07) |
| Retired | | | **0.67 (0.48, 0.93)** |
| Student | | | 1.34 (0.97, 1.84) |
| Other | | | **0.63 (0.47, 0.84)** |
| *Census Metropolitan Area* | | | |
| Montreal | | | **1.42 (1.04, 1.95)** |
| Vancouver | | | 1.33 (0.97, 1.83) |
| Other CMA | | | 1.07 (0.82, 1.38) |
| Non-CMA | | | 1.04 (0.78, 1.39) |
| *Household income (High)* | | | **1.32 (1.15, 1.51)** |
| –Log-likelihood | – 13,084,237 | – 13,056,175 | – 12,821,107 |
| $R^2$ | 0.02 | 0.02 | 0.04 |

Note: The reference categories are: age >=65, male, third-plus generation, low health literacy, no literacy practices at home, no literacy practices at work, less than high school education (own and maternal), test language and mother tongue concordant, employed, did not participate in adult education Toronto census metropolitan area, low household income; 95% confidence intervals in parentheses; Estimates in bold statistically significant at $p<0.05$. – The change in $R^2$ is assessed in relation to the model with no covariates, –LL = – 13,306,358.