The causal influence of social capital on immigrant health conditions in Canada

Caroline Berchet (Université Paris-Dauphine)

Audrey Laporte (Toronto University)

Résumé

A partir d'une enquête représentative de la population immigrée au Canada ("The Longitudinal Survey of Immigrant in Canada"), ce chapitre s'intéresse à l'influence causale du capital social (mesuré par la participation associative) sur la santé et le recours aux soins des immigrés. Ce chapitre apporte par ailleurs un éclairage empirique sur la relation existante entre le capital social, le capital humain et la santé des immigrés. Nous commençons par estimer des modèles Probit puis nous résolvons le problème d'identification du capital social en utilisant plusieurs modèles Probit dynamiques bivariés. Les résultats des estimations sont cohérents avec la littérature existante puisque nous montrons une influence positive de la participation sociale sur l'état de santé et le recours aux soins des immigrés. De plus, nos résultats indiquent que certaines activités sociales sont plus protectives que d'autres, telles que la participation à des groupes sportifs, religieux, les clubs culturels ou encore les associations politiques. Plus important encore, nous montrons que l'effet du capital social sur la santé des immigrés diffère selon leur niveau de capital humain, mesuré par leur niveau d'éducation. En particulier, le capital social semble être un substitut au capital humain dans la fonction de production de la santé des immigrés alors que le capital social et le capital humain apparaissent complémentaires pour accroitre l'utilisation des services de santé des immigrés.

Abstract

Using a representative longitudinal survey of the immigrant population in Canada (the "Longitudinal Survey of Immigrants in Canada"), this article assesses the causal influence of social capital (as measured by social participation) on immigrant health status and health care use. Furthermore, it sheds light on the relationship existing between social capital, human capital and immigrant health conditions. We begin with Probit models but then address the identification issue of social capital using several bivariate dynamic Probit models. Estimation results are consistent with exiting literature since we find a positive influence of social participation on immigrant health status and health care use. Moreover, our analyses reveal that some social activities are more protective than others such as participation to sporting groups, church groups, cultural clubs or political associations. More importantly, the effect of social capital on immigrant health conditions seems to differ according to their human capital level, measured through educational attainment. In this respect, social capital appears to act as a substitute for human capital to enhance immigrant health status while we found a complementary effect between social and human capital to increase immigrant health care utilisation.

1. Introduction

The World Health Organization's Commission on Social Determinants of Health (CSDH) identified social determinants as the most important determinants of health, beyond the traditional boundaries of the health-care sector. Therefore, they represent good candidates for the focus of public health policies aimed at "closing the gap" in health inequalities (CSDH, 2008). According to Epstein et al. (2009), one important issue that has not been fully addressed empirically is whether there is a causal link between social determinants of health and health inequalities. While a number of studies have documented the existence of differences in health or health care use according to socioeconomic status (Devaux and de Looper, 2012 ; Bago d'Uva and Jones, 2009 ; Van Doorslaer, Koolman and Jones, 2004 ; Wagstaff and Van Doorslaer, 2000), few provide evidence of a causal impact of social determinants of health, and as a consequence, it has been difficult to identify potential tools for tackling health inequities (Epstein *et al.*,2009 ; Marmot *et al.*,2008).

Apart from the usual socioeconomic characteristics, such as education, income, occupation, housing and working conditions, some recent studies have stressed the importance of factors relating to social capital to explain differences in individual health (Kawachi *et al.*,2008 ; Berkman *et al.*, 2000). In the past decade, evidence has accumulated from many countries finding an association between health status and social capital, where social capital is most often measured by social participation (Jusot *et al.*,2008 ; Scheffler and Brown, 2008 ; Islam *et al.*,2006). However, only a few studies have provided evidence of the causal impact of social capital on health status (Ronconi *et al.*,2012 ; Sirven and Debrand, 2012 ; d'Hombres *et al.*,2010 ; Folland, 2007). An important consideration in this literature is the potential endogeneity of social capital : is a large stock of social capital the result of good health or is good health the result of a large stock of social capital (Kawachi, 2007). Another issue that has not been fully explored is the extent to which social capital has a protective effect for certain population sub-groups, and in particular for immigrants who by virtue of coming from another country may have weaker links, at least initially to the formal health and social care service sectors. Finally, the interaction between social capital, human capital and health is less understood, some studies suggest that there is a substitution effect between social and human capital while others suggest that they are complementary to each other to improve population health (OECD, 2010a).

This research contributes to the existing literature in two ways. Firstly, it overcomes the problem of endogeneity and explores the causal effect of social capital on immigrant health conditions. Secondly, it sheds light on the relationship existing between social capital, human capital and immigrant health conditions in Canada. Using a representative longitudinal survey of the immigrant population in Canada, we assess the causal influence of social capital on immigrant health status and health care use according to their level of human capital. We begin with Probit models but then address the identification issue of social capital using several bivariate dynamic Probit models.

The article is structured as follows : the next section (section 2) presents a brief overview of the existing literature on immigrant health and social capital in Canada. Section 3 introduces the data and variables used in the regression analyses. The methodology and the estimation strategy are presented in section 4. The results are presented in section 5, followed by a conclusion in section 6.

2. Previous literature on immigrant health and social capital in Canada

Immigrants represent an increasing proportion of the Canadian society, accounting for 21.3% of Canada's population in 2010[1]. Welcoming a high number of immigrants (281 000 new permanent immigrants and 384 000 new temporary residents in 2010), Canada is a major immigrant-receiving country (OECD, 2012). Immigration policies are based since 1967 on a points system to highly select immigrants according to their education, language proficiency or work experience (OECD, 2006). The points system has substantially modified the immigration pattern in Canada in terms of source countries and qualification. The proportion of recent immigrants born in Asia (such as China, India, Pakistan or Philippines) has largely increased : only 12.1% of newly immigrants were born in Asia in the late 1960s against 40.8% of recent immigrants in 2006 (Statistic Canada, 2006). Immigrants in Canada also are highly educated and have in average more tertiary qualifications than the native population (OECD, 2006). Furthermore,

[1]Department of Economic and Social Affairs of United Nations : Trends in International Migrant Stock : The 2008 Revision, http ://esa.un.org/migration/index.asp ?panel=1.

immigrants to Canada are required to be screened for serious chronic conditions and infectious diseases, which excludes from migration individuals in poor health (Health Canada, 2010). This legislation makes immigrants to have higher health than the native population, a selection process known as the "Healthy Immigrant Effect". The Healthy Immigrant Effect suggests, in addition, that immigrants in good health are more likely to immigrate because they are the strongest members of their population of origin (Fennelly, 2007).

Although existing literature has confirmed that immigrants are healthier than the native population at the time of arrival, there is strong evidence suggesting that their health decline and converge with the native-born population's level over time (McDonald and Kennedy, 2004; Newbold and Danforth, 2003). Several explanations have been proposed to understand why their initial health advantages disappear with an increased length of stay in the host country. First, barriers to access the health care system may result in immigrants under-using health care services, worsening their health status (Newbold, 2009). If universality is one of the core principles of the Canada Health Act[2] (Elgersma, 2008), new immigrants[3] must face a wait of three months to be entitled to health insurance in 5 provinces (Ontario, Quebec, Nunavut, Yukon Territorry and Manitoba). In practice, the average waiting period is much longer than the three mandatory months since it can average 2.1 years (Caulford and Vali, 2006). As a result, immigration agencies recommend immigrants to buy private insurance to cover the first months of residency but this alternative is often declined by new immigrants (OMR, 2011). Furthermore, Community Health Centers offer free health care services for new immigrants but there are long waiting list that limit their access to care (OMR, 2011). Even though immigrants are entitled to a Provincial health program, the provided services is limited since prescription drugs, dental care or eyes glasses are not covered in some Canadian provinces. As a result, new immigrants to Canada may face a number of health care access problems related to financial constraints, waiting lists to access doctors or to access health facilities (Kuile *et al.*,2007), which have been shown to imply important health consequences (Elgersma, 2008).

Beyond barriers to access the health care system, the decline in immigrant health levels has

[2]The Canada Health Act entitles all residents to provincially ensured health services. A resident is a person lawfully entitled to be in or to remain in Canada and does not include tourists, transients or visitors (Elgersma, 2008, pp. 1).

[3]In the case of refugees with no permanent residency, the Interim Federal Health Program enables them to be covered for emergency medical treatment and other essential medical services (Elgersma, 2008).

also been attributed to unhealthy habits such as smoking, drinking or poor dietary practices (Cairney and Ostbye, 1999 ; McDonald and Kennedy, 2005). Immigrant's disadvantaged socio-economic status has also been associated to immigrant poorer health status. As a matter of fact, immigrant population may suffer from a loss of social status in the host country and may face a lower income than native population. Finally, new immigrants may suffer from social isolation, a loss of social networks or more broadly suffer from a lower level of social capital, factors which have been widely associated with health status or health care use[4].

In the Canadian context, the work of Deri (2005), Van Kemenade et al. (2006), Newbold (2009), and Zhao et al. (2010) provide recent evidence of the association between social capital and immigrant health or health care use. In adopting a network approach to measure social capital at the individual level, these studies show a positive relationship between immigrant social capital and health status or health care utilisation.

Deri (2005) finds that social networks, measured using an index of linguistic concentration, seems to play an important role by influencing health care utilisation. Accordingly, immigrants living in areas with a high concentration of people from their own language group have an increased likelihood to access to care (Deri, 2005). However, the study reveals that social capital may reduce health care utilisation if utilisation of the formal health care system is not part of the social network norms of the particular immigrant group. In addition, the study conducted by Van Kemenade et al. (2006) based on the Canadian General Social Survey provides evidence of a significant positive association between the size of network, measured as the number of ties or the participation in social activity and the immigrant health status. In contrast, using the Longitudinal Survey of Immigrants in Canada, Newbold (2009) finds that having family members or close friends is not a statistically significant factor influencing immigrant health status after six months of residency in Canada. However, the results do indicate that the risk of transition from good to poorer health status after two or four years of residency is lower for immigrants who had at least a monthly social interaction with friends or family. Finally, the study conducted by Zhao et al. (2010) also based on the Longitudinal Survey of Immigrants in Canada measures social capital through social networks using different dimensions such as kinship, friendship and organisational network. Their results show that the density or the diversity of friendship networks

[4]The reader could refer to chapter 1 for a more comprehensive literature review on the link between social capital and health conditions.

plays an important positive role in explaining the health status of recent immigrants while participation in social activities does not appear to influence immigrant health status, except for family class immigrants (i.e. those who have immigrated to Canada by being sponsored by a family member).

The main limitation of the studies presented above lies in the fact that they do not address the problem of causality between social capital and immigrant health. Actually, social capital may be associated with good health status but good health may result in a higher stock of social capital (e.g. the healthier you are, the more likely you are to engage in social activities), which implies an identification issue. In addition, these studies do not consider the interaction between immigrant social capital and their educational level whereas the relationship between social capital, human capital and health is less clear (OECD, 2010a). In this respect, there is contrasting evidence : some studies suggest that human and social capital could act as substitutes while others reveal that they could be complementary to each other to improve health or health care utilisation (Ross and Wu, 1995 ; Pevalin and Rose, 2000 ; Miller *et al.*,2006 ; Scheffler *et al.*,2007 ; Scheffler *et al.*,2008 ; Yoon, 2008). Accordingly, the influence of social capital on the health production function would differ by individual level of human capital, which is mostly measured through educational level.

In actual fact, some of the empirical literature based on the general population found a complementary effect between social and human capital. Ross and Wu (1995) have shown that education improves health directly but also indirectly through its impact on individual social support. Accordingly, it is possible that people with a higher level of education constitute a more influential or more reliable social network which may explain the greater health return to social capital that was observed for highly educated people. Similarly, the findings of Yoon (2008) reveal no statistically significant effect of social capital on lifestyles among people with a lower level of education, while a positive effect was found among the highly educated people. The OECD report (OECD, 2010a) specifies that more educated individuals may use social capital more efficiently because human capital provides greater abilities to understand and use information or social norms related to social capital.

Alternatively, if a substitution effect is found, social capital could be considered as an alternative resource helping individuals with low educational levels to improve their health status

(OECD, 2010a). Few researches have directly demonstrated the substitution effect between human and social capital. The study conducted by Miller et al. (2006) provides evidence of a protective effect of community level social capital, as measured by the number of community organizations, on performing Activity Daily Living (ADL) for those with low education. However, they found no statistically significant correlation between social capital and ADL for individuals with a high education level, thereby reinforcing the substitution hypothesis. Other studies reveal a stronger influence of social capital among individuals with poorer socioeconomic conditions. In this light, Pevalin and Rose (2000) have shown that the influence of social participation on health outcomes is greater among individuals that do not work.

Besides, Scheffler et al. (2007, 2008) have highlighted only a significant association between community-level social capital, measured through the Petrix Social Capital Index (PSCI), and objective measures of health among individuals living in areas with low household income or among those whose family income is inferior to the median. Accordingly, poorer individuals may be more prone to rely on their social networks to achieve better health outcomes and thus to counterbalance their lack of education, income or employment (OECD, 2010a).

To our knowledge, no empirical analysis has been proposed to (i) examine the assumptions of a substitution or a complementary effect between social and human capital on immigrant health conditions and (ii) to determine its causal influence on immigrant health conditions. In this research, we consider individual social capital measured through the participation in a range of social activities.

The aim is threefold : firstly, to determine whether individual social capital is associated with better health status and a higher health care utilisation among the immigrant population. Then, we are interested in testing a different effect of social capital according to immigrant level of human capital (as measured by their educational level) and finally, our objective is to determine the causal impact of social capital on immigrant health conditions.

3. Source and variables

3.1. Data source

The analysis of the influence of social capital on immigrant health status or health care use is based on the three waves of the Longitudinal Survey of Immigrants in Canada (LSIC) collected by Statistics Canada. The LSIC is a national survey that provides a dynamic picture of the integration experience of recent immigrants to Canada. It was designed to study immigrant integration over time and to explore the factors that hinder or assist the adaptation process in Canada. It contains information on the immigration status, demographics, socioeconomic characteristics, language proficiency, settlement experience, social network, values and attitudes. The target population is immigrants who arrived in Canada between October 2000 and September 2001 and who were 15 years of age or older at the time of arrival[5]. During the first LSIC interview, some 12,000 immigrants aged 15 and over were interviewed between April 2001 and March 2002, about 6 months after their arrival. During the second LSIC interview in 2003 approximately two years after their arrival, about 9,300 of the same immigrants were interviewed again. In the last LSIC interview wave in 2005, about 7,710 of the same immigrants were interviewed for the third time ; approximately four years after their arrival. The analysis is based on the sample of immigrants that have been tracked over the 3 waves (7,710 immigrants) and longitudinal weights designed by Statistics Canada are used to account for sample attrition (Statistic Canada, 2007)[6].

3.2. Health related variables

Two dichotomous dependant variables are considered to analyse immigrant health status and the use of health care services over time : self-rated health status and health care utilisation. Self-rated health status is derived from the following question : "In general, would you say your health is excellent, very-good, good, fair or poor ?". Respondent self-rated health is dichotomized, for each wave, to consider separately immigrants in good health (those reporting an excellent,

[5] http ://www.statcan.gc.ca/pub/11f0019m/2008312/s5-eng.htm

[6] In our data set, we only observed the 7,710 immigrants that have been tracked over the 3 waves. That is the reason why we are working on a balanced sample of immigrants and why we could not analysed the attrition in the sample.

very good or good health status) and immigrants in poor health (those reporting a fair or poor health status).

The univariate analysis depicted in Table 1 shows a decline in immigrant health status over time. The health of new immigrants is high as 97% of them report excellent, very good or good health status six months after their arrival. However, the trend seems to decline gradually over time. After two and four years of residency in Canada, the proportion of immigrants reporting a good health status is about 94.6 % and 92%[7]. One reason of this decline in health could be the ageing of immigrant population over time or the fact that immigrants cope with stress related to settlement or acculturation, decreasing or worsening their own health perception (Finch and Vega, 2003).

Table 1. Weighted distribution of health status and health care utilisation by wave

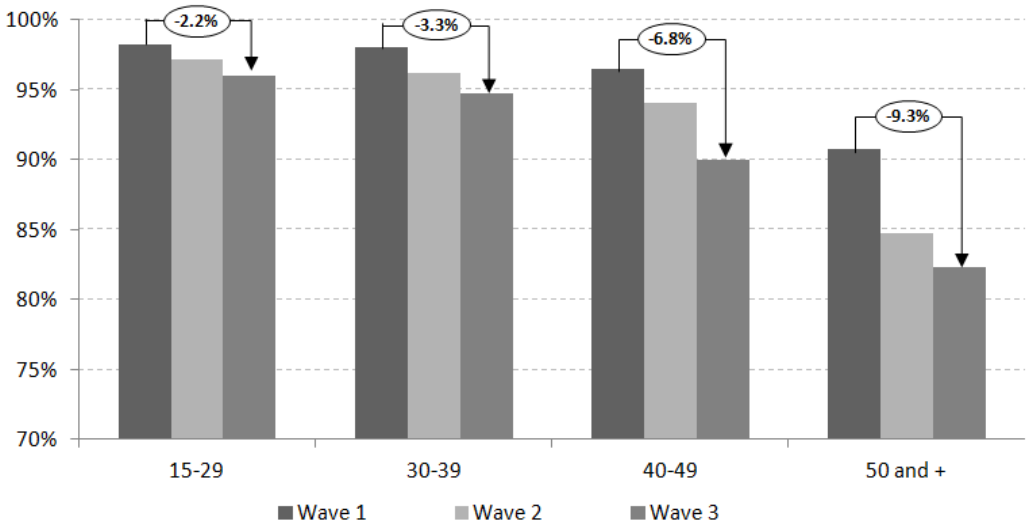
	Wave 1	Wave 2	Wave 3
	Total population (N=7,710)	Total population (N=7,710)	Total population (N=7,710)
"Good" health status	97.0%	94.6%	92.0%
Excellent	43.0%	30.3%	22.9%
Very Good	35.4%	40.0%	37.2%
Good	18.6%	24.3%	31.9%
"Poor/Fair" health status	3.0%	5.4%	8.0%
Did use health care services	20.2%	72.9%	72.1%
Did not use health care services	79.8%	27.1%	27.9%

Similar declines in health status are observed in Figure 1 for each age group of immigrants. As expected, the decline in the proportion of immigrants reporting a good health status gradually increases with age, going from 2.2% for the youngest group to 9.3% for the oldest group of immigrants.

[7] Tests of mean equality indicate that differences in self-reported health status between the 3 waves are significantly different from zero at the 1% level.

Figure 1. Proportion of immigrants reporting a good health status by age group and wave

(Surrounded figures represent the relative change in health status between wave 1 and wave 3)



For health care utilisation, the question asked to respondents was modified across the three waves. During the first wave, the question is only asked to immigrants that reported some medical problems, such as physical, dental, emotional or other medical problems. If respondents reported a medical problem, they were then asked "Did you receive medical or dental attention in Canada for this or any of these problem(s) ?". However, during the second and third waves respondents were asked : "Since your last interview, have you received any medical attention ? (For example, visited or contacted a doctor, hospital or clinic)". Although the questions were modified, we dichotomised the health care utilisation variable taking the value 1 if respondents received any medical attention.

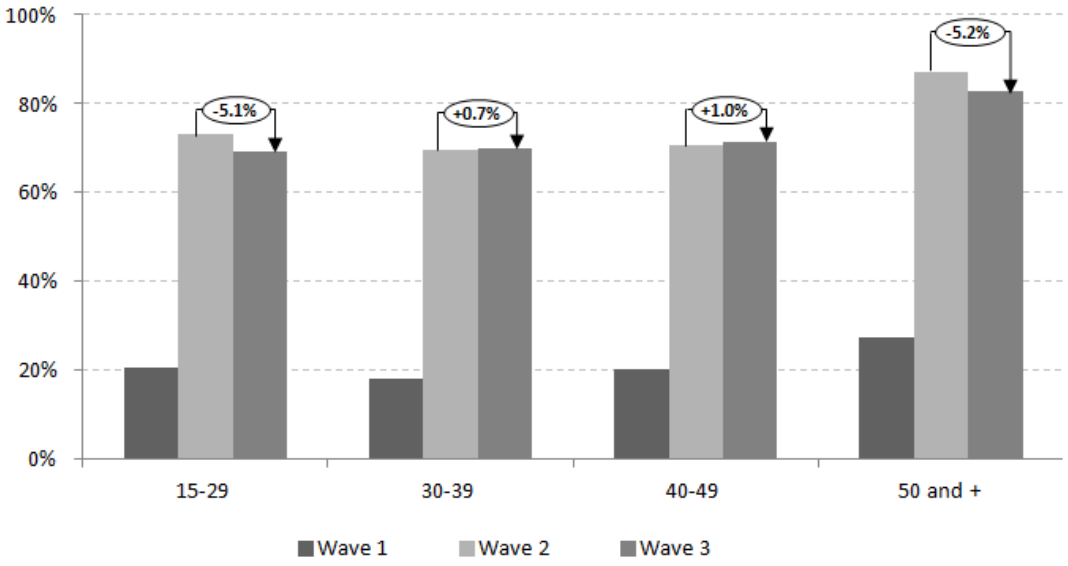
As illustrated by Table 1, the pattern of immigrant health care utilisation largely differs across waves 1, 2 and 3. Six months after arriving, only 20.2% of immigrants reported having received medical attention while in waves 2 and 3 (after 2 and 4 years of residency) 72.9% and 72.1% of immigrants respectively did so, which suggests a decrease in utilisation of 1.1% between the last two waves[8].

[8]This difference in immigrant health care utilisation between waves 2 and 3 is significantly different from zero at only the 5% level.

The small proportion of immigrants who reported having used health care services at wave 1 may be firstly explained by the fact that only respondents with health problems were asked about their health care utilisation. Secondly, immigrants residing in Canada for only 6 months must have other concerns related to the adaptation process rather than their medical needs. Finally, as mentioned previously immigrants must complete a three month waiting period before being entitled to a provincial health insurance plan, which may limit immigrant health care utilisation.

Figure 2. Proportion of immigrants using health care services by age group and wave

(Surrounded figures represent the relative change in utilisation between wave 2 and wave 3)



The pattern of health care utilisation appears more heterogeneous for each immigrant age group (Figure 2). The increase in health care utilisation between the two first waves occurs for each immigrant age group but no general trend can be outlined regarding the change in health care utilisation between waves 2 and 3. Although utilisation seems to slightly increase for immigrants aged between 30 and 39 years old and those aged between 40 and 49 years old, a decline in health care utilisation is observed for the youngest and oldest groups of immigrants (by 5.1% and 5.2% respectively).

3.3. Social participation as a proxy of social capital

To measure social capital, we used information relating to participation in social activities to determine the extent to which individual social capital influences health related variables. Involvement in a social activity is, for each wave, measured through the following question : "Are you a member, or have you taken part in the activities of any groups or organisations in Canada (such as religious groups, ethnic associations, sport club, cultural clubs or political organisations) ?". The variable is given the value of one if respondents claimed to take part in at least one of these activities and zero if they did not.

Table 2. Weighted distribution of social capital by type of social activity

	Wave 1	Wave 2	Wave 3
	Total population (N=7,710)	Total population (N=7,710)	Total population (N=7,710)
No investment in social capital	76.7%	72.2%	69.0%
Investment in social capital	23.3%	27.8%	31.0%
Church group	12.6%	12.1%	11.0%
Immigrant/Ethnic group	2.2%	3.1%	4.1%
Sporting group	2.9%	3.6%	4.0%
Hobby/Cultural group	4.1%	6.2%	7.3%
Political group	1.5%	2.8%	4.6%

Immigrant social participation seems to increase across the three waves, going from 23.3% in wave 1 to 31.0% in wave 3 (Table 2).

Table 2 also presents the distribution of social participation according to the type of social activity for each wave. Within our sample, immigrants involved in social participation are primarily members of a religious organisation (12.6% of the sample in wave 1 and 11% of the sample in wave 3) or members of a cultural and hobby club such as art club, service club or community organisation (4.1% of immigrants in wave 1 and 7.3% in wave 3). Although the proportion of immigrants involved in religious organisation decreases over time, the reverse trend is observed for the four other types of social participation.

3.4. Other covariates

To test the assumption that social capital may have a different impact on health conditions according to the level of immigrant human capital, we considered educational level on arrival as a proxy of immigrant human capital. Educational level on arrival was divided into three categories : high school degree or less, college degree and university level including bachelor, master or PhD degree. Within our sample, the proportion of highly educated people is significant since 58.2% of immigrants reported having a university degree or more while 26.3% of immigrants graduated from high school or less and finally, 15.5% of them had a diploma similar to a college degree (Table A1 in Appendix A).

To control for other characteristics that influence health status or health care use, we also introduce demographic characteristics including age (continuous) and sex (considering males as the reference group). The immigrant place of birth is grouped into 7 broad areas countries : America, Europe, Asia, Middle East, Africa, Caribbean or Guyana and finally Oceania or Australia.

Income is measured by economic family income, which refers to a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common law or adoption (Statistic Canada, 2007). We created income quintiles and included a category for respondents with missing income values in any of the three waves. The possession of health insurance is a dichotomous indicator that is given the value of one if respondents have obtained a provincial health card that entitles them to medical care in their province. Information related to employment and main activity status was used to create six activity statuses : working, homemaker, student, retired, looking for a job and other activity status. Marital status is divided into three different levels : single, married or in a common law relationship and finally separated, divorced or widowed. English proficiency on arrival is a dichotomous indicator which indicates whether respondents speak poorly or cannot speak English at all. To control for the influence of other social interactions, we included two dichotomous variables indicating whether respondents have family in Canada and whether the respondent received information. For the latter information, respondents were asked "Did you receive any information that helped you adjust to life in Canada ?"[9]. Five provinces of destination are considered : Quebec, Ontario, British Colombia,

[9]The types of information received relate to the following : finding housing, looking for a job, getting a medical care card or accessing medical care services, getting language training, finding education, getting education

Alberta and other provinces. Finally, a variable for immigrant class was created to distinguish between family immigrants (i.e. those who have immigrated to Canada by being sponsored by a family member), economic immigrants (i.e. those who arrived as skilled workers or on a business class visa) and refugee immigrants (i.e. those claiming refugee status outside Canada).

Tables A1 and A2 in Appendix A report the distribution of others covariates used in the analysis. Within our sample, the vast majority of immigrants arrived to Canada as skilled workers or on a business class visa (66.2%), which explains why immigrants are highly educated, and they are for 63.9% of the sample native from Asian countries.

4. Econometric strategy

Our methodological approach has three components. First, we ran Probit models with random effects to explore the association between social capital and health or health care use ; then we measured the relative contribution of social capital to immigrant health conditions ; and finally we built several bivariate dynamic models of health and health care use to explore the causal influence of social capital. For each component, estimates are first conducted on the whole population of immigrants and then by immigrant educational level to test the different effect of social capital according to the immigrant level of human capital. We divided the sample of immigrants between those who are "highly" educated, which includes immigrants having at least a university degree (58.2% of the sample), and those who are "poorly" educated which includes immigrants having at most a high school or a college degree (41.8% of the sample).

4.1. Determinants of immigrant health and health care use in Canada

Using only the second and third waves of the LSIC, we first estimated Model A which consists of two Probit models that attempt to understand an individual's health condition. In one such model, the dependent variable is measured by self-rated health status and in the other the dependent variable is health care use. Let us assume that health or health care use of respondent i at wave t is measured by a continuous latent variable Y_{it}^{*} which is proxied by the binary variable Y_{it} as follow :

credentials/work experience assessed, getting Canadian equivalencies for foreign qualifications, how to receive basic needs and services or how to contact immigration agencies.

$$\textit{Model A :} \quad \begin{cases} Y_{it} = 1 \text{ if } Y_{it}^* > 0 \\ Y_{it} = 0 \text{ if } Y_{it}^* \leq 0 \end{cases}$$

The general health production function that models health or health care use can be written as follows :

$$Y_{it}^* = \alpha_1 S_{it} + \alpha_2 D_i + \alpha_3 X_{it} + u_i + v_{it} \qquad (4.1)$$

with $i = 1, 2, ..., N$ and $t = 2, 3$. In equation 4.1, individual health at time t is explained by individual social capital S_{it} which is a dummy indicator representing whether respondent is involved in social activities. The vector D_i captures the time invariant determinants of health and health care use (such as sex, education level at arrival, immigrant class, place at birth, etc.) and the last set of controls X_{it} consists of time variant determinants of health or health care use (such as age, activity status, marital status, etc.). We also introduced in the health care use model, a dummy variable representing the immigrant health status. v_{it} is the time variant individual specific error term, which is assumed to be normally distributed and uncorrelated across individuals and waves while u_i is the time invariant unobserved effect which captures unobserved individual characteristics such as genetics, preferences or others personality traits (Cutler and Lleras-Muney, 2010).

We firstly estimated Probit models with random effects[10], assuming that the errors are independent over time and uncorrelated with the explanatory variables (Maddala and Lahiri, 2009). These models explore the determinants of immigrant health and health care use and highlight the relationship between immigrant social capital, as measured by their participation in social activities, and their health status (Model A1) or health care use (Model A2) after controlling for unobserved heterogeneity. As mentioned previously, estimations are first conducted on the whole population of immigrants and then by immigrant educational level to test the different effect of social capital according to immigrant level of human capital. We attempted to identify a complementary or a substitution effect between human capital and social capital depending on the sign and significance of the parameter $\widehat{\alpha_1}$ in the health production function. If, for instance,

[10]Fixed effect models are not used in the analysis because it would have substantially reduced the sample size insofar as the likelihood estimation would has been only based on immigrants that have seen a change in their health status or health care use between both waves. In addition, in using a fixed effect model we could not estimate the parameters associated with time invariant explanatory variables that may be of interest such as immigrant class, place at birth or educational level at arrival (Maddala and Lahiri, 2009).

in Model A1 (on the health status equation) $\widehat{\alpha_1} \leq 0$ among the most educated immigrants while $\widehat{\alpha_1} > 0$ among the least educated immigrants, we then will assume that social capital and human capital are substitutes for each other to improve immigrant health status. Conversely, if in Model A2 (on the health care use equation) $\widehat{\alpha_1} > 0$ among the most educated immigrants while $\widehat{\alpha_1} \leq 0$ among the least educated immigrants, we then will assume that social and human capital are complementary to each other to improve health care utilisation.

Finally, we attempted to determine whether the association between social capital and immigrant health conditions differs by type of membership in social activity. For this purpose, we ran the same random effect Probit (Model A) on the whole population of immigrants considering the following social activities separately : (i) religious groups, (ii) ethnic or immigrant associations, (iii) sporting clubs, (iv) cultural or hobby organisations and finally, (v) political organisations.

4.2. The causal influence of social capital on immigrant health conditions

Up to now we have not addressed several important issues. Firstly, any association between social capital and health conditions that we may observe in the Probit model may not be due to causality but be the result of other factors that determine both variables (implying inconsistency of parameters). One econometric solution to overcome the issue of endogeneity is to perform a bivariate Probit model to estimate simultaneously the health and social capital equations. Secondly, social capital and other covariates at each wave may have an impact on current health directly but also indirectly in influencing past health. To account for the potential correlation between social capital and the other covariates with past health conditions, we used a dynamic specification in which we introduced past health conditions. However, modelling a dynamic relationship with lagged value of health implies an "initial condition" issue, meaning the individual effect will be correlated with the lagged value of health (Jones, 2007). Wooldridge (2005) makes this point when he notes that individual initial health status or health care use cannot be assumed to be random because it also reflects the individual's past experience. To overcome this last issue, Wooldridge (2005) has suggested to model the distribution of individual unobserved effect (u_i) conditional on the initial value of health and the mean value of the time variant exogenous variables.

Considering these important issues, we built a dynamic bivariate Probit model with two equations in which lagged and initial values of each dependent variable were included[11] (Model B). The first equation explains health conditions (measured alternatively by self-rated health status in Model B1 and health care use in Model B2), whereas the second explains immigrant social participation.

We first model the dynamic bivariate Probit model as follows :

$$\textit{Model B :} \quad \begin{cases} Y_{it} = 1 \text{ if } Y_{it}^* > 0 \\ Y_{it} = 0 \text{ if } Y_{it}^* \leq 0 \end{cases} \quad \text{and} \quad \begin{cases} S_{it} = 1 \text{ if } S_{it}^* > 0 \\ S_{it} = 0 \text{ if } S_{it}^* \leq 0 \end{cases}$$

$$\text{with} \begin{cases} Y_{it}^* = a_1 Y_{i0} + a_2 Y_{it-1} + \alpha_1 S_{it} + \alpha_2 D_i + \alpha_3 X_{it} + \varepsilon_{1it} & (4.2) \\ S_{it}^* = b_1 S_{i0} + b_2 S_{it-1} + \beta_1 D_i + \beta_2 X_{it} + \beta_3 Z_{i0} + \varepsilon_{2it} & (4.3) \end{cases}$$

Y_{it}^* and S_{it}^* are the unobserved latent variables measuring respectively individual health conditions and individual social capital at wave t. In the first equation of Model B ($eq.$ 4.2), individual health conditions at wave t are made dependent on the initial value of health conditions (Y_{i0}), on lagged health conditions (Y_{it-1}), on social participation at wave t (S_{it}) and on the set of time invariant (D_i) and time variant (X_{it}) covariates. In the second equation of Model B ($eq.$ 4.3), individual social capital at wave t is explained by the initial value of social capital (S_{i0}), by lagged social capital (S_{it-1}), the common set of time invariant (D_i) and time variant (X_{it}) covariates. We finally considered Z_{i0}, a specific set of covariates that is only included in the social capital equation (eq.4.3) to be used as the identifying variable. In actual fact, Lollivier (2006) states that parameters $a_1, a_2, \alpha_1, \alpha_2, \alpha_3$ of equation 4.2 are identifiable at the first order if and only if covariates in equation 4.2 are different from those in equation 4.3.

In this respect, we need to identify at least one variable that significantly affects the probability of being involved in social activity but not affecting immigrant health conditions. From a

[11] As mentioned, Wooldridge (2005) suggested not only to include the initial value of each dependant variable but also the mean value of time variant covariates. In our research, we assume that the time variant covariates such as marital status, activity status or family income did not deeply vary between waves. Therefore, in section 4.5.2 are presented estimate results from the dynamic bivariate Probit model which solely includes initial and lagged values of each dependant variable. Nevertheless and for the sake of comparison, Table D1 in Appendix D outlines the main estimate results from the dynamic bivariate Probit model in which are also included the mean value of time variant covariates.

theoretical point of view, the choice of the identifying variable is not obvious since, to our knowledge, no formal studies exploring the causal relationship of social capital on immigrant health have been conducted. Nevertheless, in following an empirical strategy we found two identifying variables[12] that are not statistically significant with immigrant health conditions but statistically significant with the social capital equation.

For the first identifying variable, we considered a binary variable indicating whether or not respondents met friends at least once a week during the first wave of the survey. Although the frequency of meeting friends may be considered as a measure of individual social capital[13], an immigrant's social network during the first six months after his arrival may also encourage identification with a social group, fostering the creation of shared norms and values which in turn increase the likelihood that an immigrant gets involved in social activities. The second identifying variable relies on the following question "What is the most useful thing that was done to help you settle in Canada ?"[14]. We speculate that the tangible help received by a respondent (such as the help received from government program or from immigrant services) during the first six months of residency may provide information, enhancing the adaptation process and increasing opportunities to get involved in social activities.

One should notice that under some assumptions on residual terms[15] the parameters may also be identifiable at the second order, meaning that exclusion restrictions are not strictly necessary for the identification of both equations in the case of a Bivariate Probit. We thus considered a second bivariate model (Model C) in which identifying variables were removed from the analysis[16].

[12] Table A3 in Appendix A presents the distribution of both identifying variables.

[13] Refer to chapter 1.

[14] The answer to the question is categorised into the following items : nothing, social relationship, finding a job or a place to live, education or language program, government program and services for immigrants, personal quality and other things.

[15] Those parameters may be identifiable at the second order in supposing that conditional on the covariates, the residual terms ε_{1it} and ε_{2it} have a given variance, respectively σ_1^2 and σ_2^2 and present the following correlation $E(\varepsilon_{1it}\varepsilon_{2it}|X_{it}) = \rho\sigma_1\sigma_2$. Given these assumptions, the model is identifiable at the second order even if the set of covariates are identical between both equations (Lollivier, 2006).

[16] We performed both models B and C to test if results differ according to the method used in the analysis (with or without identifying variables).

The ultimate model to be considered can be written as follows :

$$\textit{Model C :} \quad \begin{cases} Y_{it} = 1 \text{ if } Y_{it}^* \geq 0 \\ Y_{it} = 0 \text{ if } Y_{it}^* < 0 \end{cases} \quad \text{and} \quad \begin{cases} S_{it} = 1 \text{ if } S_{it}^* \geq 0 \\ S_{it} = 0 \text{ if } S_{it}^* < 0 \end{cases}$$

$$\text{with} \begin{cases} Y_{it}^* = a_1 Y_{i0} + a_2 Y_{it-1} + \alpha_1 S_{it} + \alpha_2 D_i + \alpha_3 X_{it} + \varepsilon_{1it} & (4.4) \\ S_{it}^* = b_1 S_{i0} + b_2 S_{it-1} + \beta_1 D_i + \beta_2 X_{it} + \varepsilon_{2it} & (4.5) \end{cases}$$

The two equations of Models C and B respectively, are jointly estimated by Maximum Likelihood (allowing the residuals ε_{1it} and ε_{2it} of both equations to be correlated) and ρ represents the correlation coefficient between both residual terms. If ρ is significantly different from zero, it indicates that the residual terms of both equations are correlated, and in other words that there is unobserved characteristics that influence both health conditions and social participation. A significant value of ρ would thus confirm the endogenity issue of social participation and would suggest that simultaneous estimations are needed to get consistent estimates of the parameters.

We performed several robustness checks to test the validity of our results. We started with Model B specification which includes identifying variables and then we estimated Model C in which identifying variables were not included. To further test the quality of our model with the identifying variables, we also replicated Model B on linear specifications by using a Two-Stage Least Square (2SLS) model[17].

5. Results

5.1. Descriptive analysis of the determinants of immigrant health status and health care use in Canada

Before assessing the causal impact of social capital on immigrant health conditions, this section presents an outline of the main factors associated with a good health status for immigrants and their utilisation of health care services. Table 3 and Table 4 present coefficients estimated from Probit model with random effect based on waves 2 and 3 only (Model A). The model was

[17] The bivariate Probit specification does not enable to performed formal test of validity for our set of identifying variables.

first estimated based on the whole population of immigrants (column 1 of each table), then on the least educated population (column 2 of each table) and finally on the most educated sub-population (column 3 of each table).

* *The probability of reporting good health status*

Results of the random effect Probit model of health status (Model A1) are presented in Table 3. Of particular interest is the association between the level of social capital, as measured by participation in social activities, and the likelihood of reporting a good health status. The results displayed in the lower part of Table 3 show that being involved in any organisation has no significant effect on health status on the whole immigrant population[18] (Column 1). However, social capital seems to have a significant positive influence on the likelihood of reporting a good health status but only among the least educated population ($\widehat{\alpha_1}$=0.17**) (Column2). Therefore, our results suggest that less educated immigrants who are engaged in any social activity report a better health status than those not engaged in social activities ceteris paribus. Surprisingly, among the most highly educated immigrants (Column 3) the coefficient associated with social capital is negative and not statistically significant ($\widehat{\alpha_1}$=-0.04), suggesting no health return from social capital for this sub-population. This first analysis reveals that social capital is positively associated with health among immigrant with a low level of education, which may suggest that social capital may act as a substitute for human capital to improve immigrant health status[19].

Other covariates included in the model yield the expected influence on health status and are thereby consistent with the literature on social determinants of health (Marmot *et al.*,2008). Regardless of the immigrant level of education, females are less likely than males to report a good health, and the likelihood of reporting good health status declines with age. Both highly and poorly educated immigrants (columns 2 and 3) residing in British Columbia appear to have a

[18]Nevertheless, the coefficient associated with social participation is statistically significant at the 10% level on the whole population of immigrant when the other variables related to social interaction are removed from the analysis, namely when we removed "having family in Canada" and "having received information". This result means that both variables partly capture the effect of social capital on immigrant health status.

[19]Another way to test the correlation between social participation and health status is to perform a pooled Probit model to estimate the association between social participation and the likelihood of suffering from health deterioration. The new dependant variable is equal to 1 if immigrant health status has deteriorated between waves 2 and 3, versus 0 if there is no difference or if there is a positive difference in health status between those waves. Table B1 in Appendix B suggest a significant health return to social participation among less educated immigrants ($\widehat{\alpha_1}$=-0.019**) while no significant health return was found among highly educated people ($\widehat{\alpha_1}$=-0.02 NS).

lower likelihood of reporting a good health status than those living in Ontario. Among the whole population, immigrants residing in other regions are less likely to report a good health status than those residing in Ontario, while the effect is not observed among both sub-populations.

In addition, the place at birth has a significant impact on health status suggesting an important role played by cultural factors or by exposure factors before migration (Spallek *et al.*,2011). Although immigrants born in the American continent report better health status than those born in Europe, immigrants who were born in Asia or the Middle East have a decreased likelihood of reporting a good health status. Nevertheless, the effect differs according to the immigrant's level of human capital since no significant difference according to the place of birth is found among the least educated immigrants. Looking at the influence of socio-economic characteristics, there are large differences in health status across the income distribution. Immigrants in the lowest income quintile are less likely to report a good health status regardless of their human capital level, although correlations are more statistically significant among the least educated population. All other things being equal, an immigrant's educational level at arrival and their marital status are not significantly associated with their health status. For the whole population of immigrants, those having an activity status other than being a homemaker, retired, or job seeker, present a lower likelihood of reporting a good health status. Nevertheless, among the least educated immigrants, being a student decreases the propensity of reporting a good health status compared to being employed.

Table 3. Individual determinants of health status - Probit model with random effect (coeff)

	Whole Population (N=15,420)-(1)	Educ. <University (N=7,352)-(2)	Educ. ≥University (N=8,068)-(3)
Constant	4.09***(0.20)	4.22***(0.28)	3.88***(0.30)
Times dummy			
Wave 3	Ref.	Ref.	Ref.
Wave 2	0.26***(0.04)	0.25***(0.06)	0.28***(0.06)
Age	-0.03***(0.00)	-0.03***(0.00)	-0.02***(0.00)
Gender			
Male	Ref.	Ref.	Ref.
Female	-0.44***(0.06)	-0.37***(0.09)	-0.50***(0.08)
Place of birth			
America	0.40**(0.17)	0.19(0.26)	0.54**(0.24)
Europe	Ref.	Ref.	Ref.
Asia	-0.30***(0.08)	-0.16(0.11)	-0.45***(0.11)
Middle East	-0.33**(0.14)	-0.29(0.19)	-0.35(0.23)
Africa	0.02(0.11)	0.08(0.16)	-0.11(0.17)
Caribbean	-0.21(0.18)	-0.28(0.23)	0.02(0.36)
Oceania/Australia	0.21(0.41)	0.03(0.46)	6.01(15.2)
Province of destination			
Ontario	Ref.	Ref.	Ref.
Quebec	0.06(0.09)	0.13(0.13)	-0.02(0.13)
British-Columbia	-0.20**(0.07)	-0.20**(0.10)	-0.22**(0.10)
Alberta	-0.00(0.09)	-0.01(0.12)	0.01(0.12)
Others province	-0.22*(0.13)	-0.19(0.17)	-0.23(0.20)
Family income quintile			
First quintile	-0.44***(0.09)	-0.55***(0.13)	-0.37**(0.12)
Second quintile	-0.27**(0.08)	-0.38**(0.13)	-0.21*(0.11)
Third quintile	-0.14*(0.08)	-0.26**(0.13)	-0.07(0.11)
Fourth quintile	-0.17**(0.08)	-0.37**(0.13)	-0.01(0.11)
Fifth quintile	Ref.	Ref.	Ref.
Missing information	-0.04(0.16)	-0.07(0.20)	-0.17(0.26)
Activity status			
Working	Ref.	Ref.	Ref.
Homemaker	-0.06(0.08)	-0.16(0.10)	0.10(0.13)
Student	-0.04(0.09)	-0.25**(0.12)	0.22(0.15)
Retired	-0.08(0.14)	-0.07(0.17)	-0.23(0.26)
Looking for job	0.02(0.18)	-0.08(0.26)	0.08(0.24)
Other	-0.96***(0.14)	-1.08***(0.18)	-0.80***(0.24)
Marital status			
Married/Common Low	Ref.	Ref.	Ref.
Separated/Divorced	-0.03(0.10)	0.07(0.13)	-0.25(0.17)
Single	0.00(0.09)	-0.02(0.12)	-0.03(0.14)

(continued)

Table 3. Continued

	Whole Population (N=15,420)-(1)	Educ<University (N=7,352)-(2)	Educ≥University (N=8,068)-(3)
Immigrant class			
Economic immigrant	Ref.	Ref.	Ref.
Family immigrant	0.06(0.07)	0.07(0.10)	0.05(0.11)
Refugee immigrant	-0.42***(0.08)	-0.40***(0.11)	-0.46***(0.15)
English speaking at arrival			
Well/Very well/Fluently	Ref.	Ref.	Ref.
Cannot speak or Poorly speaking	-0.39***(0.07)	-0.46***(0.09)	-0.32**(0.10)
Educational level at landing			
University degree	Ref.	Ref.	Ref.
Less than high scool	-0.05(0.07)	-	-
College	0.02(0.07)	-	-
Information received			
No	Ref.	Ref.	Ref.
Yes	0.13***(0.05)	0.23***(0.07)	0.01(0.07)
Having family at landing			
No	Ref.	Ref.	Ref.
Yes	-0.07(0.05)	-0.05(0.07)	-0.11(0.07)
Social capital			
No Investment in social capital	Ref.	Ref.	Ref.
Investment in social capital	0.06(0.05)	0.17**(0.08)	-0.04(0.07)

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level

The analysis also confirms that significant differences in health status exist between immigrant classes while controlling for a wide range of health determinants. Although there is no significant difference between economic immigrants and family immigrants, results indicate that for both sub-populations refugee immigrants are less likely to report good health status than economic ones. The language proficiency at landing appears as a strong determinant of immigrant health status since individuals speaking poorly English present a reduced likelihood of reporting good or better health status. Having family in Canada upon landing is not significantly associated with better health status among both sub-populations while having received information increases significantly the likelihood to report good health status among the least educated immigrant. Finally, time dummies are statistically significant, suggesting that all immigrants report *ceteris paribus* better health status two years after arrival compared to four years after arrival. Presumably, immigrants may cope with psychosocial stress related to settlement in the host country, which decreases or worsens their own health status.

* *The use of health care services*

Results of the random effect Probit on health care use equation (Model A2) are presented in Table 4. Consistent with previous literature on social capital in Canada (Van Kemenade *et al.*,2006 ; Laporte *et al.*,2008), immigrants engaged in social activities report an increased likelihood of using medical services than those not engaged in social activities (lower part of Table 4, Column 1). Social capital networks appear to be a significant determinant of immigrant health care utilisation, possibly by sharing information on available medical resources and by providing financial or psychosocial support. Nevertheless, the influence of social participation greatly varies according to the immigrant's level of human capital. Although the effect of social capital is strongly significant among the most educated immigrants ($\widehat{\alpha_1}$=0.14***) , no significant effect is found among the least educated immigrants ($\widehat{\alpha_1}$=0.06)[20]. Therefore, at first sight the analysis highlights that higher levels of human capital may improve the efficiency of social capital to foster the utilisation of health care services, making social and human capital complementary.

Among the other determinants of the use of health care services, results indicate that having a good health status decreases the likelihood of using health care services. Among the other determinants of the use of health care services, results suggest that having a good health status decreases the likelihood of using health care services. The use of medical services also increases with age and is higher among women than men. As expected, there is a large social gradient according to income distribution, indicating that immigrants with a low level of income tend to underuse health care services compared to those with a higher level of income. Rather surprisingly, this social gradient is only observed among the most educated immigrants, meaning that income is not statistically significant to explain health care utilisation by poorly educated immigrants.

[20]In addition, Table B2 in Appendix B presents the results from a pooled Probit model that estimates the association between social participation and the likelihood to have a lower use of medical services between waves 2 and 3. The dependant variable is equal to 1 if immigrant health care use has deteriorated, versus 0 if there is no difference or if there is a positive difference in utilisation between those waves. Our results indicate that social participation is not significantly associated with a lesser use of medical services among the whole population of immigrants as well as the sub-populations of immigrants. The lack of a significant effect of social participation may be the result of a slight variability in health care utilisation between waves 2 and 3. In addition, Table B2 reveals very little or no correlation between the other covariates and the likelihood of presenting a lesser use of medical services, which may also indicate a mis-specification of the model.

Table 4. Individual determinants of health care utilisation - Probit model with random effect (coeff.)

	Whole Population (N=15,420) - (1)	Educ. <University (N=7,352) - (2)	Educ. ≥University (N=8,068) - (3)
Constant	0.79***(0.11)	0.75***(0.16)	0.95***(0.17)
Times dummy			
Wave 3	Ref.	Ref.	Ref.
Wave 2	0.04(0.03)	0.09**(0.04)	0.01(0.04)
Health status			
Poor health status	Ref.	Ref.	Ref.
Good health status	-0.82***(0.07)	-0.85***(0.09)	-0.77***(0.10)
Age	0.01***(0.00)	0.01***(0.00)	0.00**(0.00)
Gender			
Male	Ref.	Ref.	Ref.
Female	0.43***(0.03)	0.39***(0.04)	0.46***(0.04)
Place of birth			
America	0.32***(0.07)	0.43***(0.13)	0.26***(0.09)
Europe	Ref.	Ref.	Ref.
Asia	0.07**(0.04)	0.09*(0.05)	0.06(0.05)
Middle East	0.15*(0.08)	0.19*(0.10)	0.08(0.12)
Africa	0.03(0.05)	0.08(0.07)	-0.01(0.07)
Caribbean	0.01(0.09)	-0.01(0.11)	0.16(0.16)
Oceania/Australia	0.03(0.16)	-0.22(0.19)	0.68**(0.33)
Province of destination			
Ontario	Ref.	Ref.	Ref.
Quebec	-0.49***(0.04)	-0.54***(0.06)	-0.46***(0.06)
British-Columbia	0.01(0.04)	0.09*(0.05)	-0.06(0.05)
Alberta	-0.20***(0.04)	-0.19***(0.06)	-0.20***(0.06)
Others province	-0.10(0.07)	-0.06(0.09)	-0.16(0.11)
Family income quintile			
First quintile	-0.14***(0.05)	-0.05(0.07)	-0.19***(0.06)
Second quintile	-0.14***(0.04)	-0.06(0.07)	-0.19***(0.06)
Third quintile	-0.09**(0.04)	-0.05(0.07)	-0.09*(0.06)
Fourth quintile	-0.03(0.04)	0.01(0.07)	-0.06(0.05)
Fifth quintile	Ref.	Ref.	Ref.
Missing information	-0.07(0.09)	0.12(0.11)	-0.35**(0.15)
Health insurance			
No health insurance	Ref.	Ref.	Ref.
Having health insurance	0.06(0.04)	0.05(0.05)	0.04(0.05)
Activity status			
Working	Ref.	Ref.	Ref.
Homemaker	0.17***(0.05)	0.26***(0.07)	0.07(0.08)
Student	0.07(0.05)	0.12*(0.07)	0.04(0.07)
Retired	0.47***(0.13)	0.43***(0.15)	0.72***(0.23)
Looking for job	-0.24**(0.09)	-0.00(0.16)	-0.36***(0.12)
Other	0.26**(0.12)	0.42**(0.16)	0.09(0.17)

(continued)

Table 4. Continued

	Whole Population (N=15420)-(1)	Educ<University (N=7352)-(2)	Educ.≥University (N=8068)-(3)
Marital status			
Married/Common Low	Ref.	Ref.	Ref.
Separated/Divorced	-0.05(0.06)	-0.06(0.08)	-0.03(0.10)
Single	-0.16***(0.04)	-0.21***(0.05)	-0.05(0.06)
Immigrant class			
Economic immigrant	Ref.	Ref.	Ref.
Family immigrant	0.24***(0.04)	0.24***(0.05)	0.21***(0.06)
Refugee immigrant	0.05(0.04)	0.02(0.05)	0.12(0.08)
English speaking at landing			
Well/Very well/Fluently	Ref.	Ref.	Ref.
Cannot speak or Poorly speaking	-0.08**(0.04)	-0.06(0.05)	-0.14**(0.06)
Educational level at arrival			
University degree	Ref.	Ref.	Ref.
Less than high scool	0.05(0.04)	-	-
College	-0.01(0.04)	-	-
Information received			
No	Ref.	Ref.	Ref.
Yes	0.12***(0.03)	0.19***(0.04)	0.06*(0.04)
Having family at landing			
No	Ref.	Ref.	Ref.
Yes	0,16***(0.03)	0,17***(0.04)	0,15***(0.04)
Social capital			
No Investment in social capital	Ref.	Ref.	Ref.
Investment in social capital	0,10***(0.03)	0,06(0.04)	0,14***(0.04)

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level

Educational level is not significantly associated with the use of medical services, as well as the possession of a provincial health insurance card[21]. As previously outlined, the region of residence and the place of birth display a significant correlation with immigrant health care utilisation, although correlations may differ according to the immigrant's level of human capital.

Among less educated immigrants, single individuals appear to have a lower use of medical services than married ones. However, there is no significant difference between married, single or divorced individuals among highly educated immigrants. Likewise, activity status has a different impact on health care utilisation according to immigrant human capital. Among the least educated immigrants, those who are homemakers, students, retired or who are in other activities statuses are more likely to use medical services compared to employed immigrants. Conversely, among the most educated immigrants, only retired individuals are more likely to use health

[21] When we remove family income quintile from the estimation, health care utilisation significantly increases with the possession of a health insurance card.

care services. As in the previous model, results show significant differences in health care use according to immigrant classes. There is no significant difference between economic and refugee immigrants, but family immigrants are more likely than economic ones to use health care services regardless of their level of education at arrival. Similarly, speaking English poorly decreases significantly the propensity of using medical services and this is observed for all sub-populations of immigrants.

Finally, the other covariates related to social interactions are statistically associated with the likelihood of using medical services. Immigrants having family in Canada on arrival or having received information have an increased likelihood of using health care services. Furthermore, the model estimates do not show significant differences between the immigrant pattern of health care utilisation between waves 2 and 3, excepted for poorly educated immigrants who tend to use health care services significantly more often two years after their arrival compared to four years after their arrival.

* *Quantifying the association between social capital and health conditions*

To quantify the association between social participation and immigrant health conditions, we carried out an alternative situation from the one currently observed and then we predicted immigrant health considering the new estimated parameters. In our case, the alternative situation supposes that all immigrants in the sample are involved in a social activity. This strategy enables us to measure the potential gain a change in the rate of social capital could on average have on immigrant health or health care utilisation (Sirven and Debrand, 2008). Accordingly, our aim was to explore the evolution of the current situation caused by the modification of immigrant social participation.

For this purpose, two situations were considered : (i) the current one ("situation 0") and (ii) the situation that would be observed if every immigrant in the sample gets involved in a social activity ("situation 1"). We thus performed the same random effect Probit models (Models A1 and A2) presented in section 4.4.1 considering successively "situation 0" and "situation 1" to estimate the probability of reporting a good health status and to use health care services[22]. The

[22]In "situation 0" (the current one), the random Probit models (Models A1 and A2) are estimated with social participation and all the other individuals controls (time variant and invariant characteristics) as independent

estimated parameters from both situations were then used to compute, for the whole sample of immigrants, the average predicted probability of reporting a good health or of using health care services in the current and the alternative situation, after control for all individual covariates.

Finally, our objective was to compare the distribution of the predicted probabilities in order to examine the contribution of social capital to the average increase of immigrant health conditions. We used mean comparison tests and also computed the cumulative distribution functions for each situation to confirm whether the contribution of social capital to immigrant health conditions is on average statistically significant. Table 5 reports the predicted probability for the current ("S0") and the alternative situation ("S1") according to immigrants' educational level.

Table 5. Average predicted probabilities in the current "S_0"and the alternative analysis "S_1"

	"S_0"	"S_1"	Diff.[a]	Δ[b]
Good health status				
Whole population	0.929	0.940	-0.011***	1.17%
Least educated immigrants	0.924	0.935	-0.011***	1.22%
Most educated immigrants	0.935	0.941	-0.006***	0.66%
Use of health care services				
Whole population	0.722	0.747	-0.025***	3.48%
Least educated immigrants	0.721	0.735	-0.014***	1.93%
Most educated immigrants	0.724	0.759	-0.035***	4.86%

*,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.

a. Significance level of mean comparison tests between "S_0" and "S_1".
b. Relative variation in % [(S_1−S_0)/S_0].

Significant differences appear between the predicted probability in the observed situation and the alternative situation for both health outcomes (Table 5). According to mean comparison tests, the differences between the current and the alternative situations are statistically significant (p-value<0.000) among the whole population as well as the sub-populations of immigrants. Although descriptive, these results indicate that the more immigrants invest in social capital, the higher is the likelihood that they report a good health status or use health care services. Moreover, Figures C1 in Appendix C show a modification of the distribution of the predicted

variables. In "situation 1" (the alternative situation in which all immigrants are engaged in social activities), the random Probit models (Models A1 and A2) are estimated with only the other individuals controls (time variant and invariant characteristics) as independent variables. Therefore, "situation 1" is only conducted for immigrants that are getting involved in a social activity.

probabilities and suggest that social capital slightly improves immigrant health and health care use.

Nevertheless, the relative contribution of social capital is rather limited depending on the health outcomes considered. Regarding the likelihood of reporting a good health status, estimates reveal that on average social participation would lead to a relative increase in the share of immigrants reporting a good health status by 1.17%. Likewise, the share of individuals reporting a good health status would increase by 1.22% among the least educated immigrants due to an improvement of their social participation rate[23]. Turning now to the likelihood of using health care services, the evolutions caused by the modification of immigrant social participation appear more pronounced. Social capital would contribute to a relative increase in the proportion of immigrants having used medical services by 3.48% for the whole population, by 4.86% for the most educated immigrants and by 1.93% for the least educated ones.

* *The association between social capital and immigrant health conditions by type of social activity*

The following section attempts to determine whether the correlations differ by type of membership in social activity. To achieve this purpose, we ran the same estimates previously used (Models A1 and A2) on the whole population of immigrants and we considered now the following social activities separately : (i) religious groups, (ii) ethnic or immigrant associations, (iii) sporting clubs, (iv) cultural or hobby organisations and finally, (v) political organisations. The social capital variable is therefore divided in its five components. The main estimates[24] of the results are reported in Table 6.

With regards to the likelihood of reporting a good health status between waves 2 and 3, estimates indicate that only membership in sporting clubs is protective for immigrant health status. As expected, immigrants who are involved in a sporting club are more likely to report a good health status. This result may however be the result of a reverse causality between membership in sporting club and health status : immigrants in a good health status are more likely to be involved in a sporting club. We will consider this causality issue in the second part of this article.

[23]The relative change among the most educated immigrant is even more limited with an average increase in the share of individuals reporting a good health status by nearly 0.7%.

[24]We did not report the effect of the other covariates because their influence remains similar to the ones reported in Tables 3 and 4.

Table 6. Summary of the estimated coefficients associated with each type of social activity

Estimate from random effect Probit of the probability	Total population (N=15,420)
To report a good or better health status	
$\widehat{\alpha_1}$ Religious group	0.089
$\widehat{\alpha_1}$Ethnic/immigrant association	-0.242**
$\widehat{\alpha_1}$ sporting club	0.514***
$\widehat{\alpha_1}$ Cultural/Hobby organisation	0.001
$\widehat{\alpha_1}$Political organisation	0.225
To use health care services	
$\widehat{\alpha_1}$ Religious group	0.139***
$\widehat{\alpha_1}$Ethnic/Immigrant association	0.029
$\widehat{\alpha_1}$ sporting club	-0.030
$\widehat{\alpha_1}$ Cultural/Hobby organisation	0.134**
$\widehat{\alpha_1}$Political organisation	0.194***

Standard errors are in parentheses.

*,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.

More surprisingly, we found a negative correlation between membership in an ethnic or immigrant association and the chance of reporting a good health status. Our data is limited in exploring this negative relationship, but we suppose that ethnic or immigrant groups could be more isolated groups and at higher risk of discrimination, which might explain why members reported worse health status. These competing effects explain why we did not observed a significant effect of social capital on immigrant health status (Model A1 in Table 3).

Turning now to the probability of using medical services, results from the random effect Probit highlight a significant protective effect of being a member of a church group, hobby or cultural club as well as being a member of a political group. The creation of social bonds and social networks through membership in these social activities could thus foster the sharing of information, thereby lowering the cost of health information. In addition, participation in these social activities may also yield mutual assistance ensuring access to the health care system through for instance the provision of financial assistance, psychosocial support or transportation services.

Although the contribution of social capital to immigrants health condition appears on average relatively limited (between 1 and 3 percentage points) and depend on the type of membership in social activity, our results suggest that higher levels of individual social capital could improve

both the level of immigrant health status and health care utilisation. Up to now, we have observed a positive association between membership in social activities and immigrant health conditions, but we have not proved so far the causal impact of social capital on health which is the purpose of the following section.

5.2. The causal impact of social capital on immigrant health conditions

The dynamic simultaneous models provide new insights into the causal influence of social capital on immigrant health status and health care use. Table 7 presents estimate results from the dynamic bivariate models of health status and social capital with identifying variables (Model B1). This model was first estimated on the whole population of immigrants (columns 1 and 2), then on the least educated population (columns 3 and 4) and finally on the most educated population (columns 5 and 6).

* *Social capital and human capital act as substitutes to improve health status*

Columns 1, 3 and 5 of Table 7 report our estimate results regarding the likelihood of reporting a good health status (Model B1). As expected, results indicate that health status follows a time path dependency : being in good health status at time $t-1$ has a positive effect on being in good health at time t. The influence of the time invariant and time variant characteristics on immigrant health status is similar to the first analysis presented in section 4.5.1(Table 3)[25].

Column 1 of Table 7 also reports the influence of social capital on immigrant health status[26]. The results are consistent with the empirical literature (Sirven and Debrand, 2012 ; D'hombres *et al.*,2010) in suggesting that social capital has a positive causal influence on immigrant health status.

[25]Health status is significantly associated with immigrant age, gender, income, activity status, province of residence, region of birth, immigrant class, language proficiency and the other social interaction proxies. Nevertheless, the individual determinants of immigrant health status are somewhat different according to their educational level on arrival. Refer to section 4.5.1 for a more comprehensive analysis of individual determinants of health status.

[26]Table D1 in Appendix D reports the main estimate results from the dynamic bivariate Probit model when we also included the mean value of time variant covariates (Wooldridge, 2005). As expected, the introduction of mean variables did not modify the significant influence of social capital. The sign and the magnitude of the coefficient is fairly identical ($\widehat{\alpha_1}$=0.52***).

Table 7. Estimated coefficients from Bi-Probit for health (with identifying variables)

	Whole Population (N=7,710)		Educ<University (n=3,676)		Educ≥University (n=4,034)	
	(1) H[a]	(2) SC[b]	(3) H	(4) SC	(5) H	(6) SC
Constant	1.05***	-1.01***	0.95***	-1.01***	1.01***	-1.12***
	(0.20)	(0.12)	(0.27)	(0.18)	(0.33)	(0.17)
Initial value of health status						
Poor health	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Good health	0.46***	-	0.28**	-	0.68***	-
	(0.08)		(0.14)		(0.18)	
Lagged value of health status						
Poor health	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Good health	1.07***	-	1.08***	-	1.04***	-
	(0.11)		(0.12)		(0.12)	
Age	-0.02***	0.01***	-0.02***	0.01*	-0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Gender						
Male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Female	-0.29***	0.05	-0.33***	0.06	-0.27***	0.05
	(0.05)	(0.04)	(0.08)	(0.05)	(0.07)	(0.05)
Place of birth						
Europe	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Americ	-0.12	0.23**	-0.11	0.38**	-0.15	0.16
	(0.16)	(0.09)	(0.24)	(0.15)	(0.20)	(0.11)
Asia	-0.24***	0.01	-0.05	-0.08	-0.38***	0.05
	(0.08)	(0.05)	(0.11)	(0.08)	(0.11)	(0.06)
Middle East	-0.23	0.06	-0.16	-0.08	-0.16	0.19
	(0.14)	(0.10)	(0.18)	(0.13)	(0.24)	(0.15)
Africa	-0.30**	0.21***	-0.18	0.14	-0.42**	0.29***
	(0.11)	(0.07)	(0.15)	(0.10)	(0.16)	(0.10)
Carribean	-0.21	0.28**	-0.13	0.21	-0.34	0.28
	(0.16)	(0.11)	(0.19)	(0.14)	(0.28)	(0.19)
Oceania/Australia	-0.17	0.34*	-0.26	0.15	4.26***	0.66**
	(0.31)	(0.18)	(0.35)	(0.24)	(0.24)	(0.31)
Region of residence						
Ontario	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Quebec	0.03	-0.18***	0.06	-0.09	0.02	-0.28***
	(0.08)	(0.06)	(0.11)	(0.09)	(0.12)	(0.08)
British-Columbia	-0.23***	0.04	-0.24***	-0.06	-0.20**	0.14**
	(0.06)	(0.05)	(0.08)	(0.07)	(0.09)	(0.07)
Alberta	-0.09	0.13**	-0.10	0.06	-0.05	0.20***
	(0.08)	(0.05)	(0.10)	(0.08)	(0.12)	(0.07)
Other region	0.03	0.23**	0.09	0.17	0.02	0.30**
	(0.14)	(0.09)	(0.18)	(0.13)	(0.22)	(0.13)
Income quintile						
First quintile	-0.30***	-0.09	-0.34**	0.05	-0.28**	-0.16**
	(0.09)	(0.06)	(0.12)	(0.09)	(0.13)	(0.08)
Second quintile	-0.19**	-0.11*	-0.27**	0.05	-0.15	-0.21***
	(0.08)	(0.06)	(0.12)	(0.09)	(0.12)	(0.07)
Third quintile	-0.11	-0.05	-0.21	0.05	-0.08	-0.10
	(0.09)	(0.05)	(0.12)	(0.09)	(0.12)	(0.07)
Fourth quintile	-0.16**	-0.12**	-0.32**	-0.01	-0.08	-0.18***
	(0.09)	(0.05)	(0.12)	(0.09)	(0.12)	(0.07)
Fith quintile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Missing income	-0.32**	0.03	-0.18	0.15	-0.65**	-0.15
	(0.16)	(0.12)	(0.21)	(0.15)	0.25	(0.22)

(continued)

Table 7. Continued

	Whole Population		Educ<University		Educ≥University	
	(1) H[a]	(2) SC[b]	(3) H	(4) SC	(5) H	(6) SC
Activity status						
Working	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Homemaker	0.03	-0.05	-0.02	0.07	0.06	-0.23**
	(0.08)	(0.07)	(0.10)	(0.09)	(0.13)	(0.10)
Student	0.26**	-021***	0.20	-0.12	0.27	-0.32***
	(0.13)	(0.09)	(0.17)	(0.12)	(0.19)	(0.12)
Retired	0.24	0.39***	0.19	0.61***	0.01	-0.07
	(0.16)	(0.13)	(0.19)	(0.15)	(0.29)	(0.24)
Looking for a job	0.00	-0.31	-0.13	-0.22	0.08	-0.34
	(0.20)	(0.20)	(0.31)	(0.38)	(0.27)	(0.24)
Other	-0.58***	0.15	-0.45***	0.12	-0.67***	0.23
	(0.15)	(0.14)	(0.16)	(0.18)	(0.23)	(0.21)
Marital status						
Married/In common law	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Divorced	0.01	0.07	0.23*	0.04	-0.34**	0.08
	(0.10)	(0.08)	(0.13)	(0.11)	(0.14)	(0.12)
Single	0.08	0.18***	0.05	0.15*	-0.01	0.19**
	(0.09)	(0.06)	(0.11)	(0.80)	(0.14)	(0.09)
Immigrant class						
Economic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Family	0.09	-0.26***	0.15	-0.30***	0.03	-0.21***
	(0.07)	(0.05)	(0.09)	(0.07)	(0.11)	(0.07)
Refugee	-0.14*	-0.08	-0.11	-0.15*	-0.20	-0.01
	(0.08)	0.07	(0.10)	(0.08)	(0.16)	(0.13)
English proficiency on arrival						
Fluent/Very good/Good	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
None/Poor	-0.12*	-0.31***	-0.07	-0.38***	-0.14	-0.24***
	(0.07)	(0.05)	(0.10)	(0.06)	(0.11)	(0.08)
Educational level						
University degree	Ref.	Ref.	-	-	-	-
Less than high school	-0.04	-0.05	-	-	-	-
	(0.07)	(0.05)	-	-	-	-
Equivalent to college	0.09	0.02	-	-	-	-
	(0.08)	(0.05)	-	-	-	-
Having received information						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.12**	0.00	0.20***	-0.01	0.04	0.02
	(0.05)	(0.04)	(0.07)	(0.05)	(0.07)	(0.05)
Having family in Canada						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	-0.05	0.00	-0.06	0.04	-0.07	0.03
	(0.05)	(0.04)	0.07	(0.05)	(0.07)	(0.05)
Social capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	0.52**	-	0.96***	-	0.26	-
	(0.22)		(0.26)		(0.29)	
Lagged value of Social Capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	-	0.60***	-	0.53***	-	0.65***
		(0.04)		(0.06)		(0.05)
Initial value of Social Capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	-	0.34***	-	0.32***	-	0.34***
		(0.04)		(0.06)		(0.05)

(continued)

Table 7. Continued

	Whole Population		Educ<University		Educ≥University	
	(1)	(2)	(3)	(4)	(5)	(6)
	H[a]	SC[b]	H	SC	H	SC
Frequency of meeting friends						
Less than weekly	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
At least once a week	-	0.07	-	0.14**	-	0.01
		(0.04)		(0.06)		(0.06)
Things that have helped you most						
Nothing	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Social Relationship	-	0.00	-	0.00	-	0.03
		(0.07)		(0.11)		(0.08)
Job and housing	-	0.06	-	0.05	-	0.09
		(0.07)		(0.12)		(0.09)
Education	-	0.03	-	-0.01	-	0.07
		(0.08)		(0.13)		(0.10)
Government programs/Migrant services	-	0.17**	-	0.10	-	0.25**
		(0.08)		(0.14)		(0.12)
Personnal quality	-	0.16*	-	0.07	-	0.21**
		(0.09)		(0.15)		(0.11)
Other kinds of help	-	0.17**	-	0.25*	-	0.14
		(0.08)		(0.14)		(0.12)
Non response	-	-0.11	-	-0.15	-	-0.05
		(0.09)		(0.14)		(0.13)
ρ	-0.28*	(0.13)	-0.53**	(0.16)	-0.13	(0.18)

Standard errors are in parentheses.
*,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.
a. "H" represents the respondent health status. b. "SC" represents the respondent social capital.

More precisely, taking part in social activities in wave 3 increases significantly the likelihood that an immigrant will report good or better health status in the same interval of time ($\widehat{\alpha_1}$=0.52**). Turning now to the estimate results on sub-populations, columns 3 and 5 highlight a different influence of social capital according to immigrant level of human capital. As depicted in the Probit model with random effect (section 4.5.1), social capital seems to exert a positive causal influence on health status among the least educated immigrants ($\widehat{\alpha_1}$=0.96***) while no significant effect is found among the most educated people ($\widehat{\alpha_1}$=0.26).

These results prove the existence of a substitution effect between social and human capital to enhance immigrant health status, suggesting that membership in social activity does not provide a health return if the level of human capital is already important. As stated by Grossman (1972), more educated individuals are more efficient producers of health and are also more likely to make better health choices or to better manage their health related behaviours (Cutler and Lleras-Muney, 2006 ; Cutler and Lleras-Muney, 2010). In this respect, the greater ability of highly educated people in managing or producing health probably makes social capital unnecessary to improve directly health status. As stated by Scheffler et al. (2008, pp. 326), "*people with higher*

level of education are more able to find and understand information on their own rather than to receive it via social capital". On the contrary, the least educated people benefit from health return on social capital surely because they rely more on social networks to obtain information on healthy behaviour to adopt or to receive important psychosocial support.

In addition, estimate results demonstrate a significant value of ρ indicating that the residual terms of both equations are correlated among the whole immigrant population and among the least educated immigrants. It means that there is unobserved characteristics that influence both health status and social participation, which confirms the endogeneous nature of social capital and the need to estimate simultaneously both equations. Nevertheless $\rho < 0$, suggesting that some unobserved characteristics influence negatively social participation and health. One possible interpretation is related to "relative deprivation". Accordingly, some particular individuals involved in a social activity may compare their self to the other members of the social group in terms of their position in the social hierarchy or even in terms of their health. This relative deprivation may result in a poor self-assessed health for immigrants who considered, for instance, that they are at the lower end of social hierarchy (Jusot *et al.*,2008).

As a robustness analysis, we performed several alternative models. First, we ran the dynamic bivariate Probit model without identifying variables (Model C1). More precisely, we removed from the social capital equation the initial value of the frequency of meeting friends and the help received for immigrant settlement. Then, we ran the same specifications as Model B1 that we replicated on linear model (2SLS models) in order to test the validity of our identifying variables.

In the upper part of Table 8 are reported the results from the dynamic bivariate Probit model without identifying variables (Model C1). The main findings confirm the significant causal impact of social capital on immigrant health status. The coefficients associated with social capital are very close to the ones highlighted in Table 7 for both the whole population of immigrants ($\widehat{\alpha_1}$=0.48**) and the least educated people ($\widehat{\alpha_1}$=0.93***). In Table 8 are also reported the results from 2SLS estimate with the associated diagnostics tests. The 2SLS estimate provides results that are similar to the bivariate model presented in Table 7[27]. Our estimates reveal the positive influence of social capital on health status among the whole population and the least educated

[27]Coefficients in Table 8 (based on 2SLS models) are not comparable with the other coefficients that are estimated through bivariate Probit models.

immigrants. Moreover, the specification tests suggest that our set of identifying variables are valid over the general population and the least educated immigrants. The Wooldridge test of endogeneity confirms that social participation is endogenous to the health status equation with a p-value lower than 0.1. The Sargan test of over-identification does not lead us to reject the null hypothesis that the identifying variables are uncorrelated with the residual terms of health equation[28]. The joint test of significant instruments leads us to reject the null hypothesis that the set of identifying variables is weak since the p-value is lower than 0.001[29].

Table 8. Robustness analysis - Estimated coefficients

	Whole Pop.	Educ<Univ.	Educ≥Univ.
	Probability of reporting a good health		
Model C without excluded variables			
$\widehat{\alpha_1}$ Social capital	0.48**(0.22)	0.93***(0.26)	0.22(0.29)
2 Stage Least Square Model			
$\widehat{\alpha_1}$ Social capital	0.06**(0,02)	0.10***(0.04)	0.02(0.03)
Wooldridge test of endogeneity (*p-value*)	0.04	0.03	0.68
Sargan test (*p-value*)	0.36	0.46	0.69
Joint significance of instruments (*p-value*)	0.00	0.00	0.00

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.

Finally, to exclude the hypothesis that there is a reverse causality between membership in sporting group and the likelihood of reporting a good health status (refer to section 4.5.1), we performed the same bivariate Probit model (Model B1) considering now participation in sporting group as a proxy of social capital. Our results are consistent with the previous analysis since we show that being a member of sporting group significantly increases the likelihood of reporting a good health status (Table D3 in appendix D).

* *Social capital and human capital are complement for each other to increase health care utilisation*

Estimates from the dynamic bivariate model with identifying variables (Model B2) aiming to explore the causal effect of social capital on health care utilisation are depicted in Table 9.

[28] In addition, Table D4 in Appendix D confirms that identifying variables in the second equation of social capital do not directly influence immigrant health conditions.

[29] Among the most highly educated immigrants, the Wooldridge test indicates that social capital is exogenous to the health status equation while the Sargan test indicates that our set of identifying variables are uncorrelated with the residual terms of health equation.

Our results reveal that being involved in social activities four years after arrival significantly increases the likelihood of using health care services[30]. Although we find a significant influence on the utilisation of health care services over the total population ($\widehat{\alpha_1}$ =0.37**), our results indicate that the causal impact of social capital differs according to immigrant education level (columns 3 and 5 of Table 9).

As a matter of facts, we found a positive causal impact of social capital on health care utilisation only among the most highly educated immigrants ($\widehat{\alpha_1}$=0.42**). We found no significant impact of social capital on the utilisation of the least educated immigrants ($\widehat{\alpha_1}$=0.36). In this respect, we confirm that social capital and human capital are complementary to each other in enhancing immigrant health care utilisation.

Several explanations could be advanced to explain this complementary effect. Firstly, higher education may provide greater abilities to understand and use the information received through social capital. In addition, human capital has been proven to significantly impact wages, thereby influencing the ability to purchase health goods and health services (OECD, 2010a). In this respect, social capital would be inefficient to improve health care utilisation below a certain level of human capital because the latter provides better abilities and higher economic resources to adequately use the health care information received through social capital (OECD, 2010a).

The correlation coefficient ρ is also significant, indicating that the residual terms of both equations are correlated among the whole population and among the most highly educated immigrants. It confirms the endogeneous nature of social capital to health care utilisation. As previously found, $\rho < 0$ which suggests that some unobserved characteristics influence negatively social participation and health care utilisation. One possible interpretation could be the time constraint of particular individuals who are engaged in social activity, decreasing thereby their propensity to use medical services.

[30] Refer to the lower part of Table D2 in Appendix D in which we have reported the main estimate results from the dynamic bivariate Probit model of health care use and social capital when we also included the mean value of time variant covariates. The introduction of these additional variables did not modify the significant influence of social capital ($\widehat{\alpha_1}$= 0,37**).

Table 9. Estimated coefficients from Bi-Probit model B for use (with identifying variables)

	Whole Population (N=7710)		Educ<University (n=3676)		Educ≥University (n=4034)	
	(1) U[a]	(2) SC[b]	(3) U	(4) SC	(5) U	(6) SC
Constant	0.25*	-1.16***	0.26	-1.14***	0.28	-1.27***
	(0.14)	(0.15)	(0.20)	(0.22)	(0.20)	(0.21)
Initial value of use						
No use	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Use	0.07	-	0.07	-	0.67	-
	(0.04)		(0.06)		(0.06)	
Lagged value of Use						
No use	Ref.	-	Ref.	Ref.	Ref.	Ref.
Use	0.42***	-	0.41***	-	0.43***	-
	(0.04)		(0.06)		(0.04)	
Health status						
Poor health status	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Good health status	-0.55***	0.09	-0.55***	0.12	-0.60***	0.06
	(0.08)	(0.07)	(0.11)	(0.09)	(0.11)	(0.09)
Age	0.01***	0.01***	-0.00	0.01**	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Gender						
Male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Female	0.29***	0.05	0.29***	0.06	0.30***	0.05
	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)
Place of birth						
Europe	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
America	0.17*	0.23**	0.10	0.39**	0.19*	0.16
	(0.09)	(0.09)	(0.16)	(0.15)	(0.11)	(0.11)
Asia	0.11**	0.01	0.12	-0.08	0.12*	0.05
	(0.05)	(0.05)	(0.07)	(0.08)	(0.06)	(0.06)
Middle East	0.06	0.06	0.09	-0.09	0.04	0.19
	(0.10)	(0.10)	(0.13)	(0.14)	(0.15)	(0.15)
Africa	-0.09	0.21***	-0.12	0.15	-0.08	0.29***
	(0.07)	(0.07)	(0.10)	(0.10)	(0.09)	(0.10)
Carribean	-0.18	0.28**	-0.20	0.22	-0.08	0.27
	(0.11)	(0.11)	(0.14)	(0.14)	(0.18)	(0.19)
Oceania/Australia	-0.07	0.34*	-0.33	0.15	0.48	0.66**
	(0.19)	(0.18)	(0.24)	(0.23)	(0.35)	(0.31)
Region of residence						
Ontario	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Quebec	-0.38***	-0.19***	-0.39***	-0.10	-0.36***	-0.28***
	(0.06)	(0.06)	(0.08)	(0.09)	(0.07)	(0.08)
British	-0.07	0.04	0.04	-0.06	-0.16**	0.14**
	(0.05)	(0.05)	(0.07)	(0.07)	(0.08)	(0.07)
Alberta	-0.25***	0.13**	-0.28***	0.06	-0.22***	0.19**
	(0.05)	(0.05)	(0.08)	(0.08)	(0.07)	(0.07)
Other region	-0.29***	0.23**	-0.09	0.17	-0.51***	0.29**
	(0.10)	(0.09)	(0.13)	(0.13)	(0.14)	(0.13)
Income quintile						
First quintile	0.01	-0.07	0.10	0.06	-0.07	-0.14
	(0.06)	(0.06)	(0.09)	(0.09)	(0.08)	(0.08)
Second quintile	-0.09	-0.10*	-0.08	0.06	-0.10	-0.19**
	(0.06)	(0.06)	(0.09)	(0.09)	(0.08)	(0.07)
Third quintile	-0.07	-0.05	-0.10	0.06	-0.07	-0.09
	(0.05)	(0.05)	(0.09)	(0.09)	(0.07)	(0.07)
Fourth quintile	0.00	-0.12**	-0.03	-0.01	-0.01	-0.18***
	(0.05)	(0.05)	(0.09)	(0.09)	(0.07)	(0.07)
Fith quintile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

(continued)

Table 9. Continued

	Total Population		Educ<University		Educ≥University	
	(1) U[a]	(2) SP[b]	(3) U	(4) SP	(5) U	(6) SP
Missing income	-0.16	0.05	0.06	0.17	-0.54**	-0.11
	(0.12)	(0.12)	(0.16)	(0.15)	0.20	(0.22)
Health insurance						
No health insurance	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Having health insurance	0.07*	0.04	0.08	0.00	0.05	0.07
	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.05)
Activity status						
Working	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Homemaker	0.04	-0.04	0.05	0.08	0.09	-0.21**
	(0.07)	(0.07)	(0.09)	(0.09)	(0.10)	(0.10)
Student	0.15*	-022***	-0.09	-0.13	0.41***	-0.33***
	(0.08)	(0.09)	(0.11)	(0.12)	(0.12)	(0.12)
Retired	0.09	0.38***	0.10	0.60***	0.19	-0.07
	(0.15)	(0.13)	(0.18)	(0.15)	(0.29)	(0.24)
Looking for job	-0.33	-0.31	0.00	-0.18	-0.44**	-0.34
	(0.16)	(0.20)	(0.26)	(0.36)	(0.20)	(0.24)
Other	0.23	0.16	0.43*	0.11	0.10	0.26
	(0.16)	(0.14)	(0.24)	(0.19)	(0.21)	(0.21)
Marital status						
Married/In common law	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Divorced	-0.06	0.07	-0.05	0.03	-0.06	0.09
	(0.08)	(0.08)	(0.11)	(0.11)	(0.12)	(0.12)
Single	-0.17***	0.19***	-0.20***	0.15*	-0.08	0.19**
	(0.06)	(0.06)	(0.08)	(0.08)	(0.09)	(0.09)
Immigrant class						
Economic	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Family	0.18***	-0.26***	0.21***	-0.30***	0.18**	-0.20***
	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)	(0.07)
Refugee	-0.05	-0.08	-0.03	-0.15*	-0.03	-0.00
	(0.06)	0.07	(0.08)	(0.08)	(0.12)	(0.13)
English proficiency on arrival						
Fluent/very good/good	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
None/poor	-0.03	-0.31***	-0.03	-0.37***	-0.03	-0.22**
	(0.05)	(0.05)	(0.07)	(0.06)	(0.07)	(0.08)
Educational level						
University degree	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Less than high school	0.06	-0.05	-	-	-	-
	(0.05)	(0.05)				
Equivalent to college	-0.03	0.02	-	-	-	-
	(0.05)	(0.05)				
Having received information						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.06*	0.00	0.13***	-0.02	0.000	0.02
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Having family in Canada						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.08	0.03	0.11**	0.04	0.07	0.02
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Social capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	0.37***	-	0.36	-	0.42**	-
	(0.14)		(0.24)		(0.17)	
Lagged value of social capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	-	0.60***	-	0.53***	-	0.65***
		(0.04)		(0.06)		(0.05)

(continued)

Table 9. Continued

	Total Population		Educ<University		Educ≥University	
	(1) U[a]	(2) SC[b]	(3) U	(4) SC	(5) U	(6) SC
Initial value of social capital						
No investment	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Investment in social capital	-	0.33***	-	0.31***	-	0.34***
		(0.04)		(0.06)		(0.05)
Frequency of meeting friends						
Less than weekly	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
At least once a week	-	0.07*	-	0.15**	-	0.01
		(0.04)		(0.07)		(0.06)
Things that have helped you most						
Nothing	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Social Relationship	-	0.01	-	0.02	-	0.04
		(0.07)		(0.12)		(0.08)
Job and housing	-	0.06	-	0.02	-	0.09
		(0.07)		(0.12)		(0.09)
Education	-	0.03	-	0.00	-	0.07
		(0.08)		(0.13)		(0.10)
Government programs/Migrant services	-	0.17**	-	0.08	-	0.24**
		(0.08)		(0.14)		(0.12)
Personnal quality	-	0.16*	-	0.03	-	0.22**
		(0.09)		(0.16)		(0.11)
Other kind of help	-	0.17**	-	0.23	-	0.15
		(0.08)		(0.15)		(0.11)
No response	-	-0.10	-	-0.14	-	-0.05
		(0.09)		(0.14)		(0.13)
ρ	-0.17**	(0.08)	-0.14	(0.15)	-0.22**	(0.10)

Standard errors are in parentheses.

*,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.

a. "U" represents the respondent health care use. b. "SP" represents the respondent social participation.

To confirm the complementary effect between social and human capital, we performed several alternative models as a robustness check. As previously, we first ran the dynamic bivariate model without identifying variables (Model C2). Then, we ran the same specification as Model B2 but on 2SLS specifications. Results of the robustness check are presented in Table 10. Estimates from the bivariate dynamic Probit model without an identifying variable (upper part of Table 10) are very similar to that of Table 9 and thus confirm the significant causal impact of social capital on immigrant health care utilisation among the most highly educated immigrants ($\widehat{\alpha_1}$=0.43**) and the whole population ($\widehat{\alpha_1}$=0.37**).

Likewise, results from 2SLS estimates are also consistent with the previous analysis in suggesting a complementary effect. All the specification tests confirm the validity of our identifying variables for the simultaneous estimation of health care utilisation and social capital among the most educated immigrants and the whole population of immigrants[31].

[31] We thus confirm the endogeneity of social capital with the health care use equation (the p-value associated

Table 10. Robustness analysis - Estimated coefficients

	Whole Pop	Educ<Univ.	Educ≥Univ.
	Probability of using health care		
Model C without excluded variables			
$\widehat{\alpha_1}$ Social capital	0.37**(0.14)	0.34(0.24)	0.43**(0.16)
2 Stage Least Square Model			
$\widehat{\alpha_1}$ Social capital	0.11**(0.04)	0.08(0.06)	0.14**(0.05)
Wooldridge test of endogeneity (p-value)	0.03	0.44	0.03
Sargan test (p-value)	0.60	0.79	0.50
Joint significance of instruments (p-value)	0.00	0.00	0.00

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level.

* *The determinants of social capital*

The empirical literature on the determinants of social capital is much less developed in immigrant populations but our results (columns 2, 4, 6 of Tables 7 and 9) are consistent with the existing studies. The likelihood of getting involved in social activities increases with age, which can be explained by increased leisure time when respondents become older but also by the fact that individuals may need to rely more on social networks as they age. Single individuals, compared with married immigrants, have a higher likelihood of getting involved in social activities regardless of their educational level. Income differences have some explanative power in relation to social participation but only among the most educated immigrants.

The immigrant province of residence has a significant effect on the likelihood of taking part in social activities among the most educated immigrants while no differences are found for the least educated immigrants. Individuals with high level of human capital who lived in Ontario are less likely to invest in social capital than the same immigrants residing in all other provinces, excepting Quebec. The country at birth appears to have some explanative power that differs according to the immigrants' educational level : the least educated immigrants coming from America and the most educated immigrants coming from Africa, Oceania or Australia are more likely to be a member of a social activity than European immigrants.

to the Wooldridge test of endogeneity is lower than 0.1 among the whole population and highly educated immigrants). According to the Sargan test, the identifying variables appear to be orthogonal to the residual term of health care use equation. The joint test of significant instruments indicates that our set of variables is not weak with a p-value lower than 0.001. Finally, Table D4 in Appendix D proved that identifying variables including in the second equation of social capital does not directly influence immigrant health care utilisation.

Probably because of more leisure time, retired immigrants with a lower educational level are more likely to get involved in social activities while students and homemakers with a higher educational level are less likely to do so. Family immigrants, compared with economic ones, have a lower chance of being involved in social activities while there is no significant difference between refugee immigrants and their economic counterparts for both sub-populations. Finally, immigrants who speak English poorly present a lower probability of taking part in social activities than those who speak English well, suggesting the prominent role of language proficiency to be socially integrated. Surprisingly, there is no statistically significant effect of having family at arrival and having received information on the likelihood of taking part in social activities for all groups of immigrants.

More importantly, both instrumental equations (column 2 of Tables 7 and 9) explaining social capital indicate that initial conditions at wave 1 explain significantly immigrant social participation at wave 3. In particular, the frequency of meeting friends and the help received during the first six months after arrival are significantly associated with immigrant social participation after four years of residency. Therefore, immigrants having met friends at least once a week and those having, for instance, received help from government programs or from public services during the first six months of residency are more likely to be involved in social activities four years later.

Nevertheless, the effect of these initial conditions seems to differ according to the level of immigrant human capital. Although meeting friends regularly during the first six months of arrival has a positive influence on an immigrant's investment in social capital among the least educated, no significant effect is found among the most educated immigrants. Conversely, the explanative power of the received help from government programs or from public services is statistically significant among the most educated immigrants but appears to be nil among the least educated immigrants.

Considering the few statistically significant effects of the frequency of meeting friends and the help received during the first six months of residency among both highly and poorly educated immigrants, we recognised the limitation of using them as identifying variables.

6. Conclusion

This article provides new empirical evidence of the causal influence of social capital as measured by participation in social activities, on immigrant self-assessed health status and health care use in Canada. To the best of our knowledge, this is the first research that explores the causal influence of social capital on immigrant health conditions when considering together the relationship between social and human capital. Our empirical approach presents some limitations. First, some potentially important variables are missing in our analysis, such as lifestyle and the size of the city where immigrants live. Information on health-related behaviour such as smoking, drinking or physical activities are not available in the LSIC survey which could have added important information on the complex relationship between social capital, human capital and health. Regarding the size of the city, we speculate that the bigger the city of residency, the more likely is the participation in a social activity. It would have been relevant to include this information in our empirical approach to capture the level of organisational resources within the city. In the same vein, due to a lack of sub-provincial information we could not have explored the influence of community social capital, measured for example by the Petris Social Capital Index (Scheffler *et al.*,2008), in order to analyse whether the density of organisations available in an area has an influence alongside the individual social capital effect. Further research might consist in exploring the relationship between social capital, human capital and immigrant health conditions in considering both the individual and the community level of social capital. Finally, we are cautious about the two identifying variables used in the bivariate analysis. In fact, no theoretical background has been proposed to find suitable individual level instruments for social capital. Although results among sub-populations reveal few statistically significant effects of the frequency of meeting friends and the help received during the first six months of residency, the robustness analysis performed in Models C (without identifying variables) confirms our results.

Nevertheless, our empirical results confirm that social participation has a positive influence on immigrant health status and health care use, although its contribution appears relatively small (between 1 and 3 percentage points). Therefore, regular social participation of recent immigrants increases their likelihood of reporting good or better health status and their likelihood of using medical services. Moreover, our analysis reveals that some the social activities are more protective than others. In particular, only membership in a sporting group displays a statistically significant

association with better health status while being a member of a church group, cultural club or political group increases the likelihood of using medical services.

Besides, we have shed light on the complex relationship between social and human capital. On one hand, we find a substitution effect between social and human capital that enhances immigrant health status while on the other, we find a complementary effect between both variables that improves immigrant health care utilisation. These findings are not necessarily contradictory. It means that social capital operates through different mechanisms according to the immigrant level of human capital. Regarding the substitution effect, we speculate that social capital can be an alternative resource to human capital helping immigrants with low educational levels to improve their health status (OECD, 2010a). Accordingly, the least educated immigrants need to rely more significantly on their social networks to acquire information related to the adoption of healthy behaviour or to receive psychological support, which directly improves their health status (OECD, 2010a). Regarding the complementary effect, we suppose that the underlying mechanism passes through the diffusion of relevant health care information about for example diseases, drugs, hospitals or health personnel. Higher education provides greater abilities and economic resources to understand and use health care information, enabling to comply with this information and to better use medical services.

Appendix A : Descriptive statistics

Table A1. Baseline desciptive statistics of time invariant characteristics

	Total population (N=7710)
Gender	
Female	50.5%
Male	49.5%
Educational level on arrival	
Less or up to High school	26.3%
Equivalent to college	15.5%
University or more	58.2%
Immigrant Class	
Family class	27.1%
Economic class	66.2%
Refugee class	6.7%
Region of birth	
America	4.1%
Europe	15.3%
Asia	63.9%
Middle East	3.9%
Africa	9.2%
Caribbean	3.1%
Oceania/Australia	0.5%
Province of destination	
Quebec	14.3%
Ontario	57.3%
British Columbia	16.7%
Alberta	8.1%
Other province	3.6%

Table A2. Baseline desciptive statistics of time variant characteristics (% col)

	Wave 1 Total population (N=7710)	Wave 2 Total population (N=7710)	Wave 3 Total population (N=7710)
Age group			
15-29 years old	33.4%	26.1%	19.9%
30-39 years old	38.4%	40.8%	41.1%
40-49 years old	17,3%	20.6%	24.0%
50 years old and more	10.9%	12.6%	15.1%
Family income quintile			
First quintile	21.4%	17.8%	17.7%
Second quintile	20.0%	18.5%	19.1%
Third quintile	18.4%	19.9%	20.3%
Fourth quintile	17.9%	20.7%	21.8%
Fifth quintile	20.3%	20.6%	20.1%
Missing information	2.0%	2.5%	2.0%
Activity status			
Working	52.0%	74.4%	80.1%
Homemaker	15.5%	10.3%	9.8%
Student	18.4%	9.2%	4.7%
Retired	3.0%	2.8%	2.9%
Looking for job	9.7%	2.1%	1.1%
Other	1.4%	1.2%	1.4%
Marital status			
Married/Common Low	76.2%	78.0%	79.5%
Separated/divorced	3.8%	4.8%	5.8%
Single	20.0%	17.2%	14.7%
English speaking			
Cannot speak	6.4%	5.5%	4.5%
Speaks poorly	15.0%	9.4%	9.5%
Fairly well	20.1%	16.7%	16.5%
Well	25.0%	27.7%	27.3%
Very well and fluently	33.5%	40.8%	42.2%
Frequency of contact with friends			
Daily	28.0%	21.5%	18.9%
At least once per week	49.6%	56.2%	53.4%
Less than once per week	13.5%	20.3%	26.5%
No friends	8.9%	1.9%	1.1%
Information received[a]			
Yes	-	27.8%	31.0%
No	-	72.2%	69.0%

a. The question about the information received only asked during waves 2 and 3.

Table A3. Distribution of the identifying variables - Wave 1 only (% col)

	Total population (N=7710)
Things that have helped the settlement	
Nothing help me	9.0%
Help from social Relationship (having family, friends, etc)	39.2%
Practical help (a job or a place to live)	16.7%
Help with education	12.0%
Help from government/Migrant services	5.5%
My personnal quality	6.4%
Other	5.3%
No response	5.9%
Frequency with meeting friends	
Less than weekly	22.4%
At least once a week	77.6%

Appendix B : Estimation results from the pooled Probit model

Table B1. Individual determinants of health deterioration - Pooled Probit model

	Whole Population (N=15,420)	Educ<University (N=7,352)	Educ≥University (N=8,068)
Times dummy			
Wave 3	Ref.	Ref.	Ref.
Wave 2	0.01***(0.00)	0.01***(0.00)	0.01***(0.00)
Age	0.00***(0.00)	0.00***(0.00)	0.00***(0.00)
Gender			
Male	Ref.	Ref.	Ref.
Female	0.04***(0.01)	0.04***(0.04)	0.04***(0.01)
Region of birth			
America	0.01(0.02)	0.00(0.03)	0.01(0.02)
Europe	Ref.	Ref.	Ref.
Asia	0.03***(0.01)	0.01(0.01)	0.04***(0.01)
Middle East	0.03(0.02)	0.01(0.03)	0.04(0.04)
Africa	0.03**(0.02)	0.01(0.02)	0.05**(0.03)
Caribbean	0.00(0.02)	-0.02(0.02)	0.05(0.05)
Oceania/Australia	0.01(0.04)	0.02(0.06)	-
Province of destination			
Ontario	Ref.	Ref.	Ref.
Quebec	0.00(0.01)	-0.01(0.01)	0.00(0.01)
British-Columbia	0.02**(0.01)	0.02**(0.01)	0.02**(0.01)
Alberta	0.00(0.01)	0.00(0.01)	0.00(0.01)
Others province	-0.01(0.01)	-0.03(0.02)	0.01(0.02)
Family income quintile			
First quintile	0.03***(0.01)	0.03**(0.01)	0.03***(0.01)
Second quintile	0.03***(0.01)	0.02*(0.01)	0.03***(0.01)
Third quintile	0.02**(0.01)	0.01(0.01)	0.02**(0.01)
Fourth quintile	0.01*(0.01)	0.00(0.01)	0.02**(0.01)
Fifth quintile	Ref.	Ref.	Ref.
Missing information	0.02(0.02)	0.00(0.02)	0.05**(0.03)
Activity status			
Working	Ref.	Ref.	Ref.
Homemaker	0.00(0.01)	0.00(0.01)	-0.01(0.01)
Student	-0.01(0.01)	0.01(0.02)	-0.01(0.01)
Retired	-0.01(0.01)	0.00(0.02)	-0.02(0.02)
Looking for job	0.00(0.02)	0.02(0.04)	-0.01(0.02)
Other	0.04**(0.02)	0.02(0.02)	0.06**(0.04)
Marital status			
Married/Common Low	Ref.	Ref.	Ref.
Separated/divorced	-0.01(0.01)	-0.03**(0.01)	0.03**(0.02)
Single	-0.01(0.01)	-0.01(0.01)	0.00(0.01)

(continued)

Table B1. Continued

	Whole Population (N=15,420)	Educ<University (N=7,352)	Educ≥University (N=8,068)
Immigrant class			
Economic immigrant	Ref.	Ref.	Ref.
Family immigrant	-0.01(0.01)	-0.01(0.01)	0.00(0.01)
Refugee immigrant	0.01(0.01)	0.01(0.01)	0.03*(0.02)
English speaking on arrival			
Well.Very/Well/Fluently	Ref.	Ref.	Ref.
Cannot speak/Speaks poorly	0.03***(0.01)	0.03***(0.01)	0.02**(0.01)
Educational level on arrival			
University degree	Ref.	Ref.	Ref.
Less than high school	0.01(0.01)	-	-
College	-0.01(0.01)	-	-
Information received			
No	Ref.	Ref.	Ref.
Yes	-0.01*(0.00)	-0.01*(0.01)	0.00(0.01)
Having family on arrival			
No	Ref.	Ref.	Ref.
Yes	0.01*(0.01)	0.01(0.01)	0.01(0.01)
Social capital			
No investment in social capital	Ref.	Ref.	Ref.
Investment in social capital	-0.01*(0.00)	-0.02**(0.01)	-0.00(0.01)

Standard errors are in parentheses. *.**,*** indicate significantly different from 0 at the 10%, 5% and 1% level

Table B2. Individual determinants of lesser use - Probit model with random effect

	Whole Population (N=15,420)	Educ<University (N=7,352)	Educ≥University (N=8,068)
Times dummy			
Wave 3	Ref.	Ref.	Ref.
Wave 2	0.00(0.00)	0.00(0.01)	-0.00(0.00)
Health status			
Poor health status	Ref.	Ref.	Ref.
Good health status	0.07***(0.01)	0.07***(0.01)	0.07***(0.02)
Age	-0.00***(0.00)	-0.00***(0.00)	-0.02**(0.00)
Gender			
Male	Ref.	Ref.	Ref.
Female	-0.03***(0.01)	-0.03**(0.01)	-0.03**(0.01)
Region of birth			
America	-0.02(0.02)	0.02(0.04)	-0.03(0.02)
Europe	Ref.	Ref.	Ref.
Asia	-0.01(0.01)	0.00(0.02)	-0.01(0,01)
Middle East	-0.00(0.02)	0.01(0.03)	-0.01(0.04)
Africa	0.02(0.02)	0.03(0.03)	0.02(0.02)
Caribbean	0.06*(0.03)	0.06**(0.10)	0.06(0.06)
Oceania/Australia	0.04(0.05)	0.13*(0.08)	0.08(0.06)
Province of destination			
Ontario	Ref.	Ref.	Ref.
Quebec	0.04**(0.01)	0.04**(0.02)	0.03*(0.02)
British-Columbia	0.00(0.01)	-0.02(0.01)	0.03(0.02)
Alberta	0.03**(0.01)	0.07**(0.02)	-0.00(0.02)
Others province	0.06**(0.03)	0.02(0.03)	0.11***(0.05)
Family income quintile			
First quintile	-0.01(0.01)	-0.01(0.02)	0.00(0.02)
Second quintile	0.02*(0.01)	0.02(0.02)	0.03*(0.02)
Third quintile	0.03*(0.01)	0.03(0.02)	0.03**(0.01)
Fourth quintile	0.00(0.01)	0.00(0.01)	-0.00(0.01)
Fifth quintile	Ref.	Ref.	Ref.
Missing information	0.04(0.02)	0.03(0.03)	0.04(0.05)
Health insurance			
No health insurance	Ref.	Ref.	Ref.
Having health insurance	-0.01(0.01)	-0.02*(0.01)	-0.00(0.01)
Activity status			
Working	Ref.	Ref.	Ref.
Homemaker	0.01(0.01)	0.01(0.02)	-0.00(0.02)
Student	-0.01(0.01)	0.00(0.02)	-0.02(0.02)
Retired	0.01(0.01)	-0.00(0.04)	0.02(0.06)
Looking for job	0.00(0.03)	0.02(0.05)	-0.00(0.03)
Other	0.02(0.03)	-0.00(0.04)	0.04(0.04)

(continued)

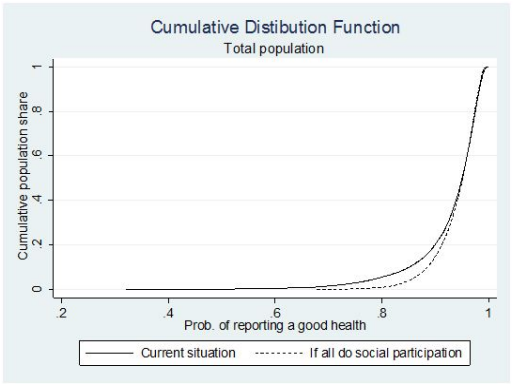
Table B2. Continued

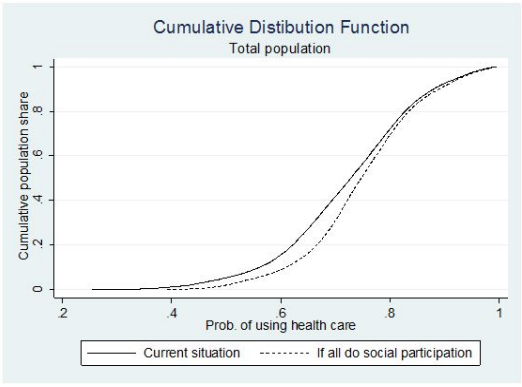
	Whole Population (N=15,420)	Educ<University (N=7,352)	Educ≥University (N=8,068)
Marital status			
Married/Common Low	Ref.	Ref.	Ref.
Separated/Divorced	0.02(0.02)	0.03(0.03)	0.01(0.03)
Single	0.00(0.01)	-0.00(0.00)	0.00(0.02)
Immigrant class			
Economic immigrant	Ref.	Ref.	Ref.
Family immigrant	-0.01(0.01)	-0.01(0.01)	-0.01(0.02)
Refugee immigrant	0.02(0.02)	0.00(0.02)	0.06(0.04)
English speaking on arrival			
Well/Very well/Fluently	Ref.	Ref.	Ref.
Cannot speak/Speaks poorly	0.01(0.01)	0.02(0.01)	0.01(0.02)
Educational level on arrival			
University degree	Ref.	Ref.	Ref.
Less than high school	-0.01(0.01)	-	-
College	-0.00(0.01)	-	-
Information received			
No	Ref.	Ref.	Ref.
Yes	-0.01(0.01)	-0.01(0.01)	-0.01(0.00)
Having family at arrival			
No	Ref.	Ref.	Ref.
Yes	-0.01(0.01)	-0.01(0.01)	-0.01(0.01)
Social capital			
No investment in social capital	Ref.	Ref.	Ref.
Investment in social capital	-0.01(0.01)	-0.01(0.01)	-0.01(0.01)

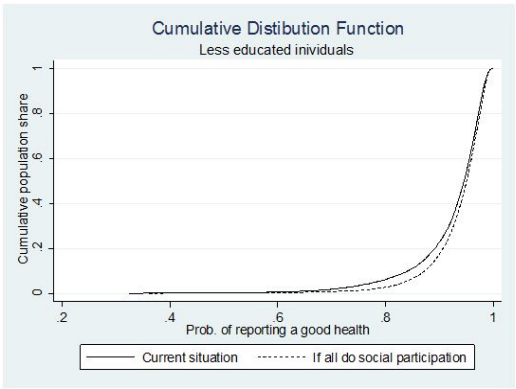
Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level

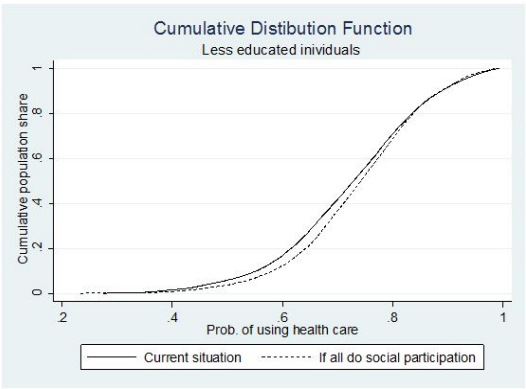
Appendix C : Cumulative Distribution Functions (CDF) from the observed and alternative situations

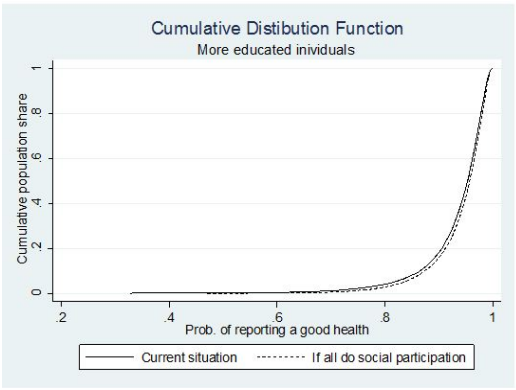
Figure C1. CDF of the probabilities of reporting a good health status or of using health care services among the whole and sub-populations of immigrants

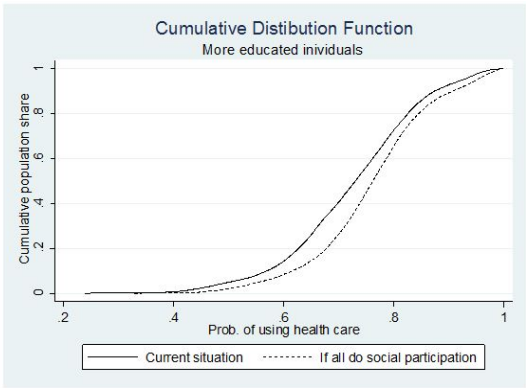












Appendix D : Additional results from bivariate dynamic Probit models

Table D1. Main estimation results from bivariate dynamic Probit model for health and social capital with mean value of time variant covariates

	Whole Population (N=7710)	
	H	SP
Control for :		
Lagged value and initial value of Health	v	-
Time invariant characteristics	v	v
Time variant characteristics	v	v
Lagged value and initial value of SP	-	v
Identifying variables	-	v
Mean value of time variant covariates		
Mean Age	0.03(0.09)	-0.05(0.06)
Mean Marital status		
Married/In common Law	Ref.	Ref.
Divorced	0.74**(0.30)	-0.19(0.23)
Single	0.35(0.23)	-0.23(0.15)
Mean Activity Status		
Working	Ref.	Ref.
Homemaker	0.30*(0.17)	0.07(0.13)
Student	0.16(0.15)	0.02(0.11)
Retired	0.12(0.31)	0.70***(0.26)
Looking for job	0.07(0.22)	-0.16(0.17)
Other activity status	0.81*(0.46)	-0.24(0.32)
Mean Income quintile		
First Quintile	-0.26(0.17)	-0.02(0.12)
Second Quintile	-0.41**(0.17)	-0.18(0.12)
Third Qintile	-0.34**(0.16)	-0.02(0.11)
Fourth Quintile	-0.05(0.18)	0.08(0.11)
Fifth Quintile	Ref.	Ref.
Miss Income	-0.08(0.22)	-0.14(0.23)
Social Participation (SP)		
No	Ref.	Ref.
Yes	0.52**(0.22)	-
Rho	-0.27*(0.14)	

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level. Estimation results from dynamic bivariate Probit model of health and social capital.
Note: "H" represents the respondent health status and "SP" represents social participation.

Table D2. Main estimation results from bivariate dynamic Probit model for care and social capital with mean value of time variant covariates

	Whole Population (N=7710)	
	C	SP
Control for :		
Lagged value and initial value of care	v	-
Time invariant characteristics	v	v
Time variant characteristics	v	v
Lagged value and initial value of SP	-	v
Identifying variables	-	v
Mean value of time variant covariates		
Mean age	-0.00(0.05)	
Mean marital status		
Married/In common Law	Ref.	Ref.
Divorced	-0.48**(0.24)	-0.21(0.22)
Single	-0.08(0.15)	-0.23(0.15)
Mean activity Status		
Working	Ref.	Ref.
Homemaker	-0.14(0.12)	0.07(0.13)
Student	-0.29***(0.10)	0.01(0.11)
Retired	-0.05(0.28)	0.70***(0.26)
Looking for job	-0.09(0.16)	-0.16(0.17)
Other activity status	-0.19(0.30)	-0.25(0.32)
Mean income quintile		
First Quintile	0.18(0.12)	-0.01(0.12)
Second Quintile	-0.02(0.12)	-0.17(0.12)
Third Qintile	0.06(0.12)	-0.01(0.11)
Fourth Quintile	0.17(0.11)	0.08(0.11)
Fifth Quintile	Ref.	Ref.
Miss Income	-0.06(0.24)	-0.13(0.23)
Mean health insurance		
No tenure of health insurance	Ref.	Ref.
Tenure of health insurance	0.49(0.33)	-0.18(0.32)
Social Participation (SP)		
No	Ref.	Ref.
Yes	0.37***(0.14)	-
Rho	-0.17**(0.08)	

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level. Estimation results from dynamic bivariate Probit model of health and social capital.
Note: "C" represents the respondent health care use and "SP" represents social participation.

Table D3. Main estimation results from bivariate dynamic Probit model for health and membership in a sporting group

	Whole Population (N=7710)	
	H	Sport club
Control for :		
Lagged value and initial value of Health	v	-
Time invariant characteristics	v	v
Time variant characteristics	v	v
Lagged value and initial value of sport	-	v
Identifying variables	-	v
Membership in sporting club (SP)		
No	Ref.	Ref.
Yes	1,37***	-
Rho	-0.47*	

Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level. Estimation results from dynamic bivariate Probit model of health and membership in sport group. "H" represents the respondent health status.

Table D4. Evidence of the non significance of the identifying variables with the health status and the health care use equations

	Health status equation	Health care use equation
Control for		
Time invariant characteristics	v	v
Time variant characteristics	v	v
Frequence of meeting friends		
Less than weekly	Ref.	Ref.
At least once a week	-0.01(0.06)	0.03(0.03)
Most things that have helped you		
Nothing	Ref.	Ref.
Social Relationship	0.11(0.11)	-0.03(0.05)
Job and housing	0.15(0.12)	-0.04(0.06)
Education	-0.03(0.12)	-0.08(0.06)
Governement programs/Immigrant serv	0.12(0.14)	0.03(0.07)
Personnal quality	0.01(0.14)	-0.04(0.08)
Other	-0.02(0.14)	-0.10(0.07)
No response	-0.03(0.14)	-0.05(0.07)
N (unweighted)	15420	15420

Note: Standard errors are in parentheses. *,**,*** indicate significantly different from 0 at the 10%, 5% and 1% level. Estimation results from random effect Probit model of reporting a good health status and then to use health care services (waves 2 and 3).