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Insights into the 'healthy immigrant effect': health status and health service use of immigrants to Canada

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Abstract

This paper combines multiple cross-sections of data drawn from the National Population Health Survey and Canadian Community Health Survey to confirm the existence of the 'healthy immigrant effect', specifically that immigrants are in relatively better health on arrival in Canada compared to native-born Canadians, and that immigrant health converges with years in Canada to native-born levels. The paper finds robust evidence that the healthy immigrant effect is present for the incidence of chronic conditions for both men and women, and results in relatively slow convergence to native-born levels. There is only weak evidence in terms of self-assessed health status. The inclusion of controls for region of origin and year of arrival does not account for the observed effects, although region of origin is an important determinants of immigrant health. The paper then considers some alternative explanations for the observed differences, and support is found for the idea that the healthy immigrant effect reflects convergence in physical health rather than convergence in screening and detection of existing health problems.

JEL classification: I1; J0

Keywords: Immigrants; Health; Cohort effects; Canada

Introduction

The health of Canada's immigrant population is of prime concern to scholars and policymakers for two main reasons. First, the large number of immigrants resident in Canada means that the health of Canada's immigrants is also an important determinant of general measures of population health, and so is directly related to issues of the cost and adequacy of the Canadian healthcare system. According to data from the 2001 Census, 18% of Canada's population was born in another country, and over 250 000 people gained permanent residency in 2001 alone. Second, the health of Canada's immigrants is one important determinant of the costs and benefits of immigration policy, and so relates to questions such as whether immigrants constitute an undue burden on Canada's taxpayer-funded healthcare system. More broadly, immigrant health is an important component of the general issue about whether Canada is maximizing the returns to its large-scale immigration program.

A key question relates to the time path of immigrant health, i.e., what happens to an immigrant's health as he or she spends more time in the new country. Much of the recent literature on immigrant health has focused on identifying the presence and magnitude of what is known as the 'healthy immigrant effect'—an observed time path in which the health of immigrants just after migration is substantially better than that of comparable native-born people, but worsens with additional years in the new country (denoted YSM—years since immigration).

The current paper contributes to this literature in two main ways. First, we present new evidence on the healthy immigrant effect for Canada, using multiple

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cross-sections from large micro-level datasets that allow for control of unobserved (cohort) effects, place of birth, and country of origin that could otherwise obscure the true YSM effect on immigrant health. Second, we provide some preliminary evidence on what might be underlying the estimated YSM effects on health, by analyzing immigrants' use of some basic health services. Similar patterns in the use of these health services might indicate that barriers in the access of health services by recent immigrants are contributing to relatively lower *reported* incidence of health conditions, giving the impression of relatively healthier immigrants.

The outline for the paper is as follows. Following a review of recent literature in the literature section, the subsequent section sets out an empirical framework for analyzing health status and specifies the estimating equations. This is followed by a section on description of the data and the construction of the sample used in estimation. The next section presents and discusses the main results. The paper then attempts to identify some possible underlying reasons for the observed differences in health patterns in the penultimate section by considering immigrant use of health services and by examining the incidence of specific health conditions. The final section concludes by summarizing the main results and outlining avenues for future research.

Review of the literature

Health researchers use a range of measures as indicators of health status, including the existence of diagnosed chronic health conditions, limitations in mobility, and indicators of general health as measured by subjective self-assessment. (See Kinnon, 1999; Hyman, 2001, for recent reviews.) Evidence of a healthy immigrant effect is reported in Chen et al., (1996), who use the 1994–95 wave of the National Population Health Survey (NPHS), Newbold and Danforth (2003) who use the 1998–99 wave of the NPHS, and Perez (2002) who uses the Canadian Community Health Survey from 2000–01. The healthy immigrant effect has also been documented in Australia (Donovan, d' Espaignet, & van Ommeren 1992; Biddle, Kennedy & McDonald, 2003) and the United States (Stephen, Foote, Hendershot, & Schoenborn, 1994).

In the literature, the healthy immigrant effect is often attributed to a number of factors. The first is immigrant self-selection, in which healthier potential immigrants are most likely to be physically or financially able to migrate. Similarly, direct health screening by Canadian authorities prior to an immigrant's arrival in Canada may give rise to relatively healthier immigrants. Although the health assessment required under the Canadian *Immigration Act* is comprehensive, in practice few immigrants are denied entry to Canada for health reasons. (See Laroche, 2000, for additional discussion.) Another possibility may be that the incidence of health conditions among recent immigrants is under-reported, perhaps because immigrants under-utilize health services that would diagnose existing medical conditions. However, even in the Canadian literature there is no unanimity about the existence of the healthy immigrant effect. Dunn and Dyck (2000) analyze the 1994–95 NPHS and find no obvious consistent pattern between immigrant characteristics and their health outcomes. Also, Laroche (2000) finds that the health status of immigrants does not differ significantly from that of the Canadian-born population.

In those studies identifying a significant difference between the health of new arrivals and the native born, it is also found that recent immigrants are healthier than immigrants who have been in Canada for more than 10 years, implying a narrowing of the health gap with the native born as years in Canada increase—in essence, a worsening of immigrant health over time in Canada compared to similar native-born persons. For example, Newbold and Danforth (2003), using the 1998–99 NPHS, find that with the exception of the most recent arrivals, immigrants to Canada experience poorer health status compared to the native-born. Some researchers hypothesize that convergence in health outcomes might arise from a process of acculturation in which recent immigrants take on characteristically Canadian ways of living. (See Hyman, 2001, for an overview.) A similar explanation may relate to exposure to common environmental factors (Stephen et al., 1994). An alternative hypothesis (see Leclere, Jensen, & Biddlecom, 1994) is that recent immigrants face barriers to the use of health services because of language or cultural differences, and a lack of information about and experience with their new health care system. This leads to worsening immigrant health status over time because of relative under-use of preventative health screening and under-diagnosis and treatment of health problems. Alternatively, in the case of the existence of diagnosed conditions, it may also be that improved access to and use of health services over time leads to increased recognition of existing but undiagnosed conditions, and so an apparent worsening of immigrant health as measured this way. Related to this is the notion that self-reported health is determined in part by cultural perception of illness as well as the presence of illness itself (Leclere et al., 1994).

Methodology

Determinants of health

Following Frank (1995) and Dunn and Dyck (2000), our theoretical starting point is the 'population health'

perspective that defines the major determinants of health status to be cultural, social and economic factors rather than medical care inputs and utilization per se. Although age and gender are key determinants of individual health, the importance of measures of socioeconomic status such as income and education is also well-established in the Canadian and international literature. We capture socioeconomic status by including controls for education and family income. Education effects are measured by a series of binary indicator variables for a range of education levels. For income, one option that is often used in the literature is current reported income. However, as noted by Ettner (1996) and others, current income is a potentially endogenous determinant of health status. For example, poor health can limit hours of work and labour force participation. Further, socio-economic status is reflected more by permanent (or long run) income than current income, but the former is unobservable. We attempt to control for differences in permanent income across individuals (part of which will also be captured by the education controls) by including a set of explanatory variables correlated with permanent income. These variables are indicator variables for whether the individual received dividend income, whether the individual owns his or her own home, the type of dwelling, the number of bedrooms in the dwelling and the number of children living at home.[1] We also include the local unemployment rate as one measure of general economic conditions at the community level, as well as indicator variables for province of residence and community size (rural areas, Census Metropolitan areas and towns/smaller cities). These region variables are included to capture factors related to accessibility of services and exposure to environmental risks.

A methodological limitation of much of the published work on the health of immigrants is that it is typically based on a single cross-section of data. With a single cross-section it is not possible to disentangle true convergence in health from unobserved characteristics related to health that differ across immigrants from different arrival periods. The health of immigrants *on average* may be affected by broad changes in the composition of immigrants (e.g., by visa category) that has occurred over time, and failing to control for these cohort effects can give rise to misleading inferences about changes in immigrant health with YSM.

When multiple cross-sections of data are available, it is possible to identify YSM effects separately from cohort effects through the use of 'synthetic cohorts', an approach widely used in the literature on the labour market experiences of immigrants. This approach is illustrated in Eq. (1), where a given (possibly unobserved) index of health is expressed as a function of age and other demographic and economic controls, as well as controls for period of arrival and YSM if the individual is an immigrant. (Immigrant terms are set to zero for the native-born.)

$$\begin{aligned} Y_i^* = {} & \alpha_0\ \alpha_1\ \mathrm{age}_i + \alpha_2\ \mathrm{age}_i^2 + \sum_{j=1}^{J-1} \gamma 0_j A_{ij}\ \mathrm{age}_i \\ & + \sum_{j=1}^{J-1} \gamma 1_j A_{ij}\ \mathrm{age}_i^2 + \mathrm{X}_i\ \delta \\ & + \beta_0\ \mathrm{FB}_i + \beta_1\ \mathrm{YSM}_i + \beta_2\ \mathrm{YSM}_i^2 \\ & + \sum_{k=1}^{K-1} \lambda 0_k C_{ik} + \varepsilon_i. \end{aligned} \tag{1}$$

The A_{ij} are a set of indicator variables for 10-year age groups indexed by 'j' (20–29, 30–39, 40–49, 50–59, and 60–65) that are assumed to be common to *all* individuals in the sample—both native-born and immigrants. The interaction of these terms with age and age-squared allows for a relatively unrestricted relationship between age and health. We limit the analysis to individuals aged between 20 and 65 in order to rule out heterogeneity in health outcomes by broad age group. The X_i term represents the other included regressors that enter the index linearly.

Variables reflecting differences in immigrant health include an indicator variable FB that takes the value 1 if the person was born outside of Canada and zero otherwise. The linear-quadratic YSM terms reflect the (possibly nonlinear) effect on health of an extra year in Canada, holding constant age and other effects. To allow for cohort effects, we include a set of indicator variables C_{ik} reflecting the period of arrival of the immigrant in Canada. We define the following 5-year arrival cohort periods: arrived 1951–55, 1956–60, 1961–65, 1966–70, 1971–75, 1976–80, 1981–85, 1986–90, 1991–95, and 1996–2001. (The small number of immigrants who arrived prior to 1951 are omitted.) If the estimated coefficients on these cohort terms are jointly zero, this is evidence that year of arrival does not affect health once YSM is controlled for (i.e., there are no cohort effects). A joint test of FB, YSM terms and the cohort effects is a test of whether there are any significant differences in immigrant versus native-born

[1] Laroche (2000) uses occupation as an instrumental variable for income, but warns that her instrument might also be endogenous to health status. Ettner (1996) uses spouse's education, education of parents, work experience and the state unemployment rate as instruments for family income. Unfortunately spouse's education level is available in only one of the datasets used in this analysis, and parental education is not available at all. The results reported later in the paper are qualitatively the same if controls for the income quintile of the family are included as additional regressors. As well, interacting the housing variables with age and number of children has little effect on the results.

health after controlling for other observable characteristics.[2]

In other regressions, we augment specification (1) by allowing the FB, YSM, and YSM^2 terms in Eq. (1) to vary by broad region of origin. Birthplace is likely to be an important determinant of immigrant health, and could reflect unobserved differences in prenatal, neonatal and early childhood care, childhood environmental factors, and differences in social and cultural attitudes to health behavior and health service use.

Similarly, age at arrival may also be important for two reasons. First, immigrants who arrived in Canada as children have been raised within Canada's social system and so would be more likely to be culturally and behaviorally similar to native-born Canadians. Second, Jasso, Massey, Rosenzweig, and Smith, (2003) suggest that there may be a process of *negative* selection for older immigrants since less healthy individuals might seek to immigrate to Canada to take advantage of access to Canada's healthcare system. They find younger immigrants are in significantly better health on arrival in the United States than older immigrants. To allow for these possibilities, we include additional interactions of FB, YSM and YSM^2 in Eq. (1) with indicator variables for whether the individual immigrated as a child (aged 12 or younger) or as an older adult (aged 50 or older).

Measures of health status

The choice of health measures is limited to some degree by what is available and consistently defined across the datasets underpinning this analysis. We focus on two specific measures of health. The first is the incidence of chronic medical conditions as diagnosed by a healthcare professional. To reflect the wide range of specific conditions identified in the population health datasets, we categorize chronic conditions into two broad groups and examine the determinants of each separately. The first group of conditions, which we call Type A conditions, includes the following: asthma, back pain, high blood pressure, allergies, migraines, ulcers, bronchitis, and arthritis. These conditions are not normally considered to be life threatening. The second group of more serious conditions, which we call Type B conditions, includes heart disease, cancer, diseases of the thyroid, Crohn's disease, and diabetes. (Other conditions specifically related to old age—glaucoma, stroke, cataracts, incontinence and Alzheimer's disease—are excluded from the analysis because of low incidence among the subpopulation of people aged 21–65.) For both Type A and B conditions, we define an indicator variable that takes the value one if the individual has been diagnosed as having at least one of the specified conditions, and zero otherwise. We estimate the incidence of a chronic condition using Probit estimation.

Our second indicator of physical health is a variable that is based on the result of a subjective self-assessment of one's general health on a five-point scale: excellent, very good, good, fair or poor. Measures of self-assessed health status (SAHS) are commonly used in the literature and have generally been found to be good predictors of mortality, although there is a significant literature on the extent to which perceptions of what constitutes good or poor health vary by age, socioeconomic status, or other characteristics.[3] Given the categorical nature of reported self-assessed health status, we estimate the incidence of less than good health (i.e., fair or poor health) using a Probit specification.

Data sources and descriptive statistics

We make use of pooled cross-sectional data drawn from two large unit record datasets on health outcomes and health services use published by Statistics Canada. These are the 1996 wave of the National Population Health Survey (NPHS) and the 2000–01 wave of the Canadian Community Health Survey (CCHS). The NPHS and CCHS are comparable in terms of survey design and collection, and both surveys are representative of the Canadian population (although the NPHS collects information on people of all ages while the CCHS is limited to people aged 12 years or older). Definitions of survey questions and response categories are also comparable across the surveys.

Although the NPHS is available biennially from 1994 to 2000 and contains a core longitudinal component, the 1996 wave is by far the largest because three provinces—Ontario, Manitoba, and Alberta—funded significant provincial supplemental data collection in their respective provinces. The total cross-sectional sample size of

[2] With a single cross-section, YSM and year of arrival (as a continuous variable) are perfectly correlated. With multiple cross-sections of data, cohort and YSM effects can be separately identified, although it is necessary to assume that period effects between the sample years are common to both immigrants and native-born people. See Borjas (1985) and Lalonde and Topel (1991) for further discussion. In the current analysis, identification is enhanced by assuming that cohort effects are constant within each 5-year arrival period. This is a widely made assumption in the immigration literature, and one that is not likely to be overly limiting given the long time frame of arrival years considered.

[3] See for example Ratner, Johnson, and Jeffrey (1998), Menec, Chipperfield, and Perry (1999), Shields and Shooshtari (2001), Crossley and Kennedy (2002), and Bailis, Segall, and Chipperfield (2003).

Table 1
Sample means and proportions of key variables: individuals aged 20–65 (Pooled 1996 NPHS and 2000–01 CCHS data)

	Women born in Canada	Women born elsewhere	Men born in Canada	Men born elsewhere
Type A condition	0.600	0.528	0.492	0.424
Type B condition	0.140	0.125	0.084	0.079
Self-reported health				
Excellent	0.265	0.241	0.279	0.273
Very good	0.391	0.345	0.390	0.355
Good	0.251	0.295	0.245	0.293
Fair	0.072	0.086	0.061	0.059
Poor	0.021	0.034	0.021	0.020
Age (years)	40.7	42.3	40.4	42.8
Did not finish high school	0.178	0.184	0.204	0.154
Graduated high school	0.267	0.273	0.244	0.241
Undergraduate degree	0.140	0.155	0.130	0.185
Other post-secondary	0.382	0.326	0.375	0.314
Higher degree	0.033	0.062	0.047	0.106
Speaks English	0.835	0.879	0.851	0.902
Speaks French	0.372	0.166	0.368	0.195
Speaks another language	0.085	0.692	0.085	0.739
Speaks neither English nor French	0.003	0.081	0.003	0.058
Entered Canada 1991–01	N/a	0.243	N/a	0.243
Entered Canada 1981–90		0.250		0.233
Entered Canada 1971–80		0.222		0.229
Entered Canada 1961–70		0.182		0.171
Entered Canada 1951–60		0.107		0.121
Born in an English-speaking country		0.190		0.152
Born in Europe (not UK)		0.284		0.305
Born elsewhere		0.527		0.542
Arrived at age 10 or less		0.168		0.178
Lives in a rural area	0.196	0.067	0.214	0.068
Lives in a CMA	0.585	0.882	0.574	0.891
Lives elsewhere	0.219	0.048	0.212	0.041
Owns residence	0.718	0.660	0.734	0.675
Receives dividend income	0.150	0.130	0.167	0.143
Pooled sample size	63953	9812	57224	8942

people aged 12 and above is 17,626 in the 1994–95 NPHS, compared with 73,402 in the 1996–97 NPHS and 131,535 in the CCHS.[4]

Sample means and proportions for the explanatory variables and measures of health are reported in Table 1, for four main subgroups of people aged 20–65: native-born women, foreign-born women, native-born men, and foreign-born men. Immigrant men and women are less likely to have been diagnosed with a chronic

[4] In related analyses (not reported here), an expanded dataset is used that merges 1996 NPHS and 2000-01 CCHS with the 1991 (health) wave of the General Social Survey (GSS) published by Statistics Canada. Because of more limited comparability between the GSS and the later surveys, we restrict use of this expanded dataset to conducting sensitivity checks on the main results. Results based on this larger dataset are consistent with what is reported in the current paper.

condition than native-born men and women. Interestingly, immigrants are also less likely to report being in very good or excellent health, and immigrant women are more likely to report being in fair or poor health than native-born women. Immigrants overall are generally relatively well educated, are on average 2 years older than the native-born, and are very likely to be able to speak English. A majority of immigrants to Canada originate from non-English speaking countries outside of Europe (particularly Asia), which also leads to a substantial percentage of immigrants who are able also to speak a language other than French or English. Immigrants are also very likely to reside in major metropolitan areas, and are less likely to receive dividends or to own their own residential dwelling.

Determinants of immigrant health

Cohort and YSM effects

The first issue of interest is whether there are significant differences in the health of immigrants compared to the native-born after controlling for differences in age and other characteristics that are important determinants of health. Coefficient estimates for the immigrant variables obtained from estimating specification (1) are reported in Table 2a for men and Table 2b for women. (Other coefficient estimates are reported in appendix Table 4.) For each measure of health, we report the results from two estimations—the first includes a quadratic in YSM to capture health differences between immigrants and the native-born, and the second includes additional controls for cohort arrival period effects.

For immigrant men, the incidence of both sets of chronic conditions is significantly different for immigrants compared to the native-born, after controlling for the effects of other observable characteristics. The pattern in the coefficients suggests evidence of the healthy immigrant effect—that is, immigrants are less likely to have a chronic condition on arrival in Canada (when YSM is zero) but incidence increases with YSM. The pattern is similar after the inclusion of controls for arrival period effects, although there is some evidence of cohort effects for immigrant men arriving prior to 1970 in that they experience relatively fewer chronic conditions. A statistical test of the significance of the cohort terms indicates that period of arrival is a statistically significant determinant of immigrant health. In terms of self-assessed health, patterns are less precise, although again there is evidence of significant cohort effects for earlier arrivals. For immigrant women, there is very strong evidence of a healthy immigrant effect in terms of each health measure. In contrast to the results for men, however, there is no suggestion that the time path of health varies significantly by period of arrival.

Since the coefficient estimates from a Probit estimation do not have an intuitive interpretation, we use the estimates to predict the health profile of a typical immigrant by arrival cohort and by years in Canada. In order to focus attention on differences by immigrant status only, we hold all other characteristics including age constant for a 'base case' individual whose characteristics, for computational simplicity, are set at age 45 plus the default characteristics in Eq. (1). These default characteristics (where all non-immigrant indicator variables take a value zero) are: Ontario resident outside of a major city, high school education, English speaker, no dividend income and living in a rented house. Predicted differences between immigrant and native-born health levels are not sensitive to the use of alternative characteristics. In each figure, we include predicted YSM profiles for specifications with and without cohort effects in order to illustrate the extent of any misspecification arising from the omission of cohort effects.

In Fig. 1a, it can be seen that a 'baseline' native-born person aged 45 years has a predicted incidence of Type A condition of around 55%. On arrival in Canada, comparable immigrant men and women have markedly lower incidence of these conditions (less than 30%), and predicted incidence increases steadily with additional years in Canada but at a decreasing rate. After about 20–25 years in Canada, a 45-year-old immigrant of either gender has an incidence of Type A conditions that is comparable to the native-born. After this point, relative immigrant health does not worsen with additional years in Canada, so that the general pattern of the YSM health path is one of *convergence* to native-born levels. Consistent with the statistical tests for cohort effects, the predicted cohort-specific YSM paths are very close to the YSM path without cohort effects. The only exception is that the YSM-only specification overpredicts the incidence of Type A conditions for immigrant men who arrived between 1956 and 1965. It is interesting to note that while native-born women are predicted to be around 10% more likely than native-born men to have a Type A chronic condition, newly arrived immigrant men and women have similar predicted incidence of Type A conditions but converge to different gender-specific native-born levels.

Fig. 1b illustrates predicted incidence of Type B conditions. As in Fig. 1a, the incidence of Type B conditions is higher for native-born women than native-born men, but recent immigrant men and women exhibit comparable incidence of these conditions. Again, as YSM increases, immigrant incidence of chronic conditions converges to the gender-specific native-born level. The incidence of Type B conditions for immigrant men shows only marginal change with additional YSM

Table 2

	Type A condition		Type B condition		Fair or poor SAH	
(a) Selected results for Men—basic specification with controls for year of arrival and years since migration						
Foreign-born (FB)	−0.6018**	−0.3241	−0.2151**	−0.5084	−0.1151	−0.3975
	(0.072)	(0.335)	(0.104)	(0.472)	(0.107)	(0.411)
Years since migration	0.0298**	0.0143	0.0118	0.0179	0.0060	−0.0094
	(0.006)	(0.020)	(0.009)	(0.028)	(0.009)	(0.024)
YSM-squared	−0.0004**	−0.0001	−0.0002	0.0001	−0.0001	0.0007*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Arrived 1996–01		−0.2382		0.1636		0.2678
		(0.300)		(0.423)		(0.372)
Arrived 1991–95		−0.2035		0.3547		0.3503
		(0.241)		(0.348)		(0.286)
Arrived 1986–90		−0.1627		0.1309		0.3227
		(0.183)		(0.248)		(0.211)
Arrived 1981–85		−0.1378		0.1666		0.5040**
		(0.144)		(0.206)		(0.197)
Arrived 1976–80		−0.0998		0.0802		0.2030
		(0.111)		(0.142)		(0.139)
Arrived 1966–70		0.0005		−0.2830**		0.0074
		(0.105)		(0.139)		(0.114)
Arrived 1961–65		−0.3759**		−0.5153**		−0.2961*
		(0.165)		(0.178)		(0.168)
Arrived 1956–60		−0.2605		−0.6674**		−0.6088**
		(0.219)		(0.246)		(0.231)
Arrived 1951–55		−0.1051		−0.5847*		−0.8355**
		(0.296)		(0.350)		(0.314)
Test of cohort effects (*p*-value)		0.0824		0.0429		0.0780
Test of all immigrant controls (*p*-value)	0.0000	0.0000	0.0401	0.0080	0.3571	0.0967
Pseudo-R^2	0.0260	0.0254	0.1150	0.1162	0.1001	0.1013
Sample size	66166	66166	66166	66166	66166	66166
(b) Selected results for Women—basic specification with controls for year of arrival and years since migration						
Foreign-born (FB)	−0.7121**	−0.5714*	−0.4634**	−0.8674**	−0.1954*	−0.0756
	(0.065)	(0.301)	(0.092)	(0.378)	(0.099)	(0.458)
Years since migration	0.0410**	0.0367**	0.0312**	0.0560**	0.0215**	0.0259
	(0.006)	(0.018)	(0.007)	(0.023)	(0.009)	(0.026)
YSM-squared	−0.0006**	−0.0006*	−0.0005**	−0.0009**	−0.0004**	−0.0007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Arrived 1996–01		−0.1311		0.3507		−0.0912
		(0.273)		(0.349)		(0.420)
Arrived 1991–95		−0.1860		0.2838		−0.1674
		(0.222)		(0.271)		(0.327)
Arrived 1986–90		−0.0411		0.1799		−0.1391
		(0.173)		(0.200)		(0.264)
Arrived 1981–85		0.0902		0.0511		−0.1713
		(0.133)		(0.149)		(0.202)
Arrived 1976–80		−0.1024		0.1848		0.0975
		(0.103)		(0.116)		(0.154)
Arrived 1966–70		−0.0343		−0.0269		0.0618
		(0.105)		(0.123)		(0.149)
Arrived 1961–65		0.1182		−0.0256		0.0939
		(0.154)		(0.200)		(0.179)
Arrived 1956–60		0.2481		−0.0002		0.2386
		(0.212)		(0.251)		(0.262)
Arrived 1951–55		0.1486		0.1653		0.5865
		(0.275)		(0.323)		(0.364)
Test of cohort effects (*p*-value)		0.2740		0.7195		0.5445
Test of all immigrant controls (*p*-value)	0.0000	0.0000	0.0000	0.0013	0.0274	0.2158
Pseudo-R^2	0.0330	0.0336	0.0631	0.0634	0.0946	0.0953
Sample size	73765	73765	73765	73765	73765	73765

Note 1: Type A conditions include allergies, asthma, backpain, high blood pressure, migraines, arthritis, ulcers, and bronchitis. Type B conditions include heart disease, cancer, Crohn's disease, diseases of the thyroid, and diabetes.

Note 2: *Denotes that the associated coefficient is individually significant at the 10% level. **Denotes that the associated coefficient is individually significant at the 5% level. Robust standard errors are in parentheses.

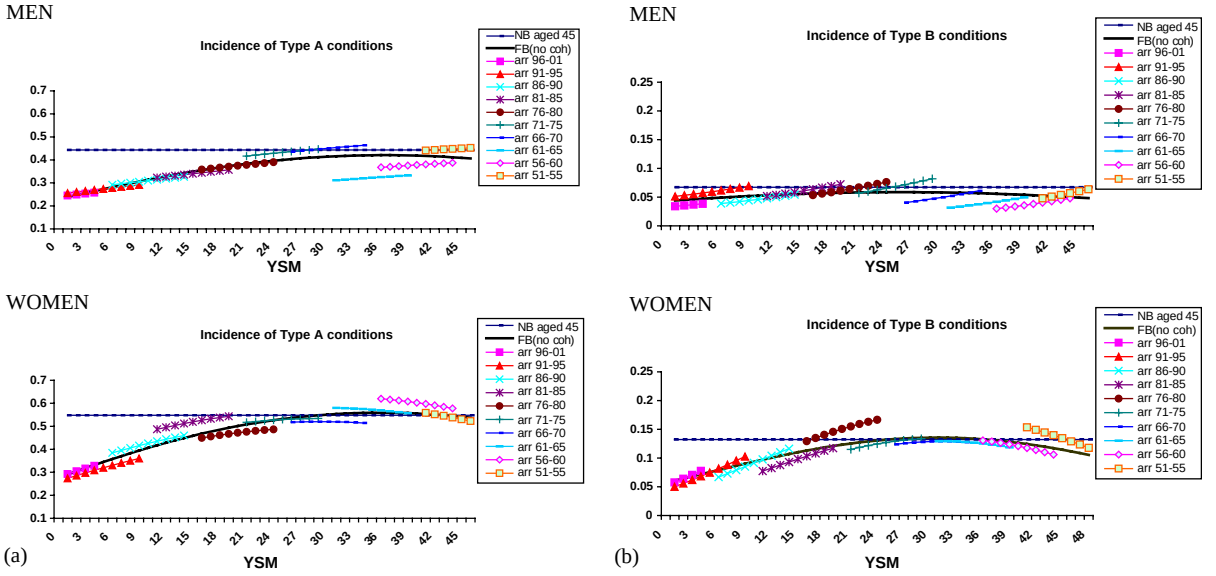

Fig. 1. (a) Predicted health status for immigrant men and women by YSM and period of arrival in Canada, graphed against a comparable native-born man and woman.

- Predictions are based on the basic specification outlined in Eq. (1) and presented in Tables 2 and 4.
- Predictions are for a 'baseline' individual who is 45-years-old, lives in Ontario outside of a CMA, speaks English, has a high-school education, does not receive dividend income, and lives in a rented house.

(b) Predicted health status for immigrant men and women by YSM and period of arrival in Canada, graphed against a comparable native-born man and woman.

- Notes as for Fig. 1a.

because the incidence of these conditions for new immigrants is only marginally below the native-born level. It is also notable that cohort effects again appear to be present for men arriving in the 1950s and 1960s. [5]

For self-assessed health, the relative incidence of 'fair' or 'poor' health for immigrant men and women is generally comparable to what is found for Type B conditions and so these figures are not reported. Recent immigrant men have marginally lower incidence of fair or poor health, and this changes only slightly with YSM. As well, immigrant men arriving prior to 1966 have better self-reported health than comparable native-born men. For immigrant women, the incidence of fair or poor self-assessed health is initially lower than for native-born women and increases with YSM before levelling off at a level that is marginally higher than for native-born women. Estimating the determinants of all five states of self-assessed health status jointly using an ordered Probit specification yields few new insights.

Region of birth and age at arrival

In this section, we report selected results from estimation of an expanded version of Eq. (1) that includes additional immigrant controls. Preliminary analysis suggested that the key distinction in health outcomes by region of origin is between immigrants arriving from countries that are predominantly English-speaking and culturally similar to Canada (UK, Ireland, USA, Australia and New Zealand—termed ESB), and immigrants arriving from other areas (mainly continental Europe and Asia—termed NESB).

As indicated in Table 3, significant differences by region of origin are found for Type A conditions but not for the other measures of health. (Specific coefficient estimates are available on request.) The estimated results are used to generate predicted YSM-health profiles for immigrants from ESB and NESB regions and these are illustrated in Fig. 2. For women, we predict health profiles without the inclusion of cohort effects, as these

[5] One caveat concerns the reliability of the self-reported incidence of chronic conditions, particularly for individuals out of the labour force, as discussed in Baker, Stabile and Deri (2001). A test of whether the results are sensitive to reporting errors is to re-estimate the main specifications using only the subsample of individuals who are currently working. For both men and women, results are qualitatively similar to what is reported.

Table 3
Tests of joint significance of selected sets of immigrant characteristics

	Type A condition (Probit)		Type B condition (Probit)		Fair/poor SAH (Probit)	
	Men	Women	Men	Women	Men	Women
Wald test for region of birth effects (*p*-value)	0.0035	0.0000	0.4071	0.8661	0.8362	0.1637
Wald test for age-at-arrival effects (*p*-value)	0.4150	0.5110	0.6776	0.1119	0.9265	0.0025

These results are based on estimation of Eq. (1) augmented with controls for region of birth and age at arrival as outlined in the text, and refer to the results of statistical tests that the specified sets of regressors are jointly insignificant. The null hypothesis is that immigrant health is not a significant function of age at arrival or country of origin after controlling for years since migration and period of arrival.

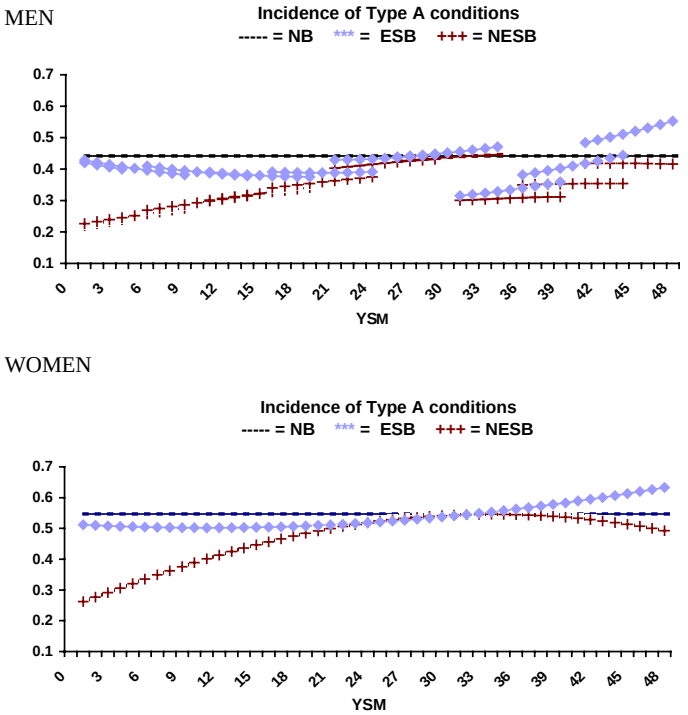

Fig. 2. Predicted health status for immigrant men and women by YSM, period of arrival in Canada, and region of origin.

- Notes as for Fig. 1a, except that predictions are based on the basic specification outlined in Eq. (1) plus with an indicator variable for a person who was born in an English-speaking country (ESB), plus interactions of ESB with YSM and YSM-squared.

continued to be jointly insignificant after including controls for region of origin.

Differences in the incidence of Type A conditions by region of origin are striking. Newly arrived immigrant men from ESB countries have very similar incidence of Type A conditions to comparable native-born levels, and there is little change with YSM. In particular, there is no pronounced increasing incidence in chronic conditions with additional years in Canada, although the cohort effects for immigrant men arriving prior to 1966 are present for both groups. Newly arrived immigrant women from ESB countries also exhibit incidence of Type A conditions that is very similar to (though marginally below) native-born levels and shows little change with YSM. Since ESB immigrants come from countries with similar culture and language to

Canada, they would be least likely to experience barriers to accessing healthcare after migration. At the same time, ESB immigrants are most similar to native-born Canadians in terms of health behaviours and come from countries with comparable health systems, demography, and environment.

Given the age restriction of the sample, earlier immigrant arrivals are more likely to have arrived as children compared to more recent arrivals. Thus, cohort effects might be reflecting differences across immigrants in age at arrival. Further, if arrival age is an important determinant of YSM effects then the cohort terms may be insufficiently flexible to capture these dynamics. However, including additional controls for age at arrival changes the reported results very little. Although Table 3 indicates that age at arrival significantly affects the incidence of fair/poor health for immigrant women, simulations indicate only minor differences in predicted health status between adult and child arrivals and so these results are not reported.

Extensions

Access to basic health services

One possible reason for the apparent decline in immigrant health in terms of chronic conditions is that for recent immigrants, chronic conditions may be more likely to go undiagnosed. This may be due to social, cultural or language differences that mean recent immigrants—particularly those from NESB regions—are less likely to interact with Canada's health system the same way that native-born Canadians do. However, with increasing years in Canada, these differences narrow as health services are utilized more widely and existing chronic conditions are more likely to be diagnosed. It should be noted however that recent Canadian studies of immigrants' use of health services by Chen et.al. (1996), Globerman (1998), and Laroche (2000) find that immigrants and native-born people exhibit similar rates of utilization of health services.

To investigate this possibility, we examine the relative incidence of three measures of the use of basic health services: does the respondent have a family doctor, did the respondent have a blood pressure test in the last 12 months, and has the respondent consulted with a doctor in the last 12 months. These measures should reflect general barriers to access of basic health services that might arise from language or social differences, or unfamiliarity with the Canadian health system. Also, given their broad importance to maintenance of good health, they should be less correlated with the incidence of health problems than other measures that reflect more specific use of health services.

For each measure, we estimate Probit models and use the results to generate predicted profiles of service use for an individual with the same 'base case' set of characteristics as before. In Fig. 3, we present predicted incidence of having a family doctor and consulting with a doctor in the last year, for immigrant and native-born men. (Results for women are similar.) While immigrant men have lower incidence of these measures on arrival in Canada, they exhibit relatively rapid convergence to native-born levels, closing the gap after around 6–8 years in Canada. Figures for blood pressure testing are reported in Fig. 4. The predicted incidence of a blood pressure test for a native born 'base case' individual is around 70% for women and 57% for men. Recently arrived immigrant men and women are both around 55–60% likely to have had a recent blood pressure test, and immigrant women are predicted to close the gap to the native-born level within 6–9 years in Canada. However, for immigrant men, there is no significant difference in the incidence of blood pressure testing between them and the native-born (p-value that all immigrant-specific variables are zero is 0.4071). That is, recent immigrant men have comparable incidence of blood pressure testing, and there is no change in this incidence with YSM.

These results indicate that immigrants' use of basic components of healthcare approaches native-born levels substantially faster than health outcomes converge to native-born levels. Thus, it does not seem that the declining health of immigrants with YSM is due to persistent barriers in *access* to health services, although it should be noted that there could still be differences in the diagnosis and treatment of possible health conditions because of cultural or language differences between patient and health care provider.

Incidence of specific chronic conditions

In this section, we discuss results from estimations where the dependent variable is the incidence of a specific chronic condition. Table 5 in the appendix reports results of significance tests of the immigrant variables, and indicates that significant differences are present for most specific chronic conditions. Predicted health profiles (not reported) indicate that the predicted incidence of almost all chronic conditions is lower for recent immigrant men and women than comparable native-born people. The only exceptions are diabetes (where incidence is higher for immigrants arriving between 1970 and 1985), migraines (where incidence is marginally higher for immigrant men), and high blood pressure (where incidence for immigrant women is comparable to native-born levels). Further, for recent female immigrants, the relative incidence of most chronic conditions increases with YSM. For recent male immigrants, this is true for a smaller

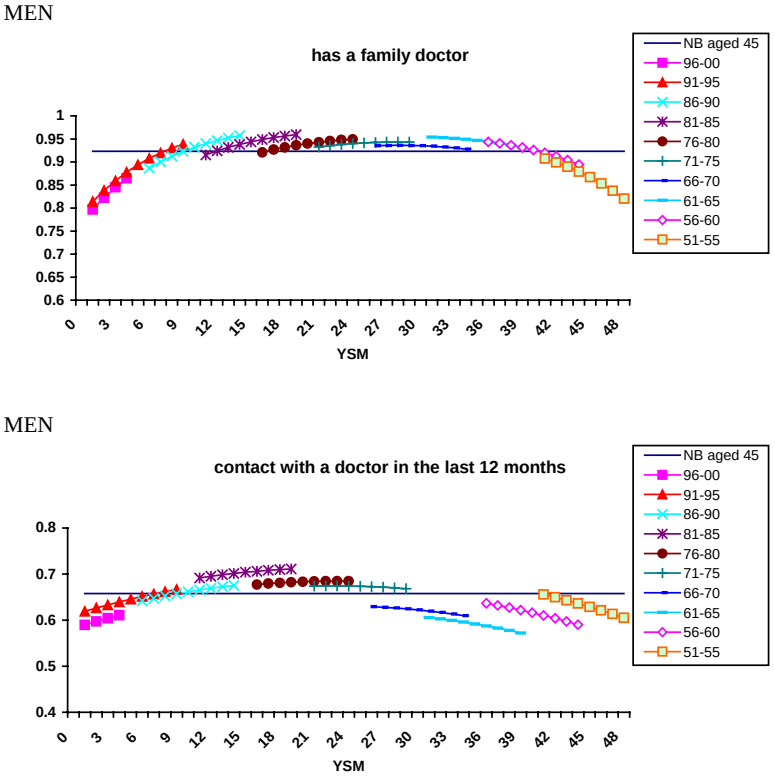

Fig. 3. Predicted incidence of basic health service use for immigrant men by YSM and period of arrival in Canada, graphed against a comparable native-born man.

- Notes as for Fig. 1a.

number of chronic conditions. However, for no chronic condition does relative incidence exhibit a significant decline.

Two results warrant additional discussion. First, it is notable that even though there is little change with YSM in the incidence of blood pressure testing for immigrant men, there is evidence that the incidence of high blood pressure increases with years in Canada. Similarly, there is marked increase with YSM in the incidence of a recent immigrant woman having a blood pressure test but no concomitant increase in the incidence of high blood pressure. The inconsistency between testing and incidence is some evidence against the notion that reduced barriers to health service use with YSM underpin changes in health. For example, if high blood pressure was more likely to go undiagnosed in recent immigrant arrivals, then one might expect the incidence of high blood pressure and the incidence of blood pressure tests to display a similar pattern. Second, when controls for broad region of birth are also included, the incidence of asthma and allergies among recent immigrant women from ESB countries is comparable to similar native-born women and indicates little change with YSM, while the incidence of other chronic conditions displays upward convergence with YSM to native-born levels. It is interesting to note that countries with some of the world's highest rates of asthma are these ESB countries: UK and Ireland, New Zealand, and Australia (Jenkins, 2002). This seems to suggest that environmental factors might explain at least some of the convergence in the incidence of chronic conditions.

Discussion

This analysis finds a number of robust results that give some insight into the determinants of immigrant health. First, there is compelling evidence of a healthy immigrant effect for recent immigrant arrivals, with both immigrant men and women significantly less likely to have been diagnosed with a chronic condition than otherwise comparable native-born Canadians. Immigrants also continue to be relatively less likely to have a chronic condition, even after many years in Canada. However, there is also evidence that the gap in health status between recent immigrants and native-born

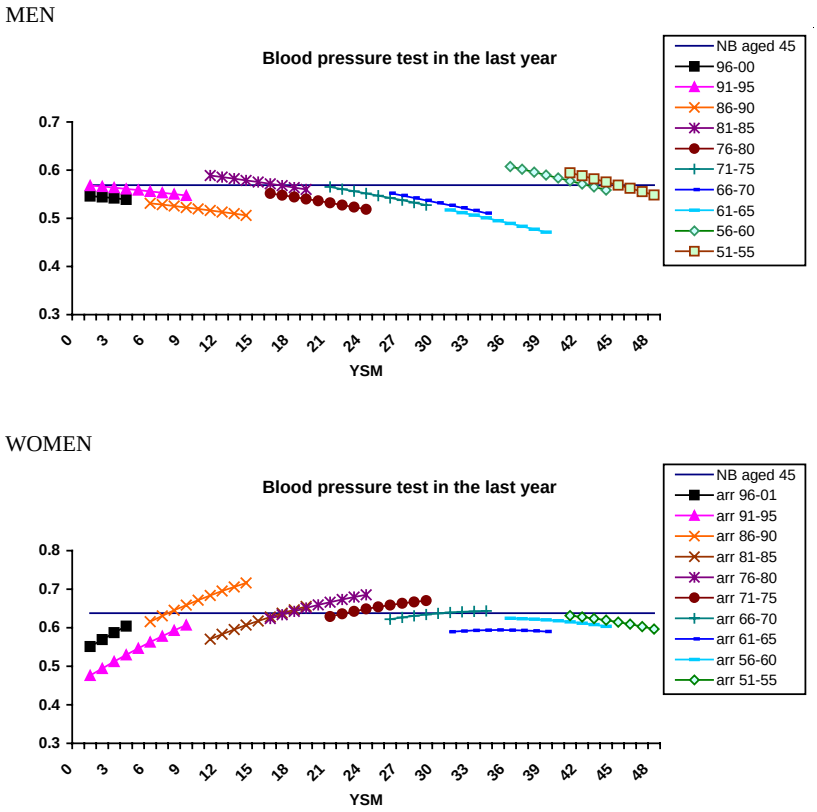

Fig. 4. Predicted incidence of basic health service use for immigrant men and women by YSM and period of arrival in Canada, graphed against a comparable native-born man and woman.

- Notes as for Fig. 1a.

Canadians narrows significantly (albeit slowly) with years in Canada. In the case of type A conditions, the incidence of chronic conditions approach native-born levels after approximately 20 years in Canada. Moreover, the overall pattern in health outcomes and health service use is one of convergence to native-born levels. For those measures where new immigrants have comparable values on arrival, there is typically little change with additional years in Canada.

There is also significant evidence of cohort effects for some specifications, i.e., year of arrival is an important determinant of health status, although the presence of these cohort effects is insufficient to explain the convergence in health with years since immigration. It was found that immigrant men who arrived in the 1950s and early 1960s are in better health than either more recent immigrants (for similar YSM) or the native-born, but the same is not true for immigrant women. The result is also robust to the inclusion of controls for age-at-arrival of the immigrants. In fact, Biddle et al., (2003) find similar results using pooled Australian data over the period 1989–2001.

One possible explanation for the apparent worsening of immigrant health with years in Canada (relative to comparable native-born Canadians) is that because of changes in social norms and increasing experience in the Canadian system, recent immigrants become increasingly likely to use the health system, and thus become more likely to be diagnosed as having chronic conditions even though underlying measures of physical health are comparable to native-born levels. However, results for basic health service use—rapid convergence to native-born levels—seem to be inconsistent with this hypothesis. A similar analysis of health behaviors—for example, smoking, alcohol consumption and diet—would give some direct insight into the appropriateness of the first hypothesis. Finally, it is interesting to note that there is relatively little change with YSM in fair or poor self reported health status, even though there are marked changes in the incidence of chronic conditions. An important caveat is that an immigrant's expectations about what constitutes 'good' or 'poor' health are also likely to evolve with years since immigration. This is an interesting area for further research.

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Appendix

Results for demographic and socio-economic variables are given in Table 4 and tests of joint significance of year of arrival and years since migration are give in Table 5.

Table 4
Results for demographic and socio-economic variables—specification 1 with controls for year of arrival and years since migration*

	Type A condition (Probit)		Type B condition (Probit)		Fair or poor health (Probit)	
	Men	Women	Men	Women	Men	Women
Age variables						
Age* (Age-group 21–29)	−0.0610	−0.0807**	−0.0526	−0.0392	−0.0075	−0.1297**
	(0.037)	(0.032)	(0.072)	(0.047)	(0.054)	(0.053)
Age^{2,*} (Age-group 21–29)	0.0020	0.0028**	0.0017	0.0014	0.0001	0.0044**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Age	−0.1781**	−0.1614**	−0.0572	0.0902	0.0448	−0.2152
	(0.085)	(0.076)	(0.191)	(0.108)	(0.128)	(0.119)
Age^2	0.0027**	0.0023**	0.0009	−0.0012	−0.0005	0.0032
	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Age* (Age-group 40–49)	0.0413**	0.0321	−0.0065	−0.0370	−0.0136	0.0344
	(0.021)	(0.019)	(0.044)	(0.026)	(0.031)	(0.028)
Age^{2,*} (Age-group 40–49)	−0.0011**	−0.0008	0.0002	0.0009	0.0004	−0.0008
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Age* (Age-group 50–59)	0.0528	0.0609**	0.0066	−0.0316	−0.0134	0.0840
	(0.032)	(0.029)	(0.070)	(0.041)	(0.049)	(0.045)
Age^{2*} (Age-group 50–59)	−0.0013	−0.0013	0.0000	0.0008	0.0004	−0.0018
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Age* (Age-group 60–65)	0.0854**	0.0793**	0.0503	−0.0469	0.0190	0.1306**
	(0.042)	(0.039)	(0.086)	(0.052)	(0.061)	(0.056)
Age^{2,*} (Age-group 60–65)	−0.0019**	−0.0016	−0.0007	0.0011	−0.0001	−0.0026**
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Age* (year 2000–01)	0.0061	0.0082	0.0006	−0.0095	−0.0114	−0.0066
	(0.011)	(0.010)	(0.021)	(0.013)	(0.015)	(0.013)
Age^{2,*} (year 2000–01)	−0.0001	−0.0001	0.0000	0.0001	0.0001	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education and Language						
Did not finish high school	0.0475	0.0800**	0.0991**	0.0727**	0.3762**	0.4425**
	(0.029)	(0.028)	(0.040)	(0.032)	(0.033)	(0.033)
Undergraduate degree	−0.0196	0.0451	−0.0399	−0.1245**	−0.2966**	−0.3520**
	(0.034)	(0.029)	(0.047)	(0.041)	(0.059)	(0.045)
Other post secondary	0.0688**	0.1099**	0.0510	0.0583	0.0162	0.0060
	(0.025)	(0.023)	(0.035)	(0.028)	(0.033)	(0.030)
Higher degree	−0.0646	0.1407**	−0.0479	−0.0455**	−0.4388**	−0.2374**
	(0.043)	(0.050)	(0.067)	(0.059)	(0.070)	(0.102)
Speaks French	−0.0835**	0.0491*	−0.0229	0.0312	−0.0037	−0.0214
	(0.027)	(0.027)	(0.039)	(0.033)	(0.036)	(0.034)
Speaks another language than French/English	−0.0421	−0.0310	−0.0290	0.0330	0.0561	0.1753**
	(0.031)	(0.029)	(0.040)	(0.037)	(0.042)	(0.0370)
Speaks neither French nor English	0.2198**	−0.1473	0.2180	0.0401	0.1534	0.1283
	(0.088)	(0.069)	(0.140)	(0.090)	(0.099)	(0.086)
Marital status and children						
Married	0.0612**	−0.0007	−0.0122	−0.0246	−0.1594**	−0.2006**
	(0.029)	(0.027)	(0.041)	(0.035)	(0.038)	(0.036)

Table 4 (*continued*)

	Type A condition (Probit)		Type B condition (Probit)		Fair or poor health (Probit)	
	Men	Women	Men	Women	Men	Women
Other marital status	0.1242**	0.0965**	-0.0129	0.0881	0.0501	0.0029
	(0.041)	(0.035)	(0.052)	(0.046)	(0.051)	(0.048)
Kids aged <11 at home	0.0316	−0.0256	−0.0335	0.0051	−0.0306	−0.0203
	(0.018)	(0.016)	(0.025)	(0.023)	(0.023)	(0.022)
Kids aged <6 at home	−0.0988**	0.0162	0.0088	0.0166	0.0070	−0.0443
	(0.026)	(0.023)	(0.040)	(0.033)	(0.036)	(0.033)
Proxy Variables for Permanent Income						
Owns own residence	−0.0598**	−0.0849**	−0.1042**	−0.0961**	−0.2712**	−0.2290**
	(0.029)	(0.028)	(0.045)	(0.035)	(0.035)	(0.033)
Received dividend income	0.0508	−0.0080	−0.0691**	−0.0098	−0.1491**	−0.2147**
	(0.030)	(0.026)	(0.034)	(0.031)	(0.041)	(0.038)
Semi-detached house	0.0072	0.0022**	0.0145	0.0046	0.0288	−0.0024
	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.007)
Apartment	0.0205	0.0799	0.0850	0.0160	−0.0095	0.0343
	(0.035)	(0.031)	(0.044)	(0.038)	(0.049)	(0.037)
Mobile home	−0.0128	0.0674	0.0625	0.0564	0.0533	0.0017
	(0.038)	(0.035)	(0.062)	(0.042)	(0.045)	(0.038)
Other type of dwelling	0.0654	0.0509	0.0078	0.1130	0.1459	0.3817**
	(0.066)	(0.064)	(0.090)	(0.083)	(0.075)	(0.092)
More than 5 bedrooms	−0.0118	0.1418	0.0917	0.0544	0.0126	0.0262
	(0.088)	(0.096)	(0.101)	(0.103)	(0.095)	(0.114)
More than 2 bedrooms	−0.1505	−0.2891	0.3267	0.0255	0.2095	0.1622
	(0.268)	(0.343)	(0.314)	(0.387)	(0.290)	(0.367)
Ethnicity						
Black ethnicity	0.0167	0.0258	−0.2052	−0.1210	−0.2270**	0.0932
	(0.089)	(0.071)	(0.109)	(0.093)	(0.115)	(0.115)
Asian ethnicity	−0.0064	−0.0790	−0.0487	−0.2134**	0.0987	−0.0301
	(0.055)	(0.054)	(0.088)	(0.079)	(0.082)	(0.081)
Native Canadian ethnicity	0.0541	0.1170	0.2716**	0.2039**	0.0261	0.4794
	(0.095)	(0.062)	(0.092)	(0.077)	(0.070)	(0.077)
Ethnicity not reported	0.0477	0.1181	0.1378	−0.1481	−0.1915	−0.1315
	(0.087)	(0.102)	(0.114)	(0.103)	(0.115)	(0.153)

*Other controls not reported include indicator variables for province and population size of region of residence, the current unemployment rate, and an indicator variable for 2001 plus interactions with age and age-squared.

**Denotes significant at the 5% level.

Table 5
Tests of joint significance of year of arrival and years since migration—specific chronic conditions (*p*-values)

Incidence of specific chronic condition	Men		Women	
	Cohort effects	Cohort and YSM effects	Cohort effects	Cohort and YSM effects
Type A				
Allergies	0.729	0.000	0.139	0.000
Asthma	0.154	0.000	0.495	0.000
Backpain	0.437	0.000	0.844	0.000
High blood pressure	0.243	0.019	0.945	0.469
Migraine	0.152	0.222	0.713	0.005
Ulcer	0.425	0.484	0.132	0.066
Arthritis	0.240	0.000	0.849	0.000
Bronchitis	0.067	0.032	0.557	0.000

Table 5 (*continued*)

Incidence of specific chronic condition	Men		Women	
	Cohort effects	Cohort and YSM effects	Cohort effects	Cohort and YSM effects
Type B				
Heart disease	0.129	0.251	0.013	0.026
Cancer	0.073	0.095	0.413	0.011
Diabetes	0.077	0.136	0.217	0.002
Crohn's disease	0.353	0.005	0.456	0.002
Thyroid	0.057	0.004	0.253	0.065

These results are based on estimation of Eq. (1) for the incidence of specific chronic conditions, and refer to the results of statistical tests that the specified sets of regressors are jointly insignificant.

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