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Different Outcomes for Different Health Measures in Immigrants: Evidence from a Longitudinal Analysis of the National Population Health Survey (1994–2006)

Maninder Singh Setia · Amelie Quesnel-Vallee · Michal Abrahamowicz · Pierre Tousignant · John Lynch

Abstract The response of immigrants to new societies is dynamic. There may be an initial period of happiness followed by peaks of stressful periods. These reactions along with socio-economic changes are likely to influence their health, which may start converging towards the average health of the host population. We used a longitudinal analysis to assess the differences in health outcomes (mental health and self-rated health), separately in men and women, in Canadian born and immigrants over a 12-year period (and the associated socio-economic factors). We used random effects logistic regression models for evaluation of these health outcomes in 3,081 men and 4,187 women from the National Population Health Survey (1994/95 to 2006/07). After adjusting for all the covariates, non-white immigrants were less likely to have severe psychological distress compared with the Canadian born individuals [odds ratio (OR) Men: 0.49, 95% confidence intervals (CI) 0.24–1.00, Women-OR: 0.54; 95% CI: 0.32–0.92]. Immigrant women (white and non-white) were more likely to rate their health as poor through this 12-year period than the Canadian born women (White-OR: 1.64, 95% CI: 1.17–2.64; Non-white-OR: 1.82, 95% CI: 1.01–3.28). Immigrants in the lowest income adequacy category reported higher psychological distress and poorer health than those in the highest income categories. We did not find any significant differences in the mental health and self-rated health of Canadian men and white male immigrants throughout this 12-year period. Though, non-white immigrant women were less likely to have severe psychological distress through this 12 year period, they were the ones most likely to rate their health as poor.

Keywords Immigrants · Mental health · Self-rated health · Longitudinal study

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Introduction

Immigrants constituted about 20% of the Canadian population according to the 2006 Census, thus making this group an important part of the Canadian population [1]. The process of immigration—regardless of the reason—is often stressful. However, the reaction to this process is often not linear and may be dynamic [2–6]. Brink and Saunders [7] have outlined the following four phases of experience in a new society: (1) honeymoon period—when the individual is very excited and wants to be a part of the new society; (2) disenchantment period—when the individual finds it hard to accept the ways of the society and has a feeling of being stuck in a different society; (3) resolution phase—when one adjusts to the realities of the new society; and (4) effective function phase—when the individual considers the new culture as own. These phases

may differentially affect the health of immigrants over time in the new adopted society.

Immigrants in a new social setting often experience loneliness and poverty, they may reside in neighbourhoods with poor resources and face discrimination. All these factors may influence the mental and physical health, more so in the ethnic visible minorities [8–11]. Authors have discussed that immigrants may have an initial stress free period for varying duration post immigration after which their distress levels are likely to peak [5, 6, 12–14]; whereas others have not found any specific euphoric or distress period post immigration [15]. Some authors have observed that overall immigrants have higher distress than the native population [16], even in the first 2 years post-immigration—thus negating the initial euphoric period [17]. Canadian studies have shown that immigrants who have spent fewer than 10 years in the adopted country are in better health (mental and general) than the host population; these health outcomes may become similar later, thus highlighting the importance of duration of stay as important predictor of health in immigrants [15, 18–21]. Other researchers have found socioeconomic factors to be more important in explaining the health of immigrants than non-immigrants [22]. Overall, however, studies comparing the health of immigrants and non-immigrants in Canada provide evidence both for and against the existence of the differences [22–25].

As immigrants adjust to the new societies their social and economic situation is likely to change. Even though, they may be at the lower end of the income scale they tend to move upwards and thus improve their economic conditions [26]. However, with increased time in the new countries they are also likely to report more chronic conditions [27]. Thus, all these changes are likely to influence the health of immigrants over time. Further, it is quite likely that these changes in socio-economic conditions may be experienced differently by male and female immigrants [28, 29].

Taking these perspectives into account, we designed a longitudinal study to assess the differences in health outcomes (mental health and self-rated health), separately in men and women, between immigrants and Canadian born over a 12-year period (and the associated socio-economic factors).

Methods

We identified immigrants and Canadian born individuals from the National Population Health Survey (NPHS). The NPHS is a nationally representative survey of individuals conducted by Statistics Canada and seeks to obtain information on socio-demographics, economic conditions, and health characteristics [30]. Detailed information on the

seven waves of the NPHS (every 2 years from 1994/95 to 2006/07) is provided elsewhere [31]. Our initial longitudinal sample comprised of 10,992 individuals; of these 8,968 were more than or equal to 18 years of age at baseline. We excluded 1,663 individuals who died during the course of the follow-up. Among the 7,235 living individuals, we excluded 33 subjects on whom data were unavailable for all the seven waves of data; thus, the final tally was of 3,081 males and 4,187 females for the present study. For the included subjects, we had 21,567 observations for males and 29,309 observations for females across these seven assessment times from 1994/5 to 2006/7.

Outcome Variables

We used these two measures of health:

(a) *Severe psychological distress*: The NPHS uses the Comprehensive International Diagnostic Interview (CIDI) to measure self reported psychological distress. A binary indicator was used for the present analysis; the cut-off for the binary outcome was a score of 4 or more, which is indicative of severe psychological distress (those who score 4 or higher have 0.80 probability of a clinical depression) [32–35].

(b) *Self-Rated Health*: This self-reported measure of health ranges from 1 to 5 (ranging from excellent health to poor health). We divided this scale into a binary one—those reporting excellent, very good, and good health were considered as reporting 'good health' and those reporting fair or poor health were considered as reporting 'poor health'.

Independent Variables Used in the Models

The main variable of interest was immigrant status (Canadian born, white immigrants, and non-white immigrants). Socio-demographic variables (age, educational level, marital status, living condition, province of residence), income adequacy categories (upper, upper-middle, lower-middle, lowest), linguistic capability (those able to communicate in French in Quebec, and in English in other provinces were considered to be linguistic majority), behavioural variables (alcohol, smoking, and physical activity), and calendar time variable were included in all the models. In addition, the presence of a chronic condition was used a covariate in the model for severe psychological distress. For self rated health, we used presence of a chronic condition, reporting an unmet health care need in the past 12 months, and having severe psychological distress as covariates in three different models. To understand the effect of time-since-immigration, we built models using only immigrants in the sample.

Statistical Analyses

All the analyses were stratified by gender. In the initial descriptive analyses we calculated the frequencies of severe psychological distress and poor self-rated health in all the immigrant groups and other covariates in the models.

We then applied random effects extensions of the logistic models for the repeated outcomes in the seven waves of our data, thus accounting for both the between- and within-subject correlation [36]. We initially built a null model with no covariates to obtain the individual level variance (level-2 variance). We then built univariate models for each of the independent variables. The third set consisted of complete models with all the covariates. We tested the interaction between immigrant type and calendar time. For self rated health, we built additional adjusted models, by using presence of a chronic condition; self reported unmet health care need; and presence of severe psychological distress; separately in addition to the initial covariates. The intra-class correlations (ICC) and Akaike information Criteria (AIC) were calculated for each of the models [36, 37]. We also performed a linear contrast test to assess the trends for severe psychological distress and poor health across the four income categories [38]. We had missing information for at least one variable in 10% of our observations. To account for these missing data, we used 'Multiple Imputations with Chained Equation' method and performed 20 imputations on the dataset [39, 40]. The estimates from these imputed data models and our original models were similar; the estimates in the imputed dataset models were less than one standard error compared with the original dataset models for the primary variable of interest (immigrant categories); hence, we refer to the original dataset with missing observations in this manuscript. We also performed sensitivity analyses and compared our results with the dataset that included males and females who were initially excluded because of death during the course of NPHS data collection. All the analyses including imputations (*ice* command) were performed using Stata (Version 10) (StataCorp, College Station, TX, USA) [41–43].

The study was approved by the Institutional Review Board of McGill University.

Results

In our sample of 3,081 men, 2,703 (88%) were Canadian-born and 378 (12%) immigrants, and among the 4,187 women, 88% were Canadian born and 12% were immigrants. There were 643 white immigrants (266 males and 377 females) and 226 non-white immigrants (112 males and 114 females) in the sample. At baseline (1994/95), about 35% of Canadian born, 38% of white immigrants,

and 44% of non-white immigrants reported graduate-level education. About 21% of non-white immigrants were in the lowest income category at baseline versus 18% and 15% for the Canadian born and white immigrants respectively. Details about the baseline characteristics of this cohort are provided elsewhere [44].

Severe Psychological Distress

The unadjusted and adjusted estimates along with the ICCs and AICs for reporting severe psychological distress are shown in Table 1. As can be seen, the unadjusted estimates indicate that white male immigrants and non-white female immigrants were less likely to have severe psychological distress than the Canadian born individuals. However, after adjusting for all the covariates, only non-white immigrants (both male and female) were less likely to have severe psychological distress compared with the Canadian born population. The likelihood of reporting severe psychological stress increased with year of data collection in both men [odds ratio (OR): 1.03, 95% confidence intervals (CI) 1.00–1.05] though a similar secular trend was not observed in women (OR: 1.00, 95% CI: 0.98–1.01). The probability of having severe psychological distress increased with decreasing income adequacy in both men and women (*P* < 0.001 for test for trend); thus, the men and women in the lowest income category were most likely to have severe psychological distress (Males-OR: 1.99, 95% CI: 1.38–2.86; Females-OR: 1.45, 95% CI: 1.14–1.85). Adjusting for all other covariates, men and women who had a chronic condition were more likely have severe psychological distress than those without it (Males-OR: 2.01, 95% CI: 1.63–2.48; Females-OR: 1.89, 95% CI: 1.62–2.20).

The interaction between immigrant type and calendar time was not significant in males and females; thus the association in these groups did not change with time.

Self-Rated Health

The estimates from the self-rated models (unadjusted and adjusted), ICCs and AICs are shown in Tables 2 and 3. As seen in the tables, after adjusting for all covariates, the odds of reporting poor health in male immigrants (white and non-white) were similar to the Canadian born males (Table 2, Adjusted Model I). In contrast, immigrant women (both white and non-white) were more likely to report poor health than Canadian born women. The odds of reporting poor health increased with age; additionally a secular trend was also observed i.e., the prevalence of reporting poor health increased with each calendar year. After adjusting for presence of a chronic condition, the odds of reporting poor health did not change much in male immigrants (both white and non-white). In contrast, the odds for reporting poor

Table 1 Random effects models showing the Crude and Adjusted estimates of odds ratios (OR) and their 95% confidence intervals (CI) for 'severe psychological distress' in 3,081 males and 4,187 females in Canada (1994–2006)

	Crude estimates		Adjusted estimates	
	Males OR (95% CI)	Females OR (95% CI)	Males OR (95% CI)	Females OR (95% CI)
Immigrant status				
Canadian born	Reference	Reference	Reference	Reference
White immigrants	0.53 (0.33, 0.85)	0.77 (0.58, 1.03)	0.73 (0.46, 1.17)	0.94 (0.71, 1.25)
Non-white immigrants	0.55 (0.27, 1.11)	0.55 (0.32, 0.94)	0.49 (0.24, 1.00)	0.54 (0.32, 0.92)
Age categories				
18–34 years	Reference	Reference	Reference	Reference
35–54 years	0.73 (0.58, 0.92)	0.83 (0.71, 0.97)	0.69 (0.53, 0.89)	0.86 (0.73, 1.01)
55–74 years	0.38 (0.28, 0.52)	0.47 (0.39, 0.57)	0.30 (0.21, 0.42)	0.43 (0.34, 0.54)
≥75 years	0.18 (0.09, 0.36)	0.19 (0.14, 0.27)	0.11 (0.05, 0.23)	0.13 (0.09, 0.20)
Time	1.00 (0.98, 1.02)	1.04 (1.02, 1.05)	1.03 (1.00, 1.05)	1.00 (0.98. 1.01)
Marital status				
Single	Reference	Reference	Reference	Reference
Married	0.44 (0.34, 0.57)	0.47 (0.39, 0.57)	0.69 (0.47, 1.01)	0.84 (0.64, 1.11)
Separated	1.08 (0.77, 1.52)	0.79 (0.64, 0.98)	1.41 (0.99, 2.00)	1.11 (0.89, 1.40)
Income category				
Highest	Reference	Reference	Reference	Reference
Upper middle	1.13 (0.90, 1.42)	1.23 (1.04, 1.45)	1.08 (0.85, 1.37)	1.11 (0.94, 1.33)
Lower middle	1.30 (1.00, 1.70)	1.49 (1.24, 1.78)	1.30 (0.97, 1.74)	1.32 (1.08, 1.61)
Lowest	2.33 (1.68, 3.23)	1.83 (1.49, 2.25)	1.99 (1.38, 2.86)*	1.45 (1.14, 1.85)**
Education				
Primary	Reference	Reference	Reference	Reference
Secondary	1.02 (0.68, 1.54)	1.20 (0.93, 1.58)	1.10 (0.74, 1.66)	1.05 (0.81, 1.37)
Post-secondary	1.37 (0.98, 1.91)	1.58 (1.27, 1.98)	1.40 (1.00, 1.96)	1.20 (0.96, 1.50)
Graduate	1.21 (0.88. 1.66)	1.32 (1.07, 1.63)	1.46 (1.04, 2.03)	1.15 (0.92, 1.44)
Province of residence				
Other provinces	Reference	Reference	Reference	Reference
Ontario	0.91 (0.68, 1.23)	0.97 (0.80. 1.18)	1.02 (0.76, 1.37)	1.03 (0.85, 1.24)
Quebec	1.29 (0.94, 1.77)	1.00 (0.80, 1.24)	1.38 (0.97, 1.97)	0.97 (0.76, 1.23)
British Columbia	1.50 (1.03, 2.20)	1.34 (1.05, 1.72)	1.68 (1.16, 2.44)	1.42 (1.14, 1.85)
Linguistic major				
No	Reference	Reference	Reference	Reference
Yes	1.14 (0.78, 1.68)	0.96 (0.74, 1.24)	1.42 (0.91, 2.22)	1.00 (0.98, 1.01)
Has a chronic condition				
No	Reference	Reference	Reference	Reference
Yes	1.68 (1.37, 2.06)	1.62 (1.40, 1.88)	2.01 (1.63, 2.48)	1.89 (1.62, 2.20)
Intra-class correlation (rho)			0.34	0.21
AIC			5680.7	12309.5
Interaction terms				
White immigrant × time			NS	NS
Non-white immigrant × time			NS	NS

The adjusted models also include living conditions, and behavioural variables (smoking, alcohol use, and physical exercise)

* Test for linear trend: $P < 0.001$

** Test for linear trend: $P = 0.001$

Table 2 Random effects models showing the Crude and Adjusted estimates of odds ratios (OR) and their 95% confidence intervals (CI) for self rated health in 3,081 males in Canada (1994–2006)

	Unadjusted estimates OR (95% CI)	Adjusted Model I OR (95% CI)	Adjusted Model II OR (95% CI)	Adjusted Model III OR (95% CI)	Adjusted Model IV OR (95% CI)
Immigrant status					
Canadian born	Reference	Reference	Reference	Reference	Reference
White immigrants	1.14 (0.74, 1.74)	1.02 (0.68, 1.53)	1.02 (0.69, 1.50)	1.03 (0.69, 1.54)	1.04 (0.70, 1.56)
Non-white immigrants	1.16 (0.61, 2.19)	1.36 (0.75, 2.48)	1.43 (0.81, 2.54)	1.39 (0.77, 2.50)	1.48 (0.81, 2.64)
Age categories					
18–34 years	Reference	Reference	Reference	Reference	Reference
35–54 years	2.20 (1.67, 2.90)	1.82 (1.34, 2.45)	1.63 (1.21, 2.19)	1.82 (1.35, 2.45)	1.86 (1.37, 2.52)
55–74 years	6.35 (4.69, 8.59)	2.92 (2.05, 4.12)	2.31 (1.64, 3.26)	3.01 (2.13, 4.25)	3.29 (2.30, 4.64)
≥75 years	19.3 (13.2, 28.2)	4.29 (2.70, 6.79)	3.18 (2.02, 4.99)	4.57 (2.89, 7.22)	4.98 (3.14, 7.90)
Time	1.11 (1.09, 1.12)	1.09 (1.07, 1.11)	1.07 (1.05, 1.09)	1.08 (1.06, 1.10)	1.08 (1.06, 1.10)
Education					
Primary	Reference	Reference	Reference	Reference	Reference
Secondary	0.22 (0.15, 0.32)	0.47 (0.32, 0.69)	0.49 (0.34, 0.71)	0.48 (0.33, 0.69)	0.47 (0.32, 0.69)
Post-secondary	0.28 (0.21, 0.38)	0.58 (0.42, 0.78)	0.58 (0.43, 0.78)	0.57 (0.42, 0.77)	0.57 (0.42, 0.78)
Graduate	0.19 (0.14, 0.25)	0.47 (0.35, 0.65)	0.49 (0.36, 0.65)	0.46 (0.34, 0.63)	0.47 (0.34, 0.63)
Income category					
Highest	Reference	Reference	Reference	Reference	Reference
Upper middle	1.53 (1.24, 1.87)	1.70 (1.37, 2.12)	1.73 (1.39, 2.15)	1.67 (1.34, 2.09)	1.69 (1.35, 2.11)
Lower middle	2.41 (1.92, 3.04)	2.55 (1.97, 3.30)	2.54 (1.96, 3.28)	2.50 (1.93, 3.24)	2.53 (1.95, 3.28)
Lowest	4.56 (3.45, 6.03)	5.53 (4.02, 7.60)*	5.40 (3.93, 7.40)	5.40 (3.94, 7.42)	5.23 (3.83, 7.25)
Marital status					
Single	Reference	Reference	Reference	Reference	Reference
Married	1.13 (0.86, 1.49)	0.93 (0.62, 1.40)	0.84 (0.56, 1.26)	0.94 (0.62, 1.41)	0.92 (0.61, 1.39)
Separated	1.73 (1.21, 2.46)	0.82 (0.56, 1.19)	0.76 (0.52, 1.10)	0.82 (0.56, 1.19)	0.81 (0.55, 1.18)
Province					
Other provinces	Reference	Reference	Reference	Reference	Reference
Ontario	0.69 (0.52, 0.93)	1.05 (0.79, 1.39)	1.04 (0.79, 1.36)	1.05 (0.80, 1.40)	1.06 (0.80, 1.40)
Quebec	0.57 (0.41, 0.81)	0.60 (0.42, 0.87)	0.67 (0.47, 0.95)	0.61 (0.43, 0.88)	0.59 (0.41, 0.85)
British Columbia	0.81 (0.54, 1.20)	1.10 (0.75, 1.61)	1.12 (0.78, 1.63)	1.09 (0.74, 1.59)	1.07 (0.73, 1.57)
Linguistic major					
No	Reference	Reference	Reference	Reference	Reference
Yes	1.51 (1.06, 2.16)	1.03 (0.68, 1.57)	1.04 (0.69, 1.58)	1.04 (0.68, 1.58)	0.99 (0.65, 1.51)
Has a Chronic condition					
No	Reference		Reference		
Yes	5.92 (4.84, 7.25)		4.41 (3.56, 5.45)		
Has an 'Unmet health care need'					
No	Reference			Reference	
Yes	2.67 (2.16, 3.30)			2.67 (2.11, 3.35)	
Has severe psychological distress					
No	Reference				Reference
Yes	5.44 (4.13, 7.15)				5.81 (4.36, 7.75)
Intra-class correlation (rho)		0.56	0.51	0.55	0.55
AIC		8816.6	8603.9	8752.1	8626.3
Interaction terms					
White immigrant × time		NS			
Non-white immigrant × time		NS			

The adjusted models also include living conditions, and behavioural variables (smoking, alcohol use, and physical exercise)

* Test for linear trend: $P < 0.001$

Table 3 Random effects models showing the Crude and Adjusted estimates of odds ratios (OR) and their 95% confidence intervals (CI) for self rated health in 4,187 females in Canada (1994–2006)

	Unadjusted estimates OR (95% CI)	Adjusted Model I OR (95% CI)	Adjusted Model II OR (95% CI)	Adjusted Model III OR (95% CI)	Adjusted Model IV OR (95% CI)
Immigrant status					
Canadian born	Reference	Reference	Reference	Reference	Reference
White immigrants	2.17 (1.54, 3.05)	1.64 (1.17, 2.30)	1.65 (1.19, 2.27)	1.65 (1.19, 2.30)	1.65 (1.19, 2.30)
Non-white immigrants	1.90 (1.05, 3.43)	1.82 (1.01, 3.28)	2.02 (1.15, 3.54)	1.94 (1.09, 3.45)	1.95 (1.10, 3.47)
Age categories					
18–34 years	Reference	Reference	Reference	Reference	Reference
35–54 years	1.73 (1.41, 2.14)	1.45 (1.16, 1.82)	1.36 (1.08, 1.70)	1.47 (1.17, 1.84)	1.48 (1.18, 1.86)
55–74 years	4.17 (3.27, 5.31)	2.01 (1.51, 2.67)	1.64 (1.24, 2.17)	2.11 (1.59, 2.80)	2.16 (1.63, 2.86)
≥75 years	11.81 (8.88. 15.69)	2.44 (1.70, 3.51)	1.91 (1.34, 2.73)	2.67 (1.86, 3.83)	2.78 (1.93, 3.99)
Time	1.08 (1.07, 1.09)	1.07 (1.05, 1.08)	1.05 (1.04, 1.07)	1.06 (1.04, 1.07)	1.07 (1.05, 1.08)
Education					
Primary	Reference	Reference	Reference	Reference	Reference
Secondary	0.26 (0.19, 0.36)	0.48 (0.35, 0.66)	0.52 (0.39, 0.71)	0.50 (0.36, 0.68)	0.49 (0.36, 0.66)
Post-secondary	0.27 (0.21, 0.35)	0.49 (0.38, 0.64)	0.50 (0.39, 0.64)	0.48 (0.37, 0.62)	0.49 (0.38, 0.63)
Graduate	0.14 (0.11, 0.18)	0.35 (0.26, 0.45)	0.37 (0.28, 0.47)	0.34 (0.26, 0.45)	0.34 (0.26, 0.45)
Income category					
Highest	Reference	Reference	Reference	Reference	Reference
Upper middle	1.71 (1.40, 2.09)	1.58 (1.27, 1.95)	1.59 (1.29, 1.97)	1.57 (1.27, 1.94)	1.56 (1.26, 1.93)
Lower middle	2.89 (2.34, 3.57)	2.16 (1.70, 2.75)	2.20 (1.74, 2.79)	2.16 (1.70, 2.74)	2.10 (1.66, 2.67)
Lowest	5.03 (3.99, 6.34)	3.66 (2.78, 4.82)*	3.68 (2.80, 4.83)	3.57 (2.72, 4.70)	3.52 (2.68, 4.64)
Marital status					
Single	Reference	Reference	Reference	Reference	Reference
Married	1.01 (0.79, 1.30)	0.87 (0.61, 1.26)	0.87 (0.61, 1.25)	0.89 (0.62, 1.28)	0.85 (0.59, 1.23)
Separated	3.14 (2.40, 4.10)	1.31 (0.97, 1.76)	1.23 (0.92, 1.65)	1.28 (0.95, 1.72)	1.33 (0.99, 1.79)
Province					
Other provinces	Reference	Reference	Reference	Reference	Reference
Ontario	0.94 (0.73, 1.20)	1.11 (0.87, 1.43)	1.10 (0.87, 1.39)	1.11 (0.87, 1.42)	1.12 (0.87, 1.42)
Quebec	0.72 (0.54, 0.96)	0.83 (0.61, 1.12)	0.89 (0.67, 1.20)	0.83 (0.62, 1.12)	0.84 (0.62, 1.13)
British Columbia	1.08 (0.78, 1.49)	1.33 (0.96, 1.84)	1.30 (0.95, 1.78)	1.30 (0.95, 1.79)	1.25 (0.91, 1.73)
Linguistic major					
No	Reference	Reference	Reference	Reference	Reference
Yes	1.35 (1.00, 1.81)	1.21 (0.85, 1.71)	1.21 (0.86, 1.70)	1.23 (0.87, 1.74)	1.20 (0.85, 1.71)
Has a chronic condition					
No	Reference		Reference		
Yes	6.57 (5.34, 8.09)		5.28 (4.24, 6.58)		
Has an 'Unmet health care need'					
No	Reference			Reference	
Yes	2.99 (2.55, 3.51)			3.19 (2.68, 3.80)	
Has severe psychological distress					
No	Reference				Reference
Yes	2.71 (2.28, 3.23)				3.18 (2.65, 3.82)
Intra-class correlation (rho)		0.61	0.57	0.60	0.59
AIC		13596.7	13176.6	13431.2	13349.9
Interaction terms					
White immigrant × time		NS			
Non-white immigrant × time		NS			

health increased in non-white immigrant women, though it remained steady in white immigrant women. Similarly, after adjusting for presence of an unmet health care need and severe psychological distress, the odds of reporting poor health increased only in non-white immigrant women. In general, men and women in the lowest income adequacy categories were more likely to report poor health; the probability increasing with decreasing income adequacy ($P < 0.01$, test for trend across the income categories). After adjusting for all other features, men and women with a chronic condition, presence of severe psychological distress, and those reporting an unmet health care need were more likely to report poor health than those without them. We did not find the interaction between immigrant type and calendar time to be statistically significant.

The difference in the estimates from models that included dead individuals (men and women) and our original models (excluding dead individuals) was less than one standard error for the primary variables of interest (data not shown here).

Immigrant Only Models

After adjusting for all other individual factors and time-since-immigration, we found that female immigrants were more likely than men to report severe psychological distress (OR: 2.29, 95% CI: 1.43–3.67). They were also more likely than men to report poor health than men, the odds was not statistically significant (OR: 1.47, 95% CI: 0.97–2.22). Non-white immigrants were less likely to report severe psychological distress (OR: 0.58, 95% CI: 0.32–1.04), yet more likely to report poor health than White immigrants (OR: 1.33, 95% CI: 0.78–2.28), although these differences were not statistically significant. As with the general population, immigrants in the lowest income adequacy categories were more likely to report severe distress and poor health than those in the highest category (Severe distress-OR: 1.94, 95% CI: 0.97–3.86; Poor health-OR: 5.40, 95% CI: 3.23–8.83). After adjusting for all individual characteristics, immigrants who had severe psychological distress were more likely to report their health as poor (OR: 7.69, 95% CI: 4.72–12.52); the odds was higher than that observed in the complete cohort.

The interaction terms: time-since-immigration, and immigrant type, sex, and age, were not statistically significant.

Discussion

Visible minority immigrants (men and women) were less likely to have severe psychological distress than Canadian born individuals. Female immigrants (both white and non-white) were more likely to report poor health than the Canadian-born women throughout this 12 year period. There was little evidence of differences in reporting of severe psychological distress or poor health in white immigrant men and Canadian born men. Immigrants in the lowest income adequacy categories were more likely to report psychological distress and poor health than those in the highest category.

Various authors have stated that though immigrants may have better psychological health initially, they start reporting poor psychological health as they settle in the new adopted country. Smith and co-workers in the 2000/01 Canadian Community Health Survey (CCHS) found that immigrants who had spent less than 10 years in Canada (both men and women) reported lower depression than those who were in Canada for more than 10 years [45]. A more recent analysis of the 2005 CCHS survey found that though visible minorities were less likely than the to have poor mental health in the first 9 years of their time spent in Canada than the Canadian born, the odds became similar for those immigrants who have been in Canada for 10 years or more [19]. However, in our analyses over these 12 years we found that non-white immigrants (males and females) were generally less likely to report poor psychological health. Among immigrants, we found that women were more likely to report severe psychological distress than men. Female immigrants, who are not often the decision makers for immigration, in general are more likely to report more psychological distress [46]. Immediately after immigration they often do not have to face the labour market and may thus be protected in the home environment; where they interact only with the family members and friends. However, in the long run this may be harmful to the mental health of women as they may not integrate well the adopted society [47]. Though immigrant women had higher distress compared to immigrant men, the non-white immigrant women had lower psychological distress when compared with the Canadian born women throughout the 12 year period in our study. These women, particularly the elderly women, often have better mental health in traditional family structures [48]. They also are likely to develop their own coping mechanisms using the traditional beliefs and cultural norms, and some form of acceptance to perceived stressors; they may develop resilience for stressful life conditions [49–51]. However, these women are less likely to access mental health services, due to personal beliefs and perceived barriers in the health care system [52, 53]. Thus, they still are an important group for improving mental health in the population.

Interestingly enough, non-white immigrant women were less likely to have severe psychological distress, but they were most likely to rate their health as poor compared to

the Canadian born women. White immigrant women were also more likely to rate their health as poor than Canadian born women, although the odds was slightly lower than the non-white immigrant women. After adjusting for health parameters (such as presence of chronic condition, unmet health care need, and severe psychological distress) the likelihood of rating one's health poor increased in the non-white females whereas there was not much of change in the white immigrant women—suggesting that the self-rated health in non-white immigrant women is poorer than what can be explained by these health conditions. The process of immigration may render women vulnerable, particularly if they are accompanying spouses and not the principal applicant [28, 54]. Often due to the difficulties in accessing the labour markets in the adopted countries women, particularly non-white immigrant women, tend to engage in household work and some of these women may actually slide down on the occupational scale [55]. Even if they are able to access the labour market, their status in the labour market is often lower than those of other women in the adopted country or other ethnic majority groups and thus may be disadvantaged [56, 57]. Llácer and coworkers have stated that non-white immigrant women may face "triple discrimination—immigrants, minorities, and women" [28].

We did not find any significant differences in mental and self-rated health between Canadian and white immigrant men. Interestingly in our previous analyses, we found that non-white immigrant women had a lower body mass index compared to the Canadian born women [31]. There was also little evidence that they have poorer access to a regular doctor in Canada and they were least likely to report an unmet health care need in the past 12 months [44]. In the current analysis, they seem to have a lower prevalence of severe psychological distress than the Canadian born women. Yet, they are most likely to rate their health as poor while answering the question on self-rated health—a more global measure of health. Thus, if we take into account some of the tangible health outcomes as discussed above, non-white immigrant women appear to do well. However, they fare the worst on the self-rated measure of health—possible other immigration specific experiences (such as gender specific roles, labour market issues or discrimination) may be partially responsible for the poor self-rated health in these women [28, 58].

The present set of analyses was not without its limitations. Self-rated health may be considered to be a soft health outcome and authors have also expressed reservations about interpretation of health in different settings, including the reliability and validity of this outcome measure [59–61]. However, researchers have also argued that this measure may represent a cognitive appreciation of health status and is a good predictor of morbidity and mortality in the population [62–65]. We used a repeated measure of self-rated health; it has been shown that prior self-rated health trajectories may be associated with mortality by their influence on the current measure of health [66]. Thus its use over time in individuals may be better than using it to compare across populations Similarly CIDI measures non-specific psychological distress sensitively, particularly in community based surveys [34, 67]. All the classes of immigrants were treated as one category (economic, family, and refugees) as we did not have information on the specific reasons for immigration. Refugees may be more likely to have poor mental and overall health. Given the relatively small proportion of refugees in the immigrant population (they formed about 8% of the total immigrants to Canada in 2008), we do not expect them to form a substantial part of this sample. Also, grouping non-white immigrants in one category underestimates the heterogeneity of this group. However, small numbers prevented us from sub-grouping these immigrants.

Despite these limitations, the study—from a national source with the longest duration of follow-up—provides useful information. By analysing these 12-year data longitudinally, we account for the repeated measures of health outcomes in individuals (within- and between-individual correlations). Thus, they cannot be accounted for as a one-off health status report in a single wave, but a reflection of poor health over a period of time. We did not find any evidence of significant differences in the mental health and self-rated health of Canadian men and white immigrants throughout this 12-year period. Non-white immigrants (both male and female) were less likely to have severe psychological distress than Canadian born individuals. Female immigrants (both white and non-white) were more likely to rate their health poorer than Canadian born women. Though, non-white immigrant women were less likely to have severe psychological distress through this 12 year period, they were the ones most likely to rate their health as poor.

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