

# Ethnicity and Postmigration Health Trajectory in New Immigrants to Canada

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Over the past 4 decades, immigrant health research has exposed 2 major contradictions to the classic models of assimilation, which have traditionally focused on the stressful process of migration and postmigration settlement and acculturation.<sup>1-3</sup> The assimilation models make 2 major immigrant health claims: (1) arriving immigrants are at risk for physical and mental illness and are thus likely to burden the receiving nation with extra health care costs, and (2) immigrant health improves over time and across generations, following the increasing degree of acculturation. Although these claims may initially appear to be intuitive and have been supported by early immigrant research,<sup>3</sup> research over the past few decades has refuted the major health premises of assimilation models.

One major finding is the healthy immigrant effect, wherein newly arrived immigrants, at least in Australia and North America, show health advantages over native-born populations on most core indicators of health, including mortality, morbidity, disability, and mental disorders.<sup>4-10</sup> The current literature on immigrant health has shown that the immigrant health advantage dissipates over years and across generations, although core settlement indicators such as language, cultural traits, and education increase among both the immigrant groups and their children.<sup>4-6,11-13</sup> These results not only contradict the health trajectory proposed by assimilation models but also raise serious concerns regarding equity in national health care policies.

A plethora of scientific literature on immigrant health has suggested significant variations in postmigration health across immigrant groups from a variety of backgrounds. Furthermore, reported declines in health over years of residence in Canada and across generations may be found only among racial/ethnic minority immigrants.<sup>14,15</sup> Some studies have found that immigrants appear to report significantly higher rates of poor self-rated health than native-born, nonimmigrant

**Objectives.** In this prospective cohort study, we examined the trajectory of general health during the first 4 years after new immigrants' arrival in Canada. We focused on the change in self-rated health trajectories and their gender and ethnic disparities.

**Methods.** Data were derived from the Longitudinal Survey of Immigrants to Canada and were collected between April 2001 and November 2005 by Statistics Canada. We used weighted samples of 3309 men and 3351 women aged between 20 and 59 years.

**Results.** At arrival, only 3.5% of new immigrants rated their general health as poor. Significant and steady increases in poor health were revealed during the following 4 years, especially among ethnic minorities and women. Specifically, we found a higher risk of poor health among West Asian and Chinese men and among South Asian and Chinese women than among their European counterparts.

**Conclusions.** Newly arrived immigrants are extremely healthy, but the health advantage dissipates rapidly during the initial years of settlement in Canada. Women and minority ethnic groups may be more vulnerable to social changes and postmigration settlement. (*Am J Public Health.* 2013;103:e96-e104. doi:10.2105/AJPH.2012.301185)

populations,<sup>9,14,16</sup> which is contrary to research findings on chronic health conditions, life expectancy, and disability.<sup>15,17,18</sup> With regard to self-rated health, research findings have also shown complex variations in immigrant health across ethnicity or place of origin. Some studies have observed that in comparison with Canadian-born individuals, non-European immigrants were twice as likely and European immigrants were less likely to report poor health.<sup>8,19,20</sup> Kobayashi et al.<sup>21</sup> found that Black and French immigrants had better self-rated health than native-born Canadians, and South Asian and Chinese immigrants had poorer health. Other researchers found no health differences between immigrants and the Canadian-born population<sup>22-24</sup> and no ethnic health variation.<sup>25,26</sup> It is possible that these studies contradict the assumption of healthy immigrant status because they included immigrants who had been settled longer and had experienced a decline in health over the years. Although understanding the health trajectory is a foundation for effectively addressing how ethnic health disparities are shaped, current

research has been limited when attempting to fully account for the complexity of the immigrant health trajectory, especially self-rated health, over time.<sup>18,19,27</sup> In Canada, the observations of the healthy immigrant effect and its decline phenomenon have been widely accepted in self-rated health<sup>18,19,27,28</sup>; however, research on the self-rated health trajectory of immigrants has been far more limited, especially in findings from longitudinal studies and in the area of gender and ethnic health disparities.

A few existing longitudinal studies from Germany and Australia have confirmed the healthy immigrant effect and its decline toward native-born levels within 5 years after arrival.<sup>29,30</sup> However, 1 US longitudinal study did not find this effect among relatively recent elderly immigrants; in addition, the health decline was not significantly different from that of nonimmigrants.<sup>31</sup> Although a Canadian longitudinal immigrant study also did not demonstrate any meaningful differences in decline in health for immigrants according to country of origin,<sup>32</sup> most studies have suggested that

recent non-European immigrants (visible minorities and refugees) were more likely than Canadian-born individuals to experience declines in self-rated health over time.<sup>6,8,13,19,26</sup> Immigrant literature has proposed that although remarkable declines in immigrants' health advantage occurred over a relatively short period of time after arriving in Canada,<sup>5,13,19</sup> the estimated duration of the healthy immigrant effect's diminishment to the point of convergence with the health level of the Canadian-born population was more than 10 years after arrival.<sup>9,18,33</sup> However, whether the healthy immigrant effect could apply uniformly to both genders and all ethnic groups and how the onset of declining health begins and engenders ethnic disparities after immigration is still unclear.

Research has identified gender as an important anchor for the diminishing healthy immigrant effect and ethnic health disparities.<sup>14,15,34–36</sup> Generally, female immigrants are considered to be more vulnerable to social changes than their male counterparts.<sup>37</sup> Corresponding to this proposition, female immigrants have been found to experience a greater risk of deteriorating physical and mental health than male immigrants, especially among South Asian and African immigrants<sup>9,19,38,39</sup>; however, a lack of evidence concerning changes in self-rated health is a major limitation to a full understanding of the gender effect on ethnic disparities.<sup>33</sup> Moreover, most empirical analyses of associations among immigrant status, acculturation, and health were based on cross-sectional data in which changes in health over years of residence or acculturation in the host society were inappropriately evaluated by comparing migration cohorts (or samples) who arrived over different periods of years or decades. Thus, to accurately assess the healthy immigrant effect, it is important to examine longitudinal cohort studies of how health changes from the point of arrival and across years of residence in the host country.

## METHODS

We examined the rate of self-rated general health among a representative national sample of immigrants, starting within the first 6 months of arrival in Canada and following them for as long as 4 years postimmigration.

We investigated several central research questions: (1) whether immigrants had good health status at the time of admission to Canada, (2) whether immigrant health declined over time and the onset and rate of this decline, (3) whether changes in health led to gender and ethnic health disparities, and (4) what were the determinants contributing to gender and ethnic variations and disparities in decline in health.

## Design and Sample

The Longitudinal Survey of Immigrants to Canada is a 3-wave panel study in which longitudinal data were collected from a sample of immigrants who arrived in Canada between October 2000 and September 2001. The survey excluded individuals who had previously resided in Canada before applying for immigration status and refugees who were claiming asylum from within Canada. Among the 250 000 people admitted to Canada within this time period, the determined target population was 169 400 immigrants, aged 15 years or older. Of the target population, we selected 20 322 respondents by means of a 2-stage stratified sampling method.<sup>40</sup>

A baseline survey, wave 1, was conducted between April 2001 and May 2002, approximately 6 months after admission to Canada. Interviews were conducted using computer-assisted interview methods. Specifically, 68% of respondents were interviewed through computer-assisted personal interviewing, and 32% were interviewed through computer-assisted telephone interviewing. All Statistics Canada survey data are collected by experienced, trained professionals who follow standardized protocols in keeping with the agency's standard operating procedures. The response rate was 59.3% ( $n = 12\,040$  immigrants). Interviews were conducted in 15 of the languages most frequently spoken in Canada. Subsequent survey waves were completed approximately 2 years apart in 2003 and 2005. Follow-up rates were 77.4% ( $n = 9322$ ) for wave 2 and 64.1% ( $n = 7716$ ) for wave 3. For our analyses, we used a weighted sample of 3309 male and 3351 female immigrants who completed all 3 surveys. We restricted our analyses to adults aged between 20 and 59 years to capture the experiences of adults in their most productive years.

## Measurements

In this study, we measured health outcome with a measure of self-rated health. Survey participants were asked, "In general, would you say your health is 1) excellent, 2) very good, 3) good, 4) fair, and 5) poor?" We classified responses of "fair" and "poor" as "poor health" to construct a binary outcome variable.

*Ethnicity.* We coded ethnicity on the basis of ethnic origin: 1 = Arabic and African, 2 = West Asian (West Central Asian, Middle Eastern Asian), 3 = South Asian (Indian, Pakistani, Nepalese, Bangladeshi, and other South Asian), 4 = Chinese (Cantonese and Mandarin), 5 = East Asian (Korean, Japanese, and Southeast Asian), 6 = Latin American (Caribbean, Mexican, Central American, South American), and 7 = European (British, French, other European, American, Australian, and New Zealander). We used the European group as a reference and the other 6 ethnic groups as binary variables to identify ethnicity.

*Demographic, socioeconomic, and acculturation-related variables.* Demographic factors (age, gender, marital status) and socioeconomic variables (education, employment status, household income) are shown in Table 1. Acculturation was indexed by language fluency, based on self-reported proficiency in writing, reading, and speaking in English. We coded responses in 4 categories: "very well," "well," "fairly," and "poorly"; we combined the first 2 categories to generate 3 levels of fluency—excellent, average, and poor.

To assess social support at the time of arrival in Canada, we used 4 binary variables representing the presence of relatives in Canada: having relatives in Canada, having close friends in Canada, having close relationships with members of the ethnic community, and participating in social activities. We measured discrimination with a binary variable, defined as a "yes" response to the question, "Since your arrival in Canada, have you experienced discrimination or been treated unfairly by others because of your ethnicity, culture, race, language, accent, or religion?"

## Statistical Analysis

We applied the  $\chi^2$  test to estimate the weighted percentages of ethnicities and socio-demographic, language fluency, discrimination, and social network variables at waves 1, 2, and

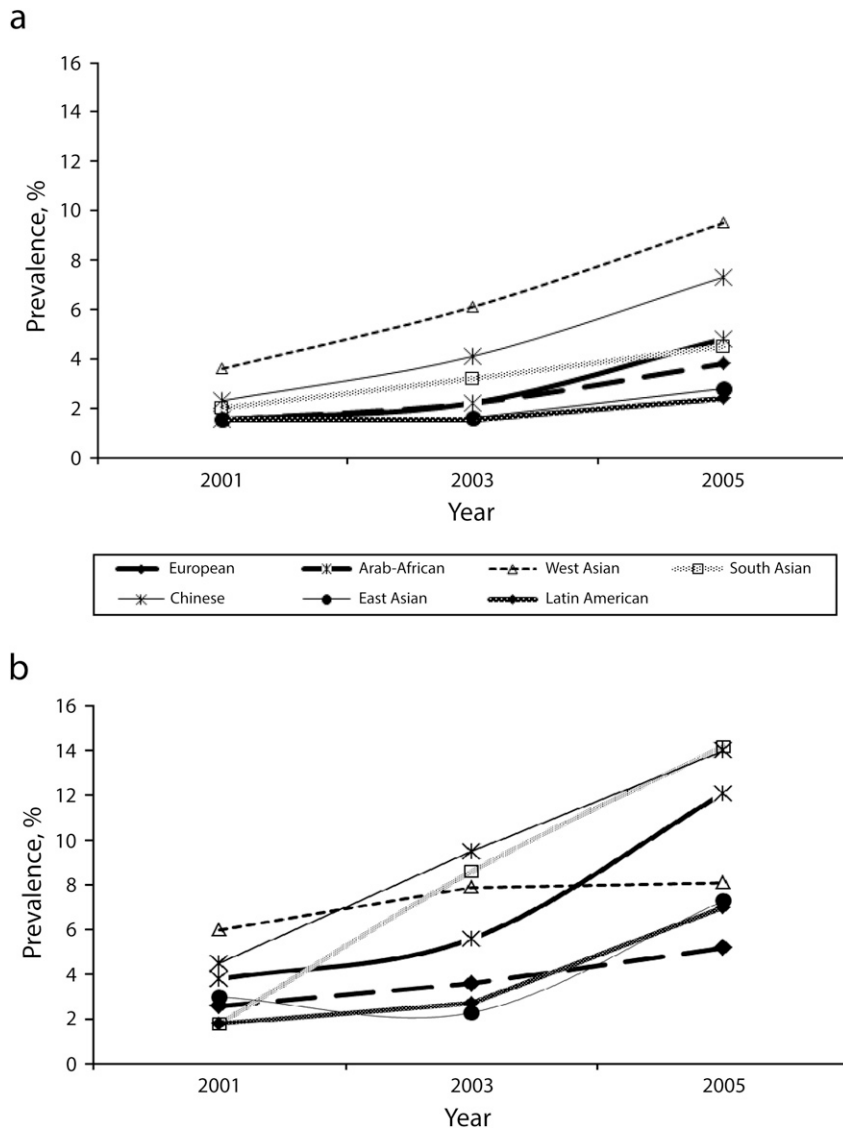
**TABLE 1—Descriptive Statistics of New Immigrants by Gender at the Baseline Survey: Longitudinal Survey of Immigrants to Canada, Wave 1, 2001–2002**

Variables and Values	Men, No. (%) or Mean ± SD	Women, No. (%) or Mean ± SD	Total, No. (%) or Mean ± SD
Total	3309 (49.7)	3351 (50.3)	6660 (100)
<b>Ethnicity</b>			
European	548 (16.5)	536 (16.0)	1084 (16.3)
Arab-African	487 (14.7)	416 (12.4)	903 (13.5)
West Asian	164 (5.0)	166 (5.0)	330 (5.0)
South Asian	816 (24.7)	845 (25.2)	1661 (24.9)
Chinese	695 (21.0)	749 (22.3)	1444 (21.7)
East Asian	435 (13.1)	431 (12.9)	866 (13.0)
Latin American	164 (5.0)	208 (6.2)	372 (5.6)
<b>Age, y</b>			
20–29	787 (23.8)	1134 (33.8)	1921 (28.8)
30–39	1564 (47.3)	1400 (41.7)	2964 (44.5)
40–49	742 (22.4)	593 (17.3)	1335 (20.1)
50–59	216 (6.5)	224 (12.9)	440 (6.6)
<b>Marital status</b>			
Married or common law	2673 (80.8)	2897 (86.4)	5570 (83.6)
Never married	589 (17.8)	333 (10.0)	922 (13.9)
Previously married	46 (3.5)	121 (3.6)	167 (2.5)
<b>Education</b>			
Graduate school	828 (25.0)	544 (16.3)	1372 (20.6)
College or university	2028 (61.3)	2039 (60.8)	4067 (61.1)
≤ high school	453 (13.7)	768 (22.9)	1221 (18.3)
<b>Employment status</b>			
Employed, full time	1712 (51.7)	886 (26.4)	2598 (39.0)
Employed, part time	205 (6.2)	345 (10.3)	550 (8.3)
Employed, self-employment	151 (4.6)	67 (2.0)	218 (3.3)
Unemployed	765 (23.1)	456 (13.6)	1221 (18.3)
Student or homemaker	476 (14.4)	1597 (47.6)	2073 (31.1)
<b>Income, Can\$</b>			
≥ 40 000	17 026 ± 67 233	17 326 ± 55 351	17 175 ± 61 290
20 000–40 000	214 (6.5)	269 (8.0)	483 (7.2)
< 20 000	446 (13.5)	518 (15.5)	964 (14.5)
	2649 (80.0)	2564 (76.5)	5213 (78.3)
<b>Language fluency</b>			
Excellent	1820 (55.0)	1384 (41.3)	3204 (48.1)
Average	695 (21.0)	731 (21.8)	1426 (21.4)
Poor	794 (24.0)	1236 (36.9)	2030 (30.5)
<b>Perceived discrimination: ever discriminated against in Canada</b>			
	1077 (32.6)	943 (28.1)	2020 (30.3)
<b>Social networks at arrival</b>			
Had relatives in Canada	1577 (47.7)	1871 (55.8)	3448 (51.8)
Had close friends	2166 (65.5)	1841 (54.9)	4007 (60.2)
Had close relations with ethnic community members	2381 (71.9)	2462 (73.5)	4843 (72.7)
Social activities	835 (25.2)	716 (21.4)	1551 (23.3)

3. To capture the changes in poor self-rated health, the study outcome, we estimated age- and gender-adjusted prevalence rates for each ethnic group at each study wave (1, 2, and 3),

using a direct method for 5-year age adjustments. We used the distribution of the total sample as the reference. To examine ethnic variations in health, we used generalized

estimating equations, a method that has been applied to analyze repeated measures data.<sup>41</sup> After adjusting for the effects of confounders, we estimated odds ratios (ORs) of poor health



Note. Because of the small incidence in 2001, we estimated some ratios for pooled samples of more than 1 ethnic group.

**FIGURE 1—Age- and gender-standardized prevalence of self-rated poor health for (a) men and (b) women: Longitudinal Survey of Immigrants to Canada, 2001–2005.**

across the 3 data (time) points for each ethnic group in comparison with the reference group (European). This approach provides a semi-parametric approach to longitudinal analysis of categorical response. By using an iterative quasi-likelihood algorithm, the generalized estimating equations model estimates coefficients and calculates parameters that specify the covariance structures. We also measured socioeconomic position (education, income, employment status) and language fluency as repeated measures. Data on discrimination

were available for waves 2 and 3. We tested ethnic disparities in health trajectory by including time  $\times$  ethnicity interactions in the model.

We conducted all analyses on separate samples of men and women, after confirming gender differences in the trend of self-rated health by using the  $\chi^2$  test for each wave sample (wave 1:  $\chi^2 = 5.65$ ;  $df = 6$ ;  $P = .463$ ; wave 2:  $\chi^2 = 12.21$ ;  $df = 6$ ;  $P < .001$ ; wave 3:  $\chi^2 = 15.26$ ;  $df = 6$ ;  $P = .018$ ). Most importantly, the extent of gender differences in changes of self-rated health varied among

ethnic groups (data not shown). Generalized estimating equations also confirmed the gender difference after adjusting for age ( $\chi^2 = 9.64$ ;  $df = 6$ ,  $P < .001$ ). All of the models used weights developed by Statistics Canada. We performed all analyses using SAS statistical software version 8.2 (SAS Institute, Cary, NC).

## RESULTS

The study sample consisted of a similar number of men (49.7%) and women (50.3%), with a mean age of 35 years (Table 1). Immigrants of South Asian and Chinese descent each represented more than 20% of the participant sample, whereas those of West Asian and Latin American descent each made up about 5% of the total sample. A large majority of respondents were married and had education beyond the completion of high school. Women (86.4%) were more likely to be married than men (80.8%). Female participants, however, were less likely than their male counterparts to have received formal education beyond high school (86.3% vs 77.1%), and less likely to be employed full time (51.7% vs 26.4%). Approximately 14.4% of men and 47.6% of women were students or homemakers. However, the sample means and distributions of annual household income were similar for both male and female samples. Approximately half of the sample (55% of men and 41% of women) rated their language fluency (in English or French) as “excellent.” Just more than 30% of the total participant sample reported that they had experienced discrimination at least once because of their ethnicity, culture, race, language, or religion since immigrating to Canada. The rate was higher for men (32.6%) than for women (28.1%). At the time of arrival in Canada, more than half of the sample had relatives (about 52%) and friends (60%) living in Canada. More than 70% reported close relationships with members of the same ethnic group, and roughly 1 in 5 men and women engaged in social activities.

Before testing multivariate models of health and health trajectory, we estimated time and gender- and age-adjusted prevalence of poor health for the 7 ethnic groups (Figure 1). The baseline rates (wave 1; 2001) for men ranged from 1% to 4%. Over the course of 4 years, the

**TABLE 2—Age-Adjusted, Gender-Specific Odds Ratios of Poor Health: Men, Aged 20–59 Years: Longitudinal Survey of Immigrants to Canada, 2001–2005**

Predictors	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)
<b>Time</b>			
Wave 1 (Ref)	1.00	1.00	1.00
Wave 2 (Year 2)	1.59 (1.16, 2.18)	1.53 (1.04, 2.23)	1.43 (0.98, 2.09)
Wave 3 (Year 4)	2.83 (2.11, 3.78)	3.08 (2.12, 4.47)	2.91 (1.94, 4.37)
<b>Ethnicity</b>			
European (Ref)	1.00	1.00	1.00
Arab-African	1.31 (0.80, 2.17)	0.89 (0.54, 1.46)	0.90 (0.53, 1.55)
West Asian	2.89 (1.70, 4.93)	2.12 (1.23, 3.65)	2.22 (1.24, 3.97)
South Asian	1.46 (0.92, 2.33)	1.30 (0.81, 2.09)	1.14 (0.85, 2.35)
Chinese	2.16 (1.38, 3.37)	1.76 (1.12, 2.75)	1.78 (1.10, 2.89)
East Asian	0.90 (0.51, 1.58)	0.90 (0.50, 1.60)	0.96 (0.52, 1.77)
Latin American	0.83 (0.36, 1.90)	0.67 (0.29, 1.55)	0.75 (0.30, 1.88)
<b>Age, y</b>			
20–29 (Ref)	1.00	1.00	1.00
30–39	1.44 (0.98, 2.12)	1.72 (1.15, 2.59)	1.73 (1.16, 2.60)
40–49	1.90 (1.21, 2.96)	2.10 (1.31, 3.39)	2.12 (1.31, 3.41)
50–59	4.39 (3.09, 7.91)	4.00 (2.39, 6.46)	3.96 (2.40, 6.53)
<b>Marital status</b>			
Currently married (Ref)		1.00	1.00
Never married		1.37 (0.89, 2.09)	1.36 (0.89, 2.09)
Previously married		1.06 (0.54, 2.08)	1.04 (0.53, 2.05)
<b>Education</b>			
Graduate school (Ref)		1.00	1.00
College or university		1.49 (1.02, 2.17)	1.49 (1.02, 2.19)
≤ high school		1.70 (1.05, 2.74)	1.71 (1.06, 2.76)
<b>Employment status</b>			
Employed, full time (Ref)		1.00	1.00
Self-employed		0.91 (0.54, 1.54)	0.92 (0.55, 1.55)
Employed, part time		2.33 (1.46, 3.72)	2.35 (1.47, 3.77)
Unemployed		2.35 (1.17, 3.18)	2.36 (1.74, 3.19)
Student or homemaker		2.18 (1.46, 3.25)	2.21 (1.48, 3.29)
<b>Income, Can\$</b>			
≥ 40 000 (Ref)		1.00	1.00
20 000–40 000		1.14 (0.84, 1.55)	1.13 (0.83, 1.54)
< 20 000		1.09 (0.73, 1.48)	1.04 (0.74, 1.47)
<b>Language fluency</b>			
Good (Ref)		1.00	1.00
Fair		1.09 (0.79, 1.50)	1.09 (0.79, 1.50)
Poor		1.76 (1.20, 2.58)	1.76 (1.20, 2.58)
<b>Social network at arrival</b>			
No relative in Canada (= 1)		0.87 (0.64, 1.19)	0.87 (0.64, 1.19)
No friends in Canada (= 1)		0.96 (0.73, 1.27)	0.96 (0.73, 1.27)
No close relationship in Canada (= 1)		1.17 (0.86, 1.59)	1.17 (0.86, 1.58)
No social activity in Canada (= 1)		1.23 (0.89, 1.70)	1.23 (0.89, 1.17)

Continued

survey data showed small but steady increases in poor health, with the exception of male immigrants from East Asia and Latin America. Indeed, ethnic disparities in poor health were most clearly demonstrated in wave 3 (2005) data. The rate of change across time in poor health was statistically significant in West Asian and Chinese samples ( $P < .001$ ). Baseline rates of poor health among immigrant women were significantly lower than national rates for women (12%).<sup>42</sup> Female immigrants from West Asian and Arab–African countries and China showed relatively higher baseline rates than female immigrants from European, South Asian, and East Asian countries. In wave 2 (2003), ethnic group differences were more pronounced, and by wave 3 (2005), the disparities between groups were large, with Arab–African, South Asian, and Chinese groups showing the most dramatic increases in poor health. The rates of change in these 3 groups were about 3 to 5 times higher than the rate of change among European immigrants ( $P < .001$ ).

On the basis of the gender differences observed in Figure 1, we examined multivariate models separately for men and women (Tables 2 and 3). For both samples, model 1 tested age-adjusted gross effects of time and ethnicity on health; model 2 tested the effects of time and ethnicity, controlling for social determinants of health; and model 3 tested the interaction between time and ethnicity.

### Men

The probability (rate) of reporting poor health increased significantly and steadily over time, when adjusted for age. Compared with the probability estimated at wave 1, the risk of reporting poor health was 1.59 and 2.83 times as high at waves 2 and 3, respectively. Model 1 also showed that when considering the effects of time, the overall rates of poor health were significantly higher for middle-aged men (aged 40–59 years) than younger adults (aged ≤ 40 years). We found the largest increase between the 40 to 49- and 50 to 59-year age groups.

In model 2, rates of poor health were significantly higher in the samples of West Asian (OR = 2.89; 95% confidence interval [CI] = 1.70, 4.93) and Chinese immigrants (OR = 2.16; 95% CI = 1.38, 3.37) than in the European sample. The results remained

TABLE 2—Continued

Perceived discrimination		
Experienced no discrimination in Canada (Ref)	1.00	1.00
Experienced discrimination in Canada	1.59 (1.20, 2.11)	1.60 (1.20, 2.13)
Time × ethnicity interaction		
Time × European (Ref)		1.00
Time × Arabic and African		0.76 (0.27, 2.17)
Time × West Asian		0.73 (0.23, 2.27)
Time × South Asian		0.60 (0.23, 1.59)
Time × Chinese		0.84 (0.32, 2.26)
Time × East Asian		0.62 (0.16, 2.39)
Time × Latin American		0.41 (0.10, 1.69)

Note. CI = confidence interval; OR = odds ratio. Model 1 tested age-adjusted gross effects of time and ethnicity on health; model 2 tested the effects of time and ethnicity, controlling for social determinants of health; and model 3 tested the time × ethnicity interaction. The sample size was  $n = 3309$ .

significant after controlling for the effects of socioeconomic determinants of health and factors relevant to the settlement and acculturation processes. Lower education, not being employed, poor language proficiency, and discrimination were associated with increased probability of reporting poor health. Overall, the results of model 3 (Table 2) suggest that the ethnic disparities in health trajectory among males were not statistically significant after controlling for other factors in the model.

### Women

Table 3 illustrates changes in poor health among female immigrants. Compared with the baseline rate of poor health, rates for waves 2 and 3 were 2.21 and 3.68 times greater, respectively. These coefficients are greater than those found among men. The effects of age, adjusted for time, were also greater for women than for men.

Compared with European women, the age- and time-adjusted rates of poor health were higher for women from Arab–African (OR = 1.86; 95% CI = 1.24, 2.78), West Asian (OR = 1.97; 95% CI = 1.25, 3.10), and South Asian countries (OR = 2.37; 95% CI = 1.68, 3.33) and China (OR = 2.64; 95% CI = 1.87, 3.74). The elevated risks for Arab–African and West Asian groups were reduced significantly when socioeconomic and acculturation factors were considered in the model, whereas Chinese and South Asian women were still at elevated risk despite these considerations (Table 3).

Unemployment, low income, poor language proficiency, and experiences of discrimination were significant risk factors for poor health among female immigrants. In model 3 (Table 3), we conducted statistical tests to identify ethnic differences in the health trajectory. Figure 1 clearly illustrates these differences; rates of self-rated poor health are significantly steeper among South Asian women than among their European counterparts.

### DISCUSSION

The data from the Longitudinal Survey of Immigrants to Canada revealed a significantly lower rate of self-rated poor health among new immigrants than in the general population. When assessed shortly after arrival in Canada, the average baseline prevalence of poor health was 3.5%, which was substantially lower than the rate of 11% found in the general population.<sup>42</sup> However, the rate of poor health increased soon after arrival. Although survey data are limited to the first 4 years of settlement, the increase in the rate of poor health during this period supports previous research.<sup>6,43,44</sup>

In regard to the deteriorating health trajectory, our results for male immigrants confirmed large and significant increases in poor health during the first 4 years postimmigration. We also found that ethnic disparities in poor health emerged within 4 years of settlement, suggesting that the ethnic disparities in immigrant health were determined by postimmigration

experiences such as acculturative stress and discrimination. When compared with the European group, male immigrants from West Asian and Chinese groups showed increased rates of poor health. Immigrant studies have proposed that European immigrants to North America may enjoy a health benefit because they can easily assimilate into the host country, which shares a similar cultural background.<sup>8,14</sup> By contrast, non-European minority immigrants may be exposed to acculturative stressors through the process of resettlement and acculturation over a short period of time.<sup>45</sup> Although previous studies have suggested a poor health profile for non-European immigrants,<sup>8,19,20</sup> our results suggest that changes in self-rated health status were not significantly different between East Asian and Latin American immigrants and European immigrants. It is important to note that ethnic minority groups should not simply be combined when measuring the healthy immigrant effect and the subsequent health trajectory.<sup>46</sup>

As in the case for male immigrants, we also confirmed a deteriorating health trajectory for female immigrants. In agreement with previous research findings,<sup>9,19,33</sup> the increase in poor health during the first 4 years of postimmigration settlement was greater for women than for men. Furthermore, our observations in this study support previous research, showing that the risk of poor health was almost 2-fold among Arab–African, West Asian, South Asian, and Chinese women when compared with the risk for their European counterparts.<sup>20,47,48</sup> We found that a large proportion of ethnic disparities were accounted for when controlling for income, language proficiency, and the experience of discrimination. In particular, the increased risk of poor health among Arab–African and West Asian women compared with European women virtually disappeared. These findings are in line with the multiple jeopardy perspective.<sup>49,50</sup> Female immigrants were less likely to have employment opportunities and more likely to experience occupational downgrading than were their male counterparts.<sup>51,52</sup> We found considerable ethnic differences among female immigrants in employment status and salaries.<sup>51</sup> Moreover, some ethnic minority immigrant families maintain patriarchal family relations, in which physical and verbal violence and abuse against women are

**TABLE 3—Age-Adjusted, Gender-Specific Odds Ratios of Poor Health: Women, Aged 20–59 Years: Longitudinal Survey of Immigrants to Canada, 2001–2005**

Predictors	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)
<b>Time</b>			
Wave 1 (Ref)	1.00	1.00	1.00
Wave 2 (Year 2)	2.21 (1.76, 2.79)	2.49 (1.91, 3.25)	1.97 (1.45, 2.67)
Wave 3 (Year 4)	3.68 (2.95, 4.60)	4.54 (3.47, 5.96)	3.86 (2.87, 5.19)
<b>Ethnicity</b>			
European (Ref)	1.00	1.00	1.00
Arab-African	1.86 (1.24, 2.78)	1.40 (0.92, 2.12)	1.29 (0.84, 1.99)
West Asian	1.97 (1.25, 3.10)	1.58 (0.99, 2.52)	1.62 (1.02, 2.57)
South Asian	2.37 (1.68, 3.33)	1.96 (1.36, 2.83)	1.57 (1.07, 2.30)
Chinese	2.64 (1.87, 3.74)	2.15 (1.51, 3.07)	2.01 (1.40, 2.88)
East Asian	1.13 (0.74, 1.73)	1.27 (0.81, 1.99)	1.14 (0.71, 1.83)
Latin American	0.99 (0.58, 1.69)	0.82 (0.48, 1.41)	0.71 (0.41, 1.22)
<b>Age, y</b>			
20–29 (Ref)	1.00	1.00	1.00
30–39	1.68 (1.28, 2.20)	1.61 (1.22, 2.13)	1.63 (1.23, 2.15)
40–49	3.56 (2.67, 4.75)	2.95 (2.18, 3.99)	2.99 (2.21, 4.05)
50–59	5.01 (3.62, 6.94)	3.03 (2.16, 4.26)	3.11 (2.21, 4.36)
<b>Marital status</b>			
Currently married (Ref)		1.00	1.00
Never married		0.84 (0.53, 1.32)	0.84 (0.53, 1.32)
Previously married		1.17 (0.80, 1.71)	1.19 (0.81, 1.74)
<b>Education</b>			
Graduate school (Ref)		1.00	1.00
College or university		0.83 (0.60, 1.15)	0.85 (0.61, 1.18)
≤ high school		1.10 (0.77, 1.57)	1.13 (0.79, 1.61)
<b>Employment status</b>			
Employed, full time (Ref)		1.00	1.00
Employed, part time		0.89 (0.65, 1.24)	0.89 (0.64, 1.23)
Self-employed		0.91 (0.55, 1.48)	0.93 (0.57, 1.52)
Student or homemaker		1.24 (0.97, 1.59)	1.21 (0.94, 1.56)
Unemployed		1.31 (1.03, 1.68)	1.31 (1.02, 1.67)
<b>Income, Can\$</b>			
≥ 40 000 (Ref)		1.00	1.00
20 000–40 000		1.21 (0.97, 1.52)	1.22 (0.97, 1.53)
< 20 000		1.45 (1.13, 1.86)	1.45 (1.12, 1.86)
<b>Language fluency</b>			
Good (Ref)		1.00	1.00
Fair		1.56 (1.15, 2.11)	1.55 (1.14, 2.10)
Poor		2.65 (1.93, 3.66)	2.60 (1.89, 3.58)
<b>Social network at arrival</b>			
No relative in Canada (= 1)		0.90(0.72, 1.13)	0.91 (0.72, 1.15)
No friends in Canada (= 1)		1.08 (0.87, 1.34)	1.08 (0.87, 1.34)
No close relationship in Canada (= 1)		0.98 (0.77, 1.25)	0.98 (0.77, 1.25)
No social activity in Canada (= 1)		1.05 (0.82, 1.35)	1.05 (0.82, 1.35)

*Continued*

prevalent and often tolerated.<sup>53,54</sup> According to previous research, one would reasonably expect greater declines in health among female immigrants of these ethnic minority groups.<sup>33</sup>

Although our data on adjusted prevalence of poor health suggested an early and fast deterioration in health in some ethnic groups, especially for women, statistical tests of ethnic group × time interactions did not provide clear support for these observations. Chinese and South Asian women had substantially steeper increases in poor health over time, but we found a statistically significant difference only between European and South Asian women. The number of observations may possibly have been insufficient to supply statistical power to reveal any statistical significance in these observed differences. Moreover, the Longitudinal Survey of Immigrants to Canada study period of 4 years after immigration may have been too short to examine significant differential trajectories among diverse groups of ethnic origin.

### Limitations

Our study has several limitations. First, we must acknowledge the possibility of reporting bias. Health expectations may differ according to the cultural background, values, and wellness threshold of each particular ethnic group. However, rigorous research has supported the assessment of self-rated health as a highly reliable and valid measure of objective and subjective health in different ethnic groups, as well as its being strongly correlated with chronic diseases and mortality.<sup>55</sup> Second, the study was also limited by omissions of stress and coping resource variables that may have contributed to differences in the study outcomes. Last, and perhaps most important, the relatively short study period of 4 years was a serious limitation. Despite these limitations, this study is, to our knowledge, the first to reveal convincing statistical evidence that a decline in self-rated health and ethnic disparities may start as early as the first 2 years of residence in the host country.

### Conclusions

We observed a deterioration in health during the first 2 years after arrival, and this deterioration was disproportionately found in female and non-European immigrants. A number of Asian immigrants, including West Asian, South Asian, and Chinese groups,

TABLE 3—Continued

Perceived discrimination		
Experienced no discrimination in Canada (Ref)	1.00	1.00
Experienced discrimination in Canada	1.49 (1.19, 1.88)	1.49 (1.19, 1.88)
Time × ethnicity interaction		
Time × European (Ref)		1.00
Time × Arab-African		1.65 (0.68, 3.96)
Time × West Asian		0.71 (0.27, 1.86)
Time × South Asian		3.64 (1.63, 8.15)
Time × Chinese		1.65 (0.76, 3.56)
Time × East Asian		1.36 (0.53, 3.46)
Time × Latin American		2.06 (0.63, 6.81)

Note. CI = confidence interval; OR = odds ratio. Model 1 tested age-adjusted gross effects of time and ethnicity on health; model 2 tested the effects of time and ethnicity, controlling for social determinants of health; and model 3 tested the time × ethnicity interaction. The sample size was n = 3351.

appeared to be at greater risk for declining health. We suggest that future immigrant studies extend the study period beyond the first 4 years of settlement to account for complex pathways linked to gender and ethnic health disparities among immigrant groups. ■

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### Contributors

I-H. Kim and S. Noh made significant contributions to the conceptualization of the study. I-H. Kim, S. Noh, and C. Carrasco contributed to the review of the literature and the development of analytic models and data analysis. All authors contributed to the development of the article.

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The study was reviewed and approved by the Research Ethics Boards of the University of Toronto and the Centre for Addiction and Mental Health.

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