Longitudinal trends in mental health among ethnic groups in Canada

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Abstract

Introduction: Immigration continues to transform the ethnic composition of the Canadian population. We investigated whether longitudinal trends in mental distress vary between seven cultural and ethnic groups and whether mental distress within the same ethnic group varies by demographic (immigrant status, sex, age, marital status, place and length of residence), socio-economic (education, income), social support and lifestyle factors.

Method: The study population consisted of 14 713 respondents 15 years and older from the first six cycles of the National Population Health Survey (NPHS); 20% reported themselves to be immigrant at Cycle 1, in 1994/1995. The logistic regression model was fitted by modifying a multivariate quasi-likelihood approach, and robust variance estimates were obtained by using balanced repeated replication techniques.

Results: Based on the multivariable model and self-reported data, we observed that female respondents were more likely to report moderate/high mental distress than male respondents; younger respondents more than older respondents; single respondents more than those in a relationship; urban-dwellers more than rural-dwellers; less educated respondents more than more educated respondents; current and former smokers more than non-smokers; and those living in a smoking household more than those living in non-smoking households. The relationship between ethnicity and mental distress was modified by immigrant status, sex, social involvement score and education. Confirming other research, we found an inverted U-shaped relationship between length of stay and mental distress: those who had lived in Canada for less than 2 years were less likely to report moderate/high mental distress, while those who had lived in Canada for 2 to 20 years were significantly more likely to report moderate/high mental distress than those who had lived in Canada for more than 20 years.

Conclusion: There is a need to develop ethnicity-specific mental health programs targeting those with low education attainment and low social involvement. Policies and programs should also target women, the younger age group (15–24 years) and low-income adequacy groups.

Keywords: *mental distress, ethnicity, National Population Health Survey, generalized estimating equations, balanced repeated replication, missing data, pattern mixture models*

Introduction

According to the World Health Organization, more than 25% of people worldwide will experience mental illness at some time during their lives.[1] In Canada, approximately 30% of disability claims are based on mental illnesses, costing between $15 billion and $33 billion dollars annually.[2] As with physical health, mental health is an interplay between demographic, lifestyle, social and environmental factors, among others. Some examples of these are age, sex, marital status, personal smoking habits, exposure to second-hand smoke, socio-economic status and social involvement.[3-8] Immigrants may be at particular risk of developing mental illnesses such as depression, and the risk may vary with the length of time since their arrival in Canada.[7] Variation between ethnic groups is also likely; therefore it is important to explore associations between the ethnicity of immigrants and mental health.

Despite its importance and relevance for policy making, the literature on the issue of ethnicity and mental health is very limited.[3] Including ethnicity in health research would improve targeting of resources to more vulnerable groups. Canadian immigrants are heterogeneous with respect to many factors such as country of origin, age group, education, income and ethnicity.[9] These factors need to be accounted for when analyzing health data because they are likely to affect the physical and mental health of individuals.

The objectives of this report were to investigate (1) how longitudinal trends in mental distress, used as a measure of mental health, vary between ethnic groups in Canada; (2) whether these trends vary between immigrant and Canadian-born members of different ethnic groups; and (3) how other variables influence the relationship between mental health and

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ethnicity, in particular, socio-economic, social support and lifestyle status, and demographic factors.

Methods

Study design and study population

Statistics Canada has used complex, multi-stage sampling designs to collect data over time from cohorts of individuals.[10] One such survey, the Canadian National Population Health Survey (NPHS), includes a set of questions designed to investigate the mental health of respondents.[10] Details of the NPHS and multi-stage sampling design can be found elsewhere.[10-12] Our study population consisted of the 14 713 respondents aged 15 years and older who were surveyed over the first six cycles of the NPHS, from 1994/1995 to 2004/2005.

Variables

Dependent variable. Mental distress, used as a measure of mental health, was computed using a six-item "distress scale" that assessed feelings of sadness, nervousness, restlessness, hopelessness and worthlessness within the preceding month. Also assessed was the frequency with which an individual felt that everything was an effort. The distress scale was based on the work of Kessler et al.[13] and was derived from the Composite International Diagnostic Interview*. Scores on the distress scale ranged from zero (no distress) to 24 (highly distressed). The derived distress scale was highly skewed and was therefore categorized into a dichotomous mental distress variable (i.e. no/low [0–5 on the distress scale] and moderate/high [6–24 on the distress scale]), as suggested by a geriatric psychiatrist (Personal communication, 27 October, 2010) and based on the available literature.[14,15]

Independent variables. The main risk factor of interest was ethnicity, which we determined from self-reported ethnicity in response to the NPHS question, "To which ethnic or cultural group(s) did your/his/her ancestors belong?" The possible responses were coded[10] and categorized into seven groups according to ethnic or cultural ancestry: British, Eastern European, Western European, Chinese, South Asian, Black and Other.

Other independent variables of interest were demographic (immigrant status, sex, age, marital status, place of residence and length of residence), location of residence (rural vs. urban†)[16], geographical area of residence (one of the 10 provinces), socio-economic status (education, income), social support status and lifestyle status. Income adequacy was derived from various combinations of total household income and the number of people living in the household, and was categorized into three groups, low, middle and high.[17] The social support variable consisted of a social involvement score (SIS)[16] based on questions on the respondents' frequency of participation in associational activities and of attending religious services. Lifestyle variables consisted of a respondent's personal smoking history and household smoking status. The general health variable consisted of a self-perceived general health status. Five dummy variables for 'Cycle' were used to study the effect of time on mental distress.

Statistical methods

We used SAS (SAS Institute Inc., version 9.2, 2007) procedure PROC GENMOD to fit the multivariable logistic regression model and to obtain the predictive model for mental distress.[18] The longitudinal weight variable computed by Statistics Canada methodologists was used in the WEIGHT statement of SAS syntax to account for unequal probability of selection. Based on the goodness-of-fit techniques, we determined within-subject correlation structure.[19] We obtained the estimates of regression coefficients for the logistic regression model by modifying the multivariate quasi-likelihood approach for complex survey designs using the weight variable.[20]

The robust variance estimation in GENMOD based on generalized estimation equations (GEE) approach accounts only for the within-subject dependencies due to the repeated measurements over time,[20,21] and does not account for design effects (stratification, clustering and unequal probability of selection). In order to allow for robust variance estimation without compromising respondents' privacy, Statistics Canada provides pre-calculated bootstrap weights with the survey. A resampling technique known as balanced repeated replication (BRR) is used for robust variance estimation. We used the BRR features of STATA (StataCorp LP, version 11, 2009), which for our purposes with pre-calculated bootstrap weights is equivalent to the bootstrapping method.[22] A classical multivariable logistic regression model based on the GEE approach was extended by including a categorical dropout variable to incorporate the missing observations. The categorical dropout variable included four categories numbered consecutively from one to four: one missing value for the response variable; two or more missing values for the response variable; deceased during study duration; and no missing value or completers (subjects who participated in all the six cycles). Models such as these that incorporate a missing pattern are called pattern-mixture models.[23] If a value was missing for any covariate for any particular cycle, then the entire observation was deleted from the multivariable analysis.

Multivariable statistical analyses were conducted in two steps. In the first, we used the GEE approach to conduct the analysis. In the second, the final model obtained in the first step was extended by including a categorical dropout variable. The dropout variable was statistically significant as a main effect and also as an effect modifier of the relationship between ethnicity and mental distress. Hence, the pattern-mixture model was used for prediction purposes. Standard errors were computed using the BRR resampling technique, which accounts for the complexities of stratified multi-stage design.

* http://www.hcp.med.harvard.edu/wmhcidi/index.php

† Urban area is defined as area that has a minimum population concentration of 1000 or more and a population density of at least 400 per square kilometre based on previous census counts.[16] Rural areas are residual of urban areas.[16]

The main risk factor of interest was ethnicity, which was adjusted for demographic, socio-economic, social support and lifestyle factors as main effects. Various interaction terms were tested in the multivariable model for statistical significance.

The final predictive model was used to determine the predicted probabilities for the moderate/high mental distress category.

Results

The study population consisted of 14 713 respondents 15 years and older. The 20% of respondents who self-reported as immigrants at baseline described themselves as belonging to the following ethnic groups: British, 37.6%; Eastern European, 4.6%; Western European, 36.4%; Chinese, 2.4%; South Asian, 1.6%; Black, 1.0%; and Other, 16.4%. At baseline, 78.2% respondents reported having no/low mental distress and 21.8% moderate/high distress. Table 1 shows the baseline characteristics of the study population stratified by mental distress status (no/low vs. moderate/high) in terms of weighted percentages. Based on standard model-building techniques,[24] these variables were selected for the multivariable modeling. Results based on the final multivariable model are shown in Table 2 (main effects) and Table 3 (interaction terms).

Table 2 shows the relationship between mental distress and the variables of interest. Female respondents were more likely to self-report mental distress than were male respondents (adjusted odds ratio [OR_{adj}] = 1.69, 95% confidence interval [CI]: 1.48–1.94). Younger respondents were more likely to self-report mental distress (15–24 years: OR_{adj} = 2.67, 95% CI: 2.21–3.22; 25–54 years: OR_{adj} = 2.23, 95% CI: 1.95–2.56; 55–69 years: OR_{adj} = 1.23, 95% CI: 1.08–1.41; reference category ≥ 70 years). Respondents who were either married, in common-law relationships or in partnerships (OR_{adj} = 0.69, 95% CI: 0.62–0.76) had significantly lower risk of moderate/high mental distress compared to single respondents. Rural residents had a significantly lower risk of reporting moderate/high mental distress than their urban counterparts (OR_{adj} = 0.87, 95% CI: 0.79–0.97), while the geographical area of residence was also a significant predictor: Quebec residents were at a significantly higher risk of reporting moderate/high distress compared to Ontario residents (OR_{adj} = 1.46, 95% CI: 1.31–1.64). The relationship between length of stay in Canada and mental distress was in the shape of an inverted *u*: those who had lived in Canada for less than 2 years were less likely to report moderate/high mental distress, while those who had lived in Canada for 2 to 20 years were significantly more likely to report moderate/high mental distress than those who had lived in Canada for more than 20 years.

We also observed an inverse dose-response relationship for income adequacy levels: the respondents in the low-income adequacy category were more likely to report moderate/high mental distress than the high-income adequacy group (OR_{adj} = 1.35, 95% CI: 1.19–1.53).

Current smokers (OR_{adj} = 1.36, 95% CI: 1.21–1.52) and ex-smokers (OR_{adj} = 1.14, 95% CI: 1.04–1.24) were at a higher risk of reporting moderate/high mental distress compared to non-smokers, while those exposed to household smoke (OR_{adj} = 1.14, 95% CI: 1.05–1.25) were also at a significantly higher risk compared to those who were not exposed to household smoke.

The self-perceived general health status variable measures the overall self-reported health, physical and mental, of an individual. A dose-response relation was observed between general health status and probability of moderate/high mental distress, with those in poor health most likely to report mental distress (OR_{adj} = 13.40, 95% CI: 11.11–16.15 against the reference category, excellent general health status).

Canadian-born people of Eastern European ethnicity had the highest predicted probability of moderate/high mental distress at Cycle 1, declining sharply over time, in contrast to immigrants of Eastern European ethnicity, who were much less likely to report moderate/high mental distress (Figure 1). The predicted probability for moderate/high mental distress of immigrants of British ethnicity was higher than for Canadian-born people of British ethnicity; however, these probabilities were the lowest of all Canadian-born and immigrant respondents. The predicted probability for moderate/high mental distress for Canadian-born respondents of Black ethnicity was average (Figure 1) and did not change substantially over the six cycles; however, among immigrants of Black ethnicity there was a steep decrease in this probability from Cycle 1 to Cycle 2, followed by a sharp increase and substantially higher probability for moderate/high mental distress compared to other ethnicities.

Among the female respondents, South Asian females had the lowest probability of reporting moderate/high mental distress. Females of British ethnicity were less likely to self-report moderate/high levels of mental distress compared to those of other ethnicities (Figure 2). In contrast to South Asian females, South Asian males had the highest probability of reporting moderate/high mental distress among males. In contrast, males of British ethnicity were the least likely to report moderate/high mental distress compared to the other ethnicities (Figure 2).

Respondents of Chinese ethnicity with less education (≤ grade 12) had the highest predicted probability of reporting moderate/high mental distress, in contrast to those with an education beyond grade 12 (Figure 3, Table 3). This pattern was opposite for respondents of South Asian ethnicity; the predicted probability of reporting moderate/high mental distress was higher (with no particular pattern over time) for those who are educated beyond grade 12, with a slight decline from Cycle 1 to Cycle 2 that then levelled off. Similar trends were observed for respondents of Eastern and Western European ethnicities. For respondents of British ethnicity, the predicted probability of reporting moderate/high mental distress was slightly lower for those who were educated beyond grade 12.

Predicted probability of self-reporting moderate/high mental distress was highest for those who had a moderate SIS and lowest for those with high SIS for all groups except for those of Black ethnicity (Figure 4).

TABLE 1
Respondent characteristics at baseline (Cycle 1) of the National Population Health Survey

Variable	Self-reported mental distress		
	No/Low[a] %	Moderate/ High[a] %	OR (95% CI)[b]
Ethnicity			
Ethnic groups			
British	39.6	32.9	1.00
Eastern European	4.8	4.6	**1.03 (1.00–1.05)**
Western European	35.3	39.3	**1.04 (1.03–1.05)**
Chinese	2.1	3.0	1.02 (0.98–1.06)
South Asian	1.6	1.5	1.01 (0.97–1.06)
Black	1.0	1.2	1.01 (0.95–1.08)
Other	15.7	17.6	**1.04 (1.02–1.06)**
Demographic variable			
Immigrant status			
Canadian-born	81.5	79.7	1.00
Immigrant	18.5	20.3	1.01 (0.99–1.03)
Sex			
Male	49.4	39.3	1.00
Female	50.6	60.7	**1.07 (1.06–1.08)**
Age group, years			
15–24	14.2	25.1	**1.10 (1.08–1.12)**
25–54	59.2	56.0	**1.03 (1.01–1.04)**
55–69	16.8	11.7	0.99 (0.97–1.00)
≥70	9.9	7.2	1.00
Marital status			
Married, common law, partnership	65.4	49.5	**0.92 (0.91–0.93)**
Widowed, separated, divorced	12.6	15.8	**0.98 (0.97–1.00)**
Single	22.0	34.7	1.00
Residence			
Rural[c]	17.6	13.9	**0.98 (0.97–0.99)**
Urban[d]	82.4	86.1	1.00
Length of stay in Canada, years			
≤ 2	1.4	0.9	1.05 (0.99–1.11)
2–20	14.4	24.5	**1.07 (1.06–1.09)**
> 20	84.3	74.6	1.00
Geographical area			
Atlantic[e]	8.5	7.6	**0.99 (0.98–1.00)**
British Columbia	13.1	11.6	1.00 (0.98–1.01)
Prairies[f]	16.6	14.2	1.00 (0.98–1.01)
Quebec	23.9	31.7	**1.06 (1.04–1.08)**
Ontario	37.8	34.9	1.00
Socio-economic status			
Income adequacy[g]			
Low	16.1	25.4	**1.13 (1.11–1.14)**
Medium	67.0	62.7	**1.03 (1.02–1.04)**
High	16.9	11.9	1.00

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TABLE 1 (continued)
Respondent characteristics at baseline (Cycle 1) of the National Population Health Survey

Variable	Self-reported mental distress		
	No/Low[a] %	Moderate/ High[a] %	OR (95% CI)[b]
Education			
≤ Grade 12	73.1	64.7	**1.06 (1.05–1.07)**
> Grade12	26.9	35.3	1.00
Social involvement score[h]			
Low	40.7	46.2	**1.06 (1.04–1.07)**
Moderate	37.4	38.4	**1.04 (1.03–1.06)**
High	21.9	15.4	1.00
Lifestyle			
Smoking status			
Current	27.8	40.9	**1.08 (1.07–1.10)**
Former	32.1	25.6	**1.01 (1.00–1.02)**
Never	40.1	33.6	1.00
Household smoking			
Yes	34.1	46.4	**1.07 (1.06–1.08)**
No	65.9	53.6	1.00
General health status			
Poor	1.0	6.4	**1.51 (1.46–1.56)**
Fair	6.4	15.4	**1.25 (1.23–1.28)**
Good	25.1	34.2	**1.12 (1.11–1.13)**
Very Good	39.1	30.6	**1.04 (1.03–1.05)**
Excellent	28.3	13.4	1.00

Abbreviations: CI, confidence interval; GEE, generalized estimating equations; OR, odds ratio; SIS, social involvement score.

Note: Bolded values are ones that are statistically significant.

[a] Weighted percentages.

[b] $p < .20$ based on the relationship between each of the risk factors and the outcome variable using GEE approach.

[c] Urban: An area that has a minimum population concentration of 1000 or more and a population density of at least 400 per square kilometre based on previous census counts.[16]

[d] Rural: Area residual of urban areas (see above).[16]

[e] Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island.

[f] Manitoba, Saskatchewan, Alberta.

[g] Based on total household income and household size.[16]

[h] The social involvement dimension is measured by two items that reflect the frequency of participation in associations or voluntary organizations and the frequency of attendance at religious services in the last year. SIS is used as a time-independent variable (computed for Cycle I).[16]

TABLE 2
Relationship between self-reported mental distress and independent variables of interest (main effects) based on dichotomous logistic regression of the prevalence of self-reported mental distress

Variable	Adjusted odds ratio (OR_{adj}) of self-reported mental distress (95% CI)
Ethnicity	
Ethnic groups (Ref: British)	1.0
Eastern European	1.72 (0.75–3.90)
Western European	1.28 (0.88–1.85)
Chinese	0.45 (0.09–2.33)
South Asian	2.93 (0.36–23.82)
Black	1.80 (0.13–25.36)
Other	1.52 (0.91–2.52)
Demographic status	
Immigrant status (Ref: Canadian-born)	1.0
Immigrant	0.89 (0.67–1.18)
Sex (Ref: Male)	1.0
Female	**1.69 (1.48–1.94)**
Age group, years (Ref: ≥ 70)	1.0
15–24	**2.67 (2.21–3.22)**
25–54	**2.23 (1.95–2.56)**
55–69	**1.23 (1.08–1.41)**
Marital status (Ref: Single)	1.0
Married/common law/partnership	**0.69 (0.62–0.76)**
Widowed/separated	0.98 (0.87–1.10)
Residence (Ref: Urban)[a]	1.0
Rural[b]	**0.87 (0.79–0.97)**
Length of residence, years (Ref: > 20)	1.0
≤ 2	0.78 (0.46–1.33)
2–20	**1.27 (1.09–1.49)**
Geographical area (Ref: Ontario)	1.0
Atlantic[c]	0.97 (0.86–1.09)
British Columbia	1.01 (0.89–1.15)
Prairies[d]	0.94 (0.84–1.04)
Quebec	**1.46 (1.31–1.64)**
Socio-economic status	
Income adequacy (Ref: High)[e]	1.0
Low	**1.35 (1.19–1.53)**
Medium	1.04 (0.86–1.25)
Education (Ref: > Grade 12)	1.0
≤ Grade 12	**1.21 (1.06–1.39)**
Social support status[f]	
SIS (Ref: High)	1.0
Low	1.14 (0.95–1.37)
Moderate	1.04 (0.86–1.25)

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TABLE 2 (continued)
Relationship between self-reported mental distress and independent variables of interest (main effects) based on dichotomous logistic regression of the prevalence of self-reported mental distress

Variable	Adjusted odds ratio (OR_{adj}) of self-reported mental distress (95% CI)
Lifestyle status	
Smoking status (Ref: Never smoked)	1.0
Current smoker	**1.36 (1.21–1.52)**
Former smoker	**1.14 (1.04–1.24)**
Household smoking (Ref: No)	1.0
Yes	**1.14 (1.05–1.25)**
General health status	
(Ref: Excellent)	1.0
Poor	**13.40 (11.11–16.15)**
Fair	**5.77 (5.07–6.57)**
Good	**2.85 (2.58–3.15)**
Very Good	**1.54 (1.41–1.69)**
Time point	
(Ref: Cycle 1)	1.0
Cycle 6	**0.75 (0.66–0.84)**
Cycle 5	**0.65 (0.58–0.72)**
Cycle 4	**0.58 (0.52–0.63)**
Cycle 3	**0.73 (0.66–0.81)**
Cycle 2	**0.68 (0.63–0.74)**
Drop (Ref: Completers)	1.0
Missing value = 1	1.13 (0.95–1.35)
Missing values ≥ 2	**1.28 (1.09–1.50)**
Died during the cycles	**1.26 (1.08–1.47)**

Abbreviations: CI, confidence interval; OR_{adj}, adjusted odds ratio; Ref, reference; SIS, social involvement score.

Note: Bolded values are statistically significant.

[a] Urban: An area that has a minimum population concentration of 1000 or more and a population density of at least 400 per square kilometre based on previous census counts.[16]

[b] Rural: Area residual of urban areas (see above).[16]

[c] Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island.

[d] Manitoba, Saskatchewan, Alberta.

[e] Based on total household income and household size.[16]

[f] The social involvement dimension is measured by two items that reflect the frequency of participation in associations or voluntary organizations and the frequency of attendance at religious services in the last year. SIS used as a time-independent variable (computed for Cycle 1).[16]

Respondents of Black ethnicity with one missing observation had an extremely high probability of reporting moderate/high mental distress, while those of Chinese ethnicity with two or more missing observations or who deceased during the study period had an extremely low probability of reporting moderate/high mental distress (Figure 5).

Discussion

Our results show that the relationship between ethnicity and mental distress was modified by immigrant status, sex, SIS, and education and by the missing data pattern variable (dropout). The predicted probability of moderate/high mental distress was slightly higher for immigrant versus Canadian-born respondents of all except Black ethnicity (Table 3) and the overall pattern of the longitudinal trend was similar for all immigrants of different ethnic groups except immigrants of Black ethnicity (Figure 1). We observed an inverted U-shaped relationship between length of stay in Canada and mental distress. These results support previous findings that the physical and mental health of immigrants deteriorates during the first couple of years after immigration, and then starts to improve slightly or to level off.[25-27]

Adjustment to a new country, for any individual, is a complex process. Some studies have shown that most new immigrants to any country experience some kind of mental or psychological distress during the first few years,[27,28] especially adolescents,[29-31] and that length of stay in the new country plays an important role in the development of well being.[27-29]

TABLE 3
Relationship between self-reported mental distress and ethnicity as modified by several factors based on dichotomous logistic regression of the prevalence of self-reported mental distress

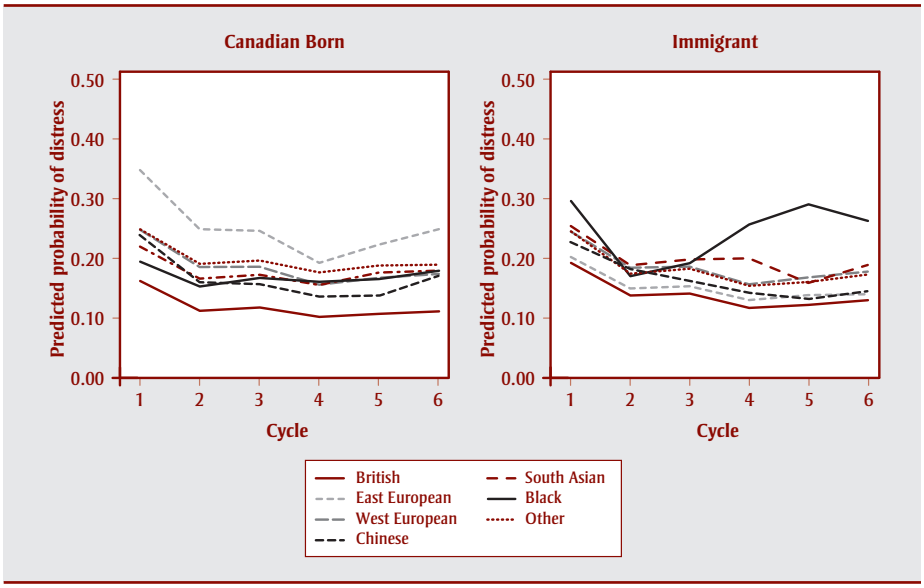
Combinations of variables		Adjusted odds ratio (OR_{adj}) of self-reported mental distress (95% CI)
Education (years) and ethnicity		
≤ 12 (vs. > 12)	Eastern European	0.81 (0.48–1.34)
≤ 12 (vs. > 12)	Western European	**0.88 (0.73–1.06)**[a]
≤ 12 (vs. > 12)	Chinese	2.16 (0.92–5.07)
≤ 12 (vs. > 12)	South Asian	0.83 (0.29–2.42)
≤ 12 (vs. > 12)	Black	0.40 (0.12–1.37)
≤ 12 (vs. > 12)	Other	1.03 (0.80–1.32)
SIS and ethnicity		
Low (vs. high)	Eastern European	1.11 (0.64–1.93)
Low (vs. high)	Western European	1.03 (0.80–1.33)
Low (vs. high)	Chinese	2.90 (0.71–11.88)
Low (vs. high)	South Asian	2.46 (0.62–9.80)
Low (vs. high)	Black	0.80 (0.25–2.51)
Low (vs. high)	Other	0.98 (0.71–1.35)
Moderate (vs. high)	Eastern European	1.51 (0.85–2.66)
Moderate (vs. high)	Western European	1.18 (0.89–1.55)
Moderate (vs. high)	Chinese	**5.67 (1.38–23.32)**
Moderate (vs. high)	South Asian	2.30 (0.64–8.27)
Moderate (vs. high)	Black	0.45 (0.10–2.07)
Moderate (vs. high)	Other	1.13 (0.81–1.57)
Immigration status and ethnicity		
Immigrant (vs. Canadian-born)	Eastern European	**1.80 (1.10–2.97)**
Immigrant (vs. Canadian-born)	Western European	**1.38 (0.97–1.96)**[a]
Immigrant (vs. Canadian-born)	Chinese	1.18 (0.55–2.53)
Immigrant (vs. Canadian-born)	South Asian	1.26 (0.35–4.57)
Immigrant (vs. Canadian-born)	Black	0.68 (0.15–3.08)
Immigrant (vs. Canadian-born)	Other	1.24 (0.88–1.74)
Sex and ethnicityy		
Female (vs. male)	Eastern European	**0.70 (0.47–1.04)**[a]
Female (vs. male)	Western European	0.98 (0.82–1.17)
Female (vs. male)	Chinese	0.73 (0.39–1.38)
Female (vs. male)	South Asian	**0.40 (0.15–1.07)**[a]
Female (vs. male)	Black	0.84 (0.22–3.16)
Female (vs. male)	Other	0.88 (0.70–1.13)
Drop and ethnicity		
Missing value, number		
1	Eastern European	1.10 (0.65–1.87)
1	Western European	1.10 (0.85–1.43)
1	Chinese	0.89 (0.39–2.05)
1	South Asian	0.80 (0.21–3.06)
1	Black	**5.25 (1.20–22.85)**
1	Other	0.90 (0.64–1.27)
≥ 2	Eastern European	1.26 (0.77–2.05)
≥ 2	Western European	**0.79 (0.63–1.00)**
≥ 2	Chinese	0.85 (0.42–1.71)
≥ 2	South Asian	**0.30 (0.09–1.04)**[a]
≥ 2	Black	0.95 (0.19–4.66)
≥ 2	Other	**0.77 (0.58–1.01)**[a]

Abbreviations: CI, confidence interval; OR_{adj}, adjusted odds ratio; SIS, social involvement score; vs., versus.

Note: Bolded values are statistically significant.

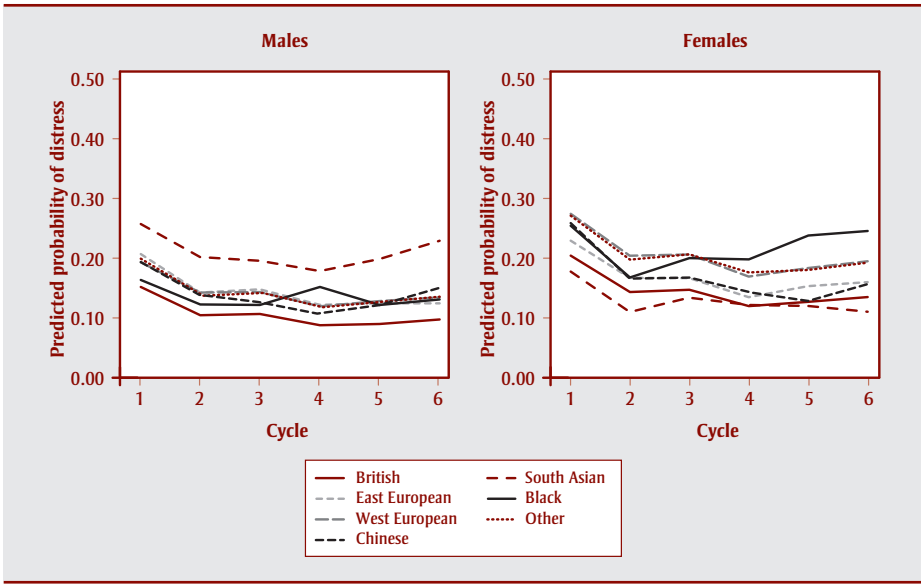
[a] Borderline significant.

FIGURE 1
Predicted probability of developing moderate/high mental distress over time among NPHS respondents aged 15 years plus stratified by ethnicity and immigration status, cycle 1 (1994/1995) to cycle 6 (2004/2005)



Abbreviation: NPHS, National Population Health Survey.

FIGURE 2
Predicted probability of developing moderate/high mental distress over time among NPHS respondents aged 15 years plus stratified by ethnicity, cycle 1 (1994/1995) to cycle 6 (2004/2005)



Abbreviation: NPHS, National Population Health Survey.

However, other studies have shown that this psychological stress does not improve over time.[14,31]

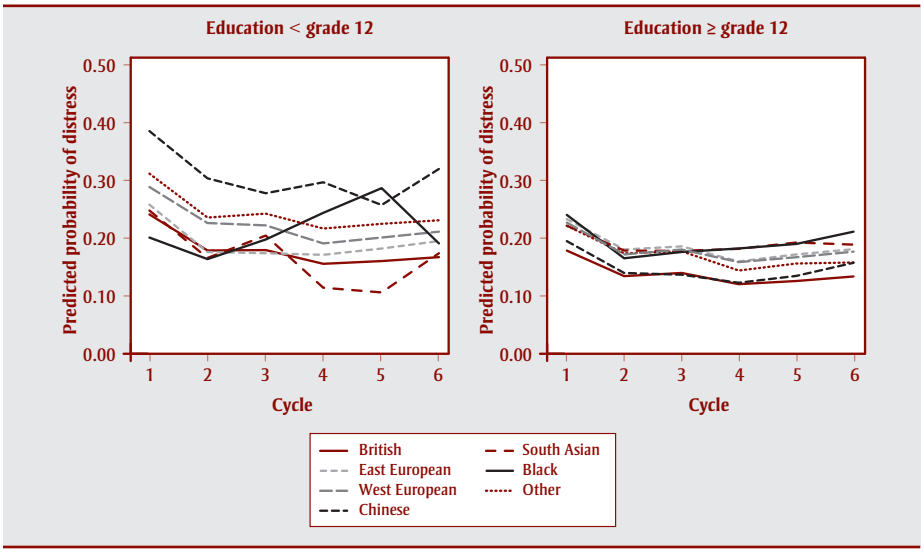
Our data did not show the significant interaction between age and ethnicity observed by Rait et al.;[29] rather, we observed a decline in moderate/high mental distress with increasing age (Table 1), a finding consistent with those of many other researchers.[4,14,30] Rait et al. also found poorer mental health among the older (65+ years) immigrants of Chinese ethnicity compared to the Canadian-born population, which our results did not show.[29] In this regard, because of the aging of the Canadian population, mental illness among elderly people is likely to be a major health problem, with a need for valid instruments to both assess the mental health of elderly people of different ethnicities and help in their treatment.[29]

Wu et al.,[31] who investigated the differences in mental distress of 12 ethnic groups using 1996/97 NPHS data, reported that Canadians of East and Southeast Asian, South Asian, Chinese and Black ethnic groups have a lower risk of depression compared to British Canadians.[31] These differences among ethnic groups persisted after adjusting for socio-economic status and social support.[31] We also observed that respondents of Chinese ethnicity with high SIS had the lowest moderate/high mental distress compared to other ethnicities and respondents of South Asian ethnicity had the second lowest moderate/highest mental distress (Table 3). Respondents of Chinese ethnicity with high SIS had remarkably low probability of moderate/high mental distress compared to those who had moderate SIS.

The inverse dose-response relationship between income adequacy and mental distress in our report (Table 2) supports the results from various Canadian, North American and British studies.[32,33] Orpann et al. reported that among both men and women low household income was a significant predictor for mental distress.[33]

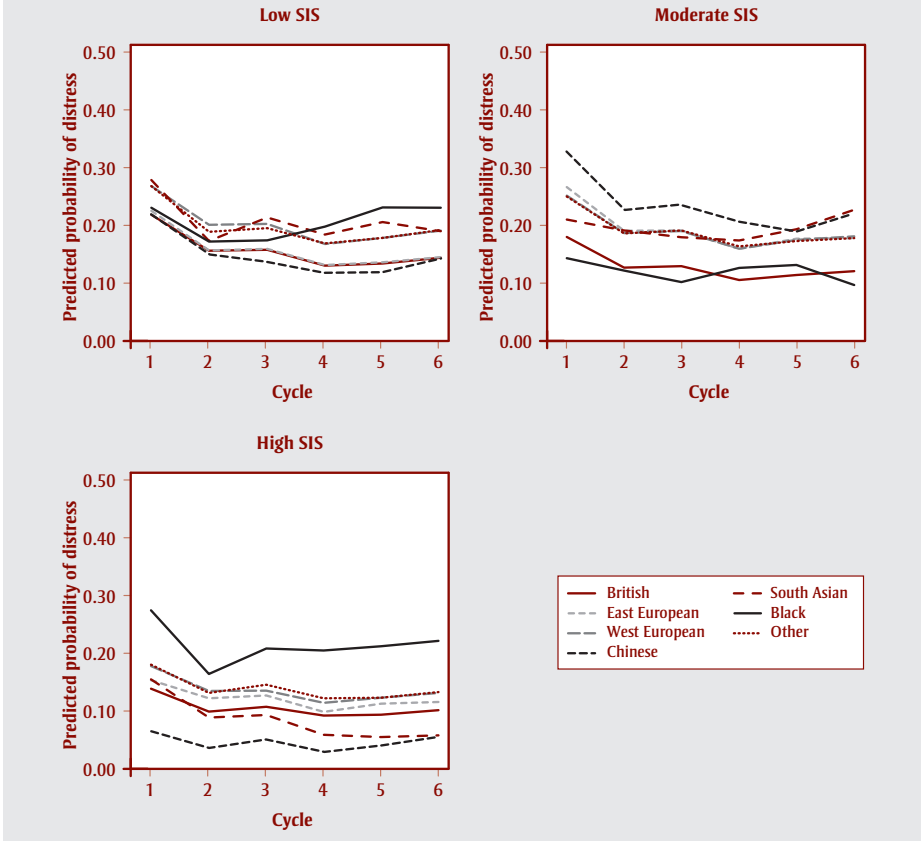
Personal smoking habits and exposure to second-hand smoke have been linked to mental health in several studies.[34-39] We found that both former and current smokers were significantly more likely to report moderate/high mental distress than non-smoking respondents, and that exposure to household smoking was significantly associated with increased risk of moderate/high mental distress (see Table 1). Evidence suggests that smoking may predate and may have a causal role in the development of mental disorders because of the complex effect of nicotine on neuroregulators.[40] Individuals with mental illnesses may "self-medicate" with tobacco.[41-43] Further research could

FIGURE 3
Predicted probability of developing moderate/high mental distress over time among NPHS respondents aged 15 years plus stratified by ethnicity and education level, cycle 1 (1994/1995) to cycle 6 (2004/2005)



Abbreviation: NPHS, National Population Health Survey.

FIGURE 4
Predicted probability of developing moderate/high mental distress over time among NPHS respondents stratified by ethnicity and social involvement score, cycle 1 (1994/1995) to cycle 6 (2004/2005)



Abbreviations: NPHS, National Population Health Survey; SIS, Social Involvement Score.

Note: For the low social involvement category, lines for British and Eastern European ethnicities overlap. For the moderate social involvement category, lines for Western European and Other ethnicities overlap.

investigate whether smoking causes mental distress or whether smoking is the result of mental health problems by comparing smoking patterns before and after incidences of mental distress.

Our findings echo those of Canadian and Australian studies reporting that the prevalence of depression or other mental disorders was significantly lower in rural populations.[44,45] We also observed that geographical area was a significant risk factor for mental distress. Caron and Liu reported that people living in Quebec demonstrated significantly higher psychological distress compared to those living in Atlantic Canada, Ontario, British Columbia and the Prairie provinces.[26] In contrast, Stephens et al. found no relationship between mental health and the province of residence.[14]

It is not clear why respondents of Black ethnicity with one missing observation had an extremely high probability of reporting moderate/high mental distress (Figure 5; Table 3). Similarly, the opposite finding for Chinese respondents for two or more missing observations and for those who had deceased during the study period is hard to explain.

Strengths and limitations

The strengths of our study were the availability of information on a large number of people over a 12-year period, the small attrition rate of respondents, and the large number of health determinants available for analysis. There were also some limitations. The NPHS survey includes respondents from all 10 Canadian provinces, but excludes people living in the territories, long-term residents of health institutions, individuals living on Indian Reserves and Crown Lands, and full-time members of the Canadian Forces. Since the prevalence of the mental distress may be higher in the excluded populations than the general population, the analysis could have underestimated the risk of moderate/high mental distress. In addition, data in this analysis relied on self-report, which always tends to be biased.

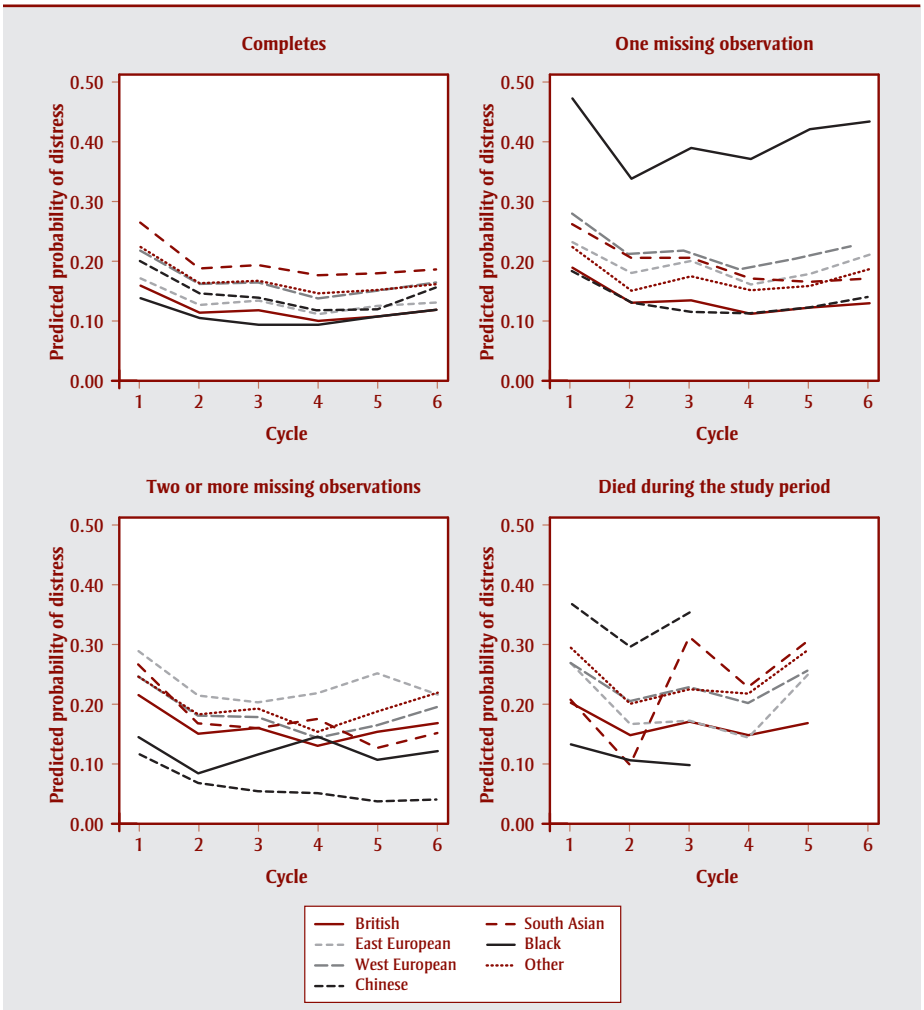
Increased prevalence of mental health problems in immigrant populations has been reported worldwide;[46,47] however,

rates are not consistently elevated in Canada.[48] Based on results from the Canadian Community Health Survey, recent first-generation immigrants to Canada had lower rates of depression compared to Canadian-born residents; however, these rates increased with length of stay in Canada and among the second generation.[9] The reason for the lower rates in the first generation could be because all applicants are screened for a wide range of health problems during the immigration process. It is also possible that recent immigrants do not seek help for mental health problems due to ethnic and cultural barriers. As their length of stay, comfort in Canadian society and awareness increases, they may seek the necessary help. Nevertheless, with immigrant population growth varying from 14% to 30% in different Canadian provinces, this remains a challenge for developing targeted mental health strategies.[48]

Conclusion

The results of our study show that the relationship between ethnicity and mental distress is modified by factors such as immigrant status (foreign born versus Canadian born), sex, education and SIS. The risk of reporting moderate/high mental distress was highest among those aged 15 to 24 years and in the low-income adequacy group. Marital status, sex, place and geographical area of residence as well as personal smoking and household smoking status were other significant predictors. Our results suggest that there is a need to develop ethnicity-specific mental-health programs targeting those with low education attainment and low social involvement. In addition, policies and programs should also be targeted towards women, the younger age group (15–24 years) and low-income adequacy groups.

FIGURE 5
Predicted probability of developing mental distress over time among NPHS respondents who participated in all the cycles from cycle 1 (1994/1995) to cycle 6 (2004/2005) stratified by ethnicity and dropout pattern



Abbreviation: NPHS, National Population Health Survey.

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