LIFESTYLE RISK FACTORS FOR CHRONIC DISEASE ACROSS FAMILY ORIGIN AMONG ADULTS IN MULTIETHNIC, LOW-INCOME, URBAN NEIGHBORHOODS

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Objectives: To describe the prevalence and co-occurrence of lifestyle risk factors for chronic disease by family origin.

Design: Cross-sectional analysis.

Setting: Multiethnic, low-income, urban neighborhoods in Montreal, Canada.

Participants: 2033 adults (42.2% male), mean age 39.7 (standard deviation 6.4) years

Outcome Measures: Smoking, level of physical activity, dietary habits, body mass index.

Methods: Subjects completed self-report questionnaires on sociodemographic characteristics, height, weight, and lifestyle behaviors. We tested family origin (based on language first learned in childhood and country of birth) as an independent correlate of co-occurrence (having at least two lifestyle risk factors) in multivariate logistic regression analyses.

Results: The prevalence of smoking and poor diet was highest among participants of French Canadian family origin. Although physical inactivity was uniformly high across family origins, it was highest among participants of Portuguese, Italian, and Haitian family origin. Obesity was highest among Europeans. The prevalence of smoking was lowest among Haitians; poor diet was lowest among South Asians; and physical inactivity was lowest among Eastern Europeans. Obesity was lowest among Asians, with the exception that 55.9% of South Asians were overweight or obese. Relative to French Canadians, adults in all other family-origin groups had a lower risk of co-occurrence of lifestyle risk factors. Adults of Asian family origin had the lowest prevalence of co-occurrence of lifestyle risk factors.

Conclusion: Variation in the distribution of lifestyle risk factors may explain in part differences in chronic disease morbidity and mortality across ethnic groups. Prevention programs should take differential distribution of lifestyle risk factors by ethnicity into account. (*Ethn Dis*. 2007;17:657–663)

Key Words: Ethnicity, Risk Factors, Cardiovascular Disease, Low Income, Smoking, Diet, Physical Activity, Body Mass Index

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INTRODUCTION

Differences across ethnic groups in genetic heritage, culture, traditions, and lifestyle behaviors all contribute to variation in the prevalence of chronic disease between and within countries,[1–4] and several studies substantiate variation across ethnicities in the prevalence of well-established risk factors for chronic disease including smoking,[5] hypertension, obesity, physical inactivity, and poor diet.[3,4,6,7] In addition, persons within the same ethnic group can adopt different lifestyles in different (health-enhancing or compromising) environments, which may then interact with a genetic predisposition to increase or protect against the risk of chronic disease.[7,8] For example, compared to those living in their country of birth, South Asian immigrants living in the United Kingdom had increased energy intake and reduced physical activity, which explained a disproportionate amount of their coronary heart disease risk.[9] Gradual adoption of lifestyles prevailing in the new host country may explain why the cardiovascular disease (CVD) and cancer mortality risk among South Asians increased with duration of residence in the United Kingdom.[10]

Research to increase understanding of ethnic variation in chronic disease has encountered at least three challenges. First, despite the acknowledged need to consider variation in lifestyle risk factors in ethnically heterogeneous populations with diverse lifestyles,[7] published reports often focus on a few select groups, rather than compare across a wide variety of groups. Previous studies for example, compare South Asians (who have among the highest rates of CVD) with Europeans and/or Chinese (who have intermediate and low rates of CVD, respectively).[1,2,7–12] Since CVD risk is preventable to a large extent through modifying lifestyle habits,[3,4] variation in risk must be assessed across many ethnic groups to establish which groups are at increased risk.

Second, comparison or synthesis of understanding across studies on ethnic differences in chronic disease is difficult because no widely accepted, standardized measures of ethnicity exist and because most reports fail to articulate hypotheses about the mechanisms underlying ethnic group differences.[13]

Third, as corroborated in a recent case-control study of 52 countries,[4] having multiple risk factors concurrently—including smoking, diabetes, hypertension, abdominal obesity, psychosocial stressors, poor nutrition, alcohol consumption three or more times per week, physical inactivity, and raised plasma lipids—has a cumulative effect on the risk of acute myocardial infarction. As the number of risk factors increased, the risk of myocardial infarction increased progressively, attaining an odds ratio of 129.2 (99% confidence interval 90.24–184.99) among persons with all nine risk factors. Although this study underscores the need to study co-occurrence of lifestyle risk factors across ethnic groups, few studies to date have done so.

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In order to address these challenges and to increase understanding of the variability in the prevalence of chronic disease across ethnic groups, this analysis examined the distribution and co-occurrence of lifestyle risk factors for chronic disease among adults of differing ethnicities living in multiethnic, low-income, inner-city neighborhoods in Montreal, Canada.

METHODS

Data were available in an evaluation of a five-year heart health promotion program targeted to elementary school children, in which parents as well as students provided data. Specifically, eight schools located in St. Louis du parc, a multiethnic, economically disadvantaged, inner-city neighborhood in Montreal, participated in the program from 1993 to 1997. Sixteen comparison schools located in Montreal were matched to the eight intervention schools based on students' mother tongue and a composite poverty index ranking each of the 330 elementary schools in Montreal in 1993.[9] All study schools were in the lowest quartile of the poverty index.

Data were collected each May/June from 1993 to 1997 in classroom-based surveys of all children in grades 4–6. In 1993, before the program was implemented, 2285 children aged 9–13 years (80.5% of 2840 eligible) completed baseline questionnaires. The current analysis used data collected in 1993 from 2362 parents/primary caretakers of these children (66.7% of those eligible to participate) in self-administered questionnaires sent home to each parent/primary caretaker and returned to school with the child. A detailed description of the methods has been reported.[6] This study received ethics approval from the Montreal General Hospital Public Health Department on April 22, 1992.

Study Variables

Data on sociodemographic characteristics included parents' years of birth, sex, family composition, language(s) spoken, country of birth, education, and employment status (employed or unemployed). Data on family composition were used to create two variables: number of persons/household and family status (single-parent, two-parent/other). Participants indicated the highest level of education they had completed (did not complete secondary school, completed secondary school/completed post-secondary degree).

Family origin was determined using data for parents/primary caretakers including language first learned in childhood (25 languages reported) and country of birth (77 countries reported). Family origin was categorized according to country of birth if language first learned was the language spoken in the country of birth or if data on language first learned were missing. When too few participants for meaningful analysis were in a single category, we grouped countries based on cultural and language similarity and/or geographic proximity. If family origin was not definable, participants were categorized in the "all others" category. Groupings were identified as:

1. French Canadian
2. Middle East/North Africa: Lebanon, Syria, Iraq, Palestinian territories, Jordan, Kuwait, Saudi Arabia, United Arab Emirates, Egypt, Tunisia, Algeria, Morocco
3. Asia: China/Hong Kong, Vietnam, Cambodia, and South Asia: India, Sri Lanka, Bangladesh, Pakistan
4. Europe: Portugal, Italy, and Eastern Europe: Greece, Cyprus, Poland, Yugoslavia, Romania, Bulgaria, Czechoslovakia, Turkey, Hungary
5. South America: Venezuela, Uruguay, Peru, Columbia, Chil, Argentina, Ecuador, Brazil, Bolivia, Guyana, Suriname, French Guyana
6. Central America/Caribbean: Haiti, Salvador, Guatemala, Dominican Republic, Honduras, Nicaragua, Mexico, Panama, Cuba, Jamaica, Trinidad, Grenada, St. Lucia, Barbados, Belize, Antigua, St. Vincent
7. All Others: including the remaining 16 countries; $n=268$.

Because the "all others" category is not interpretable as relevant to any specific family origin, data for this group are not reported in some analyses. We use the term "non-Canadian family origin" in this report to refer collectively to all groupings excluding those of French Canadian family origin.

We considered participants to be smokers if they reported smoking any cigarettes during the last 7 days. We considered participants to be physically active if they reported ≥20 minutes of leisure-time physical activity at least twice a week for the past four months. (Initially, physically active was defined as activity at least three times a week, but this cutoff was changed because so few people reported being active at least three times a week.) Body mass index (BMI) was calculated by using self-reported weight (kg) and height (m^2). Participants with a BMI ≥25 and <30 were categorized as overweight; those with a BMI ≥ 30 were categorized as obese. Data on dietary habits were collected in a 32-item food frequency questionnaire designed for and validated in low-income populations.[15] Scores for frequency of consuming six high-fat/junk-food items (bacon/sausage, ice cream, cakes/donuts/chocolate candy, potato/corn chips, French fries, deep fried onions rings/seafood) were summed to create a junk-food consump-

Table 1. Sociodemographic characteristics of adults in multiethnic, low-income, inner-city neighborhoods by family origin, Montreal

	Total	Male	Age	Single-parent Family	No. Persons/ Household	Born in Canada	Secondary Education		Employed	
							Female	Male	Female	Male
Family Origin	**n**	**%**	**Mean (SD)**	**%**	**Mean (SD)**	**%**	**%**	**%**	**%**	**%**
Total*	2033	42.2	39.7 (6.4)	16.4	4.4 (1.4)	30.2	41.9	38.6	64.2	83.2
French Canadian	575	37.8	38.8 (6.0)	23.3	3.9 (1.1)	100.0	33.2	30.5	65.7	89.8
Europe										
Portugal	294	45.4	38.3 (5.7)	3.8	4.5 (1.1)	1.4	79.4	75.2	76.6	87.2
Italy	122	51.6	41.4 (6.5)	9.0	4.5 (.9)	15.6	39.0	47.6	61.0	93.4
Eastern Europe	51	35.3	40.9 (6.1)	18.0	4.2 (1.2)	9.8	21.2	33.3	80.0	82.4
Asia										
China	87	48.3	43.9 (6.8)	11.6	4.9 (1.4)	2.3	48.9	50.0	69.1	81.0
Vietnam	76	46.0	40.4 (6.6)	5.6	5.1 (1.9)	.0	27.5	23.5	61.1	76.7
Cambodia	55	54.6	38.4 (5.3)	7.3	5.0 (1.5)	.0	72.0	33.3	56.5	65.4
South Asia	42	40.5	41.8 (6.1)	9.5	5.2 (1.2)	.0	16.0	5.9	66.7	81.3
Middle East/North Africa	87	48.8	41.1 (6.5)	7.1	5.4 (1.5)	1.2	47.7	28.6	41.9	75.6
South America	102	39.2	40.1 (6.0)	12.8	4.6 (1.1)	.0	33.9	17.5	55.7	76.9
Central America/Caribbean										
Haiti	98	36.8	42.6 (7.7)	33.7	4.5 (1.6)	.0	43.3	28.6	53.3	86.1
El Salvador	73	42.5	37.8 (5.5)	11.0	4.5 (1.3)	.0	33.3	22.6	67.4	70.0
Other	103	36.0	39.4 (7.2)	26.2	4.7 (1.6)	.0	39.1	41.7	55.7	63.9

SD= standard deviation.
* Includes $n=268$ subjects categorized in the "all others" family origin category.

tion score (mean standard deviation[sd] = 8.0[1.9]; median = 7.0; range = 6.0–17.0), with higher scores indicating more frequent consumption).[14] Similarly, scores for frequency of consuming fruits, vegetables, and juices were summed to create a fruit and vegetable consumption score (mean [sd]=2.8[0.9]; median=2.0; range=2.0–6.0, with higher scores indicating more frequent consumption). Participants were categorized as having a poor diet if they were above the median junk-food score and below the median fruit and vegetable consumption score.

Data Analysis

While having one lifestyle risk factor increases the risk of chronic disease, having two or more (co-occurrence) may be associated with a substantially increased risk.[4] To determine if family origin was associated with co-occurrence, participants were assigned a score according to how many of four risk factors (smoking in the past week, physical inactivity, obesity, and poor diet) were reported.

We examined the association between family origin and co-occurrence in multivariate logistic regression, adjusting for potential confounders including age, sex, family status, number of persons/household, employment status, and education. A total of 1452 males and females lived in the same household, likely representing 726 couples. Since lifestyle risk behaviors of cohabiting persons may be correlated, analyses were conducted within a generalized estimating equations framework[16] with an exchangeable correlation structure of residuals. Statistical analyses were conducted using SAS version 9.1.

RESULTS

Of 2362 participants who completed the parent questionnaire, 329 were excluded because data on family origin were missing. Of the remaining 2033 participants, the mean age was 41.7 (standard deviation 6.7) years among men and 38.2 (standard deviation 5.7) years among women (Table 1). Few participants of non-Canadian family origin had been born in Canada, with the exception that 15.6% of Italians and 9.8% of Eastern Europeans were Canadian-born.

The proportion of single-parent families ranged from 3.8% among Portuguese to 33.7% among Haitians. Household size was lowest among participants of French Canadian family origin (3.9 persons per household). It ranged between 4.2 and 5.4 persons per household among participants of non-Canadian family origin. Approximately 40% of participants had not completed secondary school. Employment ranged from 41.9% for women in Middle East/North African families to 80.0% of women in Eastern European families; and from 65.4% of Cambodian men to 93.4% of Italian men.

Prevalence of Risk Factors by Family Origin

The prevalence of each risk factor investigated was relatively high in this

low-income population (Table 2). The prevalence of smoking was highest among participants of French Canadian family origin. Among participants of non-Canadian family origin, the prevalence of smoking was highest among Italians and lowest among Haitians.

The prevalence of overweight and obesity was highest among participants of European and South and Central American family origin and lowest among Asians. Participants of Vietnamese family origin had the lowest prevalence of overweight and obesity overall. An exception among the Asian subgroup was that 44.1% of South Asians were overweight and 11.8% were obese.

Almost three quarters of participants were physically inactive. Participants of French Canadian family origin had the highest prevalence of poor diet. The prevalence of poor diet was lowest among Asian participants overall, and among South Asians in particular.

Sex-specific data show that the prevalence of smoking and overweight was higher in men, while the prevalence of inactivity and obesity was similar among men and women (data not shown).

Co-occurrence by Family Origin

Our measure of co-occurrence was defined as having at least two of four risk factors of primary interest (Table 3). The prevalence of co-occurrence was highest among French Canadians and Italians and lowest in Asians. Overall 9.9% of participants had 3–4 risk factors concurrently. Those of French Canadian, Middle East/North African and Italian family origin (FO) had the highest prevalence of having 3–4 risk factors concurrently (18.3%, 13.8% and 13.1% respectively); those of Chinese, Vietnamese and Central American (Haiti, Salvador) FO had the lowest (1.2%, 1.3%, 1.0% and 1.4% respectively).

Multivariate analysis substantiated that, relative to participants of French Canadian family origin, those of non-

Table 2. Prevalence of lifestyle risk factors among adults in multiethnic, low-income, inner-city neighborhoods by family origin, Montreal

Family Origin	Total	Smokes	Overweight	Obese	Inactive	Frequent Junk Food**	Infrequent Fruits and Vegetables***	Poor Diet
	n	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Total*	2033	32.3 (30.2–34.4)	32.9 (30.7–35.1)	12.2 (10.7–13.8)	71.7 (69.7–73.7)	20.3 (18.5–22.1)	23.7 (21.9–25.7)	24.2 (22.3–26.1)
French Canada	575	53.4 (49.1–57.7)	30.1 (26.3–34.1)	12.5 (9.9–15.6)	71.5 (67.6–75.1)	20.2 (17.0–23.8)	35.0 (31.1–39.1)	30.5 (26.8–34.5)
Europe								
Portugal	294	24.0 (19.2–29.4)	40.5 (34.5–46.7)	14.5 (10.5–19.4)	80.5 (75.5–84.9)	17.6 (13.4–22.5)	18.3 (14.1–23.3)	23.8 (19.0–29.1)
Italy	122	40.5 (31.5–50.0)	43.5 (34.3–53.0)	18.3 (11.7–26.6)	78.3 (69.9–85.3)	9.8 (5.2–16.6)	28.9 (21.1–37.9)	22.1 (15.1–30.5)
Eastern Europe	51	36.7 (23.4–51.7)	39.6 (25.8–54.7)	18.8 (9.0–32.6)	58.0 (43.2–71.8)	28.0 (16.2–42.5)	19.6 (9.8–33.1)	20.0 (10.0–33.7)
Asia								
China	87	12.9 (6.6–22.0)	15.7 (8.1–26.4)	5.7 (1.6–14.0)	70.6 (59.7–80.0)	16.1 (9.1–25.5)	10.3 (4.8–18.7)	14.9 (8.2–24.2)
Vietnam	76	16.4 (8.8–27.0)	6.6 (1.8–16.0)	1.6 (.0–8.8)	72.0 (60.4–81.8)	15.8 (8.4–26.0)	15.8 (8.4–26.0)	14.5 (7.5–24.4)
Cambodia	55	10.9 (4.1–22.2)	23.3 (11.8–38.6)	4.7 (.6–15.8)	67.3 (53.3–79.3)	29.1 (17.6–42.9)	21.8 (11.8–35.0)	20.0 (10.4–33.0)
South Asia	42	12.2 (4.1–26.2)	44.1 (27.2–62.1)	11.8 (3.3–27.5)	76.2 (60.6–88.0)	23.8 (12.1–39.5)	9.8 (2.7–23.1)	9.5 (2.7–22.6)
Middle East/North Africa	87	32.9 (23.1–44.0)	30.1 (20.5–41.2)	13.3 (6.8–22.5)	75.6 (65.1–84.2)	29.1 (19.8–39.9)	21.2 (13.1–31.4)	25.6 (16.8–36.1)
South America	102	26.8 (18.3–36.8)	45.9 (35.8–56.3)	5.1 (1.7–11.5)	69.3 (59.3–78.1)	19.8 (12.5–28.9)	23.5 (15.5–33.1)	26.7 (18.4–36.5)
Central America/ Caribbean								
Haiti	98	9.6 (4.5–17.4)	33.8 (23.2–45.7)	21.6 (12.9–32.7)	78.0 (68.1–86.0)	28.0 (19.1–38.2)	17.1 (9.9–26.6)	20.4 (12.8–30.1)
El Salvador	73	10.5 (4.3–20.4)	45.9 (33.1–59.2)	11.5 (4.7–22.2)	75.7 (64.0–85.2)	16.9 (9.1–27.7)	16.7 (8.9–27.3)	21.1 (12.3–32.4)
Other	103	16.7 (9.8–25.7)	32.6 (23.0–43.3)	12.4 (6.3–21.0)	62.4 (52.2–71.8)	20.6 (13.2–29.7)	9.9 (4.9–17.5)	20.6 (13.2–29.7)

CI= confidence interval.
* Includes n=268 subjects categorized in the ''all others'' family origin category.
** Includes participants in the highest quintile of the junk food consumption score distribution.
*** Includes participants in the lowest quintile of the fruit and vegetable consumption score distribution.

Table 3. Number of lifestyle risk factors among adults in multiethnic, low-income, inner-city neighborhoods by family origin, Montreal

Family Origin	Total *n*	No. of Risk Factors*				
		0 %	1 %	2 %	3–4 %	≥ 2 %
Total**	2033	15.8	43.1	31.2	9.9	41.1
French Canadian	575	11.0	33.6	37.2	18.3	55.5
Europe						
Portugal	294	12.6	43.2	36.7	7.5	44.2
Italy	122	11.5	37.7	37.7	13.1	50.8
East Europe	51	15.7	47.1	29.4	7.8	37.3
Asia						
China	87	24.1	51.7	23.0	1.2	24.1
Vietnam	76	23.7	51.3	23.7	1.3	25.0
Cambodia	55	21.8	56.4	20.0	1.8	21.8
South Asia	42	19.1	57.1	21.4	2.4	23.8
Middle East/North Africa	87	11.5	49.4	25.3	13.8	39.1
South America	102	15.8	48.5	29.7	5.9	35.6
Central America/Caribbean						
Haiti	98	17.4	49.0	32.7	1.0	33.7
Salvador	73	16.4	56.2	26.0	1.4	27.4
Other	103	27.2	42.7	25.2	4.9	30.1

* Includes smoked in past week, physically inactive, poor diet, and obese.
** Includes $n=268$ subjects categorized in the ''all others'' family origin category.

Canadian family origin were at lower risk of co-occurrence (Table 4). In particular, participants in the four Asian groups were 71%–82% less likely to be at risk of co-occurrence.

DISCUSSION

Canada is a country of high immigrant intake: more than 200,000 persons immigrate to Canada each year, of whom 20,000 settle in Montreal.[17] While the proportion of immigrants from Asia, Latin America and Africa was ≈1% before 1961, it increased to 19% by 1996.[17] Shifts in the population distribution by ethnic background related to changing immigration patterns will result in changes in the prevalence of chronic disease, and public health programming will need to adjust to changing priorities necessitated by these shifts.

In this analysis we investigated the co-occurrence of common lifestyle-related risk factors for chronic disease in an ethnically heterogeneous sample of adults; most were first generation immigrants and all lived in low-income neighborhoods. Overall, the prevalence of lifestyle-related risk factors, as well as of co-occurrence, was high. Despite challenges in delineating ethnic groups empirically, coherent patterns of lifestyle behaviors emerged, underscoring the uniqueness of each ethnic group.

French Canadians were at the highest risk of co-occurrence and, in particular, the prevalence of smoking and poor dietary habits was markedly elevated. While the risk of co-occurrence was lower among participants of non-Canadian FO, there was considerable variability in the prevalence of specific risk factors across groups, likely reflecting wide diversity in the health traditions and lifestyle behaviors that new immigrants bring to Canada. Italians and Portuguese had the highest prevalence of smoking, obesity, and physical inactivity. These two groups also had

French Canadians were at the highest risk of co-occurrence [of lifestyle risk factors] and, in particular, the prevalence of smoking and poor dietary habits was markedly elevated.

Table 4. Relative to French Canadian family origin, odds ratios (OR) (95 percent confidence intervals) for co-occurrence* of lifestyle risk factors among adults in multiethnic, low-income, inner-city neighborhoods by family origin, Montreal (*N*=2033).

	Unadjusted OR (95% CI)	Adjusted OR** (95% CI)
Portugal	.64 (.47–.87)	.57 (.40–.81)
Italy	.83 (.56–1.23)	.76 (.50–1.14)
Eastern Europe	.50 (.28–.91)	.63 (.33–1.22)
China	.26 (.15–.45)	.24 (.13–.45)
Vietnam	.28 (.16–.48)	.20 (.10–.39)
Cambodia	.22 (.12–.43)	.18 (.09–.38)
South Asia	.26 (.12–.60)	.25 (.10–.62)
Middle East/North Africa	.50 (.30–.83)	.48 (.28–.84)
South America	.44 (.27–.69)	.41 (.25–.66)
Haiti	.43 (.27–.66)	.43 (.26–.69)
El Salvador	.31 (.17–.54)	.36 (.20–.65)
Other Central America	.35 (.21–.57)	.37 (.22–.63)

* Co-occurrence defined as at least two of four risk factors, including smoked in past week, physically inactive, obese, and poor diet.
** Adjusted for age (OR [95% CI] 1.00 [.98–1.01]), male sex (1.52 [1.24–1.86]), single-parent family status (1.08 [.79–1.48]), number of persons/household (1.02 [.93–1.12]), employed (.80 [.64–1.02]), and completed secondary school (.70 [.56–.88]).

the highest proportion of participants born in Canada, which suggests that length of time in Canada may relate to increased lifestyle-related risk. Risk factor profiles of Middle East/North African, South American, and Haitian adults were also unfavorable; almost 40% had at least two of the four risk factors investigated.

Adults of Asian family origin had the most favorable risk factor profiles, with the exception that South Asians had a notably high prevalence of overweight and physical inactivity. This is worrisome since lower BMI cutoffs than those used in this current analysis have recently been recommended to classify non-European ethnic groups as overweight.[18] Our findings on lifestyle-related risk in South Asians offer some explanation for the higher CVD mortality than has been reported in this group.[1,2,8–10,18]

The differential patterns of lifestyle-related risk factors in French Canadians compared to non-Canadians warrant reflection, particularly since all resided in low-income urban neighborhoods. Many newly arrived immigrants settle initially in low-income, inner-city neighborhoods.[28,29] Similar to most industrialized countries, such communities in Canada tend to be relatively disadvantaged in terms of income, education, and infrastructure, and they tend to have a higher prevalence of lifestyle-related risk factors for chronic disease,[20] as well as higher chronic disease mortality rates.[21–22] The inner-city communities in which our sample lived are no exception.[23] While non-Canadians had better lifestyle habits compared to French Canadians, it is worrisome that they settle in neighborhoods where the lifestyle habits of the host country inhabitants are not as healthy.[24,25] If the process of acculturating to a new country involves adopting prevailing lifestyle behaviors, then exposure to poor lifestyle habits in the new host environment may result in declines over time in healthy behaviors among immigrants, with concomitant changes in health status. Indeed numerous reports describe the ''healthy immigrant effect,'' whereby immigrants, on arrival in a host country, have better health and lifestyle behaviors than that of the host population, but lose the advantage within the first 10 years of residence in the host country.[26,27] Previous research in Canada has linked the adoption of unhealthy lifestyle factors to declines in immigrant health over time spent in Canada.[28,29]

This current description of risk factor profiles across ethnic groups enables identification of groups with more and less favorable profiles, which can help prioritize and tailor prevention programs. Although groups such as South Asians have already been identified as having a relatively high chronic disease burden,[2,3,8,18,26,27] this study identifies other groups including Haitians, Middle East/North Africans, and Italians that may need targeted intervention. More studies that compare lifestyle behaviors and health outcomes across a wide range of ethnic groups are needed to help prioritize target groups for intervention.

Limitations

Risk factor data may be subject to differential misclassification by ethnicity because they were based on self-reports. External generalizability might be limited by sample uniqueness; the data were drawn from low-income neighborhoods and are not necessarily applicable to higher income populations. In addition, data were collected in 1993. While the prevalences of some risk factors have undoubtedly changed over time, it is unlikely that the association between family origin and co-occurrence has changed. This analysis did not take immigrant status or length of residence in Canada into account, although deterioration in immigrants' health status may relate to length of residence. However, the aim of this study was to assess variation in lifestyle behaviors across ethnic groups rather than according to immigrant status. Nonetheless, studies are needed to examine how ethnicity, immigrant status, and length of residence interrelate in the adoption of lifestyle risk behaviors. Finally grouping participants into family origin categories to attain adequate sample sizes for analysis may have resulted in loss of variability. Although population genetic studies generally support the notion of genetic clusters, which parallel common racial groupings (African, Asian, European Whites, Pacific-Islanders, North-American Indian), there is notable genetic variability within ethnic groups and even greater social variability. Future studies will need to characterize the composition of the sample in much more detail and in addition focus on social and cultural factors associated with the adoption and maintenance of lifestyles that are specific to each ethnic group.

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