Lifestyle Risk Factors for Chronic Disease by Family Origin Among Children in Multiethnic, Low-income, Urban Neighborhoods

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Objectives: To describe the prevalence of lifestyle risk factors (LRF) for chronic disease by family origin (FO) among children in multiethnic, low-income, urban neighborhoods.

Design: Cross-sectional analysis.

Setting: 16 elementary schools located in disadvantaged, multiethnic neighborhoods in Montreal, Canada.

Participants: 4659 schoolchildren aged 9–12 in grades 4–6.

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

Methods: Subjects completed self-report questionnaires on sociodemographic characteristics and lifestyle behaviors; height and weight were measured in a standardized protocol. Fourteen FO groupings were identified based on language(s) spoken and countries of birth of both subjects and parents. We tested FO as an independent correlate of having 2 or more LRF, using the generalized estimating equations method.

Results: Relative to Canadian children, a higher proportion of Haitian, Portuguese, and other Central American/Caribbean children had 2 or more LRF, the proportion was similar among Cambodian, Vietnamese, Chinese, South American, East European, Arabic, Italian, and South Asian children, and lower among Salvadoran children.

Conclusion: Prevention programs for youth should take differential distribution of LRF by ethnicity into account. (*Ethn Dis*. 2004;14: 340–350.)

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

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Introduction

Morbidity and mortality related to cancer, cardiovascular disease, and stroke, vary considerably among persons of differing ethnic origin. Sheth et al[1] reported substantial differences in rates of death from ischemic heart disease and cancer among European, South Asian, and Chinese Canadians. While there is evidence that biological risk factors, such as dyslipidemia and hypertension, vary between ethnic populations,[2] little is known about differences in lifestyle risk factors, including smoking, physical inactivity, unhealthy dietary habits, and obesity, that might account for ethnicity-related variations in chronic disease morbidity and mortality. In addition, there are few publications describing the clustering of lifestyle risk factors within individuals by ethnicity, although there is evidence that having several risk factors is associated with a substantially increased risk of chronic disease.[3]

In this study we examined the distribution of lifestyle risk factors for chronic disease among pre-adolescents of differing ethnicity living in socioeconomically deprived inner-city neighborhoods. Unhealthy lifestyles are often established in childhood[4]; they are prevalent in youth today,[5] track to adulthood,[6,7] and several are associated with adult morbidity and mortality.[8,9] Identification of risk profiles by ethnicity in young people could help in tailoring chronic disease prevention programs targeted to youth.

Methods

Coeur en Santé St. Louis du Parc was a 5-year school-based heart health promotion program conducted in multiethnic, low income, inner-city neighborhoods in Montreal. For the evaluation of the impact of the program, 2 comparison schools were matched to each of 8 intervention schools, based on a school-specific poverty index (an index compiled annually by the Montreal School Council to rank all elementary schools in Montreal),[10] and a language indicator. The 24 study schools represented 28% of the 86 schools in the lowest poverty index quartile. The current analysis included only subjects from the 16 comparison schools.

Data were collected from all students in Grades 4–6 in 2 visits to each school, during May/June every year from 1993 to 1997. During the first visit, height and weight were measured according to a standardized protocol.[11] During the second visit, data on students' sociodemographic characteristics and lifestyle behaviors (smoking, level of physical activity, and dietary habits) were collected in self-report questionnaires administered in French or English. Detailed descriptions of the study design and methods have been previously published.[12–14]

Data on sociodemographic characteristics included subject's date of birth, sex, family composition, language(s) spoken, number of years lived in Canada, country of birth for each subject,

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and each subject's mother and father, and employment status of the mother and father. Data on family composition were used to create 2 variables: number of persons in each household, and family status (2-parent, single-parent, other).

Family origin was categorized using an algorithm based on 3 factors: 1) parents' country of birth; 2) child's country of birth; and 3) language(s) spoken by the child. If both, or either, parent(s) and the child were born in the same country, and the child spoke a language of that country, then that country was considered to represent the child's family origin (even if the child spoke other languages). Categorization was conservative to the extent that, if the family origin was not clear according to these 3 factors, then the subject was categorized in the "All Others" category. For example, if the child was not born in one of the parents' countries of birth, and the child did not speak a language of one of the parents' countries of birth, then family origin was categorized in the "All Others" category. Family origin categories included Canada (70.6% of subjects in this category were Francophone), Arabic-speaking countries (Lebanon, Syria, Iraq, Palestine, Jordan, Kuwait, Saudi Arabia, United Arab Emirates, Egypt, Tunisia, Algeria, Morocco), Asian (sub-categories included China/Hong Kong, Vietnam, Cambodia, and South Asia [India, Sri Lanka, Bangladesh, Pakistan]), European (subcategories included Portugal, Italy, and Eastern Europe [Greece, Cyprus, Poland, Yugoslavia, Romania, Bulgaria, Czechoslovakia, Turkey, Hungary]), South American (Venezuela, Uruguay, Peru, Colombia, Chili, Argentina, Ecuador, Brazil, Bolivia, Guyana, Suriname, French Guyana), Central American/Caribbean (sub-categories included Haiti, El Salvador, and Other Central American/Caribbean countries [Guatemala, Dominican Republic, Honduras, Nicaragua, Mexico, Panama, Cuba, Jamaica, Trinidad, Grenada, St. Lucia, Barbados, Belize, Antigua, St. Vincent]), and "All Others" (including the remaining 43 countries). When there were too few students for meaningful analysis in a single category, we grouped countries based on cultural and language similarity, and/or geographic proximity. A total of 14 groupings were identified (mean *N*/grouping=333; range 82–915). Because it is not possible to interpret the "All Others" category as relevant to any specific family origin, data for this group are not reported specifically (*N*=590).

Percent of lifetime in Canada was

Table 1. Sociodemographic characteristics of elementary school children in multiethnic, low income, inner-city neighborhoods by family origin, Montreal (*N*=4659)

Family Origin	Total *N*	Male %	Age x (sd)	Single-Parent Family %	No. Persons/ Household x (sd)	Born in Canada			Lifetime in Canada <25%	Employed	
						Subject %	Mother %	Father %	%	Mother %	Father %
Total	4659	49.2	10.8 (0.9)	26.5	4.7 (1.9)	57.0	25.4	22.4	9.5	58.8	77.8
Canada	915	47.2	10.8 (1.0)	39.9	3.8 (1.5)	99.7	99.8	98.7	0.2	64.3	84.5
Europe											
Portugal	217	52.1	10.9 (0.9)	6.9	4.7 (1.3)	69.0	5.1	4.2	2.9	77.9	88.0
Italy	265	49.8	10.7 (1.0)	15.1	4.6 (1.4)	97.4	50.4	27.5	0.4	67.2	91.5
East Europe	255	52.9	10.9 (1.0)	17.3	4.4 (1.6)	38.2	3.6	2.8	20.1	58.4	77.5
Asia											
China	82	47.6	10.9 (0.9)	7.3	4.6 (1.5)	40.2	0	1.3	17.3	76.5	82.9
Vietnam	353	50.1	10.8 (0.9)	14.2	5.1 (1.9)	32.9	0	0.6	6.8	58.2	73.7
Cambodia	184	47.3	11.0 (0.9)	19	5.3 (1.7)	38.6	0	0	4.6	57.3	63.7
South Asia	250	48.2	10.9 (0.9)	10.4	5.2 (1.9)	23.3	0	0	23.5	42.7	69.0
Arabic	298	51.7	10.7 (0.9)	12.1	5.8 (2.1)	35.1	8.2	1.4	14.3	38.6	68.8
South America	192	53.1	10.8 (1.0)	28.1	4.8 (1.7)	41.9	2.1	3.7	9.2	60.1	79.9
Central America/Caribbean											
Haiti	536	46.1	10.9 (1.0)	44.6	5.1 (2.3)	65	2.7	1.8	8.5	57.2	72.0
Salvador	212	46.7	10.9 (0.9)	22.2	5.0 (1.5)	29.7	0.5	0	7.7	50.2	73.9
Other	310	51.0	10.9 (1.0)	36.8	4.9 (2.1)	42.7	3.9	1	10.4	62.3	78.9

* Includes *N*=590 subjects categorized in the ''All Others'' family origin category.

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

Family Origin	Total *N*	Ever Smoked % (95% CI)	Obese % (95% CI)	Inactive % (95% CI)	Frequent Junk Food % (95% CI)	Infrequent Healthy Food % (95% CI)	Frequent TV % (95% CI)	Frequent Video Games % (95% CI)
Total*	4659	21.0 (19.8–22.2)	7.4 (6.7–8.2)	21.9 (20.6–23.2)	22.1 (20.7–23.4)	12.5 (11.6–13.5)	26.4 (25.1–27.6)	9.4 (8.5–10.4)
Canada	915	29.4 (26.4–32.3)	6.8 (5.2–8.5)	16.4 (13.8–19.0)	15.4 (12.7–18.1)	12.2 (10.1–14.3)	21.3 (18.6–23.9)	8.6 (6.5–10.7)
Europe								
Portugal	217	31.8 (25.6–38.0)	11.5 (7.2–15.8)	15.4 (10.1–20.6)	30.1 (23.1–37.1)	14.8 (10.0–19.5)	26.3 (20.4–32.1)	10.3 (5.7–14.9)
Italy	265	24.2 (19.0–29.4)	11.8 (7.8–15.8)	18.6 (13.4–23.8)	18.1 (12.9–23.2)	9.4 (5.9–13.0)	23.0 (18.0–28.1)	7.9 (4.3–11.5)
East Europe	255	23.7 (18.4–29.0)	5.0 (2.2–7.8)	17.7 (12.5–22.9)	18.7 (13.2–24.2)	9.4 (5.8–13.1)	22.4 (17.2–27.5)	5.1 (2.0–8.2)
Asia								
China	82	18.8 (10.2–27.3)	3.9 (0.0–8.1)	34.9 (23.4–46.3)	12.7 (4.5–20.9)	8.9 (2.6–15.1)	12.2 (5.1–19.3)	9.7 (2.3–17.0)
Vietnam	353	10.5 (7.3–13.7)	1.8 (0.4–3.2)	32.3 (27.0–37.5)	17.9 (13.4–22.4)	14.6 (10.9–18.3)	26.2 (21.6–30.8)	12.2 (8.4–16.0)
Cambodia	184	18.9 (12.5–23.6)	1.7 (0.0–3.6)	25.8 (19.0–32.6)	22.4 (15.6–29.2)	16.4 (11.0–21.8)	27.2 (20.8–33.6)	9.0 (4.4–13.7)
South Asia	250	6.5 (3.4–9.6)	2.6 (0.5–4.6)	20.6 (14.9–26.3)	23.2 (17.2–29.3)	9.6 (5.9–13.4)	24.6 (19.2–30.0)	12.8 (8.0–17.5)
Arabic	298	17.3 (12.9–21.7)	6.4 (3.5–9.2)	15.1 (10.6–19.7)	17.5 (12.6–22.3)	10.2 (6.7–13.7)	29.1 (23.9–34.2)	11.2 (7.1–15.2)
South America	192	24.3 (18.1–30.5)	9.2 (5.1–13.4)	20.1 (13.8–26.5)	18.9 (12.8–25.0)	10.6 (6.2–15.0)	24.6 (18.5–30.7)	8.6 (4.3–13.0)
Central American/Caribbean								
Haiti	536	20.5 (17.1–24.0)	12.6 (9.7–15.4)	29.0 (24.7–33.3)	30.3 (26.0–34.6)	18.3 (15.0–21.6)	39.7 (35.6–43.9)	10.6 (7.8–13.5)
Salvador	212	13.3 (8.7–17.9)	12.9 (8.4–17.5)	18.8 (12.8–24.8)	17.1 (11.5–22.8)	7.1 (3.7–10.6)	21.3 (15.8–26.9)	5.9 (2.4–9.5)
Other	310	15.6 (11.6–19.7)	7.8 (4.7–10.8)	23.3 (18.1–28.5)	31.0 (25.2–36.8)	13.9 (10.0–17.8)	24.4 (21.0–27.9)	9.3 (5.7–12.9)

* Includes $N=590$ subjects categorized in the ≪ All Others ≫ family origin category.

calculated as number of years lived in Canada/age (years). Students were categorized into less than 25% of lifetime, 25%–49%, 50%–74%, 75%–99%, and 100%. Children in the 100% category included those who had been born and had lived all their lives in Canada.

Student smoking status was measured in 2 items adapted from previous research.[15] Ever smokers included subjects who reported any smoking during their lifetime, even just a puff. Frequency of physical activity was assessed in an adaptation of the self-reported Weekly Activity Checklist.[16] The original instrument correlated with an objective activity measure (Caltrac accelerometer) at $r=0.34$, $P<.01$, and 3-day test-retest reliability was 0.74.[16] For each day of the preceding 7 days, students checked which of 28 physical activities they had participated in on that day. The list of activities was determined during extensive pre-testing, and included the 28 activities most frequently engaged in by this age group during the spring months. A frequency score was computed for each student by summing the total number of activities checked for each day. Scores ranged between 0 and 105 ([sd]=15.4 [12.2]). Our version of the Weekly Activity Checklist showed evidence of convergent construct validity, because it was positively associated with energy intake.[17] Subjects were categorized as inactive if they participated in 6 activities in the past week (ie, less than one activity per day).[18]

Indicators of sedentary behavior included frequency of television viewing (0, 1, 2, 3, 4–5, 6 TV programs/day), and video game playing (every day, a couple of times each week, hardly ever, never). These variables were studied separately, because the correlation between the 2 behaviors was relatively low ($r=0.22$).

Dietary data were collected in a 35-item 7-day food frequency questionnaire. Scores for 5 healthy food items (fruits, raw vegetables, cooked vegetables, lettuce, whole wheat bread) were

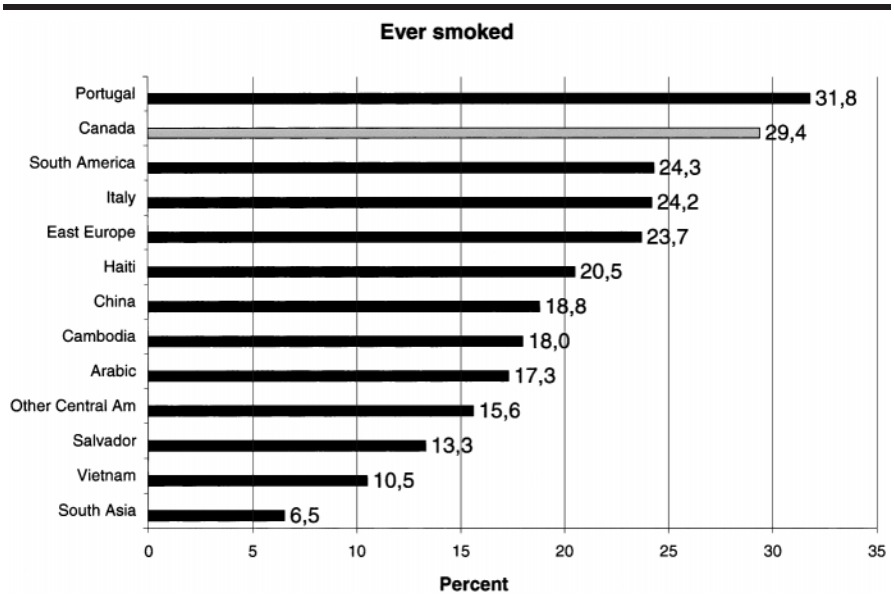

Fig 1. Prevalence of ever smoked by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

summed to create a "healthy food" score (Cronbach's alpha=0.64; range 5–15). Subjects in the lowest healthy food quintile were categorized as at risk. Scores for 10 high fat or junk food items (hot dogs, hamburgers, fried chicken [ie, Kentucky Fried Chicken], bacon or sausages, French fries/poutine, donuts/cakes/pastries, candy/chocolate bars, soft drinks, ice cream, and potato chips/Fritos/Doritos) were summed to create a "high fat/junk food" score (Cronbach's alpha=0.77; range 10–30). A validation in adults of a scale with items similar to those used in this study, indicated that the "junk food" score correlated at r=0.48, with percent of energy from fat.[19] Subjects in the highest junk food quintile were categorized as at risk. The "healthy food" and "high fat/junk food" scores were studied separately, because of the relatively low correlation between scores (r=0.22). Body mass index (BMI) was computed by weight (kg)/height (m) ^{2}. Students were categorized as obese according to international age and sex-specific BMI criteria.[20]

While having one lifestyle risk factor increases the risk of chronic disease, having 2 or more risk factors in childhood might be associated with a substantially increased risk. To determine if family origin was associated with having more than one lifestyle risk factor, subjects were assigned a score according to the total number of risk factors present (range 0–7). Risk categories included having ever smoked, being inactive (≤6 activities/week), watching ≥6 TV programs/day, playing video games every day, frequently consuming high fat/junk food, infrequently consuming healthy food, and being obese.

Data Analysis

The 5 years of data were pooled and analyzed cross-sectionally. Repeat observations of the same subject were removed (ie, if a single subject completed questionnaires in grades 4, 5, and 6, one questionnaire was randomly selected from among the 3 questionnaires available). The generalized estimating equations (GEE) method was used to test family origin as an independent correlate of having 2 or more lifestyle risk factors, while controlling for potential confounders, including age, sex, parental employment, single-parent family status, number of persons/household, and percent of lifetime spent in Canada. The GEE adjusts standard errors for the lack of independence between within-school observations.

RESULTS

Data were collected from 80.6% of eligible subjects; 3.2% of subjects were absent during questionnaire administration, and 16.2% did not participate because parents did not provide consent. Of 7125 questionnaires completed over 5 years in the 16 comparison schools, 2350 repeat observations of the same subject were removed from the database. A further 116 observations were removed, because family origin could not be determined. The data set therefore included 4659 subjects. Subjects reported a total of 104 countries of birth.

The mean age of subjects was 10.8 (0.9) years. There was considerable variability in subjects' sociodemographic characteristics by family origin (Table 1). Children living in single-parent families ranged from 6.9% among Portuguese children, to 44.6% among Haitian children. With the exception of parents of Canadian and Italian children, few parents had been born in Canada. The proportion of children born in Canada ranged from 23.3% among South Asians, to over 95% of Italian and Canadian children. Parental employment was relatively high, overall, but ranged from 38.6% of mothers in Arabic-speaking families to 77.9% of mothers in Portuguese families; and from 63.7% of Cambodian fathers to 91.5% of Italian fathers.

Regardless of family origin, the prevalence of smoking, sedentary behavior, and unhealthy dietary habits was remarkably high in this young population (Table 2). Overall, 25% of all children watched ≥6 TV programs per day, 20% had tried smoking, 21.9% were physically inactive, and 7.4% were obese. Appendix 1 and 2 suggest that the preva-

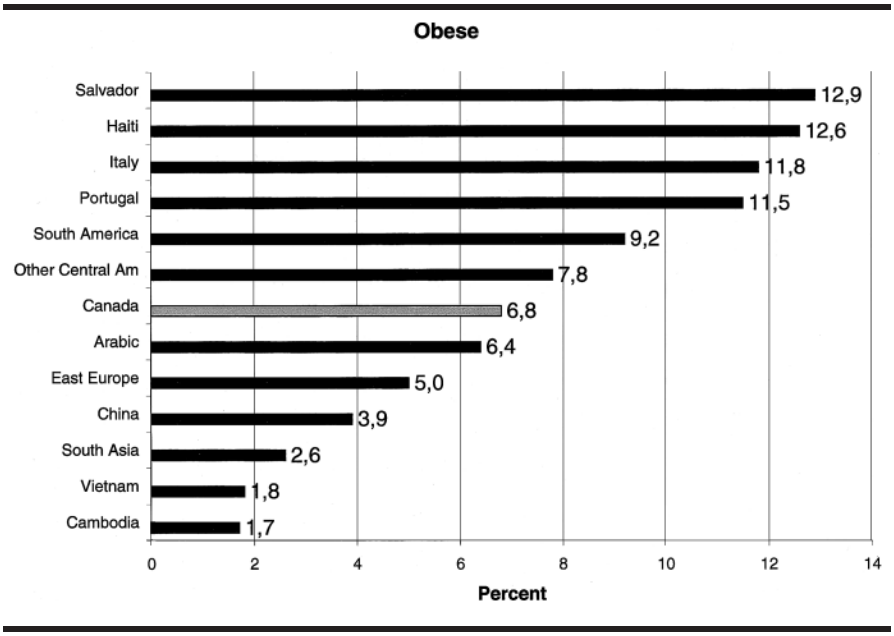

Fig 2. Prevalence of obesity by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

lence of these risk behaviors was generally higher among boys, with the exception that 25.0% of girls were physically inactive, compared to 18.7% boys.

There was considerable variability in the prevalence of the lifestyle factors investigated by family origin (Figures 1–7). With the exception of smoking, Canadian children had moderate to low prevalence rates of the risk factors investigated, relative to the other subjects. One third of Portuguese and Canadian children, and 25% each of South American, Italian, and East European children had ever smoked. The prevalence of obesity was high among El Salvadoran, Haitian, Italian, and Portuguese children. Relatively more Asian children were physically inactive and played video games frequently. Compared to children of other family origins, higher proportions of Haitian, European, and Central American children reported eating junk foods frequently, and healthy foods infrequently.

Approximately 40% of East European, Chinese, and South Asian children had none of the 7 lifestyle risk factors investigated. Having 2 or more lifestyle risk factors was notably higher among Portuguese and Haitian children, and notably low among El Salvadoran children (Table 3). Multivariate analysis substantiated these observations (Table 4).

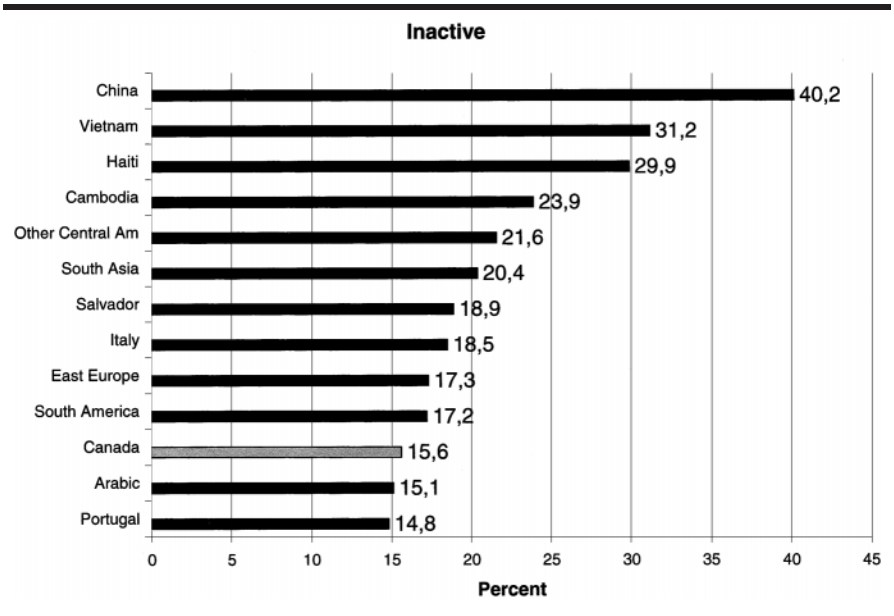

Fig 3. Prevalence of inactivity by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

DISCUSSION

While the association between ethnicity and mortality has been interpreted to reflect genetic and socioeconomic differences between groups,[21] ethnicity is, in fact, a far more complex construct, reflecting shared ancestry, cultural heritage, history, religion, and language.[22] Interest in ethnicity-related differences between populations has increased substantially, as relocations of populations across continents constantly alters the ethnic composition of many communities in North America. As part of the process of acculturation, new arrivals tend to adopt the lifestyle habits prevalent in their new environments, resulting in their developing morbidity and mortality patterns typical of the host country within one or 2 generations.[23,24] Acculturation may be particularly important in children, because the lifestyle habits they acquire in youth will influence their health for decades to come.

This current study characterizes the lifestyle habits of children with diverse family origins whose families have resided in Canada for variable lengths of time. Of most importance is the generally high prevalence of lifestyle risk

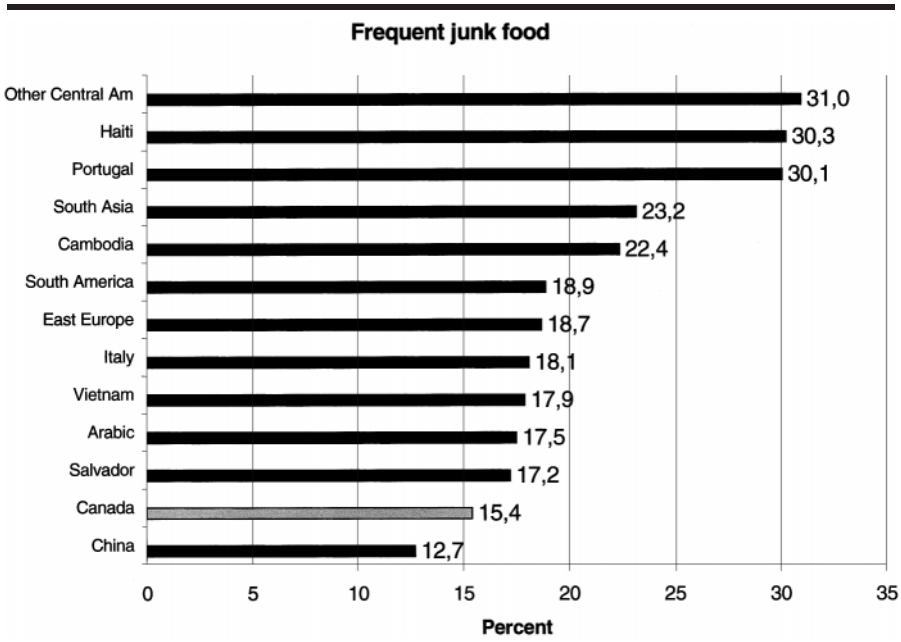

Fig 4. Prevalence of frequent junk food consumption by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

factors, regardless of family origin. These findings are congruent with many other reports detailing the high, or increasing, prevalence rates of smoking, sedentary behavior, unhealthy dietary habits, and obesity among North American children.[25] Given evidence for the tracking of these lifestyle risk factors from childhood to adulthood,[7] these disturbing data foretell that unless substantial preventive efforts are implemented, the incidence of chronic diseases, including cardiovascular disease, diabetes, and several cancers, will continue to impose a severe burden on North American society.

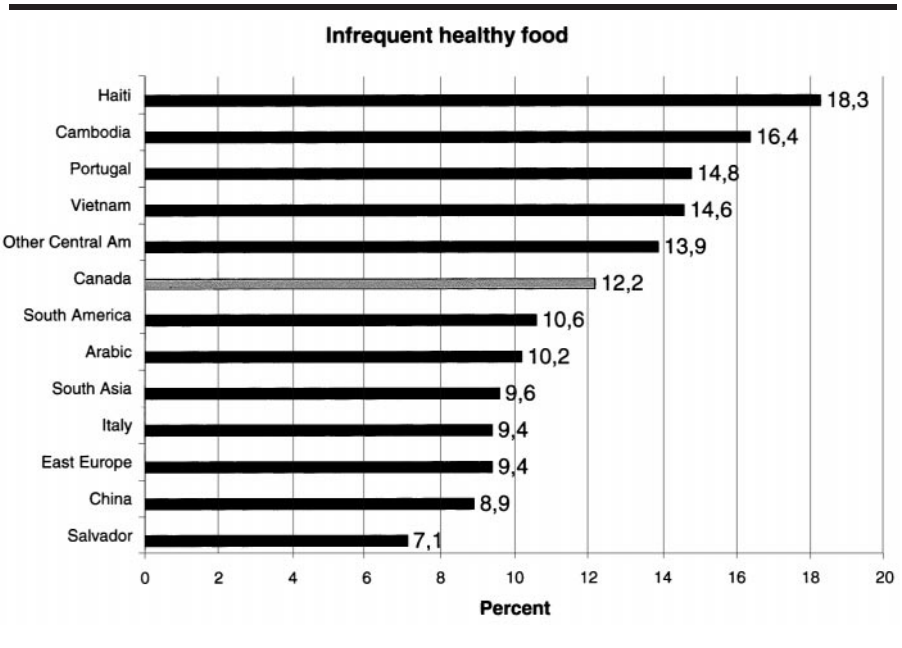

Fig 5. Prevalence of infrequent healthy food consumption by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

Several family origin-specific findings are notable. First, with the exception of smoking, Canadian children tended to have moderate to lower frequencies of lifestyle risk factors, compared to children of other family origins. It was anticipated that newer immigrants to Canada would, in fact, have healthier lifestyle habits than their Canadian counterparts. This unexpected finding could reflect that several groups, including children of Haitian, Portuguese, and Italian family origins have, in fact, resided in Canada for extended time periods. Alternatively, the process of social integration into a new society might involve adoption of culturally dominant behaviors, such as TV viewing, playing video games, and consuming junk food. The relatively high levels of physical inactivity noted among children of non-Canadian family origin could reflect their TV viewing and video game playing habits. Physical inactivity and unhealthy dietary habits are, of course, key to the energy imbalance underlying the current obesity epidemic, and should, therefore, be of particular concern to public health program planners and practitioners.

Smoking prevalence was high among children of European, Canadian, and South American family origins, suggesting that these groups might benefit from prevention and cessation efforts tailored directly to their specific needs. Although the prevalence of smoking is high among Asian men in North America,[26–27] Asian boys and girls in this study did not have notably higher frequencies of smoking than did other children. This could reflect either that this pattern is not relevant in this study population, or that age of smoking onset

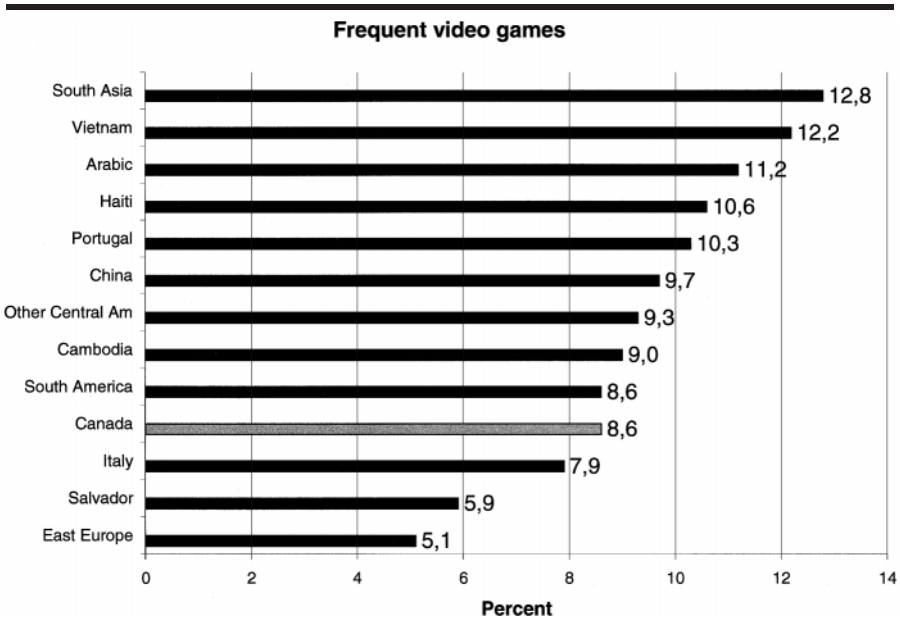

Fig 6. Prevalence of frequent video game playing by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

among Asian children is later than 9–12 years of age.

Ethnicity-related differences in the prevalence of obesity have been observed in several studies of children. Hispanic and African-American children, aged 6–11 years, exhibited a higher prevalence of obesity than did non-Hispanic Whites.[26] Similarly Hispanic and African-American origin were associated with a 33% and 49% increased risk of overweight, respectively, among third-grade children, while Asian origin was associated with a 30% reduction in risk.[6] Our data suggest that the prevalence of obesity is relatively high among El Salvadoran, Haitian, Italian, and Portuguese children. These children also had relatively higher prevalence rates of physical inactivity, eating junk foods frequently, and healthy foods infrequently, and frequent TV viewing. Again, imbalance in energy input and expenditure might be underlying the tendency toward obesity in these groups, and may indicate directions for preventive intervention.

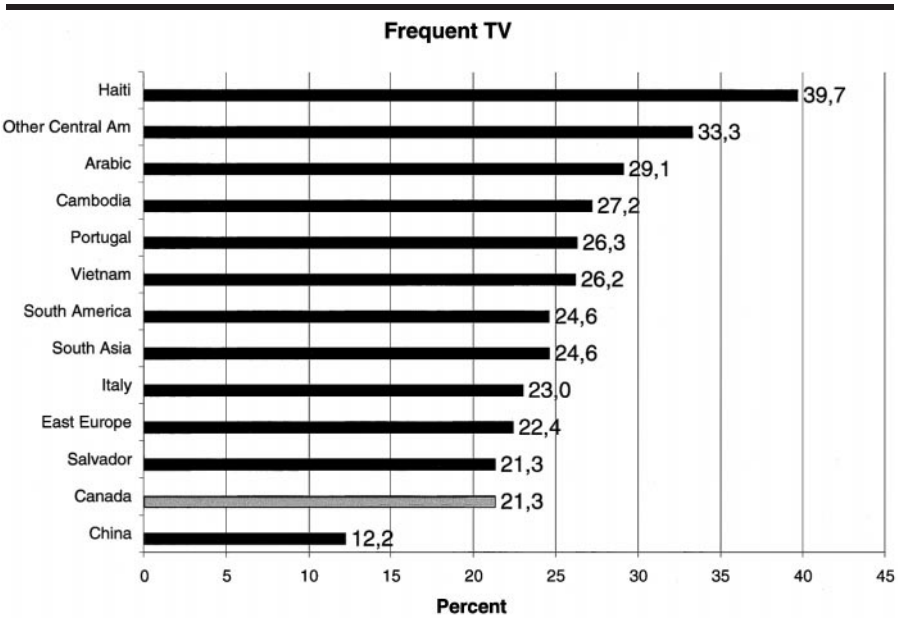

Fig 7. Prevalence of frequent TV viewing by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

Consistent with previous reports,[28] Asian children tended to be inactive and to have a high prevalence of frequent TV viewing, but the prevalence of obesity was very low. This finding could reflect lower energy intake in this group, or, possibly, measurement error if either the dietary or physical activity assessment instruments used in this study were poorly adapted to Asian children.

The proportion of children with 2 or more lifestyle risk factors was highest among children of Haitian, Portuguese, Other Central American/Caribbean, and Cambodian family origins. Because the lifestyle risk factors investigated here tend to track into adulthood,[7] because they are associated with short and long-term health consequences,[8,9] and because they are amenable to prevention,[29] these data should be a call to action to public health program and policy makers. In addition they clearly indicate possible directions for preventive intervention in specific groups.

Limitations

With the exception of height and weight, these data were based on self-reports by young children, and, therefore, differential misclassification of risk factor status by ethnicity could have biased the findings. External generalizability might be limited by sample uniqueness. It is important to note that these data were drawn from low-income neighborhoods, and that the results are

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

Family Origin	Total *N*	Number of Risk Factors: 0 %	1 %	2 %	3 %	4–7 %	≥2 %
Total*	4659	32.5	36	21.2	7.8	2.5	31.5
Canada	915	35.4	37.1	19.2	6.3	2.0	27.5
Europe							
Portugal	217	26.7	34.1	24.0	13.8	1.4	39.2
Italy	265	33.6	37.0	21.1	5.7	2.6	29.4
East Europe	255	40.4	33.3	18.8	6.3	1.2	26.3
Asia							
China	82	35.4	36.6	20.7	7.3	0.0	28.1
Vietnam	353	32.9	37.7	20.7	6.8	2.0	29.5
Cambodia	184	34.8	31.5	22.3	10.3	1.1	33.7
South Asia	250	39.2	38.0	17.6	4.4	0.8	22.8
Arabic	298	36.9	37.3	18.8	4.0	3.0	25.8
South America	192	30.7	42.2	19.9	3.7	3.7	27.1
Central America/Caribbean							
Haiti	536	20.3	31.3	28.9	14.9	4.5	48.3
El Salvador	212	35.4	43.9	15.6	4.3	0.9	20.8
Other	310	31.6	31.0	23.2	11.3	2.9	37.4

* Includes *N*=590 subjects categorized in the ''All Others'' family origin category.

. . . these disturbing data foretell that unless substantial preventive efforts are implemented, the incidence of chronic diseases, including cardiovascular disease, diabetes, and several cancers, will continue to impose a severe burden on North American society.

not necessarily applicable to higher income populations. These cross-sectional data cannot provide information on how these risk factors will evolve over time. Longitudinal studies are needed to determine whether there is differential tracking of risk factor behavior by ethnicity. Perhaps of most importance, grouping children into family origin categories could be misleading, if variability in risk factor distribution is as high, or higher, within groupings as between groupings. Although population genetics studies generally support the notion of genetic clusters which parallel the common racial groups (African, Asian, European White, Pacific-Islander, and North-American Indian), there is great genetic variability within ethnic populations, and even greater social variability.[30] Future studies of ethnic variability of disease and lifestyles will need to characterize the composition of the sample in much more detail. In addition, future research will need to focus on the social and cultural factors associated with the adoption and maintenance of lifestyles that are specific to each ethnic group. This will require contributions from several disciplines, including anthropology and sociology, as well as the behavioral sciences. Finally, research and intervention in this area will need to closely involve the communities targeted to ensure relevance of the research questions, collaboration of study subjects, and to avoid possible stigmatization of population sub-groups due to misinterpretation of research results.

Table 4. Odds ratios* (95% confidence intervals) for clustering of lifestyle risk factors by family origin among elementary school children in multiethnic, low-income, inner-city neighborhoods, Montreal (*N*=4659)

Family Origin	Odds Ratio (95% CI)
Haiti	2.36 (1.87–2.98)
Portugal	1.63 (1.29–2.07)
Other Central American/Caribbean	1.47 (1.07–2.03)
Cambodia	1.31 (0.90–1.91)
China	1.26 (0.80–1.99)
Vietnam	1.17 (0.84–1.65)
East Europe	1.02 (0.81–1.28)
South America	0.98 (0.72–1.34)
Arabic	0.95 (0.72–1.26)
Italy	0.90 (0.64–1.27)
South Asia	0.84 (0.60–1.17)
El Salvador	0.68 (0.53–0.88)

* Relative to Canada controlling for age, sex, parental employment, single-parent family status, number of persons/household, and percent lifetime in Canada.

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Appendix 1. Prevalence of lifestyle risk factors by family origin among females aged 9–12 years in multiethnic, low-income, inner-city neighborhoods, Montreal

Family Origin	Total *N*	Ever Smoked % (95% CI)	Obese % (95% CI)	Inactive % (95% CI)	Frequent Junk Food Consumption % (95% CI)	Infrequent Healthy Food Consumption % (95% CI)	Frequent TV Viewing % (95% CI)	Frequent Video Games % (95% CI)
Total*	2362	17.4 (15.8–18.9)	6.9 (5.9–7.9)	24.8 (23.1–26.5)	18.5 (16.8–20.3)	9.5 (8.3–10.7)	21.7 (20.1–23.3)	4.8 (3.8–5.8)
Canada	483	4.8 (3.8–5.8)	6.5 (4.3–8.8)	20.6 (16.8–24.5)	12.5 (9.2–15.9)	9.6 (6.9–12.3)	15.6 (12.3–18.8)	3.5 (1.6–5.4)
Europe								
Portugal	104	30.1 (21.2–39.0)	10.8 (4.8–16.8)	16.1 (8.4–23.8)	27.6 (17.6–37.7)	9.6 (4.0–15.3)	19.2 (11.7–26.8)	4.0 (0.0–8.3)
Italy	133	15.3 (9.1–21.4)	12.5 (6.8–18.2)	16.7 (9.4–23.9)	15.2 (8.5–21.8)	5.3 (1.5–9.1)	21.1 (14.1–28.0)	2.7 (0.0–5.7)
East Europe	120	21.0 (13.7–28.3)	3.4 (0.0–6.7)	20.8 (12.9–28.7)	14.6 (7.3–21.9)	4.4 (0.6–8.2)	17.5 (10.7–24.3)	1.1 (0.0–3.2)
Asia								
China	43	16.3 (5.2–27.3)	2.4 (0.0–7.0)	31.4 (16.1–46.8)	11.4 (0.1–22.0)	4.7 (0.0–10.9)	7.0 (0.0–14.6)	5.9 (0.0–13.8)
Vietnam	176	5.8 (2.3–9.2)	1.2 (0.0–2.8)	34.0 (26.4–41.6)	9.4 (4.5–14.3)	10.4 (5.9–14.9)	18.8 (13.0–24.5)	5.8 (1.9–9.6)
Cambodia	97	7.3 (2.1–12.5)	2.1 (0.0–5.0)	31.0 (21.1–40.8)	22.4 (13.0–31.7)	11.5 (5.1–17.8)	18.6 (10.8–26.3)	3.9 (0.0–8.2)
South Asia	129	5.6 (1.6–9.6)	2.5 (0.0–5.2)	25.7 (17.2–34.3)	21.7 (13.3–30.2)	6.5 (2.1–10.8)	20.3 (13.3–27.3)	5.4 (0.8–10.0)
Arabic	144	13.6 (7.9–19.2)	6.7 (2.5–10.9)	17.2 (10.4–24.1)	12.7 (6.5–19.0)	6.4 (2.4–10.4)	23.8 (16.8–30.8)	9.1 (3.7–14.5)
South America	90	24.7 (15.8–33.7)	5.7 (0.1–10.5)	21.9 (12.4–31.4)	22.1 (12.8–31.3)	6.7 (1.5–11.8)	18.9 (10.8–27.0)	3.9 (0.0–8.2)
Central American/Caribbean								
Haiti	288	18.8 (14.2–23.4)	12.8 (8.9–16.7)	31.4 (25.4–37.5)	26.4 (20.8–32.0)	16.6 (12.2–20.9)	38.0 (32.4–43.6)	5.8 (2.8–8.7)
El Salvador	43	12.4 (6.3–18.5)	11.7 (5.7–17.7)	16.7 (10.7–26.7)	14.6 (7.3–21.9)	6.3 (1.8–10.7)	17.7 (10.7–24.7)	5.6 (0.8–10.4)
Other	152	10.6 (5.7–15.5)	7.5 (3.2–11.7)	30.5 (22.7–38.4)	28.2 (20.1–36.4)	13.3 (7.9–18.8)	31.6 (24.2–39.0)	5.1 (1.1–9.1)

* Includes subjects categorized in the "All Others" family origin category.

Appendix 2. Prevalence of lifestyle risk factors by family origin among males aged 9–12 years in multiethnic, low-income, inner-city neighborhoods, Montreal

Family Origin	Total *N*	Ever Smoked % (95% CI)	Obese % (95% CI)	Inactive % (95% CI)	Frequent Junk Food Consumption % (95% CI)	Infrequent Healthy Food Consumption % (95% CI)	Frequent TV Viewing % (95% CI)	Frequent Video Games % (95% CI)
Total*	2293	24.9 (23.1–26.7)	8.0 (6.9–9.1)	18.7 (17.0–27.7)	25.7 (23.7–27.7)	15.6 (14.1–17.1)	31.1 (29.2–33.0)	14.1 (12.5–15.7)
Canada	431	32.6 (2.1–37.1)	7.1 (5.7–9.6)	11.6 (8.3–14.9)	18.6 (14.4–22.8)	14.9 (11.6–18.3)	27.7 (23.5–32.0)	14.0 (10.3–17.8)
Europe								
Portugal	113	33.3 (24.6–42.1)	12.2 (6.0–18.3)	14.7 (7.6–21.9)	32.2 (22.6–41.9)	19.5 (12.2–26.8)	32.7 (24.1–41.4)	15.7 (8.2–23.3)
Italy	132	33.3 (25.2–41.5)	11.1 (5.6–16.6)	20.4 (12.9–27.8)	21.2 (13.3–29.0)	13.6 (7.8–19.5)	25.0 (17.6–32.4)	13.5 (6.9–20.0)
East Europe	135	26.2 (18.6–33.7)	6.5 (2.2–10.9)	14.8 (8.1–21.5)	22.1 (14.1–30.1)	13.7 (7.9–19.6)	26.7 (19.2–34.1)	8.6 (3.2–13.9)
Asia								
China	39	21.6 (8.4–34.9)	5.6 (0.0–13.0)	38.7 (21.6–55.9)	14.3 (1.3–27.3)	13.9 (2.6–25.2)	17.9 (5.9–30.0)	14.3 (1.3–27.3)
Vietnam	177	15.4 (9.9–20.8)	2.4 (0.1–4.7)	30.6 (23.4–37.8)	26.2 (19.0–33.5)	18.8 (13.0–24.5)	33.7 (26.7–40.7)	18.6 (12.1–25.0)
Cambodia	87	29.9 (20.3–39.5)	1.2 (0.0–3.6)	20.0 (11.0–29.1)	22.4 (12.4–32.4)	21.8 (13.2–30.5)	36.8 (26.7–46.9)	14.9 (6.4–23.5)
South Asia	120	7.6 (2.8–12.4)	2.7 (0.0–3.6)	15.2 (7.9–22.6)	25.0 (16.2–33.9)	13.2 (7.0–19.4)	29.4 (21.2–37.6)	20.2 (12.1–28.3)
Arabic	154	20.8 (14.3–27.3)	6.1 (2.2–9.9)	13.1 (7.1–19.1)	21.6 (14.4–28.8)	13.7 (8.3–19.2)	34.0 (26.5–41.5)	13.0 (7.1–18.9)
South America	102	24.0 (15.4–32.5)	12.5 (9.0–19.1)	18.5 (10.1–27.0)	15.9 (8.0–23.8)	14.1 (7.3–21.0)	29.7 (20.8–38.6)	14.9 (5.8–20.1)
Central America/Caribbean								
Haiti	246	22.8 (17.4–28.1)	12.3 (8.1–16.5)	26.4 (20.2–32.7)	34.9 (28.2–41.5)	20.5 (15.4–25.6)	41.7 (35.5–48.0)	16.2 (11.0–21.3)
El Salvador	99	14.4 (7.4–21.4)	14.3 (7.4–21.2)	18.9 (10.0–27.8)	20.0 (11.2–28.8)	8.2 (2.7–13.6)	25.5 (16.9–34.1)	6.3 (0.1–11.6)
Other	158	20.5 (14.2–26.9)	8.1 (3.7–12.4)	15.6 (9.1–22.0)	33.6 (25.4–41.8)	14.4 (8.8–19.9)	35.0 (27.6–41.5)	13.2 (7.3–19.0)

* Includes subjects categorized in the "All Others" family origin category.