

# Obesity, overweight and ethnicity

Mark S. Tremblay, Claudio E. Pérez, Chris I. Ardern, Shirley N. Bryan and Peter T. Katzmarzyk

## Abstract

### Objectives

This article describes the prevalence of self-reported overweight and obesity, based on body mass index (BMI), by ethnicity and examines the influence of time since immigration within and between ethnic groups.

### Data sources

Results are based on data from two cycles of Statistics Canada's Canadian Community Health Survey, conducted in 2000/01 and 2003.

### Analytical techniques

Weighted prevalences of overweight (BMI  $\geq 25$ ) and obesity (BMI  $\geq 30$ ) were calculated by sex and ethnicity for the population aged 20 to 64. Multiple logistic regression models were used to examine associations between overweight/obesity and ethnicity, and within and between ethnic groups based on time since immigration, controlling for age, household income, education and physical activity.

### Main results

Aboriginal men and women had the highest prevalences of overweight and obesity; East/Southeast Asians, the lowest. Independent of age, household income, education and physical activity, Aboriginal people had elevated odds of overweight and obesity, compared with Whites; South Asians and East/Southeast Asians had significantly lower odds. Recent immigrants (10 years or less) had significantly lower prevalences of overweight, compared with non-immigrants, but this difference tended to disappear over time.

## Key words

race, body mass index, immigration, socio-economic status

## Authors

Mark S. Tremblay (613-951-4385; mark.tremblay@statcan.ca) and Shirley N. Bryan are with the Health Statistics Division and Claudio E. Pérez is with the Service Industries Division at Statistics Canada, Ottawa, Ontario, K1A 0T6. Chris I. Ardern and Peter T. Katzmarzyk are at Queen's University, Kingston, Ontario.

In recent decades, the prevalence of obesity and overweight has been rising in Canada,<sup>1-6</sup> a trend consistent with much of the developed and developing world.<sup>7,8</sup> The strong link between obesity and health risk<sup>7,9-12</sup> forecasts severe social and economic consequences.

This rise in obesity reflects an environment that is increasingly conducive to weight gain.<sup>13</sup> Reductions in physical activity and changes in nutritional practices have resulted in a sustained positive caloric balance for many people. However, evidence suggests that the likelihood that an individual will be obese is also influenced by an interaction between genetic predispositions and the environment,<sup>14</sup> which is not the same for all ethnic groups.<sup>15,16</sup> And in addition to potential genetic predispositions, ethnic groups vary on other important determinants of obesity, such as socio-economic status and lifestyle behaviours.

Ethnic differences in obesity and overweight have emerged from analyses of the National Health and Nutrition Examination Survey in the United States.<sup>17,18</sup> In Canada, small regional studies have revealed a higher prevalence of overweight among children and adolescents of First Nations ancestry, compared with those of European ancestry,<sup>19-22</sup>

consistent with observations among other Native populations.<sup>24,25</sup> As well, a developing literature suggests that although immigrants to North America are less likely than the host population to be overweight,<sup>26</sup> within two or three generations, the prevalence of overweight among these groups often exceeds that of non-immigrants.<sup>26,27</sup>

## Methods

### Data source

This analysis is based on data from the 2000/01 and 2003 Canadian Community Health Surveys (CCHS), conducted by Statistics Canada. The CCHS collects cross-sectional information about the health of the household population aged 12 or older in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, in institutions (prisons, hospitals, universities) and in some remote areas.

The first cycle (1.1) began in September 2000 and continued over 14 months. Half the interviews were conducted face-to-face. The response rate was 84.7%, yielding a sample of 131,573 respondents. This analysis was restricted to 86,687 respondents aged 20 to 64 for whom body mass index (BMI) data were available, representing an estimated 18.4 million people.

The second cycle (2.1) began in January 2003 and ended in December that year. Unlike the first cycle, most interviews were conducted by telephone, which may have resulted in differentially biased (between cycles) reports of height and weight. The response rate was 80.6%, yielding a sample of 135,573 respondents. This analysis concerns 84,709 respondents aged 20 to 64 for whom BMI data were available, representing an estimated 18.8 million people. More detailed descriptions of the CCHS design, sample and interview procedures can be found in a published report.<sup>23</sup>

The two samples were combined to increase the sample size; thus, the results represent two points in time, 2000/01 and 2003, and an unweighted sample size of 171,396. The sample distribution by ethnicity mirrors that from the 2001 Census.

### Analytical techniques

Based on the combined 2000/01 and 2003 sample, prevalence estimates of, and odds ratio estimates for, overweight and obesity by ethnicity were weighted to represent the Canadian household population aged 20 to 64 for both survey years (Appendix Tables A and B). Thus, the weighted total is double that of the Canadian population, but this does not affect prevalence or odds ratio

estimates. The logistic regression models were constructed to adjust for age, education, household income and level of leisure-time physical activity (see *Definitions*). Records with missing values for the independent variables were dropped. The models were replicated on subpopulations based on immigrant status and time since immigration (0 to 10 years and 11 or more years). For models restricted to immigrants, respondents reporting an ethnicity of North American Aboriginal (7 records) were dropped. To account for the survey design effect, coefficients of variation and p-values were estimated and significance tests were performed using the bootstrap technique.<sup>28,29</sup> The significance level was set at  $p < 0.05$ .

### Limitations

Despite the large, nationally representative sample, this study has a number of limitations. Among the most important is reliance on self-reports. Because the BMI calculations are based on self-reported height and weight, the prevalence of overweight and obesity may be under-estimated.<sup>30,31</sup> In addition, 70% of cycle 2.1 interviews were conducted by telephone versus 50% in cycle 1.1, which further biases self-reported weight.<sup>32</sup> Ethnicity may also influence self-reported height and weight,<sup>33</sup> given different perceptions of body image and body dissatisfaction.<sup>34-38</sup> The physical activity classification, too, is derived from self-reported data, and pertains only to leisure time.

Because of small sample sizes for some ethnic groups (a limitation that was greatly reduced by pooling the two survey cycles), valid estimates of the prevalence of overweight and obesity could be obtained only for broad categories, so valuable information may have been obscured. As well, evidence suggests that the use of the terms "race" and "ethnicity" may be confusing for survey respondents.<sup>39</sup>

Finally, the results for people of Aboriginal origin show an exceptionally high prevalence of overweight and obesity. However, the data tell only part of the story, as they are limited to the off-reserve population.

Few studies have examined overweight and obesity among ethnic groups in Canada (see *Defining ethnicity*). This data gap arises because ethnicity is not commonly asked on surveys, and when it is, sample sizes are usually too small to yield reliable estimates for specific groups. Cycles 1.1 (2000/01) and 2.1 (2003) of the Canadian Community Health

### Defining ethnicity

The concept of ethnicity is fluid and complex.<sup>40</sup> Distinctions between the terms “ethnicity” and “race” are not clear in the public health literature. “Ethnicity” implies cultural similarities among individuals; “race” implies biological traits indicative of meaningful genetic similarities. In practice, the terms are often used interchangeably, or are combined into a single entity such as “race/ethnicity.”<sup>40</sup> For this report, self-ascribed “ethnicity” is used in reference to racially or culturally identifiable subgroups of the Canadian population.

For this analysis, “ethnicity” was based on a question in the Canadian Community Health Survey: “People living in Canada come from many different cultural and racial backgrounds. Are you (the interviewer read categories to the respondent and allowed multiple answers):

1. White?”
2. Chinese?”
3. South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)?”
4. Black?”
5. Filipino?”
6. Latin American?”
7. Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese, etc.)?”
8. Arab?”
9. West Asian (e.g., Afghan, Iranian, etc.)?”
10. Japanese?”
11. Korean?”
12. Aboriginal Peoples of North America (North American Indian, Métis, Inuit/Eskimo)?”
13. Other - Specify”

To avoid restrictive sample sizes, respondents were grouped: White (1), East/Southeast Asian (2, 5, 7, 10, 11), West Asian/Arab (8, 9), South Asian (3), Latin American (6), Black (4), Aboriginal (12) and other (13 - multiple responses across categories defined here, and non-response/don't know/refusal). In this article, these self-ascribed ethnicity categories are used, but when citing supporting literature, the terminology in the cited source has been preserved (for instance, if a source uses “First Nations” or “Native,” the term was not changed to “Aboriginal”).

Survey (CCHS), however, each obtained ethnicity information on approximately 130,000 respondents (see *Methods* and *Definitions*). Using combined data from those two CCHS cycles, this article compares overweight and obesity in different ethnic groups, and by immigration status. Because the information is self-reported, the actual extent of overweight and obesity may be underestimated. However, the focus of the analysis is not so much on the prevalence of excess weight as on differences between ethnic groups, which should be less affected by self-report.

Given Canada’s multicultural nature,<sup>41</sup> an analysis of overweight and obesity by broad ethnic categories is an important step in identifying high-risk groups. With 18% of the Canadian population born outside the country, and visible minorities accounting for 13% of the population,<sup>41</sup> such analyses can help inform obesity prevention strategies.

### Consistent patterns

Analysis of combined data from the 2000/01 and 2003 CCHS shows that the prevalence of overweight and obesity among people aged 20 to 64, based on body mass index (BMI), differed significantly by ethnic group (see *Calculating overweight and obesity*). According to their self-reported height and weight,

### Calculating overweight and obesity

*Overweight* and *obesity* are based on body mass index (BMI), which is calculated by dividing weight in kilograms by height in metres squared. For this analysis, BMI categories were assigned according to Health Canada guidelines,<sup>42</sup> which are applicable to the non-pregnant, non-lactating population aged 18 to 64. Respondents whose BMI was 30 kg/m<sup>2</sup> or more were considered obese; those with a BMI of 25 kg/m<sup>2</sup> or more were considered overweight (overweight includes obesity).

For example, the BMI of an individual 1.7 metres (5 feet 7 inches) tall, weighing 80 kilograms (176 pounds) would be:

$$80 \div 1.7^2 = 27.7 \text{ kg/m}^2$$

which would put him or her in the “overweight” range. If this person weighed 90 kilograms (198 pounds), his or her BMI would be:

$$90 \div 1.7^2 = 31.1 \text{ kg/m}^2$$

and he or she would be “obese.”

## Definitions

In the Canadian Community Health Survey, *immigrant status* was based on the country of birth given by respondents. Those who specified a country other than Canada were asked if they had been born Canadian citizens. If they said "no," they were determined to be immigrants. Immigrant respondents were asked the year in which they had immigrated to Canada. Comparing that year with the year of the interview made it possible to derive time since immigration.

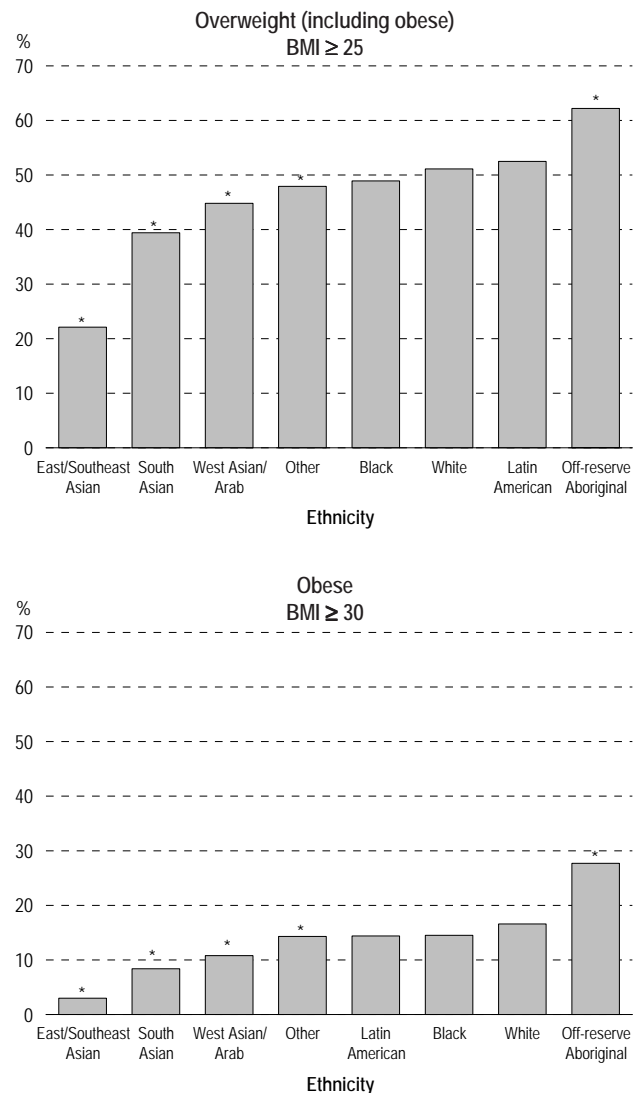
*Household income* was based on the number of people in the household and total household income from all sources in the 12 months before the interview.

Household income group	People in household	Total household income
Lowest	1 to 4	Less than \$10,000
	5 or more	Less than \$15,000
Lower-middle	1 or 2	\$10,000 to \$14,999
	3 or 4	\$10,000 to \$19,999
	5 or more	\$15,000 to \$29,999
Middle	1 or 2	\$15,000 to \$29,999
	3 or 4	\$20,000 to \$39,999
	5 or more	\$30,000 to \$59,999
Upper-middle	1 or 2	\$30,000 to \$59,999
	3 or 4	\$40,000 to \$79,999
	5 or more	\$60,000 to \$79,999
Highest	1 or 2	More than \$60,000
	3 or more	More than \$80,000

*Education* was grouped into four levels: less than secondary graduation, secondary graduation, some postsecondary, and postsecondary graduation.

*Physical activity level* was derived by asking respondents if they had participated in any of the following activities during their leisure time in the past three months: walking for exercise, gardening or yard work, swimming, bicycling, popular or social dance, home exercises, ice hockey, ice skating, in-line skating or rollerblading, jogging or running, golfing, exercise class or aerobics, downhill skiing or snowboarding, bowling, baseball or softball, tennis, weight-training, fishing, volleyball, basketball, soccer, and any additional physical activities not specified by the interviewer. They were then asked the number of times they engaged in the activity and the average duration per session. These data were used together with the MET value associated with each activity (metabolic energy cost of the activity) to arrive at an energy expenditure value for each respondent, expressed in kilocalories per kilogram of body weight per day (kcal/kg/day). Physical activity level was categorized as: inactive (0 to 1.49 kcal/kg/day), moderately active (1.5 to 2.99 kcal/kg/day) or active (3.0 or more kcal/kg/day).

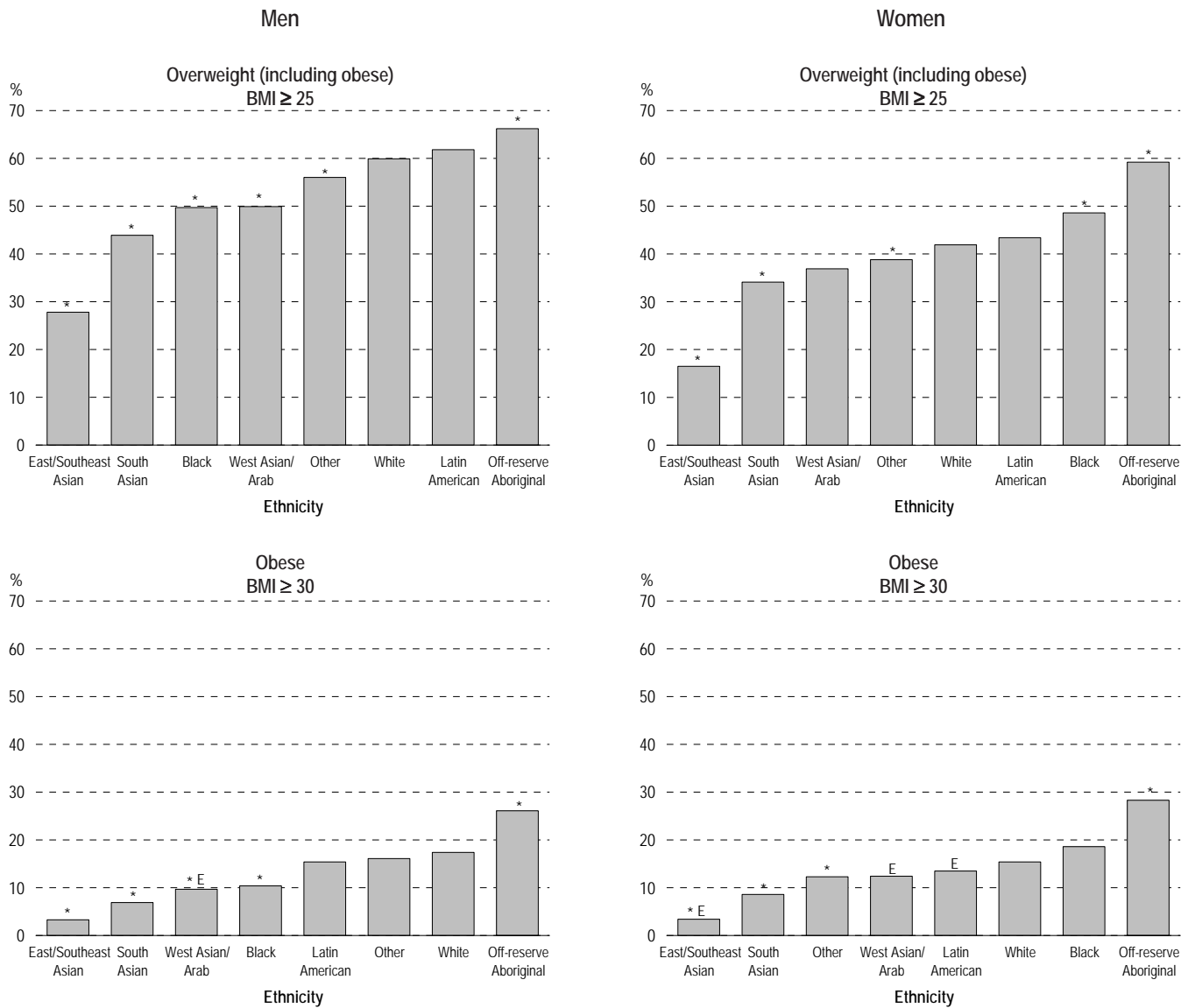
Chart 1  
Prevalence of overweight and obesity, by ethnicity, household population aged 20 to 64, Canada, 2000/01 and 2003 combined



Data source: 2000/01 and 2003 Canadian Community Health Survey  
\* Significantly different from estimate for White ( $p < 0.05$ )

about half of Whites (who constituted more than 80% of the population) were overweight (including people who were obese). East/Southeast Asians had the lowest self-reported prevalence of overweight (22%), while off-reserve Aboriginal people had the highest (63%) (Chart 1). Just 3% of East/Southeast Asians were obese, compared with 17% of Whites and 28% of Aboriginal people.

Chart 2  
Prevalence of overweight and obesity, by sex and ethnicity, household population aged 20 to 64, Canada, 2000/01 and 2003 combined



Data source: 2000/01 and 2003 Canadian Community Health Survey  
 \* Significantly different from estimate for White ( $p < 0.05$ )  
 E Coefficient of variation 16.6% to 33.3% (interpret with caution)

These patterns prevailed among both sexes (Chart 2).

The likelihood of being overweight or obese is influenced by many factors besides ethnicity, including demographic characteristics, socio-economic status, and lifestyle. In fact, among men, the odds of overweight and obesity increased with age (Table 1). As well, low education and low levels

of physical activity were significantly associated with overweight and obesity among men. Low income, by contrast, appeared to be protective from overweight, though not from obesity.

Even when the effects of age, education, household income and physical activity were taken into account, ethnic differences in overweight and obesity persisted among men. Aboriginal men had

Table 1  
Adjusted odds ratios relating ethnicity and selected characteristics to overweight and obesity, by sex, household population aged 20 to 64, Canada, 2000/01 and 2003 combined

	Overweight (BMI ≥ 25)				Obesity (BMI ≥ 30)			
	Men		Women		Men		Women	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
<b>Ethnicity</b>								
White <sup>†</sup>	1.0	...	1.0	...	1.0	...	1.0	...
Aboriginal (off-reserve)	1.7*	1.4, 2.0	2.0*	1.7, 2.3	1.7*	1.4, 2.1	2.0*	1.7, 2.4
Latin American	1.2	0.9, 1.6	1.2	0.9, 1.6	1.0	0.7, 1.6	0.8	0.5, 1.3
Other/Multiple/Unknown	0.9	0.8, 1.1	1.1	0.9, 1.3	1.0	0.8, 1.3	0.9	0.7, 1.2
West Asian/Arab	0.8	0.6, 1.0	0.7*	0.5, 1.0	0.5*	0.4, 0.8	0.6*	0.4, 0.9
Black	0.7*	0.5, 0.9	1.2	1.0, 1.5	0.5*	0.4, 0.7	1.0	0.7, 1.4
South Asian	0.6*	0.5, 0.7	0.7*	0.6, 0.9	0.5*	0.3, 0.6	0.4*	0.3, 0.6
East/Southeast Asian	0.3*	0.2, 0.3	0.3*	0.2, 0.3	0.2*	0.1, 0.2	0.2*	0.1, 0.2
<b>Age group</b>								
20-34 <sup>†</sup>	1.0	...	1.0	...	1.0	...	1.0	...
35-49	1.7*	1.6, 1.8	1.5*	1.5, 1.6	1.2*	1.2, 1.3	1.4*	1.3, 1.5
50-64	2.0*	1.8, 2.1	2.5*	2.4, 2.7	1.5*	1.4, 1.6	1.8*	1.7, 2.0
<b>Household income</b>								
Lowest	0.5*	0.5, 0.6	1.1	1.0, 1.2	0.9	0.7, 1.0	1.4*	1.2, 1.6
Lower-middle	0.7*	0.6, 0.8	1.3*	1.2, 1.5	1.0	0.8, 1.1	1.6*	1.4, 1.8
Middle	0.7*	0.7, 0.8	1.3*	1.2, 1.4	0.9	0.8, 1.0	1.5*	1.4, 1.6
Upper-middle	0.9*	0.8, 0.9	1.2*	1.1, 1.3	1.0	0.9, 1.0	1.3*	1.2, 1.4
Highest <sup>†</sup>	1.0	...	1.0	...	1.0	...	1.0	...
<b>Education</b>								
Less than secondary graduation	1.1*	1.0, 1.2	1.5*	1.4, 1.6	1.3*	1.2, 1.4	1.5*	1.3, 1.6
Secondary graduation	1.1*	1.0, 1.2	1.2*	1.2, 1.3	1.2*	1.1, 1.3	1.2*	1.1, 1.3
Some postsecondary	1.0	0.9, 1.1	1.1*	1.0, 1.2	1.1	0.9, 1.2	1.2*	1.1, 1.3
Postsecondary graduation <sup>†</sup>	1.0	...	1.0	...	1.0	...	1.0	...
<b>Physical activity</b>								
Active <sup>†</sup>	1.0	...	1.0	...	1.0	...	1.0	...
Moderate	1.2*	1.1, 1.2	1.4*	1.3, 1.4	1.4*	1.3, 1.5	1.4*	1.3, 1.6
Inactive	1.1*	1.1, 1.2	1.6*	1.5, 1.7	1.6*	1.5, 1.7	1.9*	1.8, 2.1

Data source: 2000/01 and 2003 Canadian Community Health Survey

Notes: Because of rounding, some confidence intervals with 1.0 as lower/upper limit are significant.

<sup>†</sup> Reference category

\* Significantly different from estimate for reference category ( $p < 0.05$ )

... Not applicable

significantly high odds of both overweight and obesity, compared with White men; the odds were significantly lower among East/Southeast Asian, South Asian, and Black men. West Asian/Arab men had low odds of obesity, but they were no more or less likely than White men to be overweight.

For women, the relationship between ethnicity and overweight and obesity was generally similar to that for men. Compared with White women, those of Aboriginal origin had twice the odds of being overweight or obese, while East/Southeast Asian, South Asian and West Asian/Arab women had low odds. However, unlike their male counterparts, the odds that Black women would be overweight or

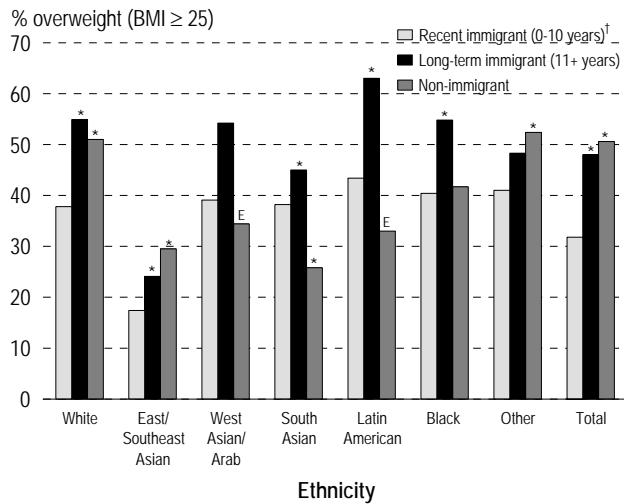
obese did not differ significantly from those of White women.

As was the case among men, women's odds of overweight and obesity rose with age. Low levels of physical activity and low educational attainment were also associated with marked increases in the odds of overweight and obesity in women. In contrast to the situation among men, living in a lower-income household was an important predictor of both overweight and obesity among women.

### Time since immigration

Some of the differences in the self-reported prevalence of overweight and obesity between

Chart 3  
Prevalence of overweight, by ethnicity and immigrant status, household population aged 20 to 64, Canada, 2000/01 and 2003 combined



Data source: 2000/01 and 2003 Canadian Community Health Survey

† Reference category

\* Significantly different from estimate for recent immigrant ( $p < 0.05$ )

E Coefficient of variation 16.6% to 33.3% (interpret with caution)

ethnic groups can be accounted for by birthplace and time since immigration to Canada (Chart 3). The prevalence of overweight and obesity was higher among long-term (11 or more years) than more recent immigrants (10 years or less).

The higher prevalence of overweight among long-term immigrants supports the notion that a “healthy immigrant” effect fades within a decade for all ethnic groups. These findings mirror those of previous Canadian<sup>26,43</sup> and American<sup>44</sup> studies. Thus, although the prevalence of overweight is relatively low among some immigrant groups, it is likely to rise as time passes. The increase in BMI may result from transitions away from cultural diets and lifestyle patterns to a more “western” diet and sedentary lifestyle, or some combination of the two.

Nonetheless, among both recent and long-term immigrants, ethnic differences were apparent. Even when the effects of age, household income, education and physical activity were taken into account, East/Southeast Asian immigrant men and women generally had lower odds of being

overweight than did White immigrants (Table 2). Regardless of when they immigrated, Black women had higher odds of overweight, compared with White immigrant women. This was also true for female long-term immigrants from Latin America.

### Pattern prevails among non-immigrants

Even among non-immigrants, the ethnic patterns of overweight prevailed. The odds of being overweight were low among non-immigrants of South Asian and East/Southeast Asian descent, compared with Whites. This held for both men and women, and persisted when age, educational attainment, household income and physical activity were taken into account.

While the low prevalence of overweight and obesity in East/Southeast Asians is consistent with other data,<sup>45,46</sup> it may be deceptive. Body mass index offers little insight into potential ethnic differences in absolute levels of adiposity, the distribution of body fat, or subsequent health consequences. After adjusting for BMI, it has been shown that Asians have a greater percentage of body fat than their European or White counterparts.<sup>47-49</sup> Indeed, recent studies have documented an increased prevalence of several metabolic disorders among Asians with a BMI of 23 to 24, suggesting that the threshold of 25 may be too high to identify those at increased risk.<sup>46,50</sup>

More broadly, mounting evidence indicates that current general body weight guidelines may be inadequate for identifying health risk equally in all ethnic groups.<sup>45,51-53</sup> The need for research in this area has been acknowledged in the Canadian Guidelines for Body Weight Classification in Adults.<sup>42</sup>

The high prevalence of overweight and obesity among Aboriginal people in this analysis echoes the findings of community-based studies<sup>6,19,22,54</sup> and results using directly measured height and weight from smaller samples.<sup>19,55</sup> These studies suggest that Aboriginal people should be considered at especially high risk for obesity and related co-morbidities.

Table 2

Adjusted odds ratios relating ethnicity to overweight, by sex and immigrant status, household population aged 20 to 64, Canada, 2000/01 and 2003 combined

	Recent immigrants (0 to 10 years)		Long-term immigrants (11 years or more)		Non-immigrants	
	Adjusted odds ratio†	95% confidence interval	Adjusted odds ratio†	95% confidence interval	Adjusted odds ratio†	95% confidence interval
<b>Total</b>						
White†	1.0	...	1.0	...	1.0	...
East/Southeast Asian	0.3*	0.3, 0.4	0.3*	0.3, 0.4	0.5*	0.4, 0.7
West Asian/Arab	1.3	0.9, 1.8	1.0	0.7, 1.5	0.8	0.4, 1.6
South Asian	1.0	0.8, 1.3	0.8*	0.7, 1.0	0.5*	0.3, 0.8
Latin American	1.6*	1.0, 2.5	1.6*	1.2, 2.2	0.5	0.2, 1.3
Black	1.2	0.8, 1.7	1.1	0.9, 1.4	0.8	0.6, 1.1
Aboriginal (off-reserve)	...	...	...	...	1.8*	1.6, 2.0
Other	1.2	0.8, 1.6	0.9	0.7, 1.1	1.3*	1.2, 1.5
<b>Men</b>						
White†	1.0	...	1.0	...	1.0	...
East/Southeast Asian	0.3*	0.2, 0.5	0.2*	0.2, 0.3	0.6*	0.4, 0.8
West Asian/Arab	1.0	0.6, 1.6	0.9	0.5, 1.5	0.7	0.2, 2.1
South Asian	0.8	0.5, 1.1	0.7*	0.5, 0.9	0.5*	0.3, 1.0
Latin American	1.8	0.9, 3.5	1.2	0.7, 1.8	1.3	0.3, 6.4
Black	0.7	0.4, 1.2	0.7	0.5, 1.0	0.7	0.5, 1.2
Aboriginal (off-reserve)	...	...	...	...	1.7*	1.4, 2.1
Other	0.9	0.6, 1.5	0.7*	0.5, 1.0	1.3*	1.1, 1.6
<b>Women</b>						
White†	1.0	...	1.0	...	1.0	...
East/Southeast Asian	0.3*	0.2, 0.5	0.4*	0.3, 0.5	0.4*	0.3, 0.6
West Asian/Arab	1.2	0.6, 2.2	1.0	0.6, 1.7	0.7	0.2, 1.8
South Asian	1.4	0.9, 2.1	0.9	0.7, 1.2	0.4	0.2, 1.2
Latin American	1.6	0.8, 3.0	2.1*	1.4, 3.4	0.3	0.1, 1.2
Black	1.9*	1.1, 3.2	1.6*	1.2, 2.2	0.9	0.5, 1.5
Aboriginal (off-reserve)	...	...	...	...	2.0*	1.7, 2.3
Other	1.6	0.9, 2.7	1.0	0.7, 1.4	1.4*	1.1, 1.7

Data source: 2000/01 and 2003 Canadian Community Health Survey

Notes: Overweight is body mass index  $\geq 25$ ; obese is body mass index  $\geq 30$ . Because of rounding, some confidence intervals with 1.0 as lower/upper limit are significant.

† Reference category

‡ Controls for age, household income, education and physical activity.

\* Significantly different from estimate for reference category ( $p < 0.05$ )

... Not applicable

## Concluding remarks

Analysis of data from the Canadian Community Health Survey reveals strong associations between ethnicity and the prevalence of overweight and obesity. These differences remain significant even when the effects of age, socio-economic status, physical activity and birthplace are taken into account.

Beyond genetic predispositions, ethnic groups have different social pressures and norms surrounding “acceptable” body weight ranges,<sup>38</sup> which may partially explain some of the variations in obesity that emerged from this analysis of CCHS data. Cultural norms related to physical activity (sex-specific, age-specific, sport-specific, perception of intensity, etc.) and nutrition (dietary customs,

acceptable foods and quantities) may also contribute to the differences.

With a substantial and growing proportion of the Canadian population overweight,<sup>56</sup> analysis of the problem by ethnicity is warranted. The information is particularly important given the emerging epidemic of type-2 diabetes,<sup>57</sup> which affects some ethnic groups, notably Aboriginal people, disproportionately.<sup>58,59</sup>

In light of Canada’s increasing ethnic diversity, it is important to understand the social and environmental contexts in which different ethnic groups develop overweight, obesity and related metabolic disorders. Such information makes it possible to identify those at high risk and to target prevention and intervention strategies. ●



## References

- 1 Tremblay MS, Katzmarzyk PT, Willms JD. Temporal trends in overweight and obesity in Canada, 1981-1996. *International Journal of Obesity and Related Metabolic Disorders* 2002; 26: 538-43.
- 2 Tremblay MS, Willms JD. Secular trends in the body mass index of Canadian children. *Canadian Medical Association Journal* 2000; 163: 1429-33. Erratum in: *Canadian Medical Association Journal* 2001; 164: 970.
- 3 Willms JD, Tremblay MS, Katzmarzyk PT. Geographic and demographic variation in the obesity of Canadian children. *Obesity Research* 2003; 11: 668-73.
- 4 Katzmarzyk PT. The Canadian obesity epidemic. *Canadian Medical Association Journal* 2002; 166: 1039-40.
- 5 Katzmarzyk PT. The Canadian obesity epidemic: An historical perspective. *Obesity Research* 2002; 10: 666-74.
- 6 Canadian Population Health Initiative. *Improving the Health of Canadians*. Ottawa: Canadian Institute for Health Information, 2004.
- 7 World Health Organization. *Obesity: Preventing and Managing the Global Epidemic*. Technical Report Series no. 894. Geneva: World Health Organization, 2000.
- 8 Organisation for Economic Co-operation and Development. *Health at a Glance: OECD Indicators 2003*. Paris: OECD, 2003.
- 9 US Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Pittsburgh, Pennsylvania: US Department of Health and Human Services, Public Health Service, Office of the Surgeon General, 2001.
- 10 Wilson PW, D'Agostino RB, Sullivan L, et al. Overweight and obesity as determinants of cardiovascular risk: The Framingham experience. *Archives of Internal Medicine* 2002; 162: 1867-72.
- 11 Bray GA. Overweight, mortality, and morbidity. In: Bouchard C, ed. *Physical Activity and Obesity*. Champaign, Illinois: Human Kinetics, 2000: 31-53.
- 12 Katzmarzyk PT, Janssen I, Ardern CI. Physical inactivity, excess adiposity and premature mortality. *Obesity Reviews* 2003; 4: 257-90.
- 13 Hill JO, Wyatt HR, Reed GW, et al. Obesity and the environment: where do we go from here? *Science* 2003; 299: 853-5.
- 14 Beamer BA. Genetic influences on obesity. In: Andersen RE, ed. *Obesity: Etiology, Assessment, Treatment and Prevention*. Champaign, Illinois: Human Kinetics, 2003: 43-56.
- 15 Weiss KM, Ferrell RE, Hanis CL. A new world syndrome of metabolic diseases with a genetic and evolutionary basis. *Yearbook of Physical Anthropology* 1984; 27: 153-78.
- 16 Dyck RF, Klomp H, Tan L. From "thrifty genotype" to "hefty fetal phenotype": The relationship between high birthweight and diabetes in Saskatchewan Registered Indians. *Canadian Journal of Public Health* 2001; 92: 340-4.
- 17 National Center for Health Statistics. Healthy weight, overweight, and obesity among persons 20 years of age and over, according to sex, age, race, and Hispanic origin: United States, 1960-62, 1971-74, 1976-80, 1988-94, 1999-2000. National Health and Nutrition Examination Survey. Centers for Disease Control. 2004. Available at <http://www.cdc.gov/nchs/data/hus/tables/2002/02hus070.pdf>
- 18 National Center for Health Statistics. Overweight children and adolescents 6-19 years of age, according to sex, age, race, and Hispanic origin: United States, selected years 1963-65 through 1999-2000. National Health and Nutrition Examination Survey. Centers for Disease Control. 2004. Available at <http://www.cdc.gov/nchs/data/hus/tables/2002/02hus071.pdf>
- 19 Katzmarzyk PT, Malina RM. Obesity and relative subcutaneous fat distribution among Canadians of First Nation and European ancestry. *International Journal of Obesity and Related Metabolic Disorders* 1998; 22: 1127-31.
- 20 Bernard L, Lavallee C, Gray-Donald K, et al. Overweight in Cree schoolchildren and adolescents associated with diet, low physical activity, and high television viewing. *Journal of the American Dietetic Association* 1995; 95: 800-2.
- 21 Potvin L, Desrosiers S, Trifonopoulos M, et al. Anthropometric characteristics of Mohawk children aged 6 to 11 years: a population perspective. *Journal of the American Dietetic Association* 1999; 99: 955-61.
- 22 Hanley AJ, Harris SB, Gittelsohn J, et al. Overweight among children and adolescents in a Native Canadian community: prevalence and associated factors. *American Journal of Clinical Nutrition* 2000; 71: 693-700.
- 23 Béland Y. Canadian Community Health Survey - Methodological overview. *Health Reports* (Statistics Canada, Catalogue 82-003) 2002; 13(3): 9-14.
- 24 Crawford PB, Story M, Wang MC, et al. Ethnic issues in the epidemiology of childhood obesity. *Pediatric Clinics of North America* 2001; 48: 855-78.
- 25 Malina RM. Ethnic variation in the prevalence of obesity in North American children and youth. *Critical Reviews in Food Science and Nutrition* 1993; 33: 389-96.
- 26 Pérez CE. Health status and health behaviour among immigrants. *Health Reports* (Statistics Canada, Catalogue 82-003) 2002; 13(suppl.): 89-100.
- 27 Popkin BM, Udry JR. Adolescent obesity increases significantly in second and third generation U.S. immigrants: The National Longitudinal Study of Adolescent Health. *Journal of Nutrition* 1998; 128: 701-6.
- 28 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.
- 29 Rust K, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.
- 30 Paccard F, Wietlisbach V, Rickenbach M. Body mass index: comparing mean values and prevalence rates from telephone and examination surveys. *Revue d'épidémiologie et de santé publique* 2001; 49: 33-40.

- 31 Strauss RS. Comparison of measured and self-reported weight and height in a cross-sectional sample of young adolescents. *International Journal of Obesity and Related Metabolic Disorders* 1999; 23: 904-8.
- 32 St-Pierre M, Béland Y. Mode effects in the Canadian Community Health Survey: a comparison of CAPI and CATI. *Proceedings of the American Statistical Association Meeting, Survey Research Methods Section, 2004*. Toronto: American Statistical Association, 2004.
- 33 Brener ND, Mcmanus T, Galuska DA, et al. Reliability and validity of self-reported height and weight among high school students. *Journal of Adolescent Health* 2003; 32: 281-7.
- 34 Yates A, Edman J, Arguete M. Ethnic differences in BMI and body/self-dissatisfaction among Whites, Asian subgroups, Pacific Islanders, and African-Americans. *Journal of Adolescent Health* 2004; 34: 300-7.
- 35 Paeratakul S, White MA, Williamson DA, et al. Sex, race/ethnicity, socioeconomic status, and BMI in relation to self-perception of overweight. *Obesity Research* 2002; 10: 345-50.
- 36 Fitzgibbon ML, Blackman LR, Avellone ME. The relationship between body image discrepancy and body mass index across ethnic groups. *Obesity Research* 2000; 8: 582-9.
- 37 Metcalf PA, Scragg RK, Willoughby P, et al. Ethnic differences in perceptions of body size in middle-aged European, Maori and Pacific people living in New Zealand. *International Journal of Obesity and Related Metabolic Disorders* 2000; 24: 593-9.
- 38 Gittelsohn J, Harris SB, Thorne-Lyman AL, et al. Body image concepts differ by age and sex in an Ojibway-Cree community in Canada. *Journal of Nutrition* 1996; 126: 2990-3000.
- 39 Hahn RA, Truman BI, Barker ND. Identifying ancestry: the reliability of ancestral identification in the United States by self, proxy, interviewer, and funeral director. *Epidemiology* 1996; 7: 75-80.
- 40 Comstock RD, Castillo EM, Lindsay P. Four-year review of the use of race and ethnicity in epidemiologic and public health research. *American Journal of Epidemiology* 2004; 159: 611-9.
- 41 Statistics Canada. *Canada's Ethnocultural Portrait: The Changing Mosaic*. 2001 Census: Analysis Series (Catalogue 96F0030XIE2001008) Ottawa: Minister of Industry, 2003.
- 42 Health Canada. *Canadian Guidelines for Body Weight Classification in Adults* (Catalogue H49-179/2003E) Ottawa: Health Canada, 2003.
- 43 Cairney J, Ostbye T. Time since immigration and excess body weight. *Canadian Journal of Public Health* 1999; 90: 120-4.
- 44 Lauderdale DS, Rathouz PJ. Body mass index in a US national sample of Asian Americans: effects of nativity, years since immigration and socioeconomic status. *International Journal of Obesity and Related Metabolic Disorders* 2000; 24: 1188-94.
- 45 Pan WH, Flegal KM, Chang HY, et al. Body mass index and obesity-related metabolic disorders in Taiwanese and US whites and blacks: implications for definitions of overweight and obesity for Asians. *American Journal of Clinical Nutrition* 2004; 79: 31-9.
- 46 Kim Y, Suh YK, Choi H. Metabolic disorders in South Korean adults: 1998 Korea National Health and Nutrition Survey. *Obesity Research* 2004; 12: 445-53.
- 47 Deurenburg P, Yap M, van Staveren WA. Body mass index and percent body fat: a meta analysis among different ethnic groups. *International Journal of Obesity and Related Metabolic Disorders* 1998; 22: 1164-71.
- 48 Deurenberg-Yap M, Schmidt G, van Staveren WA, et al. The paradox of low body mass index and high body fat percentage among Chinese, Malays and Indians in Singapore. *International Journal of Obesity and Related Metabolic Disorders* 2000; 24: 1011-7.
- 49 Wang J, Thornton JC, Russell M, et al. Asians have lower body mass index (BMI) but higher percent body fat than do whites: comparisons of anthropometric measurements. *American Journal of Clinical Nutrition* 1994; 60: 23-8.
- 50 Li G, Chen X, Jang Y, et al. Obesity, coronary heart disease risk factors and diabetes in Chinese: an approach to the criteria of obesity in the Chinese population. *Obesity Reviews* 2002; 3: 167-72.
- 51 Nakagami T, Qiao Q, Carstensen B, et al. Age, body mass index and Type 2 diabetes—associations modified by ethnicity. *Diabetologia* 2003; 46: 1063-70.
- 52 Deurenberg-Yap M, Chew SK, Lin VF, et al. Relationships between indices of obesity and its co-morbidities in multi-ethnic Singapore. *International Journal of Obesity and Related Metabolic Disorders* 2001; 25: 1554-62.
- 53 Moon OR, Kim NS, Jang SM, et al. The relationship between body mass index and the prevalence of obesity-related diseases based on the 1995 National Health Interview Survey in Korea. *Obesity Reviews* 2002; 3: 191-6.
- 54 Horn OK, Paradis G, Potvin L, et al. Correlates and predictors of adiposity among Mohawk children. *Preventive Medicine* 2001; 33: 274-81.
- 55 Anand SS, Yusuf S, Jacobs R, et al. Risk factors, atherosclerosis, and cardiovascular disease among Aboriginal people in Canada: the Study of Health Assessment and Risk Evaluation in Aboriginal Peoples (SHARE-AP). *Lancet* 2001; 358: 1147-53.
- 56 Statistics Canada. *Health Indicators* (Catalogue 82-221) 2004(1).
- 57 Rosenbloom AL, Joe JR, Young RS, et al. Emerging epidemic of type 2 diabetes in youth. *Diabetes Care* 1999; 22: 345-54.
- 58 Young TK, Reading J, Elias B, et al. Type 2 diabetes in Canada's first nations: status of an epidemic in progress. *Canadian Medical Association Journal* 2000; 163(5): 561-6.
- 59 Millar WJ, Young TK. Tracking diabetes: Prevalence, incidence and risk factors. *Health Reports* (Statistics Canada, Catalogue 82-003) 2003; 14(3): 35-47.

## Appendix

Table A  
Distribution of household population aged 20 to 64, by ethnicity

	Sample size		Estimated population	
		%	'000	%
<b>Cycle 1.1 (2000/01)</b>				
<b>Total</b>	<b>86,687</b>	<b>100.0</b>	<b>18,381</b>	<b>100.0</b>
White	77,412	89.3	15,482	84.2
East/Southeast Asian	2,597	3.0	1,048	5.7
West Asian/Arab	367	0.4	164	0.9
South Asian	1,031	1.2	526	2.9
Latin American	305	0.4	133	0.7
Black	691	0.8	318	1.7
Aboriginal (off-reserve)	2,265	2.6	198	1.1
Other/Multiple/Unknown	2,019	2.3	512	2.8
<b>Cycle 2.1 (2003)</b>				
<b>Total</b>	<b>84,709</b>	<b>100.0</b>	<b>18,788</b>	<b>100.0</b>
White	73,329	86.6	15,217	81.0
East/Southeast Asian	2,516	3.0	1,123	6.0
West Asian/Arab	389	0.5	170	0.9
South Asian	1,045	1.2	534	2.8
Latin American	383	0.5	190	1.0
Black	751	0.9	322	1.7
Aboriginal (off-reserve)	2,455	2.9	200	1.1
Other/Multiple/Unknown	3,841	4.5	1,032	5.5

*Data source: 2000/01 and 2003 Canadian Community Health Survey*

Table B  
Distribution of selected characteristics, by body mass index, household population aged 20 to 64, Canada, 2000/01 and 2003 combined

	Total			Overweight (BMI ≥ 25) <sup>†</sup>			Obese (BMI ≥ 30)		
	Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population	
		'000	%		'000	%		'000	%
<b>Total</b>	<b>171,396</b>	<b>37,169.2</b>	<b>100.0</b>	<b>89,921</b>	<b>18,202.3</b>	<b>100.0</b>	<b>30,732</b>	<b>5,745.7</b>	<b>100.0</b>
<b>Sex</b>									
Men	82,899	19,064.5	51.3	50,381	10,906.5	59.9	15,656	3,123.8	54.4
Women	88,497	18,104.7	48.7	39,540	7,295.8	40.1	15,076	2,621.9	45.6
<b>Age group</b>									
20-34	49,831	12,017.9	32.3	21,504	4,656.1	25.6	7,253	1,433.0	24.9
35-49	66,427	14,971.2	40.3	34,694	7,511.9	41.3	11,633	2,314.4	40.3
50-64	55,138	10,180.0	27.4	33,723	6,034.3	33.2	11,846	1,998.3	34.8
<b>Ethnicity</b>									
White	150,741	30,699.2	82.6	80,474	15,683.5	86.2	27,537	5,082.6	88.5
East/Southeast Asian	5,113	2,170.2	5.8	1,211	480.6	2.6	190	65.9	1.1
West Asian/Arab	756	334.8	0.9	350	149.8	0.8	95	36.0	0.6
South Asian	2,076	1,060.0	2.9	839	418.1	2.3	179	89.9	1.6
Latin American	688	322.8	0.9	349	169.4	0.9	100	46.6	0.8
Black	1,442	640.7	1.7	722	313.3	1.7	220	93.1	1.6
Aboriginal (off-reserve)	4,720	397.7	1.1	3,033	248.5	1.4	1,425	110.3	1.9
Other/Multiple/Unknown	5,860	1,543.8	4.2	2,943	739.2	4.1	986	221.3	3.9
<b>Immigrant status</b>									
Non-immigrant	146,948	28,690.2	77.2	78,810	14,565.1	80.0	27,677	4,796.4	83.5
Recent immigrant (≤ 10 years)	5,459	2,320.6	6.2	1,827	737.9	4.1	412	153.6	2.7
Long-term immigrant (11+ years)	15,997	5,307.6	14.3	7,915	2,547.4	14.0	2,250	700.8	12.2
Missing	2,992	850.8	2.3	1,369	351.9	1.9	393	95.0	1.7
<b>Education</b>									
Less than secondary graduation	31,136	5,650.2	15.2	18,497	3,224.7	17.7	7,252	1,222.1	21.3
Secondary graduation	33,297	7,393.9	19.9	17,693	3,686.0	20.3	6,044	1,186.3	20.6
Some postsecondary	13,315	3,115.6	8.4	6,537	1,393.4	7.7	2,253	447.4	7.8
Postsecondary graduation	91,366	20,461.7	55.1	45,915	9,615.2	52.8	14,724	2,799.4	48.7
Missing	2,282	547.8	1.5	1,279	283.0	1.6	459	90.5	1.6
<b>Household income</b>									
Lowest	7,360	1,115.2	3.0	3,598	483.5	2.7	1,514	183.5	3.2
Lower-middle	10,651	1,866.9	5.0	5,400	891.3	4.9	2,232	337.5	5.9
Middle	29,818	5,939.0	16.0	15,376	2,863.5	15.7	5,782	1,000.6	17.4
Upper-middle	56,770	11,841.5	31.9	30,330	5,924.3	32.5	10,251	1,893.8	33.0
Highest	49,798	12,443.1	33.5	26,831	6,248.3	34.3	8,300	1,792.5	31.2
Missing	16,999	3,963.5	10.7	8,386	1,791.5	9.8	2,653	537.8	9.4
<b>Physical activity</b>									
Active	39,265	8,189.4	22.0	18,762	3,681.6	20.2	5,045	898.9	15.6
Moderate	41,849	8,838.5	23.8	21,742	4,337.7	23.8	6,997	1,296.0	22.6
Inactive	84,553	18,552.1	49.9	46,462	9,458.5	52.0	17,824	3,346.1	58.2
Missing	5,729	1,589.2	4.3	2,955	724.6	4.0	866	204.7	3.6

Data source: 2000/01 and 2003 Canadian Community Health Survey

Note: Because of rounding, details may not add to totals.

† Includes obese