

Adult obesity

Michael Tjepkema

Abstract

Objectives

Based on direct measures of height and weight, this article compares the prevalence of obesity among adults aged 18 or older in 1978/79 and 2004. Prevalence by demographic, socio-economic and lifestyle characteristics is presented, along with associations between obesity and selected chronic conditions. Canadian and US data are also compared.

Data sources

Data are from the 2004 Canadian Community Health Survey: Nutrition, the 1978/79 Canada Health Survey and the 1986 to 1992 Canadian Heart Health Surveys. US data are from the 1999-2002 National Health and Nutrition Examination Survey.

Analytical techniques

Descriptive statistics were used to estimate the proportion of adults who were obese in 2004 in relation to selected characteristics. Logistic regression models were used to examine relationships between obesity and high blood pressure, diabetes and heart disease, controlling for socio-economic status and other risk factors such as smoking and physical activity.

Main results

In 2004, 23% of adults, 5.5 million people aged 18 or older, were obese—up substantially from 14% in 1978/79. An additional 36% (8.6 million) were overweight. Obese individuals tended to have sedentary leisure-time pursuits and to consume fruit and vegetables infrequently. As body mass index (BMI) increased, so did an individual's likelihood of reporting high blood pressure, diabetes and heart disease.

Keywords

body weight, body mass index, health behaviour, lifestyle

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The percentage of Canadians who are overweight or obese has risen dramatically in recent years, mirroring a worldwide phenomenon.¹⁻⁴ The health consequences of excess weight are well known. It is a risk factor for type 2 diabetes, cardiovascular disease, high blood pressure, osteoarthritis, some cancers, and gallbladder disease.⁵⁻⁷ As well, psychosocial problems, functional limitations and disabilities are associated with being overweight or obese.^{5,8}

For more than a decade, information about Canadians' weight has been based on self-reports; that is, survey respondents have reported their own height and weight. However, such data are known to underestimate the prevalence of overweight and obesity.⁹⁻¹² The 2004 Canadian Community Health Survey (CCHS): Nutrition, which measured respondents' height and weight, makes it possible to draw a more accurate picture.

To trace trends in obesity over the last quarter century, results from the CCHS are compared with findings from earlier Canadian surveys that also took direct measures of height and weight (see *Methods*). As well, the 2004 results for Canada are compared with American data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES).

Methods

Data sources

Data from the 2004 Canadian Community Health Survey (CCHS): Nutrition were used to estimate the prevalence of overweight and obesity among adults aged 18 or older by selected demographic, lifestyle and socio-economic factors (see <http://www.statcan.ca/english/concepts/hs/index.htm>). The 2004 CCHS was designed to gather information on the nutritional status of the Canadian population at the provincial level. It excludes residents of institutions, the three territories, Indian reserves, some remote areas, members of the regular Armed Forces, and civilian residents of military bases. The response rate was 76.5%. The height and weight of 57.5% of adults (18 or older) who responded to the survey were measured (see *Limitations*).

Historical estimates of obesity in Canada, based on measured height and weight, are from the 1978/79 Canada Health Survey (CHS) and the Canadian Heart Health Surveys that were conducted in different provinces during the 1986-to-1992 period. Estimates based on self-reported data are from the 1985 and 1990 Health Promotion Survey, the 1994/95, 1996/97 and 1998/99 National Population Health Survey (NPHS), and the 2000/01 and 2003 CCHS.

Overweight and obesity among American adults were estimated using data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES). The NHANES obtained direct measures of height and weight for 9,488 respondents aged 18 or older.

Analytical techniques

Descriptive statistics were used to estimate the proportion of adults who were obese in relation to selected characteristics (Appendix Tables A, B and C). Actual measures of height and weight were obtained for 12,428 CCHS respondents aged 18 or older. Because they represented just 57.5% of adults who responded to the 2004 CCHS, an adjustment was made to minimize non-response bias. A special sampling weight was created by redistributing the sampling weights of non-respondents to respondents using response

propensity classes. Variables such as province, age, sex, household income, education, ethnicity, physical activity, fruit and vegetable consumption and chronic conditions were used to create the classes. The classes were created with the CHAID (Chi-Square Automatic Interaction Detector) algorithm available in Knowledge Seeker¹³ to identify the characteristics that best split the sample into groups that were dissimilar with respect to response/non-response. This adjusted sampling weight was used to produce all the estimates in this analysis. Standard errors and coefficients of variation were estimated with the bootstrap technique, which accounts for the survey design effects.¹⁴⁻¹⁶

The body mass index (BMI) distribution (Chart 2) was smoothed by calculating three-point averages. For example, the percentage of the population with a BMI of 23 was calculated by summing the percentage with a BMI of 22, the percentage with a BMI of 23 and the percentage with a BMI of 24, and dividing the result by 3.

Standard errors and coefficients of variation for estimates from the 1978/79 CHS and the 1999-2002 NHANES were estimated with SUDAAN, which uses a Taylor series linearization method to account for the complex survey sample design.¹⁷ The American estimates and Canadian historical estimates are based on weighted data.

To compare the prevalence of obesity between surveys, the data were age-standardized to the 2004 CCHS using the direct method. The following age groups were used: 18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, and 75 or older.

Logistic regression models were used to determine if associations between obesity and fruit and vegetable consumption and leisure-time physical activity remained when age, marital status, education and household income were taken into account.

Separate logistic regressions for each sex were used to model having high blood pressure, diabetes or heart disease in relation to BMI. The model included the following control variables: age, marital status, education, household income, smoking and leisure-time physical activity. Respondents who were underweight or had missing information for education, smoking or leisure-time physical activity were excluded from the models.

Table 1
Percentage distribution of household population aged 18 or older, by sex and body mass index (BMI) category, Canada excluding territories, 2004

BMI category (range)	Both sexes		Men		Women	
	'000	%	'000	%	'000	%
Overweight and obese (≥ 25)	14,185	59.1	7,706	65.0*	6,480	53.4
Obese (≥ 30)	5,539	23.1	2,722	22.9	2,817	23.2
Underweight (< 18.5)	471	2.0	170 ^E	1.4* ^E	302	2.5
Normal weight (18.5 to 24.9)	9,328	38.9	3,986	33.6*	5,343	44.1
Overweight (not obese) (25.0 to 29.9)	8,647	36.1	4,984	42.0*	3,663	30.2
Obese Class I (30.0 to 34.9)	3,656	15.2	1,959	16.5	1,697	14.0
Obese Class II (35.0 to 39.9)	1,231	5.1	568	4.8	663	5.5
Obese Class III (≥ 40.0)	651	2.7	194	1.6*	457	3.8

Data source: 2004 Canadian Community Health Survey: Nutrition

* Significantly different from corresponding estimate for women ($p < 0.05$)

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

Majority overweight or obese

According to the 2004 CCHS, 23.1% of Canadians aged 18 or older, an estimated 5.5 million adults, had a body mass index (BMI) of 30 or more, indicating that they were obese (Table 1) (see *What is BMI?*). This is significantly higher than the 2003 estimate of 15.2%, which was derived from self-reported data (see *Methodology makes a difference*). Another 8.6 million Canadian adults (36.1%) were overweight in 2004.

Because BMIs vary greatly among people who are obese, obesity has been divided into three levels, with successive values representing escalating health risks.^{3,5} People in Class I (BMI 30.0 to 34.9) have a high risk of developing health problems. For those in Class II (BMI 35.0 to 39.9), the risk is

very high, and in Class III (BMI 40 or more), extremely high. In 2004, 15.2% of Canadian adults had a BMI that put them in Class I; 5.1% were in Class II, and 2.7% were in Class III.

Sharp increase

In 1978/79, the Canada Health Survey collected measurements of height and weight for a nationally representative sample of adults. That year, the age-adjusted obesity estimate was 13.8%, far below the 2004 figure of 23.1%. The increase was evident for each level of obesity, especially the two higher classes (Table 2). The proportion of adults in Class II rose from 2.3% to 5.1%; in Class III, from 0.9% to 2.7%.

Table 2
Percentage distribution of household population aged 18 or older, by sex and body mass index (BMI) category, Canada excluding territories, 1978/79 and 2004

BMI category (range)	Both sexes		Men		Women	
	1978/79	2004	1978/79	2004	1978/79	2004
Overweight and obese (≥ 25)	49.2	59.1*	54.0	65.0*	44.6	53.4*
Obese (≥ 30)	13.8	23.1*	11.5	22.9*	15.9	23.2*
Underweight (< 18.5)	2.4	2.0	1.3 ^F	1.4 ^E	3.4	2.5
Normal weight (18.5 to 24.9)	48.4	38.9*	44.6	33.6*	52.0	44.1*
Overweight (not obese) (25.0 to 29.9)	35.4	36.1	42.5	42.0	28.7	30.2
Obese Class I (30.0 to 34.9)	10.5	15.2*	9.5	16.5*	11.5	14.0*
Obese Class II (35.0 to 39.9)	2.3 ^F	5.1*	F	4.8*	2.9	5.5*
Obese Class III (≥ 40.0)	0.9 ^F	2.7*	F	1.6*	1.5 ^F	3.8*
Average BMI	25.4	27.0*	25.6	27.2*	25.2	26.7*

Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition

Note: The 1978/79 Canada Health Survey estimates were age-standardized to the 2004 CCHS population.

* Significantly different from corresponding estimate for 1978/79 ($p < 0.05$)

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

^F Coefficient of variation greater than 33.3% (suppressed because of extreme sampling variability)

What is BMI?

Overweight and obesity are based on body mass index (BMI), which is a measure of an individual's weight in relation to his or her height. BMI is highly correlated with body fat and is widely used to indicate health risks.⁵ According to Canadian guidelines, which are in line with those of the World Health Organization, BMI for adults is classified into six categories, each representing a different level of health risk:

BMI		Level of health risk
Category	Range	
Underweight	< 18.5	Increased
Normal weight	18.5 to 24.9	Least
Overweight	25.0 to 29.9	Increased
Obese Class I	30.0 to 34.9	High
Obese Class II	35.0 to 39.9	Very high
Obese Class III	≥ 40.0	Extremely high

BMI is calculated as follows:

Metric: $BMI = \text{weight (kg)} / \text{height (metres)}^2$

Non-metric: $BMI = \text{weight (pounds)} / \text{height (inches)}^2 \times 703$

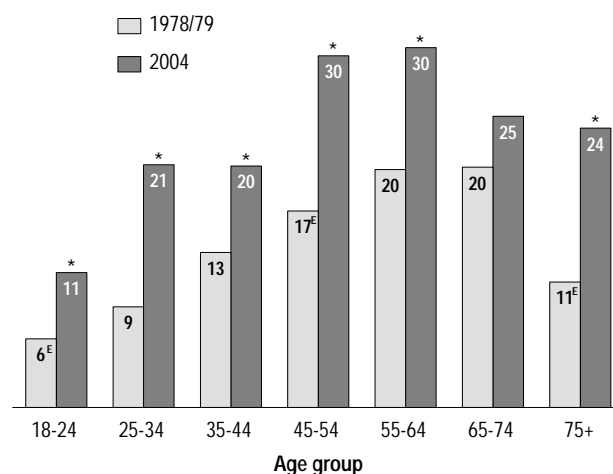
For example, the weight ranges that would place an individual with a height of 1.78m (5'10") in the various BMI classes are:

	Weight	
	Kilograms	Pounds
Underweight	≤ 58.4	≤ 128
Normal weight	58.5 - 79.0	129 - 173
Overweight	79.1 - 94.8	174 - 208
Obese Class I	94.9 - 110.7	209 - 243
Obese Class II	110.8 - 126.5	244 - 278
Obese Class III	≥ 126.6	≥ 279

From 1978/79 to 2004, the prevalence of obesity rose in every age group except 65 to 74 (Chart 1). The most striking increases were among people younger than 35 and those 75 or older. For instance, the percentage of 25- to 34-year-olds who were obese more than doubled from 8.5% to 20.5%. The magnitude of the increase among people aged 75 or older was about the same: from 10.6% to 23.6%.

The median BMI of adults rose from 24.4 in 1978/79 to 26.1 in 2004, and the BMI distribution of the adult population shifted toward the overweight and obese ranges (Chart 2).

Chart 1
Percentage obese, by age group, household population aged 18 or older, Canada excluding territories, 1978/79 and 2004

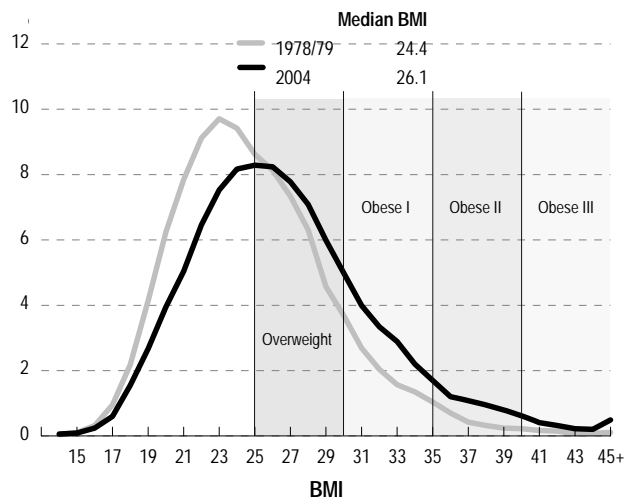


Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition

* Significantly higher than estimate for 1978/79 ($p < 0.05$)

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

Chart 2
Percentage distribution of household population aged 18 or older, by body mass index (BMI), Canada excluding territories, 1978/79 and 2004



Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition

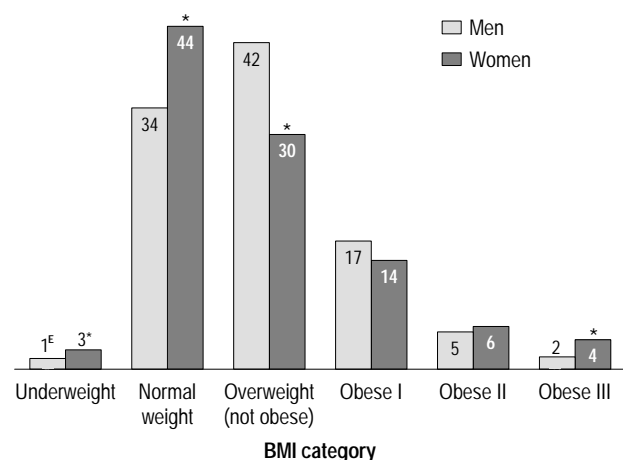
Peaks in middle-age

In 2004, men and women were equally likely to be obese: 22.9% and 23.2%, respectively (Table 1). However, when the three classes of obesity were examined separately, a difference between the sexes

emerged: a higher percentage of women were in Class III (Chart 3).

For both sexes, obesity was lowest at ages 18 to 24 (10.7% of men and 12.1% of women), and peaked at around 30% among 45- to 64-year-olds (Chart 4).

Chart 3
Percentage distribution of household population aged 18 or older, by sex and body mass index (BMI) category, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for men ($p < 0.05$)
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Chart 4
Percentage obese, by sex and age group, household population aged 18 or older, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from overall estimate for same sex ($p < 0.05$)
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

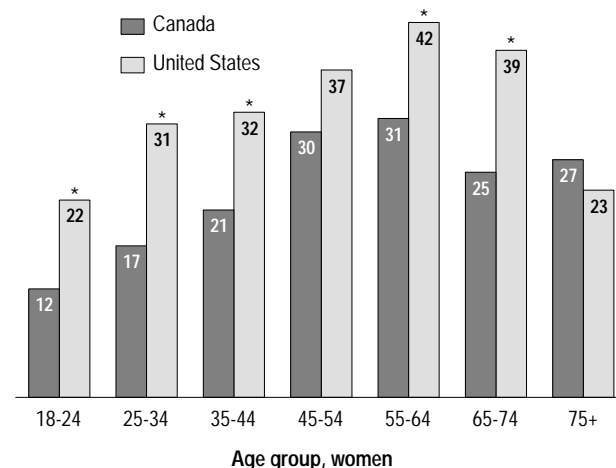
Canada/United States

While information about obesity in Canada has usually been based on self-reported data, the United States has collected actual measurements of height and weight since the early 1960s. With the direct measurements obtained by the 2004 CCHS, it is possible to compare the prevalence of obesity in the two countries.

Age-standardized results show that 29.7% of Americans aged 18 or older were obese in 1999-2002, significantly above the 2004 figure for Canada (23.1%) (Table 3). Most of this difference was attributable to the situation among women. Whereas 23.2% of Canadian women were obese, the figure for American women was 32.7%. As well, each class of obesity contained a higher percentage of American than Canadian women. This difference prevailed for women in all age groups except 45-to-54 and 75-or-older (Chart 5).

The percentage of Canadian men who were obese was also significantly below the figure for American men: 22.9% versus 26.6%. However, this was mainly a reflection of Class III obesity: American men were much more likely to have a BMI of 40 or more. The percentages of Canadian

Chart 5
Percentage obese, by age group, female household population aged 18 or older, Canada excluding territories (2004) and United States (1999-2002)



Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey
* Significantly different from estimate for Canada ($p < 0.05$)

Table 3
 Percentage distribution of household population aged 18 or older, by sex, race and body mass index (BMI) category, Canada excluding territories (2004) and United States (1999-2002)

BMI category (range)	Both sexes				Men				Women			
	All races		White		All races		White		All races		White	
	Canada	US	Canada	US	Canada	US	Canada	US	Canada	US	Canada	US
	%		%		%		%		%		%	
Overweight and obese (≥ 25)	59.1	64.0*	61.7	62.9	65.0	67.2	69.0	68.5	53.4	60.9*	54.7	57.4
Obese (≥ 30)	23.1	29.7*	25.2	29.2*	22.9	26.6*	25.5	27.6	23.2	32.7*	24.8	30.8*
Underweight (< 18.5)	2.0	2.1	1.7	2.2	1.4 ^E	1.2 ^E	1.1 ^E	1.1 ^E	2.5	2.9	2.2	3.3*
Normal weight (18.5 to 24.9)	38.9	34.0*	36.6	34.8*	33.6	31.6	29.9	30.4	44.1	36.2*	43.1	39.2
Overweight (not obese) (25.0 to 29.9)	36.1	34.3	36.5	33.7*	42.0	40.6	43.4	40.9	30.2	28.2	29.9	26.6
Obese Class I (30.0 to 34.9)	15.2	17.4*	16.5	17.4	16.5	17.5	18.3	18.7	14.0	17.3*	14.7	16.2
Obese Class II (35.0 to 39.9)	5.1	7.6*	5.6	7.5*	4.8	5.8	5.3	5.6	5.5	9.3*	5.8	9.3*
Obese Class III (≥ 40.0)	2.7	4.7*	3.1	4.3*	1.6	3.3*	1.9 ^E	3.3*	3.8	6.1*	4.2	5.3
Average BMI	27.0	27.9*	27.3	27.8*	27.2	27.7*	27.6	27.9	26.7	28.1*	27.1	27.6*

Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey

Note: The 1999-2002 NHANES estimates were age-standardized to the 2004 CCHS population.

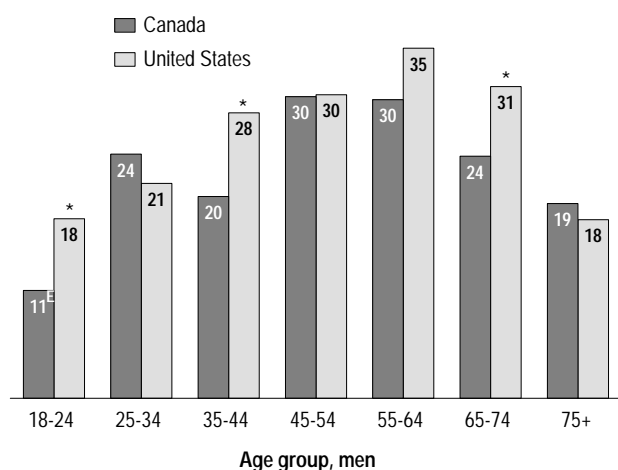
* Significantly different from estimate for Canada (p < 0.05)

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

and American men whose BMIs placed them in Class I or II were statistically similar. American men aged 18 to 24, 35 to 44 and 65 to 74 were more likely than their Canadian counterparts to be obese (Chart 6).

The racial make-up of the two countries may

Chart 6
 Percentage obese, by age group, male household population aged 18 or older, Canada excluding territories (2004) and United States (1999-2002)



Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey

* Significantly different from estimate for Canada (p < 0.05)

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

explain some of the differences, as research has shown that the prevalence of obesity varies by ethnic origin (see *Definitions*).¹⁸ In fact, the percentages of White American and Canadian men who were obese did not differ significantly. However, White women in the United States were strikingly more likely than those in Canada to be obese: 30.3% versus 24.8% (Table 3)

In Canada, a high percentage of people of Aboriginal origin (off-reserve) were obese—37.8%—about 1.6 times the national figure (Appendix Tables A, B and C). These results are consistent with other research based on self-reported data.¹⁸

Related to lifestyle

Diet and exercise, not surprisingly, were related to obesity. Men and women who ate fruit and vegetables less than three times a day were more likely to be obese than were those who consumed such foods five or more times (Chart 7). Although other factors may be driving this relationship, the association persisted when age and socio-economic status were taken into account (data not shown). Another study has also shown obesity to be independently associated with infrequent consumption of fruit and vegetables.²¹ However,

Definitions

The *frequency of fruit and vegetable consumption* was assessed with questions from the Behavioral Risk Factor Surveillance System in the United States.¹⁹ Respondents were asked:

- “How often do you usually drink fruit juices such as orange, grapefruit or tomato?” (for example, once a day, three times a week, twice a month)
- “Not counting juice, how often do you usually eat fruit?”
- “How often do you usually eat green salad?”
- “How often do you usually eat potatoes, not including French fries, fried potatoes, or potato chips?”
- “How often do you usually eat carrots?”
- “Not counting carrots, potatoes or salad, how many servings of other vegetables do you usually eat?”

Leisure-time physical activity level was based on total energy expenditure (EE) during leisure time. EE was calculated from the reported frequency and duration of all of a respondent's leisure-time physical activities in the three months before his or her 2004 CCHS interview and the metabolic energy demand (MET value) of each activity, which was independently established.²⁰

$$EE = \sum (N_i \cdot D_i \cdot MET_i / 365 \text{ days}), \text{ where}$$

N_i = number of occasions of activity i in a year,

D_i = average duration in hours of activity i , and

MET_i = a constant value for metabolic energy cost of activity i .

An EE of 3 or more kilocalories per kilogram per day (KKD) was defined as *active*; 1.5 to 2.9 KKD, *moderately active*; and less than 1.5 KKD, *sedentary*.

Ethnicity was based on the question: “People living in Canada come from many different cultural and racial backgrounds. Are you:

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)?”
13. Other – specify.

For the comparison with the White population in the United States, category 1 was selected. To compare ethnic groups within Canada, the following categories were used: White (1); Black (4); Southeast/East Asian (2, 5, 7, 10, 11); off-reserve Aboriginal (12); and Other (3, 6, 8, 9, 13). Multiple responses across the categories defined here were coded to “Other.”

Four categories were established for current *marital status*: married or living common-law; divorced or separated; widowed; and never married.

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	\$60,000 or more
	3 or more	\$80,000 or more

Respondents were grouped into four *education* categories based on the highest level attained: less than secondary graduation, secondary graduation, some postsecondary, and postsecondary graduation.

To measure chronic conditions, respondents were asked about long-term physical conditions that had lasted or were expected to last six months or longer and that had been diagnosed by a health professional. Three conditions were considered for this analysis: *high blood pressure*, *diabetes* and *heart disease*.

because the CCHS data are cross-sectional, the direction of this relationship cannot be determined (see *Limitations*).

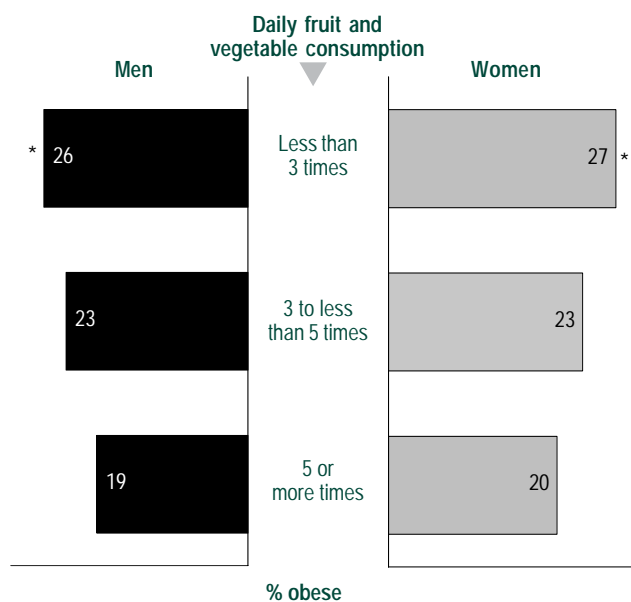
Physical activity, too, was related to obesity. People who were sedentary in their leisure time were more likely than those who were physically active to be obese. For example, 27.0% of sedentary men were obese, compared with 19.6% of active men (Chart 8). Among women, the prevalence of obesity was high not only for those

who were sedentary, but also for those who were moderately active. These relationships remained statistically significant when adjustments were made to account for age and socio-economic status (data not shown).

Socio-economic differences

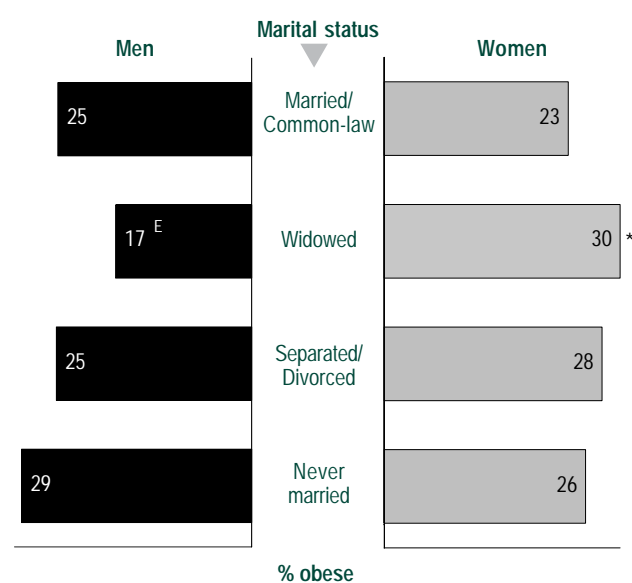
The likelihood of being obese varied by marital status for women, but not for men (Chart 9). Just under a quarter (23.4%) of married women aged

Chart 7
Percentage obese, by sex and daily fruit and vegetable consumption, household population aged 18 or older, Canada excluding territories, 2004



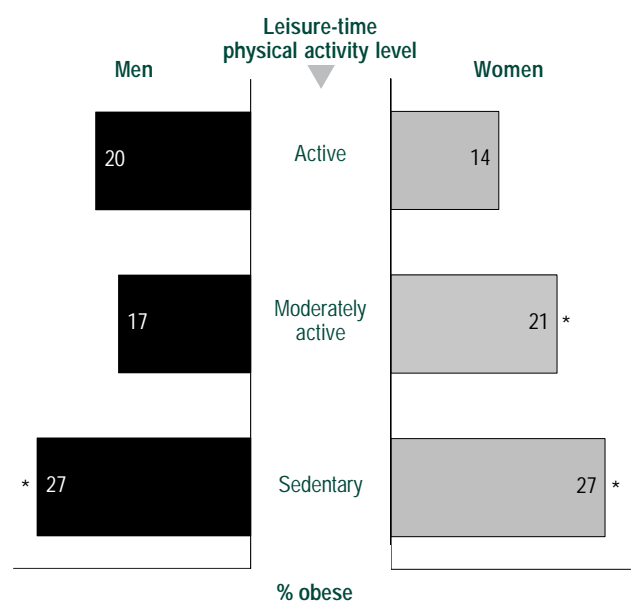
Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for 5 or more times ($p < 0.05$)

Chart 9
Percentage obese, by sex and marital status, household population aged 25 or older, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for married/common-law category ($p < 0.05$)
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Chart 8
Percentage obese, by sex and leisure-time physical activity level, household population aged 18 or older, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for active category ($p < 0.05$)

Chart 10
Percentage obese, by sex and educational attainment, household population aged 25 to 64, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for postsecondary graduation category ($p < 0.05$)
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Methodology makes a difference

In the United States, data from the National Health and Nutritional Examination Survey (NHANES) show sharp increases in the prevalence of obesity among adults from 1976-1980 to 1988-1994 and, again, from 1988-1994 to 1999-2002.²²

Because of variations in the methods used to collect information on height and weight, it is difficult to pinpoint when the prevalence of obesity increased in Canada. Comparable obesity estimates²³ for adults aged 18 or older, based on directly measured height and weight, can be calculated for 1978/79, the 1986-to-1992 period, and 2004 (see *Methods*). The data reveal little change in the proportion of adults who were obese between 1978/79 and 1986-1992, but a substantial increase by 2004. Although the percentages are consistently lower, self-reported data show that the prevalence of obesity increased substantially between 1985 and 1994/95, but stabilized from 1994/95 to 2003.

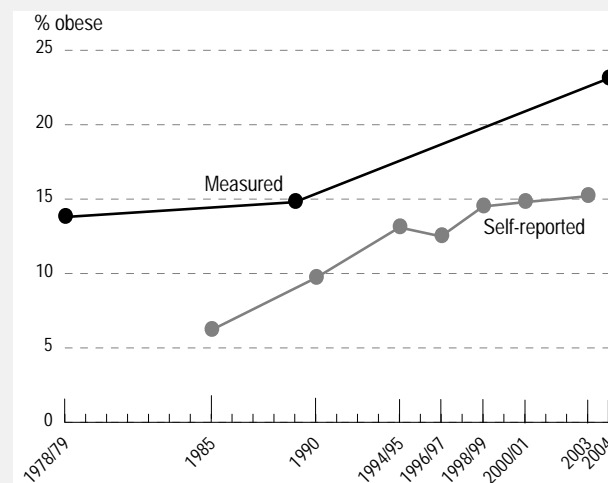
Between 2003 and 2004, when the data collection method changed to direct measures, the prevalence of obesity rose sharply. This is not surprising, as self-reports generally yield lower estimates of overweight and obesity.⁹⁻¹² Women are inclined to underestimate their weight, while men tend to overestimate their height. Moreover, underreporting of weight increases with higher levels of BMI.²⁴

Another problem with overweight/obesity information based on self-reports is variation in the mode of collection. Self-reported data from face-to-face interviews result in a higher prevalence of obesity than do data collected from telephone interviews.²⁵ In Canada, in 1985 and 1990, all interviews were conducted by telephone. In 1994/95, almost all interviews took place in person; in 1996/97 and 1998/99, most were by telephone. In 2000/01, interviews were approximately half and half, and in 2003, about one-quarter were in person.

25 or older were obese. The percentage was significantly higher among women who were widowed (30.0%). By contrast, the percentages of married, widowed, separated/divorced and never-married men who were obese did not differ significantly.

The association between level of education and obesity was not straightforward. Men aged 25 to 64 with secondary graduation or less were significantly more likely to be obese than were men with postsecondary graduation (Chart 10). Among women, those with less than secondary graduation were more likely than postsecondary graduates to be obese. As well, obesity among women who had

Trends in obesity, based on direct measures and self-reported data, household population aged 18 or older, Canada excluding territories, selected years, 1978/79 to 2004



Data sources: Measured: 1978/79 Canada Health Survey; 1986-1992 Canadian Heart Health Surveys (ages 18 to 74); 2004 Canadian Community Health Survey: Nutrition. Self-reported: 1985 and 1990 Health Promotion Survey; 1994/95, 1996/97 and 1998/99 National Population Health Survey; 2000/01 and 2003 Canadian Community Health Survey.

Notes: All survey data have been age-standardized to the 2004 CCHS population. Age-adjusted obesity rates based on measured height and weight for the population aged 18 to 74 are as follows: 13.7% (1978/79), 14.6% (1986-1992) and 23.1% (2004).

some, but not a complete, postsecondary education, was high.

Men in lower-middle income households were less likely to be obese than those in the highest income households (Chart 11). For women, those in middle and upper-middle income households had a significantly elevated likelihood of being obese, compared with women in the highest income households. When age was taken into account, the associations between level of income and obesity persisted for men, but for women, only those in middle income households were more likely to be obese (data not shown).

Limitations

For various reasons, 42.5% of respondents who participated in the 2004 Canadian Community Health Survey (CCHS) did not have their weight and height directly measured. This level of non-response might bias estimates if these people differed systematically from those for whom measurements were obtained. A special technique was employed to reduce the possibility of such bias (see *Methods*). Overall, men had a lower response rate than women: 54.4% versus 60.6%.

Percentage distribution of respondents, by response and reason for non-response

	Total	Men	Women
	%	%	%
Total	100.0	100.0	100.0
Measured	57.5	54.4	60.6
Not measured, total	42.5	45.6	39.4
Refusal	13.6	13.0	14.2
Measuring equipment	9.0	8.6	9.3
Too tall for interviewer to measure	7.1	11.5	2.8
Telephone interview	4.5	4.5	4.4
Interview setting	3.5	4.2	2.8
Physical condition	1.8	1.4	2.1
Other	3.0	2.3	3.8

Data source: 2004 Canadian Community Health Survey: Nutrition

Men's response rates differed significantly by age and household income; women's, by fruit and vegetable consumption, marital status, and household income (Appendix Table D).

Although body mass index (BMI) classifications using data from the 1978/79 Canada Health Survey (CHS), the 1986 to 1992 Canadian Heart Health Surveys (CHHS), the 1999-2002 National Health and Nutrition Examination Survey (NHANES) and the 2004 Canadian Community Health Survey (CCHS) were based on direct measurements of height and weight, the surveys did not use the same collection methods. For example, for the 2004 CCHS, field interviewers used portable electronic scales to weigh respondents in their homes; for the 1999-2002 NHANES, health professionals measured respondents in mobile laboratories.

BMI has a number of limitations. It does not measure the distribution of body fat, which is important because excess fat in the abdominal

area is associated with increased health risks.⁵ BMI may misclassify young adults who have not reached full growth, people who are naturally very lean or very muscular, people who are very tall or very short, and certain ethnic or racial groups.¹⁸ For this reason, BMI is a good measure at the population level, but not necessarily at the individual level.

BMI should not be calculated for pregnant women.⁵ However, because pregnancy status was not asked in the 1978/79 CHS, the 1985 and 1990 Health Promotion Surveys, and the 1986 to 1992 Canada Heart Health Surveys, pregnant women could not be excluded.

In the 2004 CCHS, variables other than height and weight were self-reported. The degree to which these variables accurately reflect a person's health status/characteristics is not known.

Respondents were asked about their leisure-time physical activities over the past three months. The results may have been affected by recall problems. Moreover, because physical activity at school and work were excluded, leisure time may not accurately reflect overall physical activity.

The questions on fruit and vegetable consumption pertain to the number of times a day such foods were consumed, not the amounts consumed. Because portion size was not specified, compliance with daily intake recommendations, such as the Canada Food Guide, cannot be assessed.

Rather than weight itself, factors associated with weight such as physical activity, body composition, visceral adiposity, physical fitness or dietary intake might be responsible for some or all of the associations of weight with high blood pressure, diabetes and heart disease.²⁶ As well, some diseases cause weight loss, while others are associated with weight gain. This analysis does not take into account recent weight gain/loss, which may be independently associated with poor health.

It was not possible to differentiate between type 1, type 2 and gestational diabetes in this analysis. Since the risk factors for the various forms of diabetes differ, the strength of the relationship between BMI and the prevalence of "adult onset" diabetes (type 2) may have been diluted.

Because the CCHS is cross-sectional, no causality between obesity and a health behaviour or other characteristic can be inferred.

Chart 11
Percentage obese, by sex and household income, household population aged 18 or older, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for highest income group ($p < 0.05$)
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Chronic conditions

Being overweight or obese is a risk factor for a number of chronic conditions. Analysis of CCHS data reveals associations between excess weight and concurrent high blood pressure, diabetes and heart disease.

In 2004, less than 10% of men and women whose BMI was in the normal range reported having high blood pressure (Table 4). The figure was just over 15% among those who were overweight and more than 20% among those who were obese. Even when age, marital status, education, household income, smoking status and leisure-time physical activity were taken into account, excess weight was strongly associated with high blood pressure (Table 5) (see *Limitations*).

A high BMI is a risk factor for type 2 diabetes.²⁷ Just 2.1% of men whose BMI was in the normal range reported diabetes, compared with 3.7% among overweight men. Men who were obese were five times as likely to have diabetes as were men with BMIs in the normal range. The pattern was similar for women. And even when the effects of

Table 4
Prevalence of high blood pressure, diabetes and heart disease, by BMI category, household population aged 18 or older, Canada excluding territories, 2004

BMI category (range)	Both sexes	Men	Women
	%	%	%
High blood pressure			
Normal weight (18.5 to 24.9)	8.7	7.9 ^E	9.2
Overweight (not obese) (25.0 to 29.9)	15.1*	15.1*	15.2*
Obese Class I (30.0 to 34.9)	23.7*	22.1*	25.5*
Obese Class II (35.0 to 39.9)	30.1*	32.5* ^E	28.0*
Obese Class III (≥ 40.0)	29.5*	28.1* ^E	30.1*
Diabetes			
Normal weight (18.5 to 24.9)	2.2	2.1 ^E	2.2 ^E
Overweight (not obese) (25.0 to 29.9)	4.3*	3.7*	5.2* ^E
Obese Class I (30.0 to 34.9)	9.9*	11.0* ^E	8.6*
Obese Class II, III (≥ 35.0)	12.0*	14.1* ^E	10.5* ^E
Heart disease			
Normal weight (18.5 to 24.9)	3.0	2.8	3.1
Overweight (not obese) (25.0 to 29.9)	5.2*	6.0*	4.2
Obese Class I (30.0 to 34.9)	7.2*	7.7* ^E	6.6* ^E
Obese Class II, III (≥ 35.0)	6.7* ^E	7.9* ^E	5.8 ^E

Data source: 2004 Canadian Community Health Survey: Nutrition
* Significantly different from estimate for normal weight ($p < 0.05$)
E Coefficient of variation 16.6% to 33.3% (interpret with caution)

the other factors were taken into consideration, obese men and women had significantly high odds of reporting diabetes.

The prevalence of heart disease increased with BMI among men. While 2.8% of men with a normal BMI reported heart disease, the prevalence was 6.0% among men who were overweight and nearly 8% among those who were obese (Table 4). Even when age, marital status, education, household income, smoking, and leisure-time physical activity were taken into account, the association between BMI and heart disease among men remained (Table 5).

For women, the prevalence of heart disease generally did not differ significantly by BMI. The exception was women in obese Class I who were more likely to have been diagnosed with heart disease than were women whose BMI was in the normal range (Table 4). But when the other demographic, socio-economic and lifestyle factors were considered, this relationship disappeared (Table 5).

Table 5
Adjusted odds ratios relating body mass index (BMI) category to high blood pressure, diabetes and heart disease, by sex, household population aged 18 or older, Canada excluding territories, 2004

BMI category (range)	High blood pressure		Diabetes		Heart disease	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Both sexes						
Normal weight (18.5 to 24.9)	1.0	...	1.0	...	1.0	...
Overweight (not obese) (25.0 to 29.9)	1.5*	1.2, 2.0	1.6*	1.1, 2.3	1.3	0.9, 1.9
Obese Class I (30.0 to 34.9)	2.9*	2.1, 3.8	3.8*	2.5, 5.8	1.8*	1.2, 2.9
Obese Class II, III (≥ 35.0)	...	...	5.4*	3.4, 8.4	2.1*	1.3, 3.5
Obese Class II (35.0 to 39.9)	4.7*	3.0, 7.5	...	...	...	...
Obese Class III (≥ 40.0)	5.4*	3.3, 8.6	...	...	...	...
Men						
Normal weight (18.5 to 24.9)	1.0	...	1.0	...	1.0	...
Overweight (not obese) (25.0 to 29.9)	1.8*	1.1, 2.9	1.5	0.9, 2.5	1.7*	1.1, 2.7
Obese Class I (30.0 to 34.9)	3.3*	2.0, 5.5	5.1*	2.6, 10.1	2.4*	1.2, 4.5
Obese Class II, III (≥ 35.0)	...	...	7.0*	3.4, 14.4	2.7*	1.2, 5.8
Obese Class II (35.0 to 39.9)	6.6*	3.0, 14.4	...	...	...	...
Obese Class III (≥ 40.0)	4.9*	1.9, 12.7	...	...	...	...
Women						
Normal weight (18.5 to 24.9)	1.0	...	1.0	...	1.0	...
Overweight (not obese) (25.0 to 29.9)	1.3	0.9, 1.7	1.8*	1.0, 3.3	1.0	0.6, 1.6
Obese Class I (30.0 to 34.9)	2.5*	1.7, 3.7	2.9*	1.7, 4.9	1.4	0.7, 2.7
Obese Class II, III (≥ 35.0)	...	...	4.4*	2.4, 8.1	1.6	0.8, 3.1
Obese Class II (35.0 to 39.9)	3.5*	1.9, 6.2	...	...	...	...
Obese Class III (≥ 40.0)	5.2*	2.8, 9.5	...	...	...	...

Data source: 2004 Canadian Community Health Survey: Nutrition

Note: Models control for age (continuous), marital status, education, household income, smoking, and leisure-time physical activity.

* Significantly different from estimate for normal weight ($p < 0.05$)

... Not applicable

Concluding remarks

Results from the 2004 Canadian Community Health Survey: Nutrition (CCHS), based on actual measurements of height and weight, indicate that 23% of adults were obese. This was up from 14% in 1978/79, but still below the obesity rate in the United States (30%). However, in 2004, another 36% of Canadians were overweight. Consequently, a majority of Canadian adults—almost 60%—were in a weight range that increased their risk of developing health problems. In fact, CCHS data show that BMI is strongly related to the likelihood of having high blood pressure, diabetes or heart disease. ●

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Appendix

Table A
 Percentage overweight and obese, by selected characteristics, male household population aged 18 or older, Canada excluding territories, 2004

	Estimated population '000	Overweight		Obese		Overweight/Obese	
		%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total	11,861	42.0	39.3, 44.8	22.9	20.7, 25.2	65.0	62.4, 67.5
Age group							
18 to 24	1,681	27.0*	21.5, 32.4	10.7 ^E	6.7, 14.8	37.7*	31.8, 43.7
25 to 34	1,900	39.9	33.3, 46.6	24.2	18.0, 30.4	64.1	58.1, 70.1
35 to 44	2,577	44.5	37.3, 51.7	20.0	15.2, 24.7	64.5	57.5, 71.4
45 to 54	2,370	42.4	36.0, 48.8	29.9*	24.6, 35.2	72.3*	66.2, 78.3
55 to 64	1,623	45.9	40.0, 51.7	29.6*	23.8, 35.4	75.5*	69.4, 81.5
65 to 74	1,025	52.7*	46.5, 58.8	24.0	19.4, 28.6	76.7*	71.9, 81.5
75 or older	685	49.0*	42.1, 55.8	19.3	13.5, 25.1	68.3	62.0, 74.6
Ethnicity							
White	9,720	43.4	40.5, 46.3	25.5*	23.0, 28.0	69.0*	66.4, 71.5
Black	172	31.0 ^E	10.9, 51.1	F	...	50.7 ^E	27.1, 74.3
Southeast/East Asian	811	35.4 ^E	22.1, 48.6	F	...	39.1 ^{*E}	26.0, 52.3
Aboriginal (off-reserve)	86	31.8 ^E	16.5, 47.0	33.6 ^E	19.2, 48.0	65.3	50.7, 80.0
Other	1,027	38.6	27.4, 49.8	14.2 ^{*E}	7.0, 21.4	52.8*	41.6, 64.0
Daily fruit and vegetable consumption							
Less than 3 times	4,124	37.4*	33.3, 41.5	25.8*	22.1, 29.5	63.2	58.9, 67.5
3 to less than 5 times	4,605	42.2	37.7, 46.6	23.0	19.4, 26.7	65.2	60.8, 69.7
5 or more times [†]	3,100	47.8	42.7, 52.9	19.1	15.0, 23.2	66.9	62.2, 71.6
Leisure-time physical activity level							
High [†]	2,361	45.8	40.7, 50.8	19.6	15.3, 23.9	65.3	60.1, 70.6
Moderate	2,979	44.8	39.8, 49.8	16.7	13.5, 20.0	61.5	56.4, 66.6
Sedentary	6,520	39.4	35.4, 43.4	27.0*	23.7, 30.3	66.4	62.9, 70.0
Marital status (aged 25 or older)							
Married/Common-law [†]	7,590	46.2	42.7, 49.8	24.5	21.6, 27.3	70.7	67.2, 74.2
Widowed	237	55.6	43.5, 67.7	17.2 ^E	9.7, 24.8	72.9	63.8, 81.9
Separated/Divorced	822	42.6	33.4, 51.9	24.7	17.6, 31.8	67.3	58.2, 76.5
Never married	1,516	34.8*	28.5, 41.0	29.1	22.0, 36.2	63.8*	58.3, 69.4
Education (aged 25 to 64)							
Less than secondary graduation	1,149	39.6	31.7, 47.5	34.5*	26.8, 42.3	74.1	66.7, 81.6
Secondary graduation	1,487	36.7	28.2, 45.1	32.1*	23.6, 40.6	68.8	60.4, 77.1
Some postsecondary	550	44.6	31.5, 57.6	22.6 ^E	13.7, 31.5	67.2	55.5, 78.9
Postsecondary graduation [†]	5,197	45.4	41.0, 49.8	22.0	18.6, 25.3	67.4	63.1, 71.7
Household income							
Lowest	245	36.2 ^E	20.1, 52.2	18.5 ^E	7.6, 29.5	54.7*	40.0, 69.5
Lower-middle	540	44.4	30.7, 58.1	15.6 ^{*E}	8.2, 23.0	60.0	45.2, 74.8
Middle	2,139	40.4	34.0, 46.8	22.7	16.9, 28.5	63.1*	57.1, 69.1
Upper-middle	4,160	39.6*	35.3, 43.8	24.4	20.7, 28.1	64.0*	59.5, 68.5
Highest [†]	3,886	45.9	41.3, 50.5	26.1	22.3, 29.9	72.0	67.7, 76.3
Not stated	891	40.5	29.8, 51.2	8.6 ^{*E}	4.9, 12.3	49.1*	38.2, 60.0

Data source: 2004 Canadian Community Health Survey: Nutrition

Notes: Age groups and ethnicity are compared with the estimate for Canada. Three respondents had a missing value for marital status, 40 for education, and 14 for fruit and vegetable consumption.

† Reference category

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

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

^F Coefficient of variation greater than 33.3% (suppressed because of extreme sampling variability)

... Not applicable

Table B
Percentage overweight and obese, by selected characteristics, female household population aged 18 or older, Canada excluding territories, 2004

	Estimated population '000	Overweight		Obese		Overweight/Obese	
		%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total	12,124	30.2	28.1, 32.3	23.2	21.3, 25.1	53.4	51.2, 55.7
Age group							
18 to 24	1,463	22.3*	17.6, 27.1	12.1*	8.6, 15.6	34.4*	29.2, 39.6
25 to 34	1,926	26.1	20.0, 32.2	16.9*	12.9, 21.0	43.0*	36.5, 49.5
35 to 44	2,529	27.6	22.3, 32.9	20.9	16.6, 25.2	48.5	42.5, 54.6
45 to 54	2,428	33.8	28.4, 39.2	29.6*	24.4, 34.8	63.4*	57.5, 69.3
55 to 64	1,718	32.1	27.5, 36.8	31.1*	26.2, 36.1	63.3*	58.0, 68.5
65 to 74	1,028	37.9*	32.2, 43.6	25.1	20.4, 29.8	63.0*	56.6, 69.4
75 or older	1,032	36.1*	31.3, 40.9	26.5	21.8, 31.1	62.5*	57.5, 67.6
Ethnicity							
White	10,134	29.9	27.7, 32.1	24.8*	22.7, 26.9	54.7	52.3, 57.1
Black	223	42.7 ^E	19.9, 65.5	F	...	65.8 ^E	41.5, 90.0
Southeast/East Asian	664	24.0 ^E	13.1, 34.9	F	...	31.4 ^{*E}	19.4, 43.5
Aboriginal (off-reserve)	174	29.3 ^E	19.3, 39.3	40.0*	27.9, 52.0	69.3*	56.9, 81.6
Other	930	35.3 ^E	23.1, 47.4	14.5 ^{*E}	7.9, 21.2	49.8	38.1, 61.5
Daily fruit and vegetable consumption							
Less than 3 times	2,919	29.1	25.1, 33.0	27.4*	23.2, 31.6	56.5	52.1, 60.8
3 to less than 5 times	4,681	29.5	26.5, 32.6	23.4	20.5, 26.3	53.0	49.4, 56.6
5 + times [†]	4,474	31.8	27.9, 35.8	20.3	17.1, 23.4	52.1	48.0, 56.2
Leisure-time physical activity level							
High [†]	1,945	27.0	22.0, 31.9	13.5	10.5, 16.6	40.5	35.1, 46.0
Moderate	2,905	31.4	27.1, 35.7	20.8*	17.5, 24.1	52.2*	47.5, 56.9
Sedentary	7,273	30.6	27.8, 33.5	26.8*	24.0, 29.5	57.4*	54.2, 60.6
Marital status (aged 25 or older)							
Married/Common-law [†]	7,268	32.0	29.0, 34.9	23.4	20.8, 26.1	55.4	52.2, 58.6
Widowed	1,088	37.3	32.8, 41.8	30.0*	25.2, 34.8	67.3*	63.1, 71.5
Separated/Divorced	1,124	31.5	25.1, 37.9	27.7	21.7, 33.8	59.3	51.6, 67.0
Never married	1,171	21.4*	16.4, 26.5	25.6	19.2, 31.9	47.0*	40.0, 54.1
Education (aged 25 to 64)							
Less than secondary graduation	1,168	36.5	27.9, 45.1	36.9*	28.6, 45.2	73.4*	66.9, 79.9
Secondary graduation	1,697	28.4	22.6, 34.3	24.9	19.0, 30.8	53.3	46.6, 60.0
Some postsecondary	586	31.3	22.7, 40.0	32.3*	23.9, 40.8	63.7*	54.0, 73.4
Postsecondary graduation [†]	5,027	29.0	25.6, 32.4	20.5	17.8, 23.2	49.5	45.7, 53.3
Household income							
Lowest	428	25.6	17.4, 33.9	21.4 ^E	12.9, 30.0	47.1	35.0, 59.2
Lower-middle	833	30.8	23.9, 37.6	24.8	18.5, 31.1	55.6	48.0, 63.1
Middle	2,500	31.0	26.5, 35.6	27.9*	23.3, 32.5	58.9*	54.1, 63.8
Upper-middle	3,854	28.4	24.7, 32.1	24.7*	21.6, 27.9	53.1	49.2, 57.1
Highest [†]	3,412	31.2	26.5, 35.8	19.6	15.8, 23.5	50.8	46.0, 55.6
Missing	1,097	33.1	26.2, 39.9	18.1	13.1, 23.0	51.1	43.4, 58.9

Data source: 2004 Canadian Community Health Survey: Nutrition

Notes: Age groups and ethnicity are compared with the estimate for Canada. Five respondents had a missing value for marital status, 45 for education, 30 for fruit and vegetable consumption, and 2 for leisure-time physical activity level.

[†] Reference category

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

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

^F Coefficient of variation greater than 33.3% (suppressed because of extreme sampling variability).

... Not applicable

Table C
Percentage overweight and obese, by selected characteristics, household population aged 18 or older, Canada excluding territories, 2004

	Estimated population '000	Overweight		Obese		Overweight/Obese	
		%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total	23,985	36.1	34.3, 37.8	23.1	21.7, 24.5	59.1	57.4, 60.8
Age group							
18 to 24	3,144	24.8*	21.0, 28.7	11.4*	8.7, 14.1	36.2*	32.0, 40.3
25 to 34	3,826	33.0	28.5, 37.4	20.5	16.9, 24.2	53.5*	49.1, 57.9
35 to 44	5,106	36.2	31.9, 40.4	20.4*	17.3, 23.5	56.6	52.1, 61.0
45 to 54	4,798	38.0	34.0, 42.1	29.7*	26.2, 33.3	67.8*	63.5, 72.1
55 to 64	3,341	38.8	35.2, 42.4	30.4*	26.3, 34.5	69.2*	65.0, 73.4
65 to 74	2,053	45.3*	40.7, 49.8	24.6	21.2, 27.9	69.9*	65.6, 74.1
75 or older	1,717	41.2*	37.3, 45.2	23.6	19.9, 27.3	64.8*	60.9, 68.8
Ethnicity							
White	19,854	36.5	34.7, 38.3	25.2*	23.5, 26.8	61.7*	59.9, 63.4
Black	395	37.6 ^E	22.6, 52.6	21.6 ^E	10.1, 33.1	59.2	42.1, 76.2
Southeast/East Asian	1,475	30.2	21.5, 39.0	F	...	35.7*	26.8, 44.6
Aboriginal (off-reserve)	260	30.1	21.6, 38.6	37.8*	28.2, 47.5	68.0	58.5, 77.4
Other	1,957	37.0	28.8, 45.3	14.4* ^E	9.5, 19.2	51.4*	43.6, 59.2
Daily fruit and vegetable consumption							
Less than 3 times	7,044	33.9*	31.0, 36.9	26.5*	23.8, 29.1	60.4	57.3, 63.5
3 to less than 5 times	9,287	35.8	33.1, 38.6	23.2	20.9, 25.6	59.0	56.2, 61.9
5 + times [†]	7,574	38.4	35.4, 41.4	19.8	17.3, 22.3	58.2	55.3, 61.1
Leisure-time physical activity level							
High [†]	4,306	37.3	33.6, 40.9	16.9	14.1, 19.6	54.1	50.1, 58.2
Moderate	5,885	38.2	35.0, 41.3	18.7	16.5, 21.0	56.9	53.7, 60.2
Sedentary	13,794	34.8	32.4, 37.1	26.9*	24.7, 29.0	61.7*	59.2, 64.1
Marital status (aged 25 or older)							
Married/Common-law [†]	14,858	39.3	37.0, 41.5	24.0	22.1, 25.8	63.2	60.9, 65.5
Widowed	1,325	40.6	36.1, 45.0	27.7	23.5, 31.9	68.3*	64.6, 72.0
Separated/Divorced	1,946	36.2	31.0, 41.4	26.5	22.0, 30.9	62.7	57.0, 68.4
Never married	2,688	29.0*	24.7, 33.2	27.5	22.7, 32.4	56.5*	51.8, 61.2
Education (aged 25 to 64)							
Less than secondary graduation	2,316	38.0	32.2, 43.9	35.7*	29.9, 41.5	73.8*	68.7, 78.8
Secondary graduation	3,184	32.3	27.8, 36.8	28.3*	23.1, 33.4	60.5	55.6, 65.4
Some postsecondary	1,136	37.7	29.4, 46.1	27.6	21.2, 34.1	65.4	57.8, 73.0
Postsecondary graduation [†]	10,224	37.3	34.5, 40.1	21.2	19.0, 23.5	58.6	55.6, 61.5
Household income							
Lowest	674	29.5*	21.6, 37.4	20.4 ^E	13.6, 27.2	49.9*	40.3, 59.4
Lower-middle	1,373	36.1	29.6, 42.7	21.2	16.2, 26.1	57.3	50.2, 64.4
Middle	4,639	35.4	31.5, 39.2	25.5	21.9, 29.1	60.9	57.0, 64.7
Upper-middle	8,014	34.2*	31.4, 37.0	24.6	22.0, 27.1	58.8	55.7, 61.9
Highest [†]	7,297	39.0	35.6, 42.4	23.1	20.3, 25.9	62.1	58.7, 65.5
Missing	1,988	36.4	30.3, 42.5	13.8*	10.4, 17.3	50.2*	43.8, 56.7

Data source: 2004 Canadian Community Health Survey: Nutrition

Notes: Age groups and ethnicity are compared with the estimate for Canada. Eight respondents had a missing value for marital status, 85 for education, 44 for fruit and vegetable consumption, and 2 for leisure-time physical activity level.

[†] Reference category

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

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

^F Coefficient of variation greater than 33.3% (suppressed because of extreme sampling variability)

... Not applicable

Table D
Response rates to directly measured height and weight, by selected characteristics

	Men	Women
	%	%
Total	54	61
Age group		
18 to 24	57	64
25 to 34	52	61
35 to 44	56	58
45 to 54	49*	61
55 to 64	56	62
65 to 74	59	59
75 or older	57	60
Marital status (age 25 or older)		
Married/Common-law	54	62*
Widowed	54	60
Separated/Divorced	55	57
Never married	53	56
Education (aged 25 to 64)		
Less than secondary graduation	53	57
Secondary graduation	56	65
Some postsecondary	47	56
Postsecondary graduation	53	60
Household income		
Lowest	47	70*
Lower-middle	54	65
Middle	60*	63
Upper-middle	57	65*
Highest	53	58
Missing	41*	43*
Daily fruit/vegetable consumption		
Less than 3 times	54	60
3 to less than 5 times	54	59
5 or more times	56	63*
Leisure time		
Active	57	59
Moderately active	56	61
Sedentary	53	61
High blood pressure		
Yes	56	60
No	54	61
Diabetes		
Yes	50	63
No	55	61
Heart disease		
Yes	53	58
No	55	61

Data source: 2004 Canadian Community Health Survey; Nutrition

** Significantly different from total response rate ($p < 0.05$)*