

Overweight and obesity among children and youth

Margot Shields

Abstract

Objectives

This article describes the prevalence of overweight and obesity among Canadian children and youth aged 2 to 17, based on direct measurements of their height and weight. Data from 1978/79 and 2004 are compared, and trends by sex and age groups are presented.

Data sources

Data based on direct measurements are from the 2004 Canadian Community Health Survey (CCHS): Nutrition. Other information is from the 1978/79 Canada Health Survey and the 1999-2002 National Health and Nutrition Examination Survey, conducted in the US.

Analytical techniques

The estimated prevalence of overweight and of obesity, including an overall rate reflecting both, was based on 2004 CCHS data for 8,661 children and youth whose height and weight were measured.

Main results

In 2004, 26% of Canadian children and adolescents aged 2 to 17 were overweight or obese, and 8% were obese. Over the past 25 years, the prevalence of overweight and obesity combined has more than doubled among youth aged 12 to 17, while the prevalence of obesity alone has tripled. Children and youth who ate fruit and vegetables at least five times a day were substantially less likely to be overweight or obese than were those who ate these foods less often. The likelihood of being overweight/obese rose as "screen time" (watching TV, playing video games or using a computer) increased.

Keywords

adolescence, body mass index, body weight, exercise, family health, health behaviour

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Over the past 25 years, the prevalence of overweight and obesity in children and adolescents has risen, with the most substantial increases observed in economically developed countries.¹ According to data from the 2004 Canadian Community Health Survey (CCHS): Nutrition, a considerable share of Canadian children and youth are part of this trend.

Health surveys often rely on respondents' reports of their height and weight, a practice that tends to result in underestimating the prevalence of overweight and obesity²⁻⁵ (see *Methodology makes a difference*). The 2004 CCHS, however, directly measured the height and weight of a nationally representative sample of Canadians (see *Methods*).

Before the 2004 CCHS, the 1978/79 Canada Health Survey (CHS) measured the height and weight of a representative sample of Canadian children aged 2 to 17. Results from the CHS can be compared with the recent CCHS data to form a better picture of the increase in

Methods

Data sources

Data from the 2004 Canadian Community Health Survey (CCHS): Nutrition were used to estimate the percentages of 2- to 17-year-olds who were overweight and obese. The 2004 CCHS was designed to gather information about the nutritional status of the Canadian population at the provincial level (see <http://www.statcan.ca/english/concepts/hs/index.htm>). 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%. Measured height and weight were obtained for 65% of the 2- to 17-year-olds who responded to the 2004 CCHS, a total of 8,661 children and adolescents (see *Limitations*).

Historical estimates of the percentages of Canadian children and youth in the overweight and obese categories, based on direct measures of height and weight, are from the 1978/79 Canada Health Survey, and for 12- to 17-year-olds, from the 1981 Canada Fitness Survey and the 1988 Campbell's Survey on Health and Well-being. For 12- to 17-year-olds, percentages based on self-reported data are from the 2000/01 and 2003 CCHS and the 1994/95, 1996/97 and 1998/99 National Population Health Survey (NPHS). For 2- to 11-year-olds, estimates based on data reported by parents are from the 1994/95, 1996/97, 1998/99, 2000/01 and 2002/03 National Longitudinal Survey of Children and Youth (NLSCY). NLSCY estimates for 2002/03 could be produced only for children aged 2 to 5, since the cross-sectional file does not include records for children aged 6 or older.

The prevalence of overweight and obesity among American children and adolescents was estimated using data from the 1999-2002 National Health and Nutrition Examination Survey (NHANES). The NHANES obtained measurements of height and weight for 7,297 children and adolescents.

Analytical techniques

Descriptive statistics from the 2004 CCHS were used to estimate the proportions of 2- to 17-year-olds who were overweight and obese in relation to selected characteristics (Appendix Tables A and B). All estimates were based on the 8,661 children and adolescents for whom height and weight were directly measured. Since they accounted for only 65% of children and adolescents 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 the non-respondents to the respondents, using response propensity classes. Variables such as province, age, sex, household income, ethnicity, education, 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 Seeker⁶ 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 estimates in this analysis. Standard errors and coefficients of variation were estimated using the bootstrap technique, which accounts for the survey design effects.⁷⁻⁹

The criteria specified by the International Obesity TaskForce were used to define overweight and obesity among youth (see *Calculating overweight and obesity in children and adolescents*) for all data sources used in this report.

Standard errors and coefficients of variation for estimates from the 1978/79 Canada Health Survey and the 1999-2002 NHANES were estimated with SUDAAN, which uses a Taylor series linearization method to account for the complex sample design.¹⁰

The distribution of the household population by body mass index (BMI) (Chart 3) 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 then dividing the result by 3.

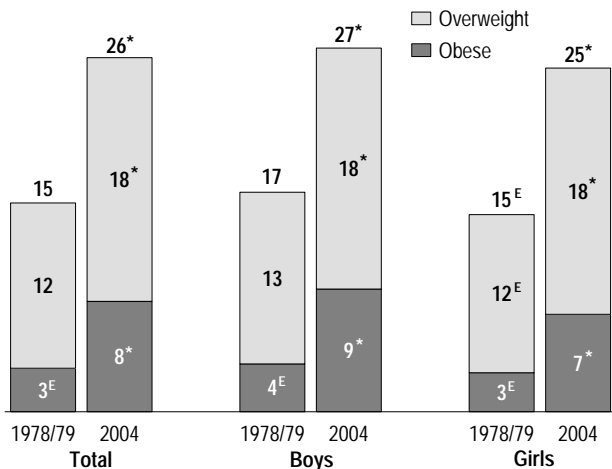
overweight and obesity among young Canadians during the past 25 years. In 1978/79, 12% of 2- to 17-year-olds were overweight and 3% were obese—a combined overweight/obesity rate of 15%. By 2004, about 1.1 million boys and girls in this age group, or 18%, were overweight, and another half a million, or 8%, were obese. This means that more than one-quarter (26%) of these young people were overweight or obese.

Notable rise in proportion overweight/obese

Increases in overweight and obesity were similar among boys and girls (Chart 1). In 2004, the combined prevalence of overweight/obesity for each sex was about 70% higher than in 1978/79, and the prevalence of obesity alone was 2.5 times higher.

Trends differed, however, for various age groups. For example, while the percentage of children aged 2 to 5 who were either overweight or obese was virtually unchanged, the figure for 12- to 17-year-olds more than doubled, rising from 14% to 29%

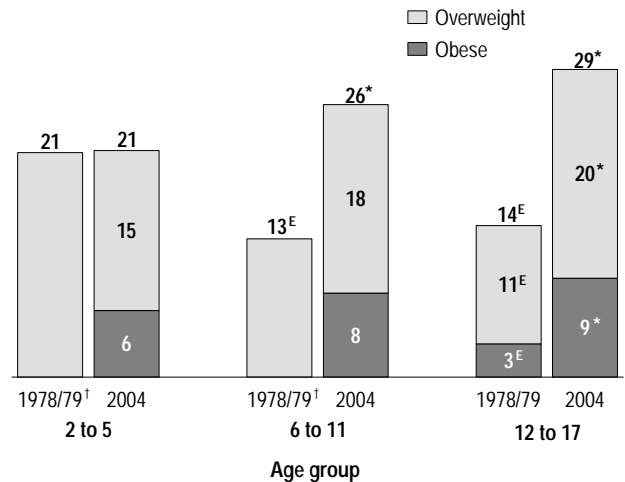
Chart 1
Percentage overweight or obese, by sex, household population aged 2 to 17, Canada excluding territories, 1978/79 and 2004



Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition
 Note: Because of rounding, detail may not add to totals.
 * Significantly different from estimate for 1978/79 (p < 0.05)
 E Coefficient of variation 16.6% to 33.3% (interpret with caution)

(Chart 2). Furthermore, the percentage of youth in this age group who were obese tripled, increasing from 3% in 1978/79 to 9% in 2004.

Chart 2
Percentage overweight or obese, by age group, household population aged 2 to 17, Canada excluding territories, 1978/79 and 2004



Data sources: 1978/79 Canada Health Survey; 2004 Canadian Community Health Survey: Nutrition
 † Obesity estimate has a coefficient of variation greater than 33.3%; therefore, it cannot be released and the combined overweight/obesity prevalence is shown.
 * Significantly different from estimate for 1978/79 (p < 0.05)
 E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Surpassing BMI cut-points

Measures of overweight and obesity are based on body mass index (BMI), which takes weight and height into account (weight in kilograms divided by height in metres squared). BMI cut-points of 25 and 30 are used to classify adults aged 18 or older as overweight or obese, respectively, based on the associated health risks.¹¹ The cut-points for children and adolescents are lower, and also rise incrementally with every year of age (see *Calculating overweight and obesity in children and adolescents*).

Between 1978/79 and 2004, the average BMI of adolescents aged 12 to 17 rose from 20.8 to 22.1, resulting in a shift in the BMI distribution of this age group toward the higher—and heavier—BMIs. The most pronounced increases were in the

Methodology makes a difference

In the United States, data from the National Health and Nutritional Examination Survey (NHANES) show sharp rises in the percentages of children and adolescents who were overweight/obese between 1976-1980 and 1988-1994 and, again, between 1988-1994 and 1999-2002.¹²

In Canada, because of variations in the methods used to collect information on height and weight, it is difficult to pinpoint when the prevalence of overweight and obesity actually began increasing. Estimates for 12- to 17-year-olds, based on measured height and weight, can be calculated for four reference years: 1978/79, 1981, 1988, and 2004 (see *Methods*). These data reveal a small decrease in adolescents' overweight/obesity and obesity rates between 1978/79 and 1981,¹³ then substantial increases between 1981 and 1988 and between 1988 and 2004 (Appendix Chart A). Calculations based on self-reported data show that figures stabilized between 1994/95 and 2003. But between 2003 and 2004, when the collection method changed from self-reported to measured data, the prevalence of overweight/obesity and obesity rose sharply. This is not surprising, as self-reports tend to yield lower estimates of overweight and obesity.^{2,5}

Comparisons of the average height and weight of 12- to 17-year-olds in 2003 (self-reported) and 2004 (measured) illustrate these tendencies. In 2004, based on direct measurements, the average height of boys and girls was a third of an inch less than the 2003 averages based on self-reports. The average weight of boys in 2004 was 3 pounds more than in 2003, and for girls, 6 pounds more. As a result, one-year increases in the prevalence of overweight and obesity among adolescents were substantial.

	2003 (self-report)	2004 (direct measure)	Difference
Boys aged 12 to 17			
Average height	66.6 in 169.2 cm	66.3 in 168.4 cm	-0.3 in -0.8 cm
Average weight	137.1 lb 62.2 kg	140.4 lb 63.7 kg	3.3 lb 1.5 kg
Average BMI	21.4	22.3	0.9
% overweight/obese	24.0%	32.3%	8.3%
% obese	5.7%	11.1%	5.4%
Girls aged 12 to 17			
Average height	63.6 in 161.5 cm	63.3 in 160.8	-0.3 in -0.7 cm
Average weight	120.3 lb 54.6 kg	126.0 lb 57.2 kg	5.7 lb 2.6 kg
Average BMI	20.7	22.0	1.3
% overweight/obese	14.2%	25.8%	11.6%
% obese	3.3%	7.4%	4.1%

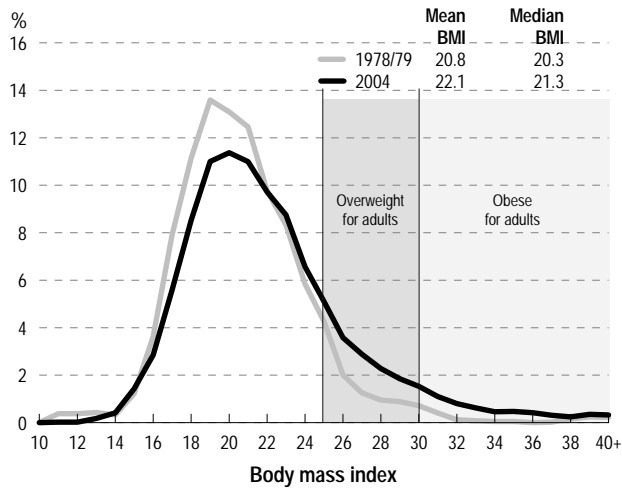
Another problem with overweight and obesity rates based on self-reports is variation in the mode of collection. Self-reported data from face-to-face interviews result in higher obesity rates than do data collected from telephone interviews.¹⁴ In 1994/95, almost all interviews were conducted in person; 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.

For children aged 2 to 11, reported data and actual measurements reveal a different bias. The data for 1994/95 to 2002/03 come from the National Longitudinal Survey of Children and Youth (NLSCY), in which parents reported the child's height and weight (Appendix Charts B and C). A comparison with direct measurements from the 2004 CCHS suggests that when parents report on behalf of their children, overweight and obesity rates are higher, largely because parents tend to underestimate their children's height. It is possible that they report the last measured height of the child, which could be inaccurate given how quickly children of these ages grow. If height is routinely underestimated, the result would be substantial overestimates of overweight and obesity.

	2002/03 (parent's report)	2004 (direct measure)	Difference
Ages 2 to 5			
Average height	39.7 in 100.8 cm	40.5 in 102.9 cm	0.8 in 2.1 cm
Average weight	38.2 lb 17.4 kg	38.5 lb 17.5 kg	0.3 lb 0.1 kg
Average BMI	17.2	16.4	-0.8
% overweight/obese	36.1%	21.5%	-14.6%
% obese	20.1%	6.3%	-13.8%

	2000/01 (parent's report)	2004 (direct measure)	Difference
Ages 6 to 11			
Average height	52.0 in 132.1 cm	53.0 in 134.6 cm	1.0 in 2.5 cm
Average weight	70.0 lb 31.8 kg	73.7 lb 33.4 kg	3.7 lb 1.6 kg
Average BMI	18.2	18.1	-0.1
% overweight/obese	32.1%	25.8%	-6.3%
% obese	11.7%	8.0%	-3.7%

Chart 3
Percentage distribution of household population aged 12 to 17, 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

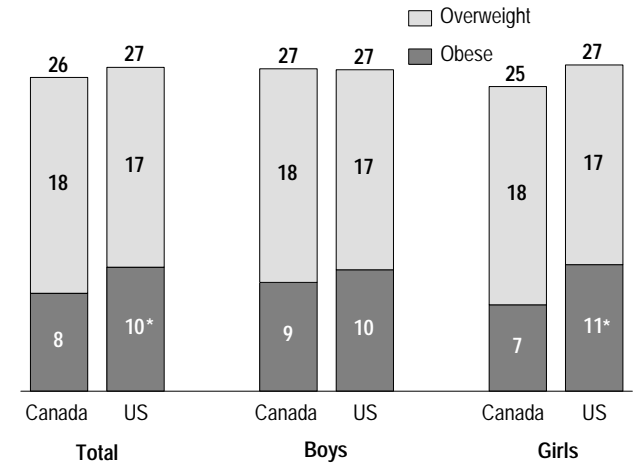
proportions of 12- to 17-year-olds whose BMI exceeded 25 or 30, the overweight and obese thresholds for adults (Chart 3). This is particularly important, given that adolescence is a critical period for the development of adult obesity.^{1,15-18}

Canada–US comparisons

Since the early 1960s, the height and weight of a nationally representative sample of Americans have been directly measured as part of the National Health and Nutrition Examination Survey (NHANES). Based on the most recent NHANES data (1999 to 2002), the percentage of overweight/obese 2- to 17-year-olds was similar in the United States and Canada (Chart 4). In the US, however, the prevalence of *obesity* was slightly higher: 10% versus 8% in Canada.

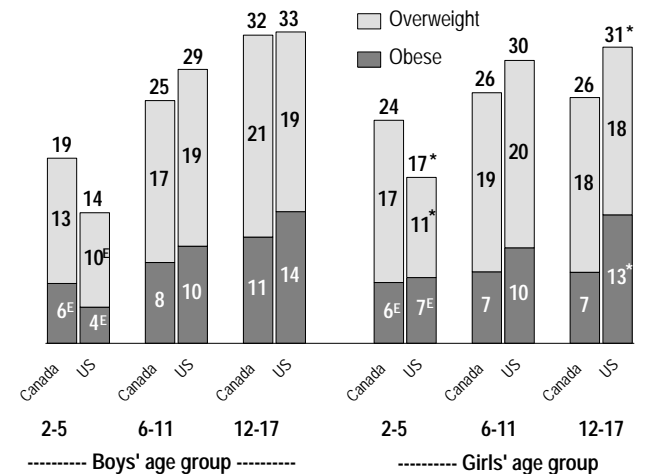
The proportions of boys who were overweight/obese, or simply obese, were similar in both countries, but differences were apparent for girls (Chart 5). Canadian girls aged 2 to 5 were more likely to be overweight/obese than were US girls

Chart 4
Percentage overweight or obese, by sex, household population aged 2 to 17, Canada (2004) and United States (1999-2002)



Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey
Note: Because of rounding, detail may not add to totals.
* Significantly different from estimate for Canada ($p < 0.05$)

Chart 5
Percentage overweight or obese, by sex and age group, household population aged 2 to 17, Canada (2004) and United States (1999-2002)



Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey
Note: Because of rounding, detail may not add to totals.
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)
* Significantly different from estimate for Canada ($p < 0.05$)

in the same age group. By contrast, at ages 12 to 17, American girls were almost twice as likely (13%) as Canadian girls (7%) to be obese.

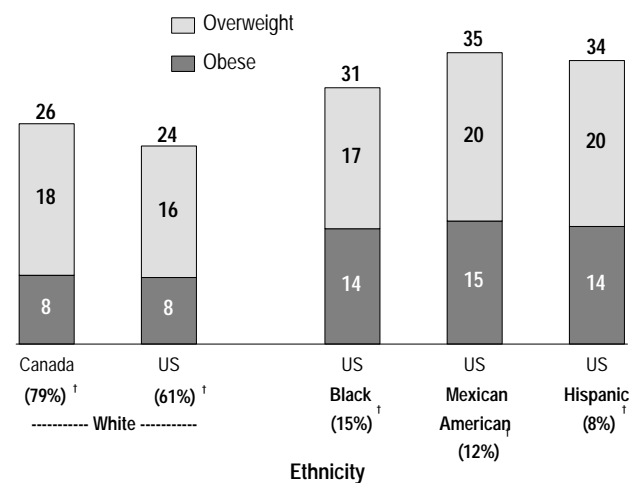
For young people of both sexes in the United States, the prevalence of overweight and obesity increased with age. Among American boys, the prevalence of overweight/obesity was 14% at ages 2 to 5 and 33% at ages 12 to 17; for American girls, the corresponding figures were 17% and 31%. In Canada, the proportion of overweight/obese boys was higher among those aged 12 to 17 (32%), compared with those aged 2 to 5 (19%). However, the proportion of Canadian girls who were overweight/obese was around 25%, regardless of age.

If the prevalence of overweight and obesity among youth is still increasing, differences between Canada and the United States may be greater because the American estimates are based on earlier data (collected from 1999 to 2002).

The ethnic composition of the two countries should also be considered when making comparisons. In the United States, overweight/obesity was relatively high (more than 30%) among Black, Mexican-American and Hispanic children and adolescents (Chart 6). These ethnic groups represent about one-third of American youth, but constitute a very small share of the population in Canada. Comparisons between White Canadian and American youth indicate that the proportions of overweight/obese did not differ significantly.

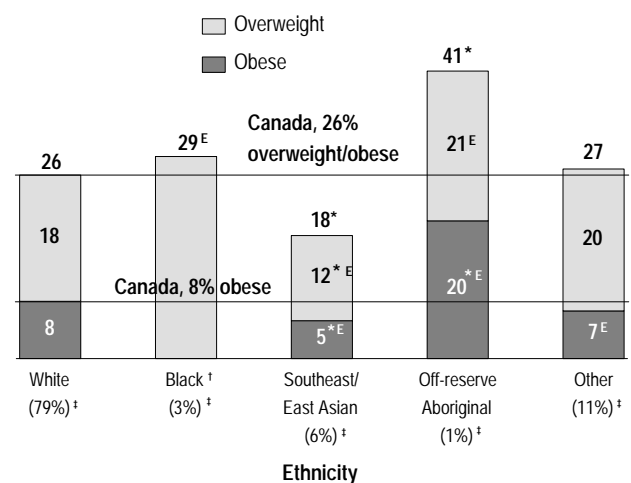
In Canada, a significantly high percentage of young people of Aboriginal origin (off-reserve) were overweight/obese (41%); in fact, 20% were obese—2.5 times the national average (Chart 7). By contrast, a relatively low percentage of youth of Southeast Asian or East Asian origin were overweight/obese: 18%. These differences between ethnic groups persisted when age and socio-economic factors were taken into account (data not shown). However, because of their relatively small numbers, these groups did not strongly influence national overweight/obesity estimates.

Chart 6
Percentage overweight or obese, by ethnicity, household population aged 2 to 17, Canada (2004) and United States (1999-2002)



Data sources: 2004 Canadian Community Health Survey: Nutrition; 1999-2002 National Health and Nutrition Examination Survey
† Percentage of population aged 2 to 17 in this group

Chart 7
Percentage overweight or obese, by ethnicity, household population aged 2 to 17, Canada excluding territories, 2004



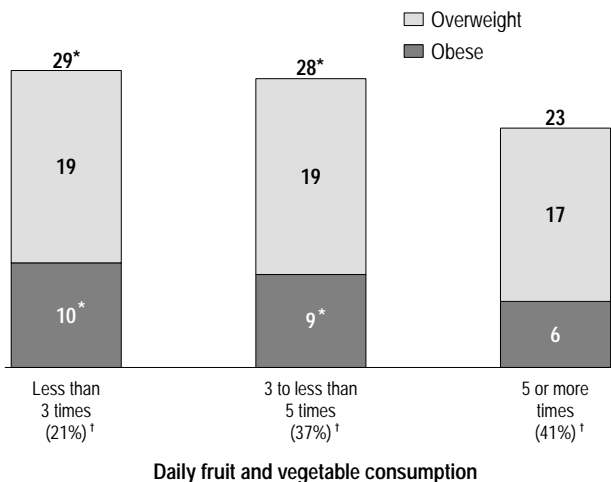
Data source: 2004 Canadian Community Health Survey: Nutrition
† The obesity estimate has a coefficient of variation greater than 33.3%; therefore, it cannot be released and the combined overweight/obesity prevalence is shown.
‡ Percentage of population aged 2 to 17 in this group
E Coefficient of variation 16.6% to 33.3% (interpret with caution)
* Significantly different from estimate for Canada (p < 0.05)

Diet, exercise and screen time

Studies based on American data have shown that children’s consumption of fast food has increased dramatically over the past two decades, and that a large majority of them do not eat enough fruit and vegetables.^{1,18} Based on data from the 2004 CCHS, 59% of Canadian children and adolescents were reported to consume fruit and vegetables less than five times a day (see *Definitions*). These young people were significantly more likely to be overweight/obese than were those who ate fruit and vegetables more frequently (Chart 8).

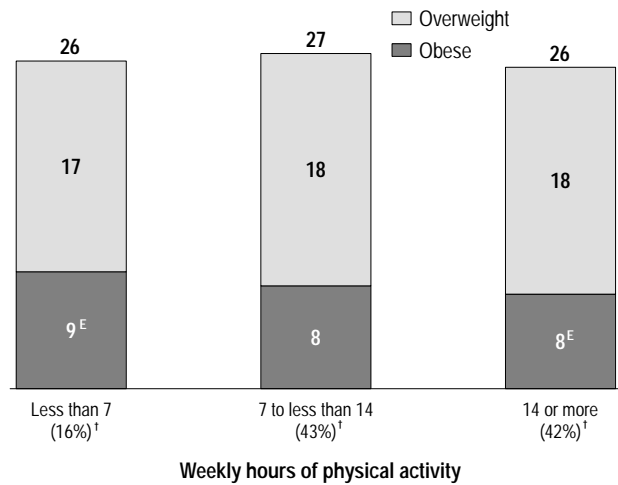
Some studies have found that physical activity protects against childhood obesity,¹⁹ while others have not found such a relationship¹ (see *Limitations*). Analysis of CCHS data shows that physical activity levels were not associated with overweight and obesity at ages 6 to 11 (Chart 9), but by ages 12 to 17, associations were significant, though only for boys (Chart 10). Sedentary boys were more likely than more active boys to be obese: 16% versus 9%. Unexpectedly, a higher proportion of active and moderately active boys were overweight (but

Chart 8
Percentage overweight or obese, by daily fruit and vegetable consumption, household population aged 2 to 17, Canada excluding territories, 2004



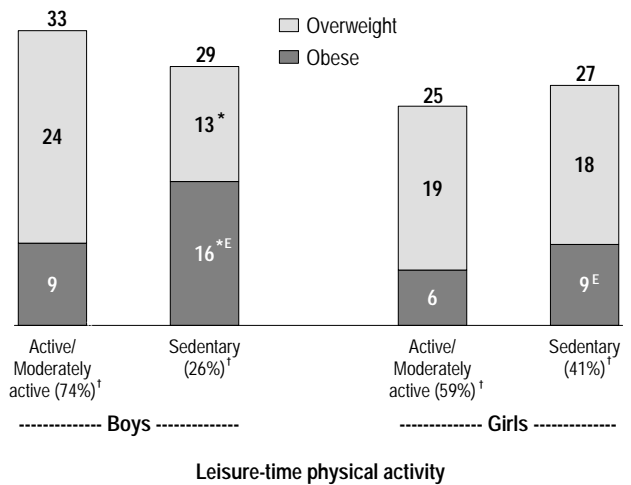
Data source: 2004 Canadian Community Health Survey: Nutrition
[†] Percentage of population aged 2 to 17 in this group
 * Significantly different from estimate for 5 or more times ($p < 0.05$)

Chart 9
Percentage overweight or obese, by weekly hours of physical activity, household population aged 6 to 11, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
[†] Percentage of population aged 6 to 11 in this group
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Chart 10
Percentage overweight or obese, by sex and leisure-time physical activity level, household population aged 12 to 17, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
[†] Percentage of male/female population aged 12 to 17 in this group
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)
 * Significantly different from estimate for active/moderately active ($p < 0.05$)

Definitions

The *frequency of fruit and vegetable consumption* was assessed with questions from the Behavioral Risk Factor Surveillance System in the United States.²⁰ Canadian Community Health Survey (CCHS) 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?"

For 6- to 11-year-olds, *leisure-time physical activity level* was measured by asking, "About how many hours a week do you usually take part in physical activity (that makes you out of breath or warmer than usual):

- in your free time at school (for example, lunch)?"
- in your class time at school?"
- outside of school while participating in lessons or league or team sports?"
- outside of school while participating in unorganized activities, either on your own or with friends?"

For each item, the response categories were "never," "less than 1 hour per week," "2 to 3 hours per week," "4 to 6 hours a week" or "7 or more hours per week." Total physical activity was derived by taking the mid-point of the response category (0, 0.5, 2.5, 5 or 7) for each of the four items and summing the resulting values.

For 12- to 17-year-olds, *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.²¹

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

Screen time is the amount of time spent watching television or videos, playing video games, or using a computer. Children aged 6 to 11 were asked:

- "On average, about how many hours a day do you watch TV or videos or play video games?"
- "On average, about how many hours a day do you spend on a computer, playing games, e-mailing, chatting, surfing the Internet, etc.?"

The response categories were: "I don't watch TV or videos or play video games/I don't use a computer," "less than 1 hour a day," "1 to 2 hours a day," "3 to 4 hours a day," "5 to 6 hours a day," and "7 or more hours a day." Total daily screen time was calculated by combining the time reported in the two questions, using the mid-point of the category (0, 0.5, 1.5, 3.5, 5.5 or 7).

For 12- to 17-year-olds, the following questions were asked: "In a typical week in the past three months, how much time did you usually spend:

- on a computer, including playing computer games and using the Internet or the World Wide Web?"

- playing video games, such as SEGA, Nintendo and Playstation?"
- watching television or videos?"

The response categories were: "none," "less than an hour," "1 to 2 hours," "3 to 5 hours," "6 to 10 hours," "11 to 14 hours," "15 to 20 hours," and "more than 20 hours." Total weekly viewing time was derived by taking the mid-point of each response category (0, 0.5, 1.5, 4, 8, 12.5, 17.5, or 20) and summing the resulting values across the three questions.

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 three *education* categories based on the highest level of attainment in the household: secondary graduation or less, some postsecondary, and postsecondary graduation.

Self-perceived health was assessed with the question, "In general would you say that your health is excellent, very good, good, fair or poor?" For this analysis, children were divided into two groups: those who reported very good or excellent health, and those who did not.

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.

In this analysis, category 1 was used for the comparison with the White population in the United States. 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 these categories were coded to "Other."

Calculating overweight and obesity in children and adolescents

For the 2004 Canadian Community Health Survey, body mass index (BMI) was derived using the child's or adolescent's weight and height as measured by the interviewer. BMI is calculated by dividing weight in kilograms by height in metres squared.

BMI cut-points of 25 and 30 are used to classify adults as overweight and obese, based on health risks associated with being in these BMI categories.^{11,22} Recently, the International Obesity TaskForce (IOTF) agreed on a new approach to measure overweight and obesity among children and adolescents.²³ Because it is not clear which BMI levels are associated with health risks at younger ages, the group recommended extrapolating the adult cut-points of 25 and 30 to create sex- and age-specific values. Using data collected between 1963 and 1993 from the United States, Great Britain, the Netherlands, Brazil, Hong Kong and Singapore, BMI centile curves that passed through the points of 25 and 30 at age 18 were derived. Because sexual maturation influences body fat, the IOTF cut-points are sensitive to the timing of puberty.¹⁷ The overweight and obesity rates in this analysis are based on the IOTF criteria.

For example, a 7-year-old boy who is 3 feet 11 inches (119 cm) tall who weighs 56.9 pounds (25.8 kg) would have a BMI of 18.2, and would be considered overweight; a 13-year-old girl who is 5 feet 3 inches (160 cm) tall who weighs 161 pounds (73 kg) would have a BMI of 28.5 and would be considered obese.

Many previous studies have used US growth curves and classified BMIs falling over the 85th and 95th centiles for age- and sex-specific categories as overweight or obese. While the two methods generally yield similar results, the IOTF reference values tend to give lower estimates for young children and higher estimates for older children.^{1,24}

not obese), compared with boys who were sedentary.

Watching television, playing video games and using the computer are common activities for many Canadian children. Time spent in this way is often referred to as "screen time." In 2004, over a third (36%) of children aged 6 to 11 logged more than 2 hours of screen time each day (Chart 11). These children were twice as likely to be overweight/obese (35%) as were those whose daily viewing amounted to an hour or less (18%). Obesity was also about twice as common in this group (11%),

Age (years)	Overweight cut-points		Obese cut-points	
	BMI greater than or equal to:		BMI greater than or equal to:	
	Boys	Girls	Boys	Girls
2	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18+	25.00	25.00	30.00	30.00

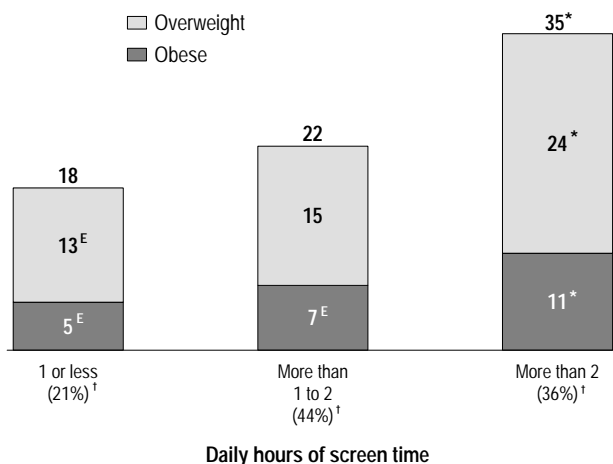
Source: Cole et al., Reference 23

compared with those who had an hour or less of daily screen time (5%).

For adolescents aged 12 to 17, screen time was measured on a weekly basis. The proportions who were overweight/obese ranged from 23% of those whose viewing amounted to less than 10 hours a week to 35% of those who spent 30 or more hours a week in front of a screen (Chart 12).

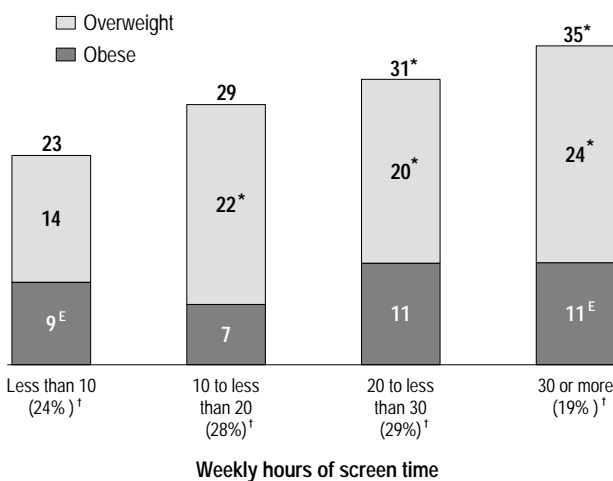
The relatively recent introduction and rapid proliferation of video games and home computers make it difficult to track trends in screen time. In 1988, when the Campbell's Survey on Health and

Chart 11
Percentage overweight or obese, by daily hours of screen time, household population aged 6 to 11, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
[†] Percentage of population aged 6 to 11 in this group
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)
^{*} Significantly different from estimate for 1 or less category ($p < 0.05$)

Chart 12
Percentage overweight or obese, by weekly hours of screen time, household population aged 12 to 17, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
[†] Percentage of population aged 12 to 17 in this group
^{*} Significantly different from estimate for less than 10 ($p < 0.05$)
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Well-being asked 12- to 17-year-olds how many hours they watched television, the weekly average was 9. In 2004, average weekly television hours were almost the same, at 10. But when time spent using a computer and playing video games was included, adolescents' total average weekly screen time doubled to 20 hours (data not shown).

All associations between these lifestyle factors—fruit and vegetable consumption, leisure-time physical activity and screen time—persisted when the effects of age and socio-economic status were taken into account (data not shown).

Socio-economic status

For adults, lower socio-economic status tends to be associated with obesity. While the same relationship has been observed for children, the association is usually not as strong, and results have been inconsistent.²⁵⁻²⁷

According to the 2004 CCHS, children and adolescents in middle-income households were more likely to be obese than were those in high-income households (Chart 13). The proportions of obese youth in low-income and high-income households were similar.

The pattern was clearer by level of education. Young people in households where no members had more than a high school diploma were more likely to be overweight/obese than were those in households where the highest level of education was postsecondary graduation.

Negative perceptions of health

In 2004, 18% of adolescents aged 12 to 17 reported that they had at least one diagnosed chronic condition (data not shown). While this figure did not vary significantly by weight (normal, overweight or obese), young people's perceptions of their health did (Chart 14). Boys who were obese were much less likely than those whose weight was in the normal range to report their health as excellent or very good. For girls, negative ratings of their health were evident not only among those who were obese, but also among those who were

Limitations

The response rate to the 2004 Canadian Community Health Survey (CCHS): Nutrition was 76.5%. For various reasons, direct measurements of height and weight were obtained for only 65.5% of 2- to 17-year-olds.

Response rates to directly measured height and weight differed significantly by sex, age group and province. Measurements were slightly more likely to have been obtained for girls than for boys. The response rate was lowest for 2- to 5-year-olds (55%) and highest for adolescents (71%). At 56%, Ontario's response rate was particularly low. The likelihood of responding was not associated with fruit and vegetable consumption, leisure-time physical activity, screen time, household income, highest level of education in the household, presence of a chronic condition, or self-perceived health (data not shown).

Because it is difficult to measure physical activity, evidence of a relationship between energy expenditure and overweight and obesity among children and adolescents is lacking in many studies.²⁸ In the 2004 CCHS, parents of children aged 6 to 11 were asked about activities that increased the child's heart rate and made him/her feel out of breath some of the time (see *Definitions*). The child was encouraged to participate in answering these questions. The degree to which parents and/or children can accurately recall and report such information is unknown and may affect associations with overweight and obesity. Adolescents were asked about their leisure-time physical activities over the past three months. Again, there may have been recall problems, and leisure-time may not reflect overall physical activity because school and work were excluded.

The questions about fruit and vegetable consumption asked the *number of times* fruit and vegetables were consumed per day, but not the *amounts* consumed. Because the questions did not request portion size, compliance with daily intake recommendations, such as the Canada Food Guide, could not be assessed.

Percentage distribution of respondents aged 2 to 17, by response and reasons for non-response to measured height and weight

	Age group		
	Total	2-11	12-17
	%	%	%
Total	100.0	100.0	100.0
Measured	65.5	61.9	70.8
Not measured, total	34.5	38.1	29.2
Child not available	14.6	24.5	...
Refusal	4.4	1.7	8.3
Measuring equipment	7.2	6.2	8.7
Too tall for interviewer to measure	2.3	...	4.2
Telephone interview	1.5	...	3.4
Interview setting	0.9	...	2.0
Other	3.6	5.7	2.8

Data source: 2004 Canadian Community Health Survey: Nutrition ... Rate too low to report

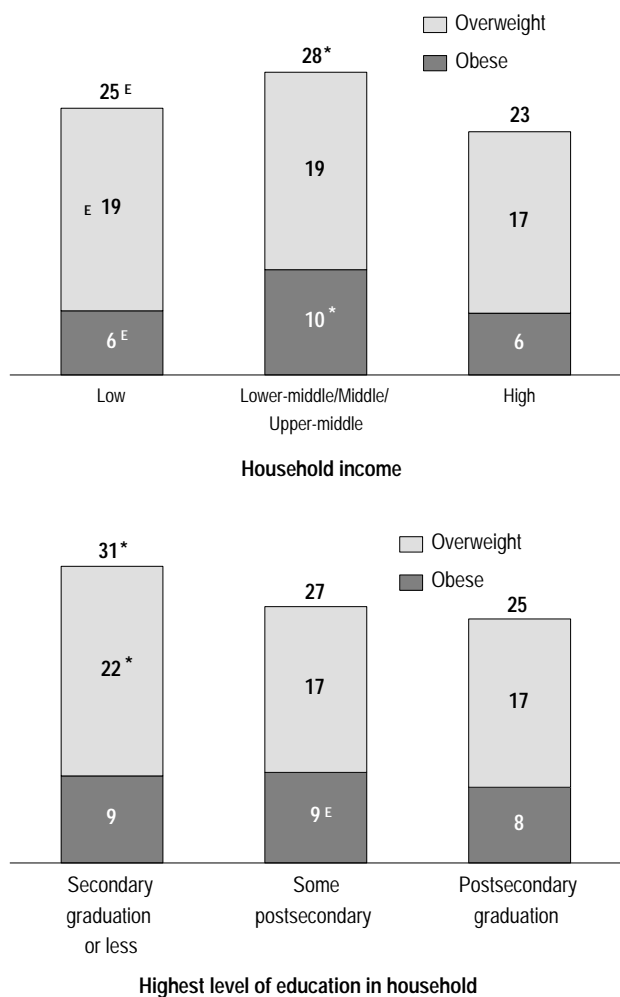
Response rates to directly measured height and weight

	%
Overall	66
Sex	
Boys	64*
Girls	67*
Age group	
2 to 5	55*
6 to 11	66
12 to 17	71*
Province	
Newfoundland and Labrador	74*
Prince Edward Island	72
Nova Scotia	77*
New Brunswick	71
Quebec	73*
Ontario	56*
Manitoba	76*
Saskatchewan	71*
Alberta	69
British Columbia	71*

Data source: 2004 Canadian Community Health Survey: Nutrition

* Significantly different from overall rate ($p < 0.05$)

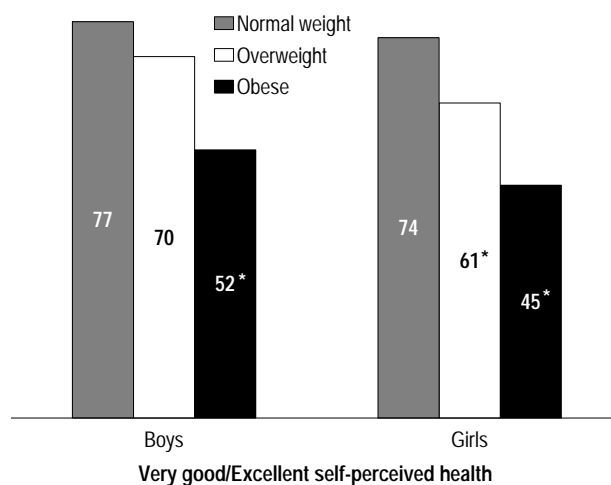
Chart 13
 Percentage overweight or obese, by household income and highest level of education in household, household population aged 2 to 17, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
Note: Because of rounding, detail may not add to totals.
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)
^{*} Significantly different from estimate for high household income/postsecondary graduation ($p < 0.05$)

overweight. These associations between weight and health perceptions persisted for both sexes when socio-economic status and the presence of a chronic condition were taken into account (data not shown).

Chart 14
 Percentage reporting very good or excellent health, by weight status and sex, household population aged 12 to 17, Canada excluding territories, 2004



Data source: 2004 Canadian Community Health Survey: Nutrition
^{*} Significantly different from estimate for normal weight ($p < 0.05$)

Concluding remarks

Over the past 25 years, the percentage of Canadian children and adolescents who are overweight or obese has risen considerably. The increase is particularly notable among 12- to 17-year-olds, whose overweight/obesity rate has more than doubled, and whose obesity rate has tripled.

The burden that childhood obesity places on the health care system is difficult to quantify because the related physical health problems are usually not evident until later in life. Nonetheless, the upturn in the prevalence of overweight/obesity among young people is important because excess weight in adolescence often persists into adulthood.^{1,15-18} Longitudinal data indicate that once an adult is overweight, further weight gain is likely and very few lose enough weight to return to the normal weight range. (See Le Petit and Berthelot in this issue.)

Some of the factors associated with overweight and obesity among young people can be modified. Eating more fruit and vegetables, increasing physical activity and devoting less time to sedentary

activities such as watching television and playing video games may help reverse the upward trend. ●

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Appendix

Table A
Percentage overweight and obese, by selected socio-demographic characteristics, household population aged 2 to 17, Canada excluding territories, 2004

	Estimated population '000	Overweight		Obese		Overweight/Obese	
		%	95% confidence interval	%	95% confidence interval	%	95% confidence interval
Total	6,184	18.1	16.8, 19.3	8.2	7.3, 9.1	26.2	24.8, 27.7
Sex							
Boys†	3,178	17.9	16.0, 19.8	9.1	7.7, 10.5	27.0	24.6, 29.3
Girls	3,007	18.3	16.4, 20.1	7.2	6.1, 8.4	25.5	23.4, 27.6
Age group							
2 to 5	1,348	15.2	12.3, 18.0	6.3	4.6, 8.0	21.5	18.3, 24.6
Boys†	684	13.1	9.4, 16.9	6.3 ^E	3.9, 8.6	19.4	15.0, 23.7
Girls	664	17.3	12.9, 21.6	6.4 ^E	4.0, 8.8	23.6	19.1, 28.2
6 to 11	2,321	17.9	15.8, 19.9	8.0	6.4, 9.6	25.8*	23.4, 28.3
Boys†	1,173	17.0	13.9, 20.0	8.5	6.0, 11.0	25.4	21.6, 29.2
Girls	1,148	18.8	15.9, 21.6	7.5	5.2, 9.8	26.3	22.8, 29.8
12 to 17	2,515	19.8	17.8, 21.8	9.4	7.9, 10.9	29.2	26.9, 31.5
Boys†	1,320	21.1	18.3, 24.0	11.1	8.8, 13.4	32.3	28.9, 35.6
Girls	1,195	18.3	15.6, 21.0	7.4*	5.6, 9.3	25.8*	22.6, 28.9
Ethnicity							
White	4,907	18.1	16.7, 19.6	8.2	7.2, 9.3	26.3	24.7, 28.0
Black	186	17.6 ^E	8.6, 26.6	F	...	29.3 ^E	18.0, 46.0
Southeast/East Asian	343	12.2* ^E	7.5, 17.0	5.4* ^E	2.7, 8.2	17.7* ^E	12.3, 23.0
Aboriginal (off-reserve)	84	21.5 ^E	12.5, 30.5	19.8* ^E	10.8, 28.7	41.3*	30.4, 52.1
Other	665	20.4	15.8, 25.0	6.8 ^E	4.0, 9.6	27.2	22.1, 32.3
Household income							
Low	143	19.0 ^E	9.1, 28.8	6.0 ^E	2.8, 9.2	25.0 ^E	15.0, 34.9
Lower-middle/Middle/Upper-middle	3,574	18.5	16.8, 20.2	9.8*	8.5, 11.2	28.3*	26.4, 30.3
High†	1,856	17.0	14.6, 19.4	5.8	4.2, 7.3	22.8	20.0, 25.5
Highest level of education in household							
Secondary graduation or less	1,036	21.7*	18.5, 24.9	9.0	6.9, 11.1	30.7*	27.4, 34.1
Some postsecondary	477	17.2	12.0, 22.3	9.4 ^E	6.1, 12.7	26.5	20.5, 32.6
Postsecondary graduation†	4,570	17.4	15.9, 19.0	7.8	6.8, 8.9	25.3	23.5, 27.0

Data source: 2004 Canadian Community Health Survey: Nutrition

Notes: For age, the reference category is the previous age group; for ethnicity, the overall Canadian estimate. One respondent had a missing value for ethnicity, 952 for household income, and 137 for household education.

† 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 health behaviours, household population aged 2 to 17, Canada excluding territories, 2004

	Estimated population '000	Overweight		Obese			Overweight/Obese	
		%	95% confidence interval	%	95% confidence interval	%	95% confidence interval	
Total	6,184	18.1	16.8, 19.3	8.2	7.3, 9.1	26.2	24.8, 27.7	
Daily fruit and vegetable consumption								
Less than 3 times	1,307	18.7	16.1, 21.3	10.2*	8.0, 12.3	28.9*	25.6, 32.1	
3 to less than 5 times	2,310	19.0	16.7, 21.4	9.0*	7.4, 10.7	28.1*	25.5, 30.7	
5 or more times [†]	2,552	16.8	14.7, 19.0	6.4	5.2, 7.7	23.3	21.0, 25.6	
Weekly hours of physical activity (ages 6 to 11)								
Less than 7 [†]	359	16.7	12.1, 21.3	9.3 ^E	5.2, 13.4	26.0	20.2, 31.8	
7 to less than 14	982	18.4	15.2, 21.7	8.2	5.7, 10.6	26.6	22.8, 30.4	
14 or more	957	18.0	14.5, 21.5	7.5 ^E	4.9, 10.1	25.5	21.3, 29.7	
Leisure-time physical activity (ages 12 to 17)								
Boys								
Active/Moderately active [†]	974	24.0	20.5, 27.5	9.3	7.2, 11.4	33.3	29.7, 37.0	
Sedentary	346	13.0*	9.3, 16.7	16.3* ^E	10.3, 22.2	29.3	22.4, 36.2	
Girls								
Active/Moderately active [†]	709	18.5	15.3, 21.8	6.3	4.2, 8.3	24.8	21.1, 28.5	
Sedentary	486	18.0	13.4, 22.6	9.2 ^E	5.8, 12.6	27.1	21.7, 32.6	
Daily hours of screen time (ages 6 to 11)								
Less than or equal to 1 [†]	484	12.5 ^E	8.0, 17.1	5.3 ^E	2.2, 8.4	17.8	12.6, 23.0	
More than 1 to 2	1,013	15.3	12.4, 18.2	7.1 ^E	4.7, 9.5	22.4	18.9, 25.9	
More than 2	824	24.1*	19.6, 28.6	10.6*	7.7, 13.6	34.8*	29.9, 39.6	
Weekly hours of screen time (ages 12 to 17)								
Less than 10 [†]	614	13.9	11.0, 16.8	9.1 ^E	5.6, 12.5	23.0	18.6, 27.4	
10 to less than 20	699	21.9*	18.0, 25.9	6.6	4.7, 8.6	28.6	24.6, 32.6	
20 to less than 30	728	20.2*	16.8, 23.6	11.2	8.3, 14.0	31.4*	27.2, 35.6	
30 or more	466	23.8*	18.9, 28.8	11.2 ^E	7.5, 14.9	35.0*	29.4, 40.6	

Data source: 2004 Canadian Community Health Survey: Nutrition

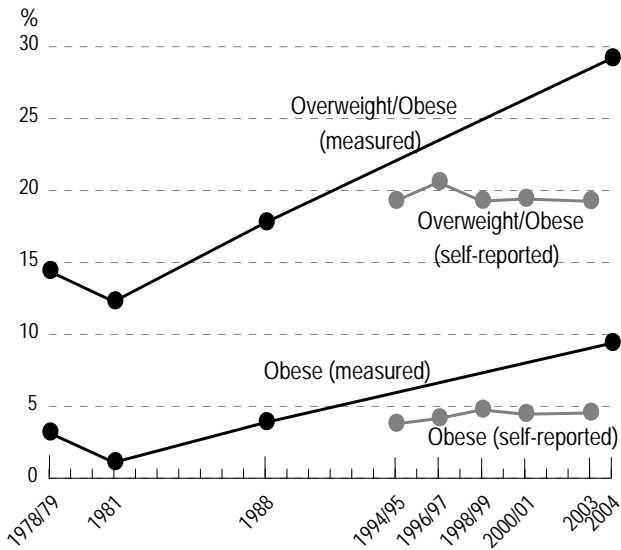
Note: There were 27 respondents with a missing value for fruit and vegetable consumption, 18 for physical activity for ages 6 to 11, 2 for screen time for ages 6 to 11, and 7 for screen time for ages 12 to 17.

[†] Reference category

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

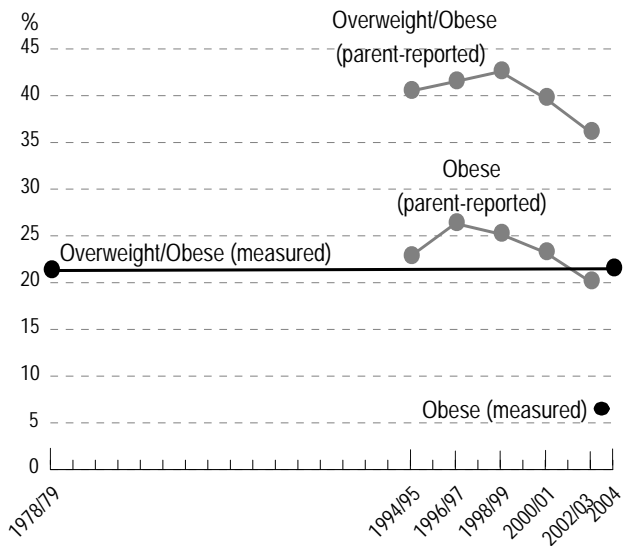
^E Coefficient of variation 16.6% to 33.3% (interpret with caution)

Chart A
Trends in prevalence of overweight/obese and obesity, household population aged 12 to 17, Canada excluding territories, selected years 1978/79 to 2004



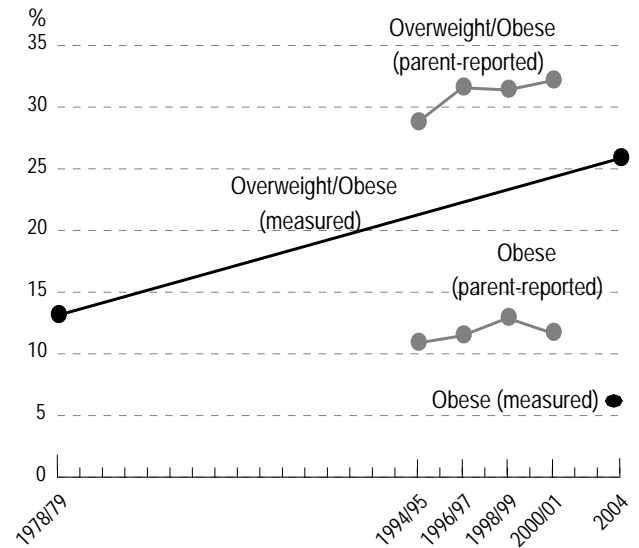
Data sources: 1978/79 Canada Health Survey; 1981 Canada Fitness Survey; 1988 Campbell's Survey on Health and Well-being; 1994/95, 1996/97 and 1998/99 National Population Health Survey; 2000/01, 2003 Canadian Community Health Survey; 2004 Canadian Community Health Survey; Nutrition

Chart B
Trends in prevalence of overweight/obese and obesity, household population aged 2 to 5, Canada excluding territories, selected years 1978/79 to 2004



Data sources: 1978/79 Canada Health Survey; 1994/95, 1996/97, 1998/99, 2000/01, 2002/03 National Longitudinal Survey of Children and Youth; 2004 Canadian Community Health Survey; Nutrition
Note: The obesity estimate for the 2-to-5 age group from the 1978/79 Canada Health Survey has a coefficient of variation greater than 33.3%; therefore, it cannot be released.

Chart C
Trends in prevalence of overweight/obese and obesity, household population aged 6 to 11, Canada excluding territories, selected years 1978/79 to 2004



Data sources: 1978/79 Canada Health Survey; 1994/95, 1996/97, 1998/99, 2000/01 National Longitudinal Survey of Children and Youth; 2004 Canadian Community Health Survey; Nutrition
Note: The obesity estimate from the 1978/79 Canada Health Survey has a coefficient of variation greater than 33.3%; therefore, it cannot be released. The 2002/03 NLSCY cross-sectional file has records only for children aged 0 to 5.