

Parent and child factors associated with youth obesity

- In 2000/01, boys were twice as likely as girls to be obese, even though they were more likely to have reported being physically active.
- Girls who were former smokers had higher odds of obesity than their non-smoking counterparts.
- Health behaviours of both boys and girls were associated with those of the responding parent, and for boys only, those with a parent who smoked had higher odds for obesity.
- Parental obesity was strongly associated with youth obesity.

Abstract

Objectives

This article examines relationships between parent and adolescent weight, as well as other selected characteristics and health behaviours of both, and then explores which factors are associated with youth obesity.

Data source

The analysis is based on cross-sectional household data from cycle 1.1 of the 2000/01 Canadian Community Health Survey (CCHS), conducted by Statistics Canada. The sample comprises 4,803 girls and 4,982 boys who were aged 12 to 19 in 2000/01.

Analytical techniques

Estimates of body mass index (BMI) were calculated and selected health behaviours were evaluated for adolescents and a parent who lived in the same household. Multiple logistic regression was used to identify factors associated with youth obesity while controlling for age of the youth and the sex of the reporting parent.

Main results

For both sexes, having an obese parent greatly increased the odds for youth obesity. Among girls, former smokers had higher odds for obesity, but smoking behaviour was not associated with obesity for boys. For boys, being physically inactive or even moderately active increased the odds of obesity. And if the responding parent smoked daily, this increased the odds of obesity for boys.

Key words

adolescence, body weight, exercise, family health, health behaviour, health surveys

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Overweight children have become a major health concern in Canada. Between 1981 and 1996, the prevalence of overweight among 7- to 13-year-old boys rose from 15% to 35%; among girls of the same ages, the prevalence increased from 15% to 29%.¹ And beyond the overweight category, the prevalence of obesity tripled during the same period, from 5% for both sexes to 17% for boys and to 15% for girls.¹ Such trends have been attributed to the lifestyles of an “obesogenic” society.²

Along with issues of social acceptance, body image and self-esteem,³ obese children are more likely to face short-term health problems (hypertension, glucose intolerance and orthopedic complications, for example) than their non-obese counterparts.⁴ Overweight children also tend to remain overweight as adults,⁵ and there are well documented long-term health consequences associated with childhood obesity.

Definitions

Two age groups—12 to 15 and 16 to 19—were used, based on the age of the youth at the time of the interview. In the multivariate analysis, years of age was used as a continuous variable.

Body mass index, or BMI, is calculated by dividing weight in kilograms by height in metres squared. Youth respondents were classified as *overweight* or *obese* according to the age- and sex-specific BMI cut-offs defined by Cole et al.⁶

Age (years)	Overweight is BMI greater than or equal to:		Obese is BMI greater than or equal to:	
	Boys	Girls	Boys	Girls
12.0	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13.0	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14.0	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15.0	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16.0	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17.0	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

Mid-year age points were chosen as the age criteria (for example, 12.5 for 12-year-olds). Overweight, therefore, was defined as having a BMI that fell within the 85th to 95th centile curves modelled by Cole et al.⁶ for children of the same age and sex; obese, as having a BMI that fell at or over the 95th percentile within the age and sex group. For example, a 13-year-old girl who was 160 cm (5 feet, 3 inches) tall would be considered obese if she weighed 73 kg (161 pounds) (BMI = 28.5).

Self-perceived weight of youth was based on respondents' answers to a question that asked whether they considered themselves to be "overweight", "underweight" or "just about right" (see *Girls, boys and weight—self-perceptions versus reality*).

The *reporting parent's BMI* was calculated by dividing weight in kilograms by height in metres squared. Overweight was defined as a BMI of 25 or more and less than 30, obese as a BMI of 30 or more.

Leisure-time activity level was categorized using respondents' answers to questions about the frequency and duration of their participation in a variety of physical activities. To derive respondents' overall level of activity, their energy expenditure was estimated for each reported activity. Energy expenditure (EE) was calculated by multiplying the number of times a respondent engaged in an activity over a 12-month period (a 3-month recall period multiplied by 4) by the average duration in minutes and the energy cost of the activity (expressed as kilocalories expended per kilogram of body weight per hour of activity). To calculate the daily energy expenditure for

the activity, the yearly estimate was divided by 365. This calculation was repeated for all leisure-time activities reported, and the resulting estimates were summed to provide the aggregate average daily energy expenditure. Respondents whose leisure-time EE was below 1.5 kcal/kg/day were considered physically inactive. A value between 1.5 and 2.9 kcal/kg/day indicated moderately active; 3.0 or more, active.⁷ This index does not consider physical activity during school or in the workplace.

Three types of *smoking status* were considered for youth. Daily and occasional smokers were grouped together, as the numbers of occasional smokers were too small to analyze separately. Youth who had smoked either daily or occasionally in the past, but who were no longer smoking were considered former smokers. And non-smokers were those who reported not smoking and never having smoked a cigarette. For responding parents, daily smokers and occasional smokers were separated, but the other categories remained the same.

Daily fruit and vegetable consumption was based on the number of times respondents reported drinking fruit juices or eating fruits and vegetables. The amount consumed was not measured. The derived frequency was first grouped into three categories: less than 5 times per day; 5 to 10 times; and more than 10. Youth responses were regrouped as less than 5 times per day and 5 or more.

Household income groups were based on the number of people in the household and total household income from all sources in the 12 months before the 2000/01 interview:

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

For the logistic regression model, household income was regrouped into three categories: low income (includes lowest and lower-middle incomes), middle income, and high income (includes upper-middle and highest incomes).

For example, it has been associated with chronic and life-threatening conditions such as diabetes and heart disease.^{5,8} In fact, a high body mass index in adolescence has been shown to be predictive of earlier adult mortality.⁹

Research indicates that parental obesity is a risk factor for obesity in children;¹⁰⁻¹² therefore, the link between health behaviours of parents and those of their offspring is an important consideration. It is possible that behaviours predictive of obesity prevail in some households. Some researchers have reported evidence of parent-child correlations across a variety of behaviours, including diet and exercise.¹³⁻¹⁵

This analysis uses a subset of data from the 2000/01 Canadian Community Health Survey (CCHS) to examine relationships between parents' and adolescents' weight, as well as other selected characteristics and health behaviours of both, and then to determine which factors are associated with youth obesity (see *Definitions, Methods and Limitations*). Previous studies have been criticized for their reliance on children's perceptions of their parent's behaviours, or parents' reports of their children's behaviour.¹⁵ However, this analysis is based on two independent reports: one directly from a youth aged 12 to 19, and another from one of his or her parents. Both were living in the same household at the time of the CCHS interview. The large national sample permits separate analysis by sex.

Excess weight more common among boys

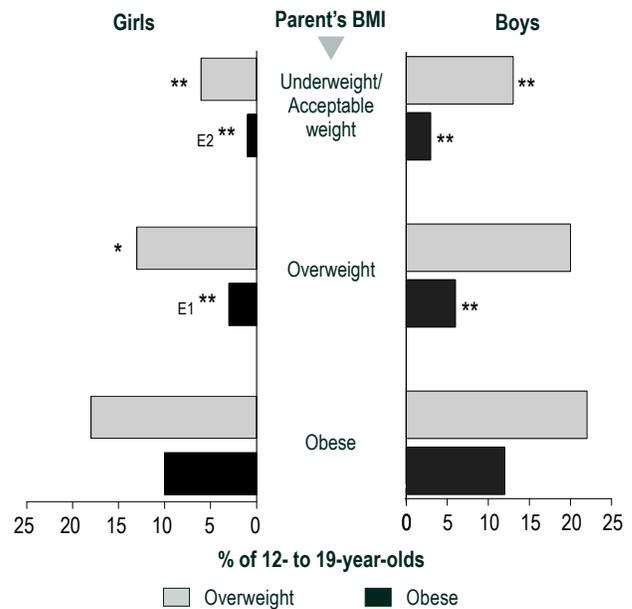
Among the subset of 12- to 19-year-olds examined in this analysis, close to 5% were considered obese in 2000/01. The proportion of boys who were obese (6%) was about twice that for girls (3%) (Table 1). And nearly 17% of the boys these ages were overweight, as were 10% of the girls. Among boys, the prevalence of overweight was higher in the 12-to-15 age group, compared with the 16-to-19 group. The differences in weight between boys and girls did not always match their self-perceptions. For example, girls were more likely to erroneously see themselves as overweight, while boys were more likely to perceive themselves as underweight (see *Girls, boys and weight—self-perceptions versus reality*).

Factors related to overweight/obesity

Consistent with previous research, this analysis found associations between the weight of young people and that of their parents. Adolescents who lived with an obese parent were more likely to be overweight or obese than their counterparts whose reporting parent

Chart 1

Overweight or obese youth, by sex and parent's BMI, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01



Data source: 2000/01 Canadian Community Health Survey, cycle 1.1

* Significantly different from value for corresponding category in household with an obese parent ($p < 0.05$, adjusted for multiple comparisons)

** Significantly different from value for corresponding category in household with an obese parent ($p < 0.01$, adjusted for multiple comparisons)

E1 Coefficient of variation between 16.6% and 25.0%

E2 Coefficient of variation between 25.1% and 33.3%

had a BMI in the acceptable-to-underweight range (Table 1, Chart 1).

Excess parental weight was a major factor in excess weight for youth of both sexes (Table 1). Among girls with an obese parent, 18% were overweight and 10%, obese. The situation was similar for boys with an obese reporting parent: about 22% were overweight and 12% were obese. Among both girls and boys, obesity and overweight were much less common if they lived with a parent whose weight was considered underweight or acceptable, or even overweight (Chart 1). Other associations emerged between parents and youths, not only with weight, but also with physical activity, smoking and eating habits—a set of risk factors that other researchers have suggested should be considered together in investigations of youth obesity.¹⁶⁻¹⁸ In this analysis, the 12- to 19-year-olds with a reporting parent who was inactive during leisure time, who was a smoker, or who consumed fruits and vegetables less than five times a day, were likely to report these behaviours as well (Charts 2 to 4).

Table 1
Prevalence of overweight and obesity, by sex and selected characteristics, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01

	Girls						Boys					
	Overweight			Obese			Overweight			Obese		
	Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population	
	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%
Total	529	81	10[‡]	162	26	3[‡]	904	148	17	326	52	6
Age group												
12-15	301	44	10	81	14	3	485	85	18*	153	26	6
16-19 [†]	228	36	10	81	12	3	419	63	15	173	26	6
Reporting parent's BMI												
Obese	163	24	18**	79	14	10**	224	32	22**	113	17	12**
Not obese [†]	356	55	8	78	11 ^{E1}	2 ^{E1}	655	111	15	200	33	5
Leisure-time												
Inactive	184	28	11*	69	10	4**	176	28	16	91	13	7*
Moderately active	130	22	11*	39	5 ^{E1}	3 ^{E1}	167	25	14	66	13 ^{E1}	8*
Active [†]	145	20	7	35	6 ^{E2}	2 ^{E2}	407	66	17	121	17	5
Smoking status												
Daily/Occasional	79	13	11	24	3 ^{E2}	3 ^{E2}	144	22	18	55	8 ^{E1}	6
Former	91	11	10	34	6 ^{E1}	5 ^{E1}	133	18	15	48	8 ^{E1}	6 ^{E1}
Never [†]	357	56	10	103	16	3	621	107	17	222	36	6
Daily frequency of fruit/vegetable consumption												
Less than 5 times	305	44	10*	101	17	4	541	86	16	214	31	6
5-10 times	179	28	9	54	8 ^{E1}	3 ^{E1}	302	50	16	94	17	6
More than 10 times [†]	41	8 ^{E1}	17 ^{E1}	6	F	F	53	11 ^{E1}	23 ^{E1}	15	2 ^{E2}	F
Reporting parent's leisure time												
Inactive	289	44	10	105	17	4	474	78	17	187	32	7
Moderately active	121	18	10	25	4 ^{E2}	2 ^{E2}	220	34	17	63	8	4
Active [†]	85	12	9	22	3 ^{E2}	2 ^{E2}	134	22	15	51	9 ^{E1}	6 ^{E1}
Reporting parent's smoking status												
Daily	142	19	10	67	9	5	230	34	17	106	16	7
Occasional	22	3 ^{E2}	9 ^{E2}	6	F	F	32	6 ^{E1}	19 ^{E1}	15	F	F
Former	223	35	10	56	8 ^{E1}	2 ^{E1}	420	66	17	128	19	5
Never [†]	142	24	11	33	8 ^{E2}	3 ^{E1}	222	42	17	76	14	5
Reporting parent's daily frequency of fruit/vegetable consumption												
Less than 5 times	361	53	11	110	16	3	620	98	17	215	33	6
5-10 times	147	24	9	47	9 ^{E1}	3 ^{E1}	249	44	16	103	18	7
More than 10 times [†]	18	3 ^{E2}	F	5	F	F	28	5 ^{E1}	16 ^{E2}	6	F	F
Household income												
Lowest/Lower-middle	44	7 ^{E1}	10 ^{E1}	18	F	F	76	13	16	35	6 ^{E2}	8 ^{E2}
Middle	115	16	10	45	8 ^{E1}	5 ^{E1}	175	26	15	71	11 ^{E1}	7 ^{E1}
Upper-middle/Highest [†]	344	54	10	95	15	3	597	99	17	202	32	6

Data source: 2000/01 Canadian Community Health Survey, cycle 1.1

Note: Based on a sample of 4,803 female and 4,982 male youth (see Appendix Table A)

† Reference category

‡ For total, significantly different from corresponding estimate for boys (p < 0.01)

E1 Coefficient of variation between 16.6% and 25.0%

E2 Coefficient of variation between 25.1% and 33.3%

F Coefficient of variation greater than 33.3%

* Significantly different from reference category (p < 0.05)

** Significantly different from reference category (p < 0.01)

A subtle sex difference in adolescent's activity during leisure time is evident (Chart 2). The proportion of boys who reported being active was similar in households with an active (62%) or moderately active (58%) reporting parent. This was not the case for girls, as they were less active even when the reporting parent was moderately active. This raises the possibility that if parents' level of physical activity is

emulated by their children, then the parental example may be more important for girls than for boys.

The youths most likely to smoke, either daily or occasionally, lived in homes where the reporting parent was a daily smoker (Chart 3). And the highest proportion of adolescents who had never smoked was in homes where the reporting parent had also never smoked. This calls into question the notion that there

Girls, boys and weight—self-perceptions versus reality

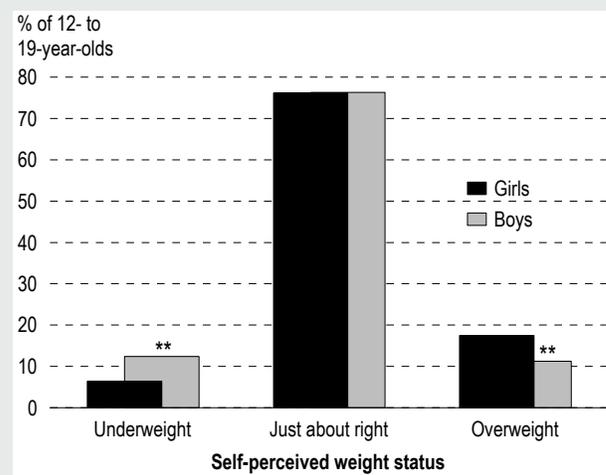
According to the 2000/01 CCHS, about three-quarters (76%) of both boys and girls aged 12 to 19 thought their weight was "just about right" (Chart). Boys were more likely to see themselves as underweight (12% versus 6% for girls), while a higher proportion of girls perceived themselves as overweight.

Yet comparing the adolescents' self-perceptions with their actual body mass index (BMI) revealed that perceptions may not always mesh with reality (all differences between sexes are significant; $p < 0.05$).

Girls were more likely than boys to misjudge themselves as overweight when they were not (Table). Slightly more than half (53%) of the girls who perceived themselves as overweight were neither obese nor overweight according to their BMI. By contrast, the proportion of boys who thought themselves overweight when they were neither obese nor overweight was 22%. Overall, these findings are consistent with those reported elsewhere on self-perceptions of weight among adolescents.¹⁹ Among those who perceived their weight as "just about right" or "underweight," only 6% of girls, compared with 16% of boys, had a BMI that classified them as overweight.

The implications of these results are cause for concern. Dieting has been associated with the likelihood that adolescents view themselves as overweight, whether or not they actually are.¹⁹ This

Self-perceived weight, by sex, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01



Data source: 2000/01 Canadian Community Health Survey, cycle 1.1
****** Significantly different from value for corresponding category for females ($p < 0.01$, adjusted for multiple comparisons)

raises the possibility of unhealthy eating practices, especially among young women who may, in fact, already be a healthy weight.

Youth body mass index (BMI) by sex and self-perceived weight, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01

	BMI girls						BMI boys					
	Obese/Overweight			Normal/Underweight			Obese/Overweight			Normal/Underweight		
	Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population	
		'000	%		'000	%		'000	%		'000	%
Self-perceived weight												
Overweight†	441	66	47	405	74	53	497	77	78	120	22	22
Just about right/Underweight	248	40	6*	3,520	626	94*	731	122	16*	3,522	657	84*

Data source: 2000/01 Canadian Community Health Survey, cycle 1.1

Notes: Based on a sample of 4,803 female and 4,982 male youth (see Appendix Table A).

† Reference category

* Significantly different from self-perceived overweight ($p < 0.05$)

Methods

Data source

This analysis is based on a subset of data from cycle 1.1 of Statistics Canada's 2000/01 Canadian Community Health Survey (CCHS). The CCHS collects cross-sectional information about the health of Canadians every two years. Data collection for cycle 1.1 began in September 2000 and continued over 14 months. The sample used for this analysis represents the household population aged 12 to 19 in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. More detailed descriptions of the CCHS design, sample and interview procedures can be found in a published report.²⁰

The area frame designed for the Labour Force Survey is the primary sampling frame of the CCHS. A multistage stratified cluster design was used to sample dwellings within the area frame. A list of the dwellings was prepared, and a sample was selected from the list. The majority (83%) of the sampled households came from the area frame. Face-to-face interviews were held with respondents randomly selected from households in this frame. In some areas, a random digit dialling technique and/or a list frame of telephone numbers was used to conduct telephone interviews with the remaining 17% of the targeted sample.

In about 82% of the households selected from the area frame, one person was randomly selected; two people were randomly chosen in the remaining households. For households selected from the telephone frames, one person was randomly chosen. The response rate for the combined frame was 84.7%, with a responding sample size of 131,535. A total of 6.3% of interviews were obtained by proxy.

For this analysis, a subset of the sample was created from households in the CCHS area frame in which two people were randomly chosen to complete the interview. This represents approximately 15% of the total sample. From this subset, 12- to 19-year-olds were included for analysis if: (1) they were identified as living with one or both parent(s); and (2) if the second person who responded to the survey was identified as a parent, with or without a spouse, living with one or more children. This information was derived from the household roster that was collected at the start of the interviews. The analysis excludes 188 youth cases because the age difference between the youth and parent was less than 18 years or more than 45 years. In these cases, it was assumed that there may have been more than one family in the household (for example, a youth respondent and an unrelated parent with his/her own child in the same household), or some type of extended family within one household (for example, a youth and grandparent were selected for the survey, but the youth's parent, also living in the house, was not selected). For the subset of youth retained for analysis, the responses from the parent were attached to the youth file using the unique identifier for the household to match the cases. The final sample comprised 9,785 respondents aged 12 to 19: 4,803 girls and 4,982 boys (Appendix Table A). In the CCHS subset, the proxy rates for youth and responding parents were 13% and 7%, respectively.

Analytical techniques

Cross-tabulations were used to estimate the prevalence of various characteristics and health behaviours as reported independently by

an adolescent and one of his or her parents, both in the same household. Proportions were estimated using the CCHS sample weights so that the findings could be generalized to the general population of the same ages.

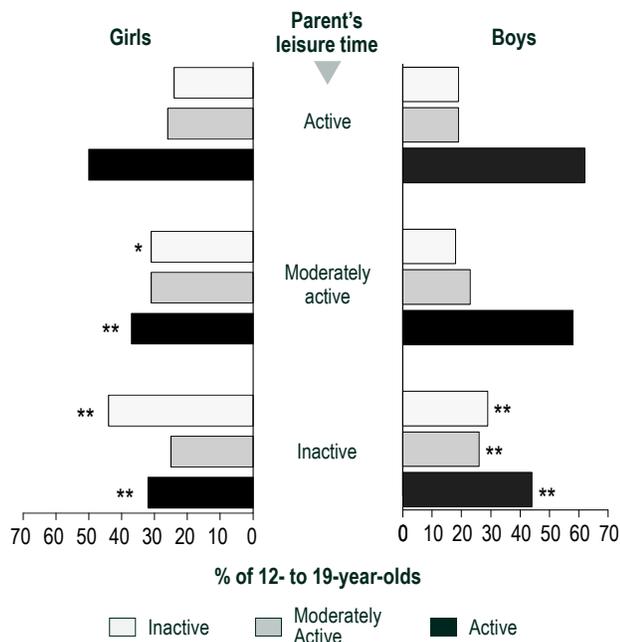
Multiple logistic regression was used to model associations between youth obesity, selected characteristics and health behaviours of the adolescents and the reporting parent, while adjusting for youth age and household income. Obesity was chosen as the dependent variable, based on research showing clearly that obesity is a factor in ill health. As well, because BMI was derived from self-report rather than direct physical measurement (see *Limitations*), it was assumed that selection of a more extreme BMI status (obese) would serve as a conservative starting point in the investigation of factors associated with weight in youth. Without adjustment for parent physical activity level and smoking behaviour, the odds ratios for age and physical activity for males were not significant (data not shown). This was also the case if parent physical activity only was added to the model. However, adjusting for the responding parent's smoking behaviour produced the effects seen for males. To minimize the number of cases dropped, parental physical activity was excluded from the model while smoking behaviour was included.

The sex of the reporting parent was also taken into account, because previous research has found that associations between parental and child behaviours and obesity may vary depending on the sex of the parent and child.^{11,13,21} In this subset of CCHS data, 55% of the parents selected for interview were mothers; 45%, fathers. The distribution was similar for both girls and boys, meaning that for more than half (56%) of the girls, their mother responded, and for 46% of the boys, their father responded (data not shown). An interaction variable built using the sex and obesity status of the parent was included in preliminary modelling, but was not significant. Because Canadian research has shown an association between socio-economic status and body mass index,^{22,23} household income was added to the model. Separate analyses were performed for male and female youth in order to examine any associations between obesity and other factors that might be sex-specific.

With the exception of age, a continuous variable, the outcome and explanatory variables considered in the regression models were dichotomized. The dependent variable was defined as a body mass index of "obese", compared with underweight, acceptable and overweight. Youth obesity as an outcome was examined in relation to the following independent variables: age, leisure-time activity level, smoking status, daily fruit and vegetable consumption, reporting parent's smoking status and BMI, and household income group. Adolescents may be influenced differently by their parents, depending on the sex of the child and the parent. Therefore, a variable defining the sex of the reporting parent as the same as or different from his or her child was also included in the multivariate analysis.

To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.²⁴⁻²⁶ The significance level was set at $p < 0.05$. When testing for differences between more than two estimates, adjustment was made to account for multiple comparisons.

Chart 2
Youth leisure time, by sex and parent's leisure-time, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01



Data source: 2000/01 Canadian Community Health Survey, Cycle 1.1
 * Significantly different from value for corresponding category in household with an active parent ($p < 0.05$, adjusted for multiple comparisons)
 ** Significantly different from value for corresponding category in household with an active parent ($p < 0.01$, adjusted for multiple comparisons)

is little parents can do to prevent external influences from encouraging adolescents to become smokers.²⁷

As parents often prepare family meals, it is not surprising that adolescents' eating habits mirrored those of the reporting parent. For example, those with parents who consumed fruits and vegetables five or more times per day were more likely to do the same (Chart 4).

Parental obesity strongly associated with youth obesity

If the ultimate goal is to understand the risk factors for youth obesity, the characteristics of both adolescents and their parents must be examined. In this case, the youth's age, leisure time activity level, smoking status and daily fruit and vegetable consumption, as well as the reporting parent's smoking status and BMI, and household income, were all taken into account, along with the sex of the reporting parent (see *Methods*).

Consistent with previous research,¹⁰⁻¹² parental obesity emerged as being strongly associated with youth obesity. For both girls and boys, the odds of being obese were high if their parent was obese,

Chart 3
Youth smoking status, by sex and parent's smoking status, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01



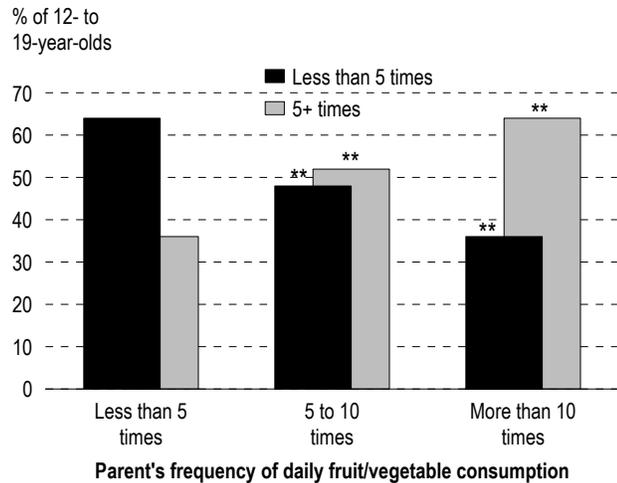
Data source: 2000/01 Canadian Community Health Survey, Cycle 1.1
 † Daily and occasional smokers
 * Significantly different from value for corresponding category in household with a smoking parent ($p < 0.05$, adjusted for multiple comparisons)
 ** Significantly different from value for corresponding category in household with a smoking parent ($p < 0.01$, adjusted for multiple comparisons)

compared with their contemporaries whose parent was not obese: almost six times higher for girls and three times higher for boys (Table 2).

In this analysis, male responding parents were more likely to be obese than their female counterparts (19% versus 15%); however, further analysis confirmed that obese mothers were as likely as obese fathers to have an obese youth (data not shown). And more specifically, in households with an obese father, boys and girls had the same rates of obesity. This suggests that, even though the male parents in this study were more likely to be obese than the female parents, there was no association between the sex and BMI of the parent and the sex and BMI of the child.

Leisure-time activity level was not associated with obesity for girls, but boys who were moderately active or inactive had higher odds of obesity (1.63 and 1.55), compared with those who were active. It may be that because the prevalence of obesity was lower in girls than in boys, any association of physical exercise with girls' weight status may have been too small to detect. Others have found a negative association between

Chart 4
Youth daily frequency of fruit and vegetable consumption, by parent's frequency of daily consumption, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01



Data source: 2000/01 Canadian Community Health Survey, Cycle 1.1
** Significantly different from value for corresponding category in household with parent consuming fruits/vegetables less than five times daily ($p < 0.01$, adjusted for multiple comparisons)

physical activity and overweight and obesity in both females and males.²⁸ It is also possible that girls tend to manage their weight by eating less rather than with exercise;¹⁶ therefore, weight may not vary systematically by physical activity level among girls.

For boys, but not girls, an association with age is evident; with every year of age, the odds that boys would be obese increased by 11%. As well, for boys whose responding parent smoked daily, the odds of being obese were 1.6 times as high as those for boys whose parent had never smoked. Although the findings were similar for girls, they were not statistically significant. Further analysis revealed that while parents who were daily smokers were not more likely to be obese, they did have lower rates of physical activity, compared with parents who were former smokers or who had never smoked (data not shown).

Among girls, those who had quit smoking had approximately twice the odds of being obese as girls who had never smoked. No similar association between smoking cessation and obesity emerged for boys. Past research on adults has produced similar findings on BMI for former smokers.^{22,29} Some evidence suggests that smoking cessation in adult women may produce metabolic changes that contribute to weight gain,³⁰ but for this analysis, it is not possible to determine if obesity preceded or

Table 2
Adjusted odds ratios for obesity, by sex and selected youth and parental characteristics, population aged 12 to 19 in households where both a youth and parent were surveyed, Canada, 2000/01

	Girls		Boys	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Age (continuous)	0.98	0.86, 1.11	1.11*	1.00, 1.22
Reporting parent's BMI status				
Obese	5.94**	3.54, 9.95	2.88**	1.96, 4.22
Not obese†	1.00	...	1.00	...
Leisure time				
Inactive	1.89	0.96, 3.72	1.55*	1.00, 2.41
Moderately active	1.26	0.63, 2.53	1.63*	1.05, 2.52
Active†	1.00	...	1.00	...
Smoking status				
Daily/Occasional	0.89	0.43, 1.86	0.63	0.38, 1.05
Former smoker	1.91*	1.06, 3.45	1.08	0.63, 1.84
Non-smoker†	1.00	...	1.00	...
Daily frequency of fruit/vegetable consumption				
Less than 5 times	1.27	0.77, 2.10	1.02	0.70, 1.48
5+ times†	1.00	...	1.00	...
Reporting parent's smoking status				
Daily smoker	1.55	0.76, 3.16	1.61*	1.01, 2.58
Occasional smoker	1.12	0.37, 3.40	1.92	0.62, 5.90
Former	0.55	0.28, 1.09	0.95	0.59, 1.54
Nonsmoker†	1.00	...	1.00	...
Household income				
Lowest/Lower-middle	1.00	0.44, 2.28	1.01	0.58, 1.76
Middle	1.35	0.70, 2.63	1.18	0.75, 1.86
Upper-middle/Highest†	1.00	...	1.00	...

Data source: 2000/01 Canadian Community Health Survey, cycle 1.1
Notes: Based on a sample of 3,796 female and 3,842 male youth for whom there were no missing values on any variable included. Controls for the sex of the reporting parent as same or different from the youth (not shown in table). Because of rounding, some odds ratios having confidence intervals with 1.00 as the upper/lower limit are statistically significant.

† Reference category
* $p < 0.05$
** $p < 0.01$
... Not applicable

followed smoking cessation. It is possible that factors related to smoking, such as diet and inactivity, lead to increased body weight and that quitting smoking occurred afterwards. A relationship between dieting and smoking as a means to control weight in adolescent girls has been documented elsewhere,¹⁸ but this smoking behaviour has been shown to be related to self-perceptions of weight rather than actual BMI.¹⁷

Limitations

This analysis is based on data collected independently from an adolescent between the ages of 12 and 19 and one of his or her parents, both of whom were living in the same household at the time of the survey. Therefore, it is restricted to relationships between the behaviours of the youth and the reporting parent. Because the Canadian Community Health Survey (CCHS) is cross-sectional, no inferences can be drawn about temporal or causal relationships among the behaviours reported or between these behaviours and obesity.

This analysis was formulated considering social learning theory and its assumptions about modelled behaviours.³¹ However, because information on the duration and stability of the child-parent relationships is not available from the CCHS, such factors could not be included.

Associations between parental and adolescent behaviours may be underestimated. Evidence of significant additive effects of both parents' behaviours on youth behaviors has been reported elsewhere.¹³ The CCHS, however, offers no information on the health behaviours of a second parent or another adult who may have influenced the adolescent. It is possible that, for example, young smokers in homes with a non-smoking reporting parent may have had a second parent who was a smoker. Although research has revealed a significant correlation of behaviours between spouses for substance use, diet, physical activity, and BMI,^{11,13,32} without more information, conclusions cannot be made about the behaviours of the entire household.

The self-reported data used in this analysis were not verified by direct measures or independent sources and may therefore be inaccurate. For example, recall errors may have affected reported levels of physical activity. In addition, there were no independent

sources to confirm whether people who reported engaging in specific activities actually did so, or with the frequency and duration claimed. It is also possible that respondents may have provided what they perceived as socially desirable responses to questions on issues such as activity, smoking and weight. Self-reported height and weight, in fact, tend to underestimate the prevalence of overweight, in particular among women.³³

The possibility that an adolescent respondent may have been influenced by the presence of a parent at the time of the interview was considered. However, administrative data provided by interviewers indicated that 77% of youth were actually alone during their interview. In addition, in 91% of the cases in which another person was present, the interviewer did not feel that the young person's responses were influenced by that person.

Non-responses, defined as refusals to reply, "missing" (no response stated) or responses of "don't know," were excluded from all analyses. Responses to all measures included in this analysis were obtained directly from the respondent with the exception of actual height, weight (not self-perceived) and smoking, in which case a proxy response could have been collected from another household member. If non-response or proxy responses were systematic in some way, this would have introduced error into the results. Youth smoking estimates, for example, might be affected, given that the proxy rate for youth in the CCHS subset used for this analysis was 13%.

Factors such as parenting style, developmental trajectories, and adolescent characteristics such as stress and coping styles, which have been included in other research, are not available from the CCHS and therefore could not be considered in this analysis.

Concluding remarks

According to this analysis of self-reported data from the 2000/01 Canadian Community Health Survey (CCHS), having an obese parent in the same household was strongly associated with youth obesity. Other similarities between adults and youth in the same household were evident. Physical activity levels, smoking status and eating habits among 12- to 19-year-old boys and girls were associated with those of a parent.

Over half (52%) of the reporting parents in this study were overweight or obese, which does not bode well for the health of their children who may face the risk of obesity, diabetes and cardiovascular disease.

Inferences about causation cannot be drawn from the cross-sectional data of the CCHS. However, the

results of this analysis do support the claim that parents may provide their children with examples of behaviours that may influence health and play a role in the development or prevention of childhood obesity. Parental overweight or obesity may be an early indicator of children at risk and may help identify certain family lifestyle factors that indicate intervention and prevention measures targeted to families. ■

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Appendix

Table A

Distribution of selected characteristics, household population aged 12 to 19 in households where both a youth and one of his/her parents were surveyed, Canada, 2000/01

	Girls			Boys			Girls			Boys		
	Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population		Sample size	Estimated population	
		'000	%		'000	%		'000	%		'000	%
Total	4,803	836	100	4,982	899	100						
Age												
12	660	102	12	705	114	13						
13	675	108	13	699	125	14						
14	656	111	13	644	122	14						
15	677	131	16	630	123	14						
16	651	130	16	660	121	13						
17	592	96	12	604	105	12						
18	498	89	11	550	99	11						
19	394	68	8	490	90	10						
Body mass index												
Under to normal weight	3,933	701	84	3,647	680	76						
Overweight	529	81	10	904	148	16						
Obese	162	26	3	326	52	6						
Missing	179	30	4	105	19	2						
Self-perceived weight												
Underweight	256	52	6	605	110	12						
Just about right	3,543	618	74	3,685	676	75						
Overweight	856	142	17	620	101	11						
Missing	148	24	3	72	12 ^{E1}	1 ^{E1}						
Leisure time												
Inactive	1,553	274	33	1,024	186	21						
Moderately active	1,101	197	24	977	182	20						
Active	1,623	269	32	2,235	385	43						
Missing	526	96	11	746	146	16						
Smoking status												
Daily/Occasional	695	120	14	748	128	14						
Former	725	119	14	741	125	14						
Never	3,367	595	71	3,458	641	71						
Missing	16	F	F	35	6 ^{E1}	1 ^{E1}						
Daily frequency of fruit/vegetable consumption												
Less than 5 times	2,704	458	55	3,067	537	60						
5-10 times	1,818	326	39	1,621	305	34						
More than 10 times	247	47	6	245	47	5						
Missing	34	5 ^{E1}	1 ^{E1}	49	10 ^{E1}	1 ^{E1}						
Responding parent's sex												
Male	2,222	372	44	2,373	416	46						
Female	2,581	464	56	2,609	483	54						
Responding parent's BMI												
Under to normal weight	2,101	397	48	2,190	421	47						
Overweight	1,689	277	33	1,754	310	34						
Obese	895	142	17	929	151	17						
Missing	118	20	2	109	18	2						
Responding parent's leisure time												
Inactive	2,555	459	55	2,605	480	53						
Moderately active	1,098	190	23	1,139	199	22						
Active	815	130	16	856	152	17						
Missing	335	57	7	382	68	8						
Responding parent's smoking status												
Daily	1,172	186	22	1,275	211	24						
Occasional	194	36	4	173	32	4						
Former	2,184	375	45	2,220	392	44						
Never smoked	1,244	237	28	1,308	263	29						
Missing	9	F	F	6	F	F						
Responding parent's daily frequency of fruit/vegetable consumption												
Less than 5 times	3,170	529	63	3,320	588	65						
5-10 times	1,474	276	33	1,490	278	31						
10+ times	136	28	3	137	28	3						
Missing	23	3 ^{E2}	0 ^{E2}	35	5 ^{E1}	1 ^{E1}						
Household income												
Lowest	106	23	3	113	27	3						
Lower-middle	317	60	7	310	57	6						
Middle	960	171	20	990	176	20						
Upper-middle	1,763	288	34	1,747	292	32						
Highest	1,370	245	29	1,526	298	33						
Missing	287	49	6	296	50	6						

Data source: 2000/01 Canadian Community Health Survey, cycle 1.1

Note: Because of rounding, detail may not add to 100%.

E1 Coefficient of variation between 16.6% and 25.0%

E2 Coefficient of variation between 25.1% and 33.3%

F Coefficient of variation greater than 33.3%