

## Article

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by Stefan Kuhle and Paul J. Veugelers

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## Abstract

### Background

In developed countries, there is a negative association between socioeconomic status (SES) and a variety of health outcomes, known as the social gradient in health. This is contrasted by a weak, absent or even positive gradient for overweight. The objective of this study was to investigate why overweight does not follow the social gradient.

### Data and methods

Data from adult respondents to the 2004 Canadian Community Health Survey (cycle 2.2) were used. A series of multivariate models regressing overweight and determinants of overweight on household education and household income were performed, stratified by gender.

### Results

Except for education among women, negative associations between SES measures and overweight emerged. Respondents from higher household income groups reported more meals away from home, compared with those from lower household income groups. In addition, adults in higher-education households were more likely than those in lower-education households to have quit smoking.

### Interpretation

Differences in food consumption patterns and smoking cessation between SES groups may have contributed to the lack of a clear negative association between household education and income and overweight in the CCHS.

## Keywords

body weight, dietary habits, education, income, nutrition, physical activity, smoking, socio-economic factors

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One of the paradigms of public health is that in developed countries, individuals of lower socio-economic status (SES) tend to have poorer health. Numerous studies have demonstrated a higher prevalence of risk factors for cardiovascular diseases<sup>1</sup> and type 2 diabetes,<sup>2</sup> a higher incidence of cardiovascular disease<sup>3</sup> and some cancers,<sup>4</sup> and higher all-cause,<sup>5</sup> cardiovascular<sup>6</sup> and cancer mortality<sup>7</sup> in lower SES groups. This phenomenon, commonly known as the "social gradient," may reflect the fact that lower SES is associated with barriers in access to quality health care; environmental exposures; and limitations in knowledge, time and opportunity for making healthy lifestyle choices.<sup>8</sup>

Findings are less consistent when the outcomes are overweight and obesity. A seminal review by Sobal and Stunkard in 1989 found that associations between SES and obesity in women followed the social gradient in the majority of studies, but for men, half of studies reported an absent (17%) or even reversed (30%) gradient.<sup>9</sup> Similar, albeit less striking, figures were reported in a 2007 update of the review.<sup>10</sup>

Survey data from a number of industrialized countries continue to show a negative association between SES and overweight/obesity for women and an inconsistent relationship for men.<sup>11-19</sup> Studies that compared national data longitudinally found that over the past decades, the prevalence of obesity has increased faster in the highest SES groups than in lower SES groups.<sup>11,19</sup> This coincided with the surge in the overall prevalence of obesity.<sup>11</sup>

Recent data from Canada show that the SES gradient for overweight/obesity is associated with gender.<sup>20,21</sup> Univariate analyses of Public Use Microdata from the 2004 Canadian Community Health Survey (CCHS) revealed no discernible association between household income and obesity among women, but a positive association among men. A negative association between education and obesity was observed for women, but not for men.

To date, there is only speculation about why the social gradient is less pronounced for overweight/obesity and why gender differences exist. Smoking cessation, alcohol intake and chronic illness have been suggested as potential confounders,<sup>9</sup> but no previous study has conducted an in-depth analysis of this counter-intuitive phenomenon.

The richness and high quality of the CCHS data offer an opportunity to examine a number of hypotheses about these unexpected findings. The objective of the present paper is to investigate associations that may underlie the blurred or positive gradient between SES and overweight, and also gender differences, by assessing the distribution of risk factors for overweight across SES groups. Being able to explain these findings may further understanding of the causes and consequences of the high levels of obesity in the Canadian population.

## Hypotheses

Four *a priori* hypotheses were formulated.

**Hypothesis I:** *Higher SES groups more frequently have meals prepared outside the home, have higher total calorie intake, and have lower fruit and vegetable consumption than do lower SES groups.*

Rationale: While higher SES groups have traditionally had a better-quality diet, changes in time available for meals and for food preparation over the last two decades<sup>22,23</sup> may have altered SES differences in diet quality. For example, owing to time constraints faced by dual-

earner families, members of higher-income households may eat meals prepared outside the home more often than do members of lower-income households. Such meals are typically high in fat and calories and low in fruits and vegetables.

**Hypothesis II:** *Higher SES groups are less physically active than lower SES groups.*

Rationale: Technological advances during recent decades, notably computerization, entertainment technology and automated transport, have reduced physical activity.<sup>22</sup> If these technologies are more affordable to and more readily adopted by higher SES groups, this would decrease their physical activity.

**Hypothesis III:** *Members of higher SES groups are more likely than those in lower SES groups to quit smoking.*

Rationale: Smoking cessation has been reported to increase the likelihood of becoming obese.<sup>24</sup> If smoking cessation campaigns have been more successful among higher SES groups, this may have increased the prevalence of overweight in these groups.

**Hypothesis IV:** *Neighbourhood factors confound the association between SES and overweight.*

Rationale: A number of studies have shown that area-level factors are important for the development of obesity.<sup>13,25,26</sup> The built environment facilitates physical activity that may be associated with obesity.<sup>27</sup> Recreational spaces and facilities, neighbourhood walkability and safety, healthy food choices, and peer role model behaviour adoption may be more common in wealthier neighbourhoods.

## Methods

### Data source

The current study used data from the 2004 Canadian Community Health Survey (CCHS), cycle 2.2. The CCHS is a nationally representative cross-

sectional survey assessing demographics, health, social environment, physical activity, nutrition (24-hour dietary recall), and anthropometric measures (height and weight). The survey excluded residents of the territories, Indian Reserves, Canadian Forces bases, institutions, and some remote areas.

The area frame of the Canadian Labour Force Survey, a multi-stage stratified cluster design, was used to select participating households. One respondent per household was chosen using probabilities of selection that vary by age and by sampling frame. A detailed description of the sampling strategy is available elsewhere.<sup>28</sup> Interviews were conducted from January 2004 through the entire calendar year. The overall response rate was 76.5%. A total of 35,107 individuals participated in the survey, 21,160 of whom were aged 18 or older. The current study uses data from 12,428/21,160 (59%) adult respondents for whom anthropometric measures were available. Information from participants with measured height and weight was obtained by face-to-face interviews.

## Definitions

### Socioeconomic factors

Household income, highest level of household education, average area-level household income, and age (range 18 to 101 years) were used as covariates, based on *a priori* assumptions about confounding.

*Household income* was considered as a four-level categorical covariate that accounts for the number of people in the household and total household income from all sources in the 12 months before the interview<sup>29</sup>: lowest (less than \$15,000 if one or two people; less than \$20,000 if three or four people; less than \$30,000 if five or more people); lower-middle (\$15,000 to \$29,999 if one or two people; \$20,000 to \$39,999 if three or four people; \$30,000 to \$59,999 if five or more people); upper-middle (\$30,000 to \$59,999 if one or

two people; \$40,000 to \$79,999 if three or four people; \$60,000 to \$79,999 if five or more people); highest (\$60,000 or more if one or two people; \$80,000 or more if three or more people).

*Household education* was used as a three-level categorical covariate representing the highest level of educational attainment in the household (secondary graduation or less; some postsecondary education or college diploma; university degree).

Statistics Canada 2001 Census Division (CD) areas were used as proxies for neighbourhoods. *Area-level household income* was used as a proxy for neighbourhood SES.

## Outcomes

Overweight, low fruit and vegetable intake, total daily energy intake, eating out, low physical activity and former smoker were assessed in separate regression models. Detailed information about the underlying survey variables is available elsewhere.<sup>29</sup>

### *Overweight*

Height and weight were directly measured using standardized procedures and calibrated instruments. Body mass index (BMI) was calculated as weight in kilograms/height in metres squared. Respondents were classified as normal weight (BMI less than 25 kg/m<sup>2</sup>) or overweight (BMI greater than or equal to 25 kg/m<sup>2</sup>).

### *Low fruit and vegetable intake*

Self-reported consumption of fruit/vegetables was assessed using an adapted version of the Behavioral Risk Factor Surveillance System<sup>30</sup> frequency of fruit and vegetable consumption module. Respondents were classified according to whether their reported intake of fruit/vegetables was less than five versus five or more times per day.

### *Total daily energy intake*

Total daily calorie intake (continuous) was determined as the sum of all energy intakes (in kilocalories) from food sources reported in the first 24-hour dietary recall component of the CCHS.

### *Eating out*

Based on data from the first 24-hour dietary recall, respondents were classified as those who had consumed at least one meal that had not been prepared at home and those who had not.

Because total energy intake and eating out are based on the first of two dietary recalls, the results represent nutrition habits only *on the day of the survey*.

### *Low physical activity*

Low physical activity was assessed as a binary variable based on the physical activity index,<sup>31</sup> which takes into account the frequency, duration and intensity of self-reported leisure-time physical activity. Respondents whose physical activity index was less than 1.5 kcal/kg/day were classified as having a low level of physical activity.<sup>29</sup>

### *Former smoker*

Based on self-reports, respondents were classified as current smokers, former smokers, or never smokers. To enable logistic regression analysis for this outcome, smoking status was dichotomized (former versus current smokers); never smokers were omitted from this model.

## Statistical analysis

Associations between the above outcomes and socio-economic factors were examined using linear (total daily calorie intake) or logistic regression (all other outcomes). To harmonize the interpretation of the linear and logistic regression models, linear regression coefficients were exponentiated to represent the relative risk (and 95% confidence interval) for a 1,000-calorie increase in total daily energy intake.<sup>32, 33</sup> Age (continuous variable), age-squared, household income and household education were considered simultaneously in the models. To adjust for the confounding effect of age, age was used as a continuous covariate with a quadratic term, thereby accounting for the peak in the prevalence of overweight around the sixth decade of life.

Household income from 2001 Census income data was standardized and divided into quartiles, and then linked to the CCHS data at the Census Division (CD) level. The influence of neighbourhood income on the odds of being overweight was examined using multilevel regression methods. Respondents (individual level, n=12,428) were nested within CD areas (area level, n=274); average household income quartiles were used as an area-level covariate. To assess between-neighbourhood variation, the intraclass correlation coefficient (ICC) was calculated using the latent variable approximation.<sup>34</sup>

Because associations between SES and the outcomes were expected to differ between men and women,<sup>20, 21</sup> all analyses were stratified by gender. Information about household income and household education was missing for 9% and 2% of adult respondents, respectively. Missing values were considered as separate covariate categories, but the results are not presented.

Estimates were obtained using sampling weights provided by Statistics Canada to account for design effect and non-response bias. Standard errors were estimated using a bootstrapping procedure.<sup>35,36</sup> However, bootstrap weights could not be applied to the multilevel models; standard errors for these models are, therefore, likely biased, and results must be interpreted with caution. Stata Version 9 (Stata Corp, College Station, TX, USA) was used to perform the statistical analyses.

## Results

The descriptive statistics for CCHS respondents aged 18 or older whose height and weight were directly measured are shown in Table 1. The coefficients of variation for the prevalence estimates in Table 1 were all below the 16% cut-off (indicating acceptable sampling variability) recommended by Statistics Canada.<sup>28</sup>

In 2004, 53% of women and 65% of men were overweight. The majority of adults (68%) consumed fruit and vegetables fewer than five times a day and were physically inactive (58%).

Among women, in both the unadjusted and adjusted analyses, a strong inverse association was evident between household education and overweight, but not between household income and overweight (Table 2).

Among men, in both the unadjusted and adjusted analyses, a positive association emerged between overweight and household income, but no gradient could be discerned in the relationship between household education and overweight (Table 2).

### Hypothesis I (eating habits)

The social gradient persisted for fruit and vegetable consumption, with the frequency of consumption tending to rise with household education and income for both sexes, although it was not statistically significant among men (Table 3). By contrast, for calorie consumption, no clear gradient for either SES measure was apparent, except that women in the highest household education category had significantly higher intake. However, adults from higher-income households were significantly more likely than those in lower-income households to report having had a meal on the recall day that had not been prepared at home.

### Hypothesis II (physical activity)

For physical activity, the social gradient was present for household education among women, and for household income among men, with lower SES groups being more likely to report a low level of activity (Table 3).

### Hypothesis III (smoking)

For women, the odds of being a former rather than current smoker were significantly greater for those in higher education and higher income households (Table 3). By contrast, smoking cessation was generally not significantly associated with household education or income among men.

### Hypothesis IV (neighbourhood)

Adjusting the overweight model for average area-level household income did not change the associations between household education and income and overweight for either sex (Table 2). The variance attributable to between-neighbourhood variations in household income was 5% in women and 8% in men.

**Table 1**  
Selected characteristics of adults with measured height and weight in 2004  
Canadian Community Health Survey, cycle 2.2

	Total (n=12,428)	Women (n=7,176)	Men (n=5,252)
Mean total energy intake (kilocalories per day)	2,145	1,829	2,468
Overweight	59	53	65
Obese	23	23	23
Low fruit/vegetable intake (consumption less than 5 times per day)	68	63	74
Eating out (at least one meal per day prepared outside the home)	53	51	55
Low physical activity (less than 1.5 kilocalories/kilogram/day)	58	60	55
Smoking status			
Current smoker	25	23	28
Former smoker	27	24	31
Never smoker	47	53	41
Age			
18 to 24	13	12	14
25 to 34	16	16	16
35 to 44	21	21	22
45 to 54	20	20	20
55 to 64	14	14	14
65 or older	16	17	14
Education			
Secondary graduation or less	21	21	20
Some postsecondary or college diploma	44	44	45
University degree	33	33	33
Household income			
Lowest	9	10	7
Lower-middle	19	21	18
Upper-middle	33	32	35
Highest	30	28	33

Source: 2004 Canadian Community Health Survey: Nutrition.

## Discussion

The results of the current study are in keeping with recent international data, which have found a negative association between SES and overweight/obesity for women and an inconsistent relationship for men.<sup>11,12,14-19</sup> The analyses presented here expand on previous findings by using directly measured (as opposed to self-reported) height and weight, thereby eliminating reporting bias, and by providing an in-depth look at associations underlying the narrowed or reversed social gradients for overweight.

We had hypothesized that greater calorie consumption in higher SES groups could potentially explain the narrowed or reversed social gradients for overweight. However, except for a positive association with education



**Table 2**  
**Adjusted and unadjusted odds ratios relating socio-economic factors to overweight, by sex, household population aged 18 or older, Canada excluding territories, 2004**

	Women									Men								
	Univariate			Multivariate <sup>†</sup>			Multilevel multivariate <sup>‡</sup>			Univariate			Multivariate <sup>†</sup>			Multilevel multivariate <sup>‡</sup>		
	Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval	
		from	to		from	to		from	to		from	to		from	to		from	to
<b>Education</b>																		
Low	2.17*	1.69	2.77	1.89*	1.42	2.51	1.76*	1.40	2.21	1.18	0.88	1.58	1.25	0.90	1.74	0.95	0.68	1.34
Middle	1.78*	1.41	2.26	1.81*	1.42	2.32	1.84*	1.45	2.33	0.88	0.67	1.16	0.94	0.70	1.26	0.78	0.60	1.01
Highest <sup>§</sup>	1.00	...	...	1.00	...	...	1.00	...	..	1.00	...	..	1.00	...	...	1.00	...	...
<b>Household income</b>																		
Lowest	1.07	0.76	1.51	0.89	0.61	1.30	0.99	0.72	1.36	0.54*	0.33	0.91	0.51*	0.28	0.90	0.58*	0.42	0.80
Lower-middle	1.39*	1.05	1.84	1.10	0.81	1.50	1.18	0.89	1.57	0.66*	0.47	0.94	0.63*	0.43	0.92	0.62*	0.41	0.93
Upper-middle	1.10	0.86	1.40	0.94	0.73	1.22	0.92	0.72	1.16	0.69*	0.51	0.93	0.72*	0.52	0.99	0.80	0.58	1.11
Highest <sup>§</sup>	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
<b>Area-level household income</b>																		
Lowest <sup>§</sup>	1.00	...	...	...	...	...	1.00	...	...	1.00	...	...	...	...	...	1.00	...	...
Lower-middle	0.65*	0.61	0.69	...	...	...	1.48*	1.24	1.78	0.83*	0.75	0.91	...	...	...	0.86*	0.76	0.98
Upper-middle	0.52*	0.49	0.57	...	...	...	0.65*	0.55	0.78	1.05	0.95	1.16	...	...	...	1.04	0.93	1.16
Highest	0.62*	0.59	0.66	...	...	...	0.87	0.73	1.03	0.73*	0.66	0.80	...	...	...	0.74*	0.65	0.84

<sup>†</sup> adjusted for household education, household income, age and age squared  
<sup>‡</sup> adjusted for average area-level household income, household education, household income, age and age squared  
<sup>§</sup> reference category  
\* significantly different from estimate for reference category (p < 0.05)  
... not applicable

Source: 2004 Canadian Community Health Survey: Nutrition.

among women, no clear gradient in the associations between SES and total energy intake emerged. Moreover, the association of both household education and household income with fruit and vegetable consumption followed the traditional gradient, with lower SES groups being less likely to consume fruit and vegetables.

There was a strong positive association between household income and eating out, which has gained attention as a potential contributor to the rising prevalence of obesity. In recent decades, food establishments, in particular fast-food outlets, have seen unprecedented growth, catering to the demand for time-saving food preparation.<sup>37</sup> For example, from 1990 to 2006, restaurant revenues in Canada more than doubled, rising from \$16.5 billion to \$34.4 billion.<sup>38</sup> People who often eat out tend to consume more calories<sup>39,40</sup> and to have a higher BMI<sup>41</sup> than do those who usually eat home-prepared meals. Thus, greater frequency

of eating out among higher income groups may be associated with the inverse gradient between household income and overweight among men, but it does not explain the gender differences. As well, this contrasts with the lack of a social gradient for total energy intake. However it is possible that estimates of energy intake for meals eaten out are subject to error because respondents lack detailed knowledge about the food they consumed.

We had further hypothesized that higher SES groups had lower levels of leisure-time physical activity than did lower SES groups, possibly because they can more readily afford computers and entertainment technology, which foster sedentary behaviour. Nonetheless, higher SES groups actually tended to be more physically active during their leisure time. It may be that their greater leisure-time physical activity is counterbalanced by sedentary activity in the workplace.<sup>42,43</sup> He *et al.* reported

that lower leisure-time physical activity rates among lower education groups were offset by more strenuous activity at work, resulting in an overall similar total energy expenditure across education groups.<sup>44</sup>

A number of studies have reported associations between smoking cessation and weight gain.<sup>24,45-47</sup> We had hypothesized that members of higher SES groups are more likely than those in lower SES groups to quit smoking, and that this could be associated with a higher prevalence of overweight (Hypothesis III). And indeed, the analyses showed a strong positive association between SES and smoking cessation. Thus, smoking cessation may, in part, account for the lack of a clear gradient for SES and overweight. Although some studies did not observe gender differences in weight gain after smoking cessation,<sup>24,45,48</sup> two reported greater gains among men than among women.<sup>49,50</sup> This could explain the

**Table 3****Adjusted odds ratios and risk ratios relating socio-economic factors to determinants of overweight, by sex, household population aged 18 or older, Canada excluding territories, 2004**

	Low fruit/vegetable intake (less than 5 times per day)			Total daily energy intake			Eating out (at least one meal prepared outside the home)			Low physical activity (less than 1.5 kilocalories/kilogram/day)			Smoking cessation		
	Odds ratio	95% confidence interval		Risk ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval	
		from	to		from	to		from	to		from	to		from	to
<b>Women</b>															
<b>Household education</b>															
Low	1.74*	1.26	2.40	0.81*	0.73	0.90	0.99	0.75	1.30	1.71*	1.27	2.32	0.33*	0.20	0.54
Middle	1.29*	1.00	1.68	0.90*	0.82	0.99	1.08	0.83	1.39	1.34*	1.04	1.72	0.53*	0.34	0.81
High <sup>†</sup>	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
<b>Household income</b>															
Lowest	1.60*	1.01	2.53	0.97	0.87	1.07	0.52*	0.36	0.75	1.26	0.85	1.86	0.48*	0.29	0.78
Lower-middle	1.56*	1.07	2.26	0.99	0.89	1.10	0.64*	0.47	0.87	1.51*	1.10	2.08	0.60*	0.37	0.98
Upper-middle	1.14	0.84	1.53	1.02	0.93	1.13	0.75*	0.58	0.97	1.04	0.80	1.35	0.79	0.51	1.24
Highest <sup>†</sup>	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
<b>Men</b>															
<b>Household education</b>															
Low	1.45	0.98	2.15	1.14	0.95	1.38	0.83	0.60	1.15	1.21	0.87	1.67	0.47*	0.29	0.78
Middle	1.21	0.89	1.65	1.23*	1.08	1.42	0.89	0.67	1.18	1.01	0.77	1.33	0.69	0.45	1.07
High <sup>†</sup>	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
<b>Household income</b>															
Lowest	1.84*	1.05	3.22	0.87	0.67	1.12	0.49*	0.31	0.78	2.31*	1.43	3.71	0.55	0.27	1.11
Lower-middle	1.16	0.76	1.79	0.84*	0.70	0.99	0.52*	0.37	0.73	1.94*	1.37	2.74	0.58*	0.36	0.94
Upper-middle	1.43*	1.04	1.96	0.95	0.83	1.10	0.69*	0.51	0.92	1.64*	1.25	2.48	0.89	0.62	1.27
Highest <sup>†</sup>	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...

<sup>†</sup>reference category\* significantly different from estimate for reference category ( $p < 0.05$ )**Note:** Models are adjusted for household education, household income, age and age squared. Results for Total daily energy intake represent the risk of a 1,000-calorie higher energy intake, compared with reference category.**Source:** 2004 Canadian Community Health Survey: Nutrition.

gender differences in the association between SES and overweight.

In the past decade, neighbourhood characteristics have received attention as determinants of an individual's body weight.<sup>13,25,26</sup> We hypothesized that neighbourhood SES confounds the association between SES and overweight (Hypothesis IV). Our multilevel analyses, however, do not support this hypothesis. The low percentage of variance attributable to neighbourhood factors may be because Statistics Canada's Census Divisions are not "functional" neighbourhoods, given that their average size is about 110,000 people. Yet even based on smaller clusters (Census Subdivisions, average size ~ 5,500), the variance explained by area-level factors did not change

substantially. It is possible that area-level income is not the optimal measure of neighbourhood factors that are relevant for health-related behaviours.

The cross-sectional design of the study makes it difficult to determine if the blurred/reversed gradient represents a new phenomenon or if it has always been present. As early as the 1960s through the 1980s, survey data reported gender differences in the association between SES and overweight/obesity.<sup>51-54</sup> Longitudinal data from large representative surveys such as the NHANES in the US show marked changes in the association between SES and obesity coinciding with the increase in the prevalence of obesity during the period just before NHANES III (1988 to 1994).<sup>11,19</sup>

Similarly, Canadian data from the Heart Health Surveys (1986 through 1992)<sup>55</sup> found a negative association between income and obesity for both sexes. The greatest increase in obesity prevalence since the late 1980s was among men in higher income groups; the prevalence of obesity in the lowest income group was virtually unchanged. Shifts in the association between SES measures and overweight/obesity are now consistently seen in other developed countries as well.<sup>12-18</sup> Differing gender role expectations may, in part, be responsible for paradoxical associations. While male overweight/obesity is considered acceptable, excess body weight in females is more socially undesirable.<sup>56</sup>

### **What is already known on this subject?**

- Individuals of lower socio-economic status (SES) tend to have poorer health, a phenomenon commonly referred to as the social gradient of health.
- Associations between SES and overweight/obesity are less consistent and show gender differences.
- The lifestyle factors related to SES that may underlie this observation have not been investigated.

### **What does this study add?**

- Differences between SES groups in food consumption patterns and smoking cessation may be associated with the lack of a strong negative association between SES measures and overweight.

### **Limitations**

Socio-economic status is a complex construct that is determined by income, education, occupation, family background, and place of residence. In practice, SES is measured with indicators such as income, educational attainment, occupational status, or composite indices. Any social gradient may be influenced by the indicator used, and none may capture the full meaning of the construct.

The two SES indicators in the current study—household education and household income—have shortcomings. Because both were measured at the household rather than the individual level, it was not possible to determine if these indicators differed for men and women in a given household.

Income commonly has more missing values than education and is less constant over time. Another challenge in the use of income as a proxy for SES is that the association between income and overweight may operate in the reverse direction; that is, obesity may reduce labour market success. Finally, the dollar values assigned to the higher household income categories in the CCHS may not represent monetary wealth in some locations, thereby potentially misclassifying respondents' SES. On the other hand, a disadvantage

of education as an indicator of SES is that some groups like immigrants or visible minorities may be underpaid relative to their educational background.

The self-reported measures used in this analysis, notably, total calorie intake and the frequency of fruit and vegetable consumption, have inherent limitations, and these results should be interpreted with caution.

### **Conclusion**

The strength of the current study is that BMI is based on physical measures, as opposed to the self-reported anthropometric data in other studies. Also, the broad scope of the CCHS enabled an in-depth analysis of associations between household education and income and various lifestyle determinants of overweight. However, the study is limited by its cross-sectional design and the self-reported nature of the data.

The results of the current study confirm research from other developed countries showing that the social gradient for overweight is reduced or, in the case of income in men, even reversed. The current study found some evidence that differences in food consumption patterns and smoking cessation between SES groups may have contributed to this finding. ■

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