The Relationship Between Income and Weight Control Strategies Among Canadian Adults

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ABSTRACT

Objective: The goal of this study was to examine use of weight control strategies in Canadian adults and the role of income as a barrier to using these strategies.

Methods: Data from the Canadian Community Health Survey cycle 4.1 on health behaviour change was used for this study. Analysis was restricted to adults (18+ years) residing in the 10 provinces of Canada. Respondents were categorized as having used weight control strategies in their lifestyle if they responded that they increased exercise, improved/modified their eating habits, or lost weight in the previous 12 months, as the primary means of health improvement. An adjusted household income ratio divided into deciles was used as a measure of income. Multivariable logistic regression was used to examine the relationship between income and weight control strategies adjusting for known confounders.

Results: Of the 103,990 respondents analyzed, 60% were overweight or obese and 45% reported using weight control strategies in the previous 12 months. Age, sex, ethnicity, having a regular doctor, education, and income were all significantly associated with using weight control strategies in the multivariable model. Results that included all two- and three-way interactions between sex, weight category, and income found that lower income was significantly associated with using fewer weight control strategies – more so for obese men and normal weight women.

Conclusion: Efforts must be made to create equal access to services and food products that promote weight reduction or control strategies given the rising prevalence of adult obesity in Canada.

Key words: Income; weight control; barrier; Canada; adults; survey

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2012;103(6):e438-e442.

Globally, there has been a rise in the prevalence of obesity since the early 1980s.^{1,2} In Canada, the percentage of obese adults increased from 14% in 1979 to 23% in 2004.³ There is evidence that this trend may be due to an increase in sedentary behaviour and calorie intake and a decline in physical activity.^{4,5}

Research has shown that intentional weight loss or weight maintenance through lifestyle changes, such as increasing level of physical activity and reducing calorie intake, can significantly reduce the risk of diabetes and cardiovascular disease.^{6,7} Although the benefits of making these lifestyle modifications are widely recognized, sustained behaviour change among individuals is still difficult to achieve.^{8,9} The majority of people may undertake such efforts on their own, through the commercial weight loss/fitness industry and sometimes through the health care system.^{10,11} However, there are subpopulations who face certain barriers to improving their health.^{12,13}

Low socio-economic status (SES) has been identified as a potential barrier to weight reduction.¹⁴ A review of longitudinal studies describing the relationship between SES and weight change found evidence that individuals of low SES are at higher risk of weight gain.¹⁵ Possible pathways by which low SES could lead to increased weight gain may include: 1) neighbourhood factors such as density of fast-food restaurants and recreational facilities or safety concerns which can impact opportunities for physical activity; and 2) income factors such as equipment or membership costs for phys-

ical activities or higher costs of healthy food.^{14,16,17} However, few studies have reported on the relationship between income and use of weight control strategies. Several cross-sectional population-based studies described factors related to weight loss attempts; however, income was not examined as a determinant.^{10,18,19} In contrast, qualitative studies of low-income adults with issues of overweight or obesity found that the costs associated with exercising (e.g., cost of exercise equipment and gym memberships) and eating healthy foods were barriers to using them as weight control strategies.^{20,21}

Using a national population survey, this study describes the extent to which Canadian adults have used weight control strategies in the previous year and explores the relationship between use of weight control strategies and income. Given the upward trend in the prevalence of obesity, this study attempts to understand the role of income as a barrier to improving health behaviours related to obesity.

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Acknowledgements: The authors thank Mieke Koehoorn for her edits of a previous draft and the reviewers for their helpful comments.

Conflict of Interest: None to declare.

METHODS

Sample

Data from the Canadian Community Health Survey (CCHS) cycle 4.1 were used for this study. The CCHS is a nationally representative survey of the Canadian population.²² The survey sampled individuals aged 12 and over, living in private dwellings, from all health regions in Canada and excluded those living on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Forces, and residents of certain remote regions.²² Responses were collected from January 2007 to December 2008.²²

The study analysis was restricted to adults (18+ years) who provided a valid response to the outcome measure. The following were excluded from the analysis: pregnant women, as their Body Mass Index (BMI) is transiently influenced; adults who require help moving about inside their home given their inability to be physically active; and data from the three Territories, as Statistics Canada does not report income decile for the Territories (our main independent variable).

Measures

The outcome variable, weight control strategies, was derived from two CCHS questions: 1) "In the past 12 months, did you do anything to improve your health?" and 2) "What is the single most important change you have made?" Those who responded "yes" to the first question and selected either "increased physical activity," "changed diet/improved eating habits," or "lost weight" to the second question were categorized as having incorporated weight control strategies. We assumed that those who chose "lost weight" made an adjustment to their lifestyle which could have resulted in weight control or weight loss. Those who answered "no" to the first question or provided an alternative response to the second question were categorized as not using weight control strategies.

The income decile variable created by Statistics Canada was used as a relative measure of household income. Statistics Canada derived this variable by first dividing each respondent's household income by the low-income cutoff corresponding to the respondent's household and community size, resulting in an adjusted household income ratio.²³ Then, each ratio was divided by the highest ratio for all survey respondents.²³ Finally, deciles of the adjusted household income ratio were created for each province and the corresponding deciles were combined for the nation (each decile contains approximately the same percentage of residents for each province).²³ Because 12.5% of respondents failed to report their household income, a "missing" category was included in the analysis.

A number of confounders found to be associated with both income and weight control strategies in previous studies¹⁵⁻¹⁷ were included as covariates in the analysis. These were age (18-24, 25-34, 35-44, 45-54, 55-64, 65+), sex, ethnicity (white, visible minority), education (< secondary school, secondary school graduation, some post-secondary, post-secondary degree/diploma), marital status (married/common-law, widowed/separated/divorced, single), having a regular medical doctor (yes, no), and BMI (<25, 25-30, 30+; referred to as normal, overweight, and obese, respectively²⁴). BMI was calculated from self-reported height and weight ($[\text{weight (kg)}]/[\text{height (m)}]^2$). To account for the known bias associated with self-reported BMI, the estimates were adjusted using the published

Table 1. Sample Characteristics of Adults (N=103,990) by Weight Control Strategies Used in the Previous 12 Months, Canadian Community Health Survey Cycle 4.1

	Sample	Used Weight Control Strategies (%)*
Weight category		
Normal	38,532	41.9
Overweight	37,981	46.8
Obese	27,477	47.2
Age group (years)		
18-24	8,694	55.7
25-34	15,093	49.1
35-44	17,106	46.0
45-54	18,184	44.3
55-64	19,527	44.6
65+	25,386	31.6
Sex		
Male	47,525	42.0
Female	56,465	47.8
Ethnicity		
White	92,225	44.2
Visible minority	11,765	47.8
Marital status		
Married or common-law	59,045	44.2
Widowed/separated/divorced	22,444	38.3
Single, never married	22,501	50.5
Has a regular medical doctor		
Yes	89,596	45.3
No	14,394	42.7
Chronic condition		
Yes	35,908	41.9
No	68,082	46.0
Education		
Less than secondary	20,869	34.6
Secondary graduate	17,474	43.2
Some post-secondary	8,003	48.3
Post-secondary graduate	57,644	47.5
Household income		
Decile 1	9,036	40.4
Decile 2	10,138	40.7
Decile 3	9,168	41.5
Decile 4	8,975	44.4
Decile 5	8,778	45.0
Decile 6	8,883	46.5
Decile 7	8,694	46.9
Decile 8	8,760	49.1
Decile 9	8,974	48.4
Decile 10	9,586	48.4
Missing	12,998	42.4

* Percentages are weighted to reflect the Canadian population.

correction factor which was based on previous CCHS data.²⁵ A chronic condition variable (yes/no) was created to identify individuals with conditions that may affect use of weight control strategies and was included as a covariate in the analysis. Chronic conditions included chronic obstructive pulmonary disorder, diabetes, heart disease, stroke, arthritis, ulcers, and bowel disorders.

Analysis

All analyses were conducted using SAS 9.1 (SAS Institute, Cary, NC). To account for the complex sampling design of the CCHS, probability sampling weights were applied prior to analysis to produce representative estimates. Univariable logistic regression was used to examine bivariable relationships. Multivariable logistic regression was used to examine the relationship between income and weight control strategies controlling for known confounders. A p-value of <0.05 was considered significant. As the study by Bish et al. found differences in weight loss attempts by sex and BMI,¹⁸ we included interaction effects of all two- and three-way interactions between sex, weight category and income in our analysis. Interactions that were significant based on Type 3 analysis of effects remained in the final model.

Table 2. Unadjusted and Adjusted Odds Ratios (OR) and 95% Confidence Intervals of Factors Related to Using Weight Control Strategies in the Previous 12 Months*

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Weight category		
Normal	1.00	1.00
Overweight	1.22 (1.19-1.26)	1.44 (1.39-1.48)
Obese	1.24 (1.20-1.28)	1.47 (1.42-1.52)
Age group (years)		
18-24	1.00	1.00
25-34	0.77 (0.73-0.80)	0.69 (0.65-0.72)
35-44	0.68 (0.65-0.71)	0.59 (0.56-0.62)
45-54	0.63 (0.61-0.66)	0.55 (0.52-0.58)
55-64	0.64 (0.61-0.67)	0.55 (0.52-0.59)
65+	0.37 (0.35-0.39)	0.36 (0.33-0.38)
Sex		
Male	1.00	1.00
Female	1.26 (1.23-1.30)	1.39 (1.36-1.43)
Ethnicity		
White	1.00	1.00
Visible minority	1.16 (1.12-1.19)	1.16 (1.12-1.20)
Marital status		
Married or common-law	1.00	1.00
Widowed/separated/divorced	0.78 (0.75-0.81)	0.93 (0.90-0.97)
Single, never married	1.29 (1.25-1.33)	1.09 (1.05-1.13)
Has a regular medical doctor		
Yes	1.00	1.00
No	0.90 (0.87-0.93)	0.84 (0.81-0.87)
Chronic condition		
Yes	0.85 (0.82-0.87)	1.06 (1.03-1.09)
No	1.00	1.00
Education		
Less than secondary	0.59 (0.57-0.61)	0.70 (0.67-0.73)
Secondary graduate	0.84 (0.81-0.87)	0.82 (0.79-0.85)
Some post-secondary	1.03 (0.99-1.08)	0.91 (0.87-0.96)
Post-secondary graduate	1.00	1.00
Household income		
Decile 1	0.72 (0.68-0.77)	0.75 (0.70-0.79)
Decile 2	0.73 (0.69-0.78)	0.82 (0.77-0.87)
Decile 3	0.76 (0.71-0.80)	0.81 (0.77-0.87)
Decile 4	0.85 (0.80-0.90)	0.89 (0.84-0.95)
Decile 5	0.87 (0.82-0.92)	0.89 (0.84-0.94)
Decile 6	0.93 (0.88-0.98)	0.93 (0.88-0.99)
Decile 7	0.94 (0.89-1.00)	0.94 (0.88-0.99)
Decile 8	1.03 (0.97-1.09)	1.02 (0.96-1.08)
Decile 9	1.00 (0.95-1.06)	0.98 (0.93-1.04)
Decile 10	1.00	1.00
Missing	0.78 (0.74-0.83)	0.80 (0.76-0.85)

* Each covariate was modelled separately with weight control strategies for unadjusted results. All covariates were entered into the model for adjusted results. Nagelkerke R-square for the multivariate model was 0.05.

RESULTS

A total of 112,799 adults were eligible for inclusion in the analysis. The study analyzed the 103,990 (92%) who had valid responses for all variables under study. Of the 8,809 respondents excluded due to missing data, 47% also had missing income information. Excluded respondents were significantly less likely to report using weight control strategies and to be educated but were more likely to be younger, female, of lower income, of a visible minority, to have a regular doctor, and to be widowed/separated/divorced.

Approximately 60% of the adult respondents were overweight or obese (BMI ≥ 25) and 45% reported using weight control strategies in the previous 12 months (Table 1). Among those who reported using weight control strategies, 64.5% reported they exercised more, 21.5% reported they modified/improved their diet, and 14% reported they lost weight. Use of weight control strategies was less common in the lowest income categories (40-41% in the lowest three categories) compared to the highest income categories (48-49% in the highest three categories).

Table 3. Adjusted Odds Ratios and 95% Confidence Intervals of Income Decile Related to Using Weight Control Strategies From a Three-way Interaction Between Income Decile, Sex, and Weight Category*

	Male	Female
Normal		
Decile 1	0.98 (0.85-1.14)	0.58 (0.51-0.65)
Decile 2	0.94 (0.81-1.10)	0.65 (0.57-0.74)
Decile 3	0.84 (0.72-0.97)	0.72 (0.64-0.81)
Decile 4	1.02 (0.88-1.18)	0.78 (0.69-0.88)
Decile 5	1.02 (0.88-1.18)	0.77 (0.68-0.87)
Decile 6	0.91 (0.78-1.05)	0.92 (0.81-1.04)
Decile 7	0.91 (0.78-1.05)	0.85 (0.75-0.96)
Decile 8	1.09 (0.94-1.25)	0.86 (0.76-0.98)
Decile 9	0.92 (0.79-1.06)	0.92 (0.81-1.04)
Decile 10	1.00	1.00
Missing	0.81 (0.70-0.93)	0.70 (0.63-0.78)
Overweight		
Decile 1	0.82 (0.71-0.94)	0.86 (0.73-1.00)
Decile 2	0.95 (0.83-1.08)	0.85 (0.72-0.99)
Decile 3	0.76 (0.67-0.86)	1.05 (0.90-1.23)
Decile 4	0.91 (0.81-1.03)	0.90 (0.77-1.05)
Decile 5	0.92 (0.81-1.03)	0.99 (0.84-1.15)
Decile 6	0.95 (0.85-1.07)	0.97 (0.83-1.13)
Decile 7	0.98 (0.88-1.10)	1.16 (0.99-1.35)
Decile 8	1.05 (0.94-1.18)	1.12 (0.96-1.32)
Decile 9	0.93 (0.83-1.04)	1.22 (1.04-1.43)
Decile 10	1.00	1.00
Missing	0.92 (0.82-1.04)	0.83 (0.72-0.95)
Obese		
Decile 1	0.64 (0.53-0.77)	0.68 (0.56-0.82)
Decile 2	0.85 (0.71-1.01)	0.79 (0.65-0.95)
Decile 3	0.72 (0.61-0.86)	0.84 (0.69-1.02)
Decile 4	0.88 (0.74-1.04)	0.89 (0.73-1.08)
Decile 5	0.71 (0.61-0.83)	0.97 (0.79-1.18)
Decile 6	0.88 (0.76-1.04)	0.95 (0.78-1.16)
Decile 7	0.85 (0.73-0.99)	0.88 (0.72-1.08)
Decile 8	0.96 (0.83-1.11)	1.13 (0.92-1.40)
Decile 9	0.99 (0.85-1.15)	1.05 (0.85-1.30)
Decile 10	1.00	1.00
Missing	0.86 (0.74-1.01)	0.71 (0.59-0.86)

* Adjusted for age group, ethnicity, marital status, having a regular doctor, having a chronic condition, education, and all two- and three-way interactions between sex, weight category, and income decile. Nagelkerke R-square = 0.052.

Results from the bivariable analysis found that all covariates were significantly associated with using weight control strategies (Table 2). Many of the bivariable associations were maintained in the multivariable logistic regression (Table 2), with the exception of having a chronic condition, which went from decreased odds to increased odds of using weight control strategies.

In the multivariate analysis, the relationship between income and weight control strategies revealed a trend toward lower odds of using weight control strategies with low income: decile 1 had 25% lower odds of using weight control strategies, deciles 2 and 3 had about 18% lower odds, and deciles 4 to 7 had 6-11% lower odds.

Testing for interactions found that sex and weight category both moderated the effect of income on use of weight control strategies. A three-way interaction was introduced into the model by including all two- and three-way interaction terms between income, weight category and sex. All interaction terms were significant in Type 3 analysis ($p < 0.01$) except for the interaction between sex and weight category ($p = 0.19$). Results for the model with the two- and three-way interactions are found in Table 3. For males, income decile three in the normal weight category, one and three in the overweight category, and one, three, five, and seven in the obese category had significantly lower odds of incorporating weight control strategies in the previous 12 months compared to those in the highest income level. For females, the lowest five income deciles in the normal weight category had significantly reduced odds of

using weight control strategies while only the lowest two income deciles among overweight and obese women had significantly reduced odds compared to the highest income decile.

DISCUSSION

This study found that 45% of adults had actively used weight control strategies in the previous 12 months. This is higher than previously reported: 33% of Canadian adults reported trying to lose weight between 1986 and 1992.²⁶ As previously reported, women and adults with higher BMI reported using more weight control strategies in the previous 12 months than men and adults with lower BMI.²⁶

The association between income and weight control strategies was moderated by sex and weight category. More lower income deciles among obese men and normal weight women had reduced odds of using weight control strategies than other weight categories of the same genders. Although previous literature has shown sex and BMI category differences in using weight control strategies,¹⁸ no study has shown these differences in relation to income. The study by Green et al. found that the main reason normal weight women attempted to lose weight was to become more attractive, whereas the main reason overweight and obese women attempted to lose weight was to improve their health.²⁶ The difference in reasoning may explain why income for women in the normal weight category is more of a barrier to using weight control strategies than for overweight and obese women. Improving health could be a more serious issue for women, as women would be more inclined to use weight control strategies despite their income level. The same explanation cannot be given for men as men have attempted to lose weight to improve their health regardless of their BMI.²⁶ More research is needed to explore reasons why income was more of a barrier to use weight control strategies among certain subpopulations.

Although there are differences in the association of income level and weight control strategies by sex and weight category, at least one low income group in each comparison had significantly reduced odds of using weight control strategies compared to the highest income group. This study could not determine whether income acted as a barrier for these individuals or if some other factor related to income affected their decision to use these strategies; however, the existence of inequality in using weight control strategies should be a concern for public health professionals. This is particularly relevant if the aim is to help adults reduce their weight or maintain their weight, given the recognition that health benefits are achieved by maintaining an active lifestyle and healthy diet regardless of weight status.²⁷

In accordance with previous studies, this research found that the following characteristics were all associated with higher odds of using weight control strategies: younger adult; visible minority; having a regular doctor; having higher education; being single.^{10,18,19} Although there are ethnic disparities in weight control strategies by SES,²⁸ we were limited in our ability to identify ethnic differences in this study due to Statistics Canada's broad visible minority variable. Perhaps most troubling is the finding that adults over the age of 45 were almost two times less likely to use weight control strategies than those 18-24 years of age, despite being at higher risk for many chronic diseases. In a post-hoc analysis, we found no significant interaction between age, weight category, and chronic conditions, indicating that the association between age and weight

control strategies exists regardless of BMI or presence of chronic condition. Efforts need to be made to promote healthier lifestyle choices (e.g., increasing physical activity, improving diet) among the older population.

The results must be interpreted with caution due to the limitations of this study. First, when respondents were asked about use of health improvement strategies, they were only allowed to select one strategy from a list; however, they could have used a weight control strategy not listed. Also, this study assumed that those who selected "lost weight in the past 12 months" used at least one lifestyle modification strategy (e.g., change in physical activity and/or eating behaviours); however, it is possible that non-behavioural strategies were employed (e.g., medication, surgery). The selection of "changed diet/improved eating habits" was also assumed to have meant healthier dietary habits, but we do not know the extent to which the diet selected was healthy. Second, our findings were compared to studies that reported weight loss attempts although our study focused on weight control, which may include adults who have used the strategies to maintain their weight as well as those who would have used them to lose weight. Given these differences, our comparisons should be cautiously interpreted. Third, all responses were self-reported and there may be biases in the way people self-report their weight, income, or health behaviour. Fourth, the respondents included in the analysis were found to be different than the ones excluded due to missing data, which is important to consider as it can limit the generalizability of our findings to the Canadian population. Fifth, the multivariable models used in the study accounted for a small percentage of the variation of weight control strategies used by the respondents, suggesting that other unknown factors not examined may play a larger role in predicting the likelihood of using these strategies. Sixth, the use of BMI as an anthropometric measure has been criticized,²⁹ especially in light of new measures such as the Edmonton Obesity Staging System;³⁰ however, self-reported BMI remains the most practical and a valid measure of body fatness for large epidemiological studies.²⁵ Finally, this was a cross-sectional study; therefore, we were not able to assess direction of causality nor were we able to assess whether the use of weight control strategies changed weight status.

Despite these limitations, this is the first study in over 15 years to report national population estimates of use of weight control strategies among Canadian adults. This study found evidence that the lowest income groups were associated with reduced odds of using weight control strategies. This association was present for more income deciles of normal weight women and obese men than any other combination of weight category and sex. More research is needed to understand the decisions behind using weight control strategies and to determine the types of strategies used to ensure that these benefit overall health.

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Received: April 2, 2012
Accepted: September 3, 2012

RÉSUMÉ

Objectif : Examiner l'utilisation des stratégies de contrôle du poids chez les adultes canadiens et le rôle du revenu comme obstacle à l'utilisation de ces stratégies.

Méthode : Pour cette étude nous avons utilisé les données sur le changement des habitudes de santé du cycle 4.1 de l'Enquête sur la santé dans les collectivités canadiennes. Notre analyse s'est limitée aux adultes (18 ans et plus) résidant dans les 10 provinces du Canada. Les répondants ont été catégorisés comme ayant utilisé des stratégies de contrôle du poids dans leur mode de vie s'ils disaient avoir augmenté leur niveau d'activité physique, amélioré ou modifié leurs habitudes alimentaires ou perdu du poids au cours des 12 mois précédents comme principal moyen d'améliorer leur santé. Nous avons choisi comme indicateur du revenu un ratio de revenu du ménage ajusté divisé en déciles. Par régression logistique multivariée, nous avons examiné la relation entre le revenu et les stratégies de contrôle du poids en tenant compte des facteurs confusionnels connus.

Résultats : Sur les 103 990 répondants analysés, 60 % étaient en surpoids ou obèses et 45 % ont déclaré avoir utilisé des stratégies de contrôle du poids au cours des 12 mois précédents. L'âge, le sexe, l'ethnicité, le fait d'avoir un médecin régulier, la scolarité et le revenu présentaient tous une corrélation significative avec l'utilisation de stratégies de contrôle du poids dans le modèle multivarié. Selon les résultats incluant toutes les interactions possibles entre le sexe, la catégorie de poids et le revenu, un revenu inférieur présentait une corrélation significative avec l'utilisation d'un moins grand nombre de stratégies de contrôle du poids – davantage encore chez les hommes obèses et les femmes de poids normal.

Conclusion : Étant donné la prévalence croissante de l'obésité à l'âge adulte au Canada, il faut s'efforcer d'assurer un accès égal aux services et aux produits alimentaires qui favorisent les stratégies de réduction ou de contrôle du poids.

Mots clés : revenu; contrôle du poids; obstacle; Canada; adulte; enquête