Association of Education with Overweight and Obesity among Canadian Adults

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Introduction

- Obesity is the 3rd leading risk factor contributing to the burden of diseases in Canada. [1]
- In 2018, 63% of Canadian adults were classified as overweight or obese. [2]
- Individual's level of education has been found to be negatively associated with overweight and obesity in developed countries. [3]
- Education has also been shown to be associated with overweight and obesity indirectly through physical activity - one of the key modifiable risk factors that drive obesity. [4,5]

Objectives

- To investigate the association between individual's educational attainment and risk of overweight and obesity using the most recent data available for the Canadian population
- To determine the mediating effect of physical activity in the relationship between individual's educational attainment and risk of overweight and obesity

Methodology

- This study was conducted using the cross-sectional data obtained from the 2017-2018 Canadian Community Health Survey (CCHS). [6]
- The analytical sample included a subpopulation of 82,508 adults aged 35 years and over living in the ten provinces and three territories
- **Outcome variable:** Using the self-reported height & weight, individuals were categorized as overweight and obese (BMI ≥25 kg/m^2 and <30 kg/m^2, and BMI ≥30 kg/m^2, respectively) Vs others. [7]
- **Primary predictor:** Respondent's highest level of education was grouped into three categories: less than secondary school graduation, secondary school graduation/no post-secondary education, and post-secondary certificate/diploma or university education
- **Other Covariates:** Sociodemographic and lifestyle factors were included
- **Mediator:** The physical activity variable included three categories: Physically active at or above recommended level (at least 150 minutes of moderate- to vigorous-intensity physical activity per week), physically active below the recommended level, and no physical activity. [8]
- A multivariable logistic regression model adjusted for age and ethnicity was used to evaluate the association between educational attainment and risk of overweight or obesity.
- Generalized Structural Equation Model (GSEM) and post estimation using nlcom technique were used to examine the mediating effect of physical activity. [9, 10]
- The estimates were weighted to the Canadian population and were adjusted to account for complex survey design effects using the Taylor linearization robust variance estimator. [11]
- All analyses were conducted using Stata version 17.0

Results

The prevalence of overweight and obesity among Canadians aged 35 years and over was 60.3% [95%CI: 59.6, 60.9]

In the multivariable analysis, significant associations were found with individuals who were white, Aboriginal, current smokers, ex-smokers, regular drinkers, occasional drinkers, and physically active at or above the recommended level

We detected significant interaction between an individual's education level and household income, individual's education level and sex, and marital status and sex

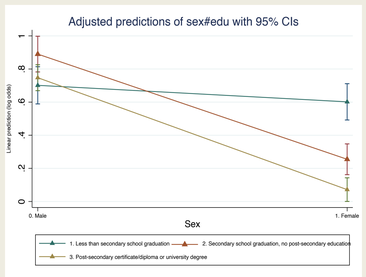

Figure (i): Predictive margins for the significant interactions between Sex and Educational Attainment

Females with Secondary school and post-secondary diploma or university education had a significantly less likelihood of being overweight/obese than their male counterparts.

Table 1: Prevalence of overweight & obesity among Canadians aged ≥ 35 years by sociodemographic and lifestyle characteristics; and adjusted odds ratio (OR) with 95% Confidence interval

Overweight/obese (% row) Yes	Variable	Multivariable model OR_{adj} [95% CI]
	Sex	
48.24	Female [ref]	1.00
64.51	Male	1.50 [1.29,1.74]***
	Age	
55.43	35 to 49 years [ref]	1.00
59.32	50 to 64 years	1.04 [0.97, 1.11]
53.07	65 years and over	0.81[0.75,0.87]***
	Ethnicity	
46.45	Non-White [ref]	1.00
58.46	White	1.80 [1.64,1.97]***
65.46	Aboriginal	2.52 [2.16, 2.94]***
	Marital Status	
54.01	Unmarried [ref]	1.00
57.44	Married/common-law	0.96 [0.85, 1.08]
52.5	Widowed/Divorced/Separated	0.87 [0.77, 0.99]*
	Individual level of education	
54.87	Post-secondary certificate diploma/university [ref]	1.00
59.61	secondary school education	1.44 [1.27, 1.63]***
57.32	Less than secondary school education	2.53 [2.09, 3.06]***
	Smoking Status	
53.55	Non-Smoker [ref]	1.00
53.31	Current smoker	0.71 [0.66, 0.77]***
61.96	Ex-smoker	1.18 [1.11,1.25]***
	Alcohol use	
51.56	Did-not drink in last 12 month [ref]	1.00
57.77	Regular Drinker	0.88 [0.82, 0.95]**
56.68	Occasional drinker	1.16 [1.05, 1.27]**
	Physical activity level	
54.27	No physical activity [ref]	1.00
58.93	Physically active below recommended level	1.07 [0.98, 1.16]
56.13	Physically active at or above recommended level	0.83 [0.78, 0.89]***
	Total Household Income	
56.98	$80, 000 or more [ref]	1.00
58.13	$60,000 to $79,999	1.18 [1.07, 1.31]**
54.47	$40,000 to $59,999	1.14 [1.03, 1.27]**
53.66	$20,000 to $39,999	1.19 [1.06, 1.33]**
54.53	No income or less than $20,000	1.10 [0.94, 1.28]

**** p-value <0.001; ** p-value <0.01; * p-value <0.05*

Table 2: Mediation Estimates

Effect	Coefficient	Std. Error	Z	P-value	% Mediation
Indirect	0.24	.10	2.23	0.024	16
Direct	1.29	.12	10.54	0.000	84
Total	1.53	.157	9.69	0.000	100

The indirect effect results revealed that physical activity significantly mediates the relationship between individual's educational attainment and overweight/obesity status (β = 0.24, P<0.05). The significant direct effect after accounting for mediation suggests that the mediation is partial.

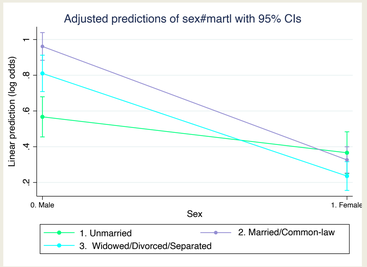

Figure (ii): Predictive margins for the significant interactions between sex and marital status

The likelihood of overweight/obesity was significantly higher among males than females if they were widowed/divorced/separated or married/ in common-law.

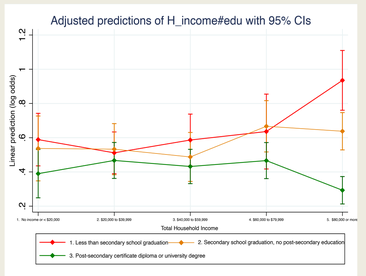

Figure (iii): Predictive margins for the significant interactions between Household Income and Educational Attainment

Low-household income individuals who had less than post-secondary education were significantly more likely to be overweight or obese compared to those with post-secondary education in high-household income group.

In almost all household income categories, the highest level of education was more protective against overweight and obesity.

Discussion

- In consistent with existing evidence, more than half of the Canadians aged ≥35 years are overweight and Obese.[12]
- As confirmed by other studies, higher educational attainment is more protective against overweight/obesity in females than in males. [13, 14]
- Males who were married/ in-common-law are more likely to be obese than unmarried females.
- In line with previous findings, higher educational attainment proved protective against overweight/obesity in both highest and lowest household income groups. [15]
- 16% of the effect of education on overweight/obesity is indirect via individual's physical activity level
- Even after accounting for the mediating effect of physical activity, individual's education accounted for 84% of the total effect.

Conclusion

- The association of individual's educational attainment with overweight and obesity is complex and differs by sex and household income
- Further study is needed to understand the reasons for these different patterns
- In addition, other relevant factors that could account for the indirect associations between education and overweight/obesity should be examined

Key strengths & limitations

- The major strength of this study is the large, nationally representative CCHS data used, which enables us to generalize the study findings to the Canadian population
- In addition, the educational level may have different meanings for different birth cohorts. Therefore, not taking the cohort effect into consideration may cause bias.
- The existence of reverse causality (individuals were overweight/obese at young age and could not reach the aspired educational level) may affect the association.

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