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Original quantitative research

Social determinants of adolescent eating behaviours: findings from the 2019 Canadian Health Survey on Children and Youth

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This article has been peer reviewed.

Abstract

Introduction: Limited evidence is available on the eating behaviours of Canadian adolescents. We examined how eating behaviours vary by social factors in a large nationwide sample of Canadian adolescents.

Methods: This cross-sectional study used data from the 2019 Canadian Health Survey on Children and Youth (n = 13 605 adolescents aged 12–17 years). Gender-stratified multivariable regression models were used to test for differences in the likelihood of breakfast consumption, evening family meals, sugar-sweetened beverages (SSB) intake and restrictive eating by gender, age, racial/cultural background, parental education, household income, and food security status.

Results: Compared to boys, girls were more likely to consume breakfast infrequently, have fewer evening family meals, engage in restrictive eating, but were less likely to consume SSB frequently. Adolescents aged 14 to 17 demonstrated a higher likelihood of infrequent breakfast consumption, reduced participation in family meals, engagement in restrictive eating behaviours, and frequent consumption of SSB compared to those aged 12 to 13. Black adolescents were more likely to report infrequent breakfast, lower participation in evening family meals and frequent SSB consumption compared to their White peers. Adolescents whose parents had a high school degree or lower education were more likely to report infrequent breakfast consumption and frequent SSB consumption compared to adolescents whose parents had a college degree or higher. Lower household income and food insecurity were linked to adolescents' frequency of breakfast consumption, evening family meals, and SSB intake, but showed no association with restrictive eating behaviours.

Conclusion: Disparities in eating behaviours exist among Canadian adolescents, underscoring the need for social policies that address structural determinants shaping dietary behaviours in this population.

Keywords: *dietary behaviours, youth, social factors, population-based surveys*

Introduction

Adolescence is a critical developmental period when lifelong dietary habits are formed and nutritional needs peak due to rapid growth and cognitive maturation.¹ Healthy eating behaviours established during this stage, such as regular meals, limited sugary drink intake, and shared

family meals, have cumulative effects on long-term health and well-being.² Yet, not all adolescents have equitable opportunities to adopt or maintain these habits.³

National nutrition surveys indicate that many Canadian adolescents do not meet dietary guidelines, characterized by inadequate intakes of fruits, vegetables, and

key nutrients, alongside excessive consumption of ultra-processed foods, which now account for more than half of their

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Highlights

- Nationally representative data from the 2019 Canadian Health Survey on Children and Youth were used to examine how eating behaviours vary by social factors among adolescents.
- Compared with boys, girls were more likely to report infrequent breakfast consumption, fewer family meals, and restrictive eating, but less likely to consume sugar-sweetened beverages frequently.
- Older adolescents exhibiting less healthful behaviours overall than younger adolescents.
- Racial/cultural differences were observed, with Black adolescents more likely to report less desirable eating behaviours compared with White peers.
- Socioeconomic indicators were associated with three of four eating behaviours examined, suggesting disparities in eating behaviours.
- Findings underscore the need for interventions to address the structural determinants shaping adolescent eating behaviours in Canada.

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total daily energy intake.⁴ Research also highlights gaps in specific eating behaviours, including breakfast consumption and family meals. Regular breakfast intake is linked to improved cognitive and academic performance;^{5,6} yet missing breakfast is common, with international prevalence estimates ranging from 10% to 35%.⁷ Similarly, family meals are linked to better diet quality, improved well-being, and lower engagement in other risk behaviours.^{8,9} However, participation declines with age, often due to competing schedules and reduced family time.^{10,11} Sugary drink consumption, a leading source of added sugars among adolescents in Canada,¹² has declined modestly in recent years but remains high. In 2015, a little over half of Canadian children and adolescents reported consuming a sugar-sweetened beverage (SSB) on a given day.¹² An emerging concern is the rising purchase of newer categories of SSB (such as energy and sports drinks) among Canadians over time,¹³ a trend that parallels patterns documented in the United States.¹⁴ Additionally, unhealthy restrictive eating behaviours such as dieting and fasting for weight control are also common among adolescents, with recent Canadian data indicating that nearly one-third of adolescents report changing their eating habits for weight management. Recognizing these challenges, Health Canada's *Healthy Eating for Teens* guidance emphasizes the importance of developing healthy eating habits early in life by getting involved in meal preparation, planning meals and snacks, eating with your family and making healthy drink choices.¹⁵

Evidence suggests that diet-related social inequities exist among adolescents, though Canadian-specific data remain limited. In a large cross-sectional study of adolescents attending secondary schools in four Canadian provinces, eating behaviours differed by gender, race, and socioeconomic status.¹⁶ For example, Black and Latin American adolescents were more likely than their White and Asian peers to engage in restrictive eating and to consume purchased snacks and fast food, while being less likely to drink water daily. Daily breakfast consumption was highest among Latin American students, whereas Black students were least likely to eat breakfast regularly or consume fruits and vegetables. Lower socioeconomic status was associated with lower odds of eating breakfast, drinking water daily, and consuming fruits and vegetables,

as well as higher odds of restrictive eating and purchasing snacks.

To our knowledge, the study by Patte and colleagues¹⁶ is the only Canadian research to date documenting inequities in adolescents' eating behaviours.¹² Nationally representative estimates are thus needed to inform health promotion interventions targeting adolescents. The 2019 Canadian Health Survey on Children and Youth (CHSCY)¹⁹ offers a unique opportunity to address this knowledge gap, as it is the most recent nationwide survey capturing a broad range of eating behaviours among Canadian children and adolescents. In the present study, we examined the prevalence of four eating behaviours (breakfast consumption, evening family meals, sugar-sweetened beverages, and restrictive eating) in a nationwide sample of Canadian adolescents, and assessed how engagement in these behaviours varied by social factors.

Methods

Study design and data source

This study used data from the 2019 CHSCY, a nationally representative survey of children and adolescents between the ages of 1 and 17 years living across all 13 provinces and territories, collected between February and August 2019.¹⁷ The total sample size for the 2019 CHSCY was 47 871 participants (response rate of 53%). For this study, the analytical sample was restricted to adolescents aged 12 to 17 years because this developmental period is critical for shaping eating behaviours, aligns with prior literature,¹⁸ and reflects the availability of adolescent-specific measures in the CHSCY.

Data were collected via online or telephone questionnaires completed by both adolescents and their parents or guardians. Adolescents provided self-reports on eating behaviours and demographics, while parents or the household member most knowledgeable about the family provided socioeconomic information. Additional details regarding study methods can be found elsewhere.¹⁷

Measures

Eating behaviour variables were dichotomized to align with public health guidelines and ensure interpretability,^{15,19,20} while also meeting Statistics Canada's disclosure

requirements and maintaining stable estimates given subgroup sample sizes.

Eating behaviours

Frequency of breakfast consumption was measured using the single item "In the past 7 days, how many days did you eat breakfast?" (response options 0–7 days, or "don't know"). Consistent with previous research,²¹ data were dichotomized as to whether participants were "regular breakfast eaters" (≥ 5 days during the previous week or more) or "irregular breakfast eaters" (< 5 days during the previous week).

Frequency of evening family meals was measured using the single item "In the past 7 days, how many days did [he/you] eat the evening meal with [his/your] family sitting at the dinner table together?" This variable was recoded and dichotomized, classifying adolescents as having frequent family dinner (≥ 5 days during the previous week) or infrequent family meals (< 5 days during the previous week).^{22,23}

Sugar-sweetened beverage (SSB) consumption was a composite measure using the items from the question "How many times during the past 7 days have you consumed the following sugary beverages?" Respondents were asked to report the frequency of consumption for each of the following beverages: fruit flavoured drinks, regular soft drinks, sports drinks, energy drinks, chocolate milk or hot chocolate beverages, milkshakes or ice cream sodas and sweetened coffee or tea. Responses across all beverage categories were summed to create a composite measure of the frequency of different types of SSB (excluding 100% fruit juice) over the past week. Participants were then dichotomized as low consumers (< 5 SSB/week) or high consumers (≥ 5 SSB/week). This threshold was selected a priori to identify frequent consumption, consistent with recommendations to limit added sugars and sugary beverage intake, while ensuring adequate distribution across categories for meaningful group comparisons and stable estimates.^{24–27}

Restrictive eating was measured by asking participants how often, in the past 12 months, they had changed their eating habits to manage their weight, and the response options were: "never," "a few times," "monthly," "weekly," "daily" or "don't know." Respondents were dichotomized into two groups based on whether

they engaged in any level of restricted eating in the past 12 months versus none (“never”).

Social factors

Social factors included self-reported measures of gender, age, racial/cultural background, and parent-reported measures of parental education, household income and food security status. *Gender* was a measure where adolescents were asked “What is your gender?”, with response options of “male gender,” “female gender,” or “gender diverse.” “Gender diverse” responses were excluded from the analyses because the small sample size ($n = 45$) produced estimates with coefficients of variation (CVs) equal to or greater than 35%, which, according to the CHSCY data user guide (Table 9.1: Sampling variability guidelines), are considered too unreliable for publication.²⁸ The item explicitly stated that gender referred to current gender identity, which could differ from sex assigned at birth or from that indicated on legal documents. *Age group* was derived from participants’ self-reported continuous age. Because the CHSCY youth sample includes participants aged 12 to 17 years, participants were classified as younger (12–13 years) and older adolescents (14–17 years) to reflect earlier versus later adolescence, which may differ in autonomy, social influences, and eating behaviours.²⁹ *Racial/cultural identity* was initially classified into multiple groups (South Asian, Chinese, Black, Filipino, Arab, Latin American, Southeast Asian, West Asian, Korean, Japanese, and other visible minorities). To address small cell sizes and disclosure constraints, categories were combined into a recoded variable comprising five groups: White (not a visible minority), Asian, Black, Arab, and Latin American/mixed-race adolescents. *Parental education* was recoded as a dichotomous variable. The “high school degree or less” category included individuals with less than a high school diploma, its equivalent, or a high school equivalency certificate. The “college degree or higher” category included those with a trades certificate or diploma, college/CEGEP or other non-university credentials, a university certificate or diploma below the bachelor’s level, a bachelor’s degree, or a university credential above the bachelor’s level. *Total household income* was reported by the person most knowledgeable. The income ranges were recoded to be consistent with Statistics Canada’s standard reporting thresholds.³⁰ The final categories were: $\leq \$40\,000$;

$\$40\,001$ – $\$60\,000$; $\$60\,001$ – $\$80\,000$; and $> \$80\,000$. *Food security status* was measured using the validated Household Food Security Survey Module, which is an 18-item questionnaire that includes 10 specific questions for the adult household members, and eight items specific to children in the household.³¹ Household-level food security status was classified into four different levels (food secure, marginally food insecure, moderately food insecure, and severely food insecure) and scored based on the number of positive responses to the questionnaire. To facilitate comparison with previous research,^{32,33} the variable was dichotomized into food secure versus food insecure (combining all three levels of food insecurity).

Covariates

Models controlled for age (in years), gender (boy, girl), body mass index (BMI) z-scores (defined according to World Health Organization growth reference standards),³⁴ cultural/racial background (5 groups), urbanicity (urban area vs. rural area), parental education (high school degree or less vs. college degree or higher), household food security status (secure vs. insecure) and total household income (4 groups), as they have been previously found in the literature to be associated with eating behaviours among adolescents.¹⁶

Statistical analysis

Descriptive analyses were first conducted to characterize the sociodemographic characteristics and the prevalence of eating behaviours between boys and girls in the study sample. Chi-square tests were used to test for significant differences in the prevalence of eating behaviours between boys and girls. Multivariable logistic regression models were then applied to examine associations between each independent variable (gender, age, race/ethnicity, parental education, household income, and food security) and the likelihood of engaging in a given eating behaviour. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were estimated. Benjamini-Hochberg adjusted p values were used to control the false discovery rate across multiple regression tests.³⁵ Post-estimation analyses included Wald tests, estimation of marginal effects, and Bonferroni-adjusted pairwise comparisons where relevant. Missing data were handled using a complete case analysis approach, as the proportion of missing

data across covariates was relatively low ($< 7.9\%$). All analyses incorporated Statistics Canada’s survey and bootstrap weights to account for the complex sampling design and to ensure nationally representative, robust variance estimates. Analyses were performed in Stata 13³⁶ with a significance set at a p value of less than 0.05.

Ethics approval

This study used confidential microdata from the 2019 CHSCY, collected by Statistics Canada with prior ethics approval and informed consent. Data access was granted through the Ottawa Research Data Centre (ORDC) under Statistics Canada’s confidentiality and data use agreements. All analyses complied with ORDC and Statistics Canada’s ethical and privacy requirements.

Results

After excluding individuals aged 1 to 11 years, our final analytical sample included 13 605 participants. Tables 1 and 2 summarize the sociodemographic characteristics and prevalence of eating behaviours of the study sample. Over 70% of adolescents identified as White and about 80% had parents with some post-secondary education (college degree or higher). Around 60% reported total household incomes above $\$80\,000$ while approximately 10% experienced some level of food insecurity. A higher proportion of girls reported infrequent breakfast consumption (33%), evening family meals (37%) and restrictive eating (21%) compared to boys (26%, 31% and 12% respectively). However, boys reported consuming SSB (50%) more frequently compared to girls (42%).

Associations between gender and eating behaviours are shown in Table 3. Girls had higher odds of reporting infrequent breakfast consumption, infrequent evening family meals, engaging in restrictive eating but reported lower odds of frequent SSB consumption compared to boys.

Table 4 shows associations between age group and eating behaviours. Adolescents aged 14 to 17 years were more likely than those aged 12 to 13 years to report infrequent breakfast consumption, infrequent evening family meals, frequent SSB consumption, and engage in restrictive eating behaviours.

TABLE 1
Sociodemographic characteristics of the analytical sample, Canadian Health Survey on Children and Youth 2019 (n = 13 605)

	%	n
Gender^a		
Boys	49.7%	6 760
Girls	49.8%	6 780
Gender diverse	0.3%	45
Cultural/racial background^b		
White	73.8%	10 045
Asian	17.7%	2 410
Black	3.6%	490
Arab	1.8%	245
Latin American and mixed-race adolescents	2.5%	340
Urbanicity		
Urban area	75.9%	10 325
Rural area	24.1%	3 280
Highest parental education^c		
High school degree or less	20.8%	2 830
College degree or higher	78.8%	10 720
Total household income		
≤ \$40 000	11.3%	1 540
\$40 001–\$60 000	14.4%	1 965
\$60 001–\$80 000	11.4%	1 550
> \$80 000	62.8%	8 550
Food security status^d		
Food secure	87.1%	11 845
Food insecure	10.6%	1 450

Note: Percentages are weighted estimates based on survey sample weights; counts are unweighted sample sizes.

^a Missing data on gender for 20 youth (0.2% of the sample).

^b Missing data for 70 youth (0.5% of the sample).

^c Missing data for 50 youth (0.4% of the sample).

^d Missing data on household food security status for 305 youth (2.2% of the sample).

TABLE 2
Prevalence of eating behaviours in the analytical sample, Canadian Health Survey on Children and Youth 2019 (n = 13 605)

	Girls		Boys		Pearson chi-square	p value
	%	n	%	n		
Breakfast consumption						
< 5 days/week	33.5%	2 263	26.6%	1 788	90.06	< 0.001
Evening family meals						
< 5 days/week	37.2%	2 525	31.3%	2 115	53.67	< 0.001
Frequency of SSB consumption						
≥ 5 times/week	42.1%	2 855	50.8%	3 435	104.17	< 0.001
Restrictive eating						
Yes	21.2%	1 435	12.9%	870	173.06	< 0.001

Abbreviation: SSB, sugar-sweetened beverage.

Notes: Percentages are weighted estimates based on survey sample weights; counts are unweighted sample sizes. Estimates for gender diverse youth are not shown due to large coefficients of variation. Differences in the prevalence of eating behaviours between genders were tested using chi-square test. Statistically significant associations ($p < 0.05$) are **bolded**.

TABLE 3
Associations between eating behaviours and gender among adolescents, Canadian Health Survey on Children and Youth 2019 (n = 13 605)

Outcomes and contrasts	AOR	95% CI	p value*
Infrequent breakfast (< 5 times/week)			
Boys (reference)	1.00		
Girls	1.44	1.30–1.61	< 0.001
Infrequent evening family meals (< 5 days/week)			
Boys (reference)	1.00		
Girls	1.27	1.15–1.40	< 0.001
Frequent SSB consumption (≥ 5 times/week)			
Boys (reference)	1.00		
Girls	0.73	0.66–0.80	< 0.001
Restrictive eating (> than once/year)			
Boys (reference)	1.00		
Girls	1.86	1.63–2.10	< 0.001

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; SSB, sugar-sweetened beverage.

Notes: Models are adjusted for age (in years), body mass index Z scores, cultural/racial background, parental education, household food security status, urbanicity and total household income. Survey sample weights and 1000 bootstrap weights were applied to generate nationally representative rates and robust standard errors.

* Benjamini-Hochberg adjusted p values. Statistically significant associations ($p < 0.05$) are **bolded**.

Table 5 summarizes associations between racial/cultural groups and eating behaviours. Asian adolescents had lower odds of reporting infrequent breakfast compared to their White peers. Compared to White adolescents, Asian, Latin American and mixed-race adolescents had lower odds of infrequent evening family meals. In contrast, Black adolescents were more

likely to report infrequent breakfast consumption, infrequent evening family meals, and frequent SSB intake. Arab adolescents had higher odds of reporting infrequent breakfast consumption and restrictive eating compared to White peers.

Table 6 presents the results of the associations between eating behaviours and

indicators of socioeconomic position (parental education, income and food security status). Adolescents with parents with a high school degree or less were more likely to report infrequent breakfast and more frequent SSB consumption compared to their peers with parents who had a college degree or higher. Individuals in the lowest income bracket (total household

TABLE 4
Associations between eating behaviours and age group among adolescents, Canadian Health Survey on Children and Youth 2019 (n = 13 605)

Outcomes and contrasts	AOR	95% CI	p value*
Infrequent breakfast (< 5 times/week)			
Younger adolescents (12–13 years) (reference)	1.00		
Older adolescents (14–17 years)	2.09	1.85–2.35	< 0.001
Infrequent evening family meals (< 5 days/week)			
Younger adolescents (12–13 years) (reference)	1.00		
Older adolescents (14–17 years)	2.34	2.10–2.61	< 0.001
Frequent SSB intake (≥ 5 days/week)			
Younger adolescents (12–13 years) (reference)	1.00		
Older adolescents (14–17 years)	1.62	1.47–1.78	< 0.001
Restrictive eating (> than once/year)			
Younger adolescents (12–13 years) (reference)	1.00		
Older adolescents (14–17 years)	2.26	1.96–2.60	< 0.001

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; SSB, sugar-sweetened beverage.

Notes: Models are adjusted for gender, body mass index Z scores, cultural/racial background, parental education, household food security status, urbanicity and total household income. Survey sample weights and 1000 bootstrap weights were applied to generate nationally representative rates and robust standard errors.

* Benjamini-Hochberg adjusted p values. Statistically significant associations ($p < 0.05$) are **bolded**.

TABLE 5
Associations between eating behaviours and racial/cultural identity among adolescents,
Canadian Health Survey on Children and Youth 2019 (n = 13 605)

Outcomes and contrasts	AOR	95% CI	p value*
Infrequent breakfast consumption (< 5 times/week)			
White (reference)	1.00		
Asian	0.68	0.59–0.79	< 0.001
Black	1.40	1.09–1.81	0.009
Arab	1.41	1.00–1.99	0.047
Latin American and mixed-race	0.92	0.67–1.25	0.599
Infrequent evening family meals (< 5 days/week)			
White (reference)	1.00		
Asian	0.78	0.68–0.90	< 0.001
Black	2.05	1.61–2.62	< 0.001
Arab	0.84	0.59–1.20	0.353
Latin American and mixed-race	0.72	0.54–0.96	0.028
Frequent SSB intake (≥ 5 days/week)			
White (reference)	1.00		
Asian	0.90	0.79–1.05	0.852
Black	1.59	1.25–2.01	0.001
Arab	1.19	0.83–1.68	0.470
Latin American and mixed-race	1.05	0.79–1.39	0.789
Restrictive eating (> than once/year)			
White (reference)	1.00		
Asian	1.15	0.98–1.35	0.074
Black	1.14	0.82–1.57	0.416
Arab	1.89	1.29–2.77	0.001
Latin American and mixed-race	1.27	0.90–1.80	0.165

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; SSB, sugar-sweetened beverage.

Notes: Models are adjusted for age (in years), gender, body mass index Z scores, parental education, household food security status, urbanicity and total household income. Survey sample weights and 1000 bootstrap weights were applied to generate nationally representative rates and robust standard errors.

* Benjamini-Hochberg adjusted *p* values. Statistically significant associations (*p* < 0.05) are **bolded**.

income ≤ \$40 000) had higher odds of reporting infrequent breakfast consumption, fewer evening family meals, and frequent SSB intake when compared to their peers in the highest income bracket (total household income > \$80 000). Adolescents living in food insecure households were more likely to report infrequent breakfast consumption, infrequent evening family meals, and frequent SSB intake.

Discussion

This study examined the prevalence and social factors associated with four eating behaviours (breakfast consumption, evening family meals, SSB intake and restrictive eating) among Canadian adolescents in 2019. Our findings confirm those from prior research,^{16,37} suggesting socioeconomic disparities in eating behaviours. Overall, less favourable behaviours were more

common among girls, older adolescents, and those from racialized and socioeconomic disadvantaged backgrounds. Socioeconomic indicators were associated with several eating behaviours, underscoring the role of structural and social conditions in shaping adolescents' dietary practices.

Gender was associated with all four eating behaviours examined, supporting previous

TABLE 6
Associations between eating behaviours and indicators of socioeconomic position among adolescents,
Canadian Health Survey on Children and Youth 2019 (n = 13 605)

Outcomes and contrasts	2019		
	AOR	95% CI	p value*
Parental education			
Infrequent breakfast (< 5 times/week)			
College degree or higher (reference)	1.00		
High school degree or less	1.19	1.05–1.36	0.006
Infrequent evening family meals (< 5 days/week)			
College degree or higher (reference)	1.00		
High school degree or less	1.03	0.91–1.17	0.601
Frequent SSB intake (≥ 5 days/week)			
College degree or higher (reference)	1.00		
High school degree or less	1.25	1.11–1.40	< 0.001
Restrictive eating (> than once/year)			
College degree or higher (reference)	1.00		
High school degree or less	1.12	0.92–1.37	0.231
Household income			
Infrequent breakfast (< 5 times/week)			
> \$80 000 (reference)	1.00		
\$60 001–\$80 000	1.24	1.05–1.46	0.496
\$40 001–\$60 000	1.16	0.98–1.34	0.952
≤ \$40 000	1.25	1.05–1.49	0.012
Infrequent evening family meals (< 5 days/week)			
> \$80 000 (reference)	1.00		
\$60 001–\$80 000	1.06	0.90–1.26	0.455
\$40 001–\$60 000	1.12	0.95–1.32	0.151
≤ \$40 000	1.20	1.01–1.42	0.034
Frequent SSB intake (≥ 5 days/week)			
> \$80 000 (reference)	1.00		
\$60 001–\$80 000	1.05	0.90–1.26	0.824
\$40 001–\$60 000	1.18	0.95–1.32	0.190
≤ \$40 000	1.20	1.01–1.42	0.016
Restrictive eating (> than once/year)			
> \$80 000 (reference)	1.00		
\$60 001–\$80 000	1.01	0.84–1.23	0.386
\$40 001–\$60 000	1.09	0.91–1.28	0.783
≤ \$40 000	0.98	0.81–1.19	0.816

Continued on the next page

TABLE 6 (continued)
Associations between eating behaviours and indicators of socioeconomic position among adolescents,
Canadian Health Survey on Children and Youth 2019 (n = 13 605)

Outcomes and contrasts	2019		
	AOR	95% CI	p value*
Food security status			
Infrequent breakfast (<5 times/week)			
Food secure (reference)	1.00		
Food insecure	1.76	1.49–2.07	< 0.001
Infrequent evening family meals (< 5 days/week)			
Food secure (reference)	1.00		
Food insecure	1.46	1.24–1.71	< 0.001
Frequent SSB intake (≥ 5 days/week)			
Food secure (reference)	1.00		
Food insecure	1.32	1.12–1.53	< 0.001
Restrictive eating (> than once/year)			
Food secure (reference)	1.00		
Food insecure	1.12	0.92–1.37	0.231

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; SSB, sugar-sweetened beverage.

Notes: Models are adjusted for age (in years), gender, body mass index Z scores, cultural/racial background, urbanicity, parental education (when not the exposure), household food security status (when not the exposure) and total household income (when not the exposure). Survey sample weights and 1000 bootstrap weights were applied to generate nationally representative rates and robust standard errors.

* Benjamini-Hochberg adjusted *p* values. Statistically significant associations (*p* < 0.05) are **bolded**.

research.^{5,16} Girls were more likely than boys to skip breakfast and engage in restrictive eating, reflecting broader societal and media influences that reinforce thinness ideals among adolescent girls.³⁸ This study identified a gender difference in evening family meal frequency among adolescents, diverging from prior research that has generally found minimal or no differences by gender.^{8,9} Girls were less likely to participate in evening family meals, which may indicate avoidance related to body dissatisfaction or dietary restraint.³⁹ However, this difference was modest and could represent a chance finding. Boys reported more frequent consumption of SSB, consistent with evidence that beverage marketing disproportionately targets male adolescents.³⁷ Gender-diverse youth could not be examined separately because of small sample size and data quality constraints; however, future research should examine whether their eating behaviours and nutrition-related risks differ from those observed among binary gender groups.

Age was significantly associated with all four eating behaviours, with older adolescents

generally displaying less favourable patterns than their younger peers. This overall pattern is consistent with previous literature showing that health-promoting routines often decline across adolescence as autonomy increases and parental influence decreases.^{10,11,40} The lower frequency of family meals among older adolescents aligns with international and longitudinal evidence that shared meals become less common as youth age and household routines change.^{10,11} Similarly, the higher likelihood of breakfast skipping observed among older adolescents is consistent with studies showing lower breakfast consumption from early to late adolescence.^{40,41} Prior research also suggests that adolescents commonly report lack of time, valuing sleeping over eating and not feeling hungry as reasons for skipping breakfast.^{42,43} Older adolescents also reported higher consumption of SSB, which is in line with surveillance data indicating greater intake among older youth, potentially due to increased independent purchasing, peer norms, and marketing exposure.^{40,44} In addition, dietary restriction for weight management was more prevalent among older adolescents, consistent

with evidence of increasing body image concerns and disordered eating behaviours from adolescence into adulthood.⁴⁵ Collectively, these findings highlight adolescence as a critical developmental period in which increasing independence and social influence may contribute to the loss of structured, health-promoting eating behaviours.

Racial and cultural background was associated with several eating behaviours among adolescents. Black adolescents were more likely than their White peers to skip breakfast, consume SSB frequently, and participate less often in evening family meals, echoing previous findings of racial disparities in adolescent nutrition.^{16,46} Prior literature suggests that structural and socioeconomic inequities, including differential exposure to food insecurity and unhealthy food environments, may contribute to these patterns, although these factors were not directly examined in the present study.^{47,48} Arab adolescents in this study also showed a greater risk of suboptimal eating behaviours, including higher prevalence of breakfast skipping and restrictive eating, consistent with

previous studies reporting disparities in eating behaviours across ethnocultural groups.⁴⁹ Conversely, Asian individuals demonstrated more structured eating patterns, reporting more frequent breakfast consumption and family meals, which aligns with evidence that eating patterns vary across cultural groups and family contexts.³⁹ Taken together, these findings highlight meaningful differences in adolescent eating behaviours across population groups and support the need for culturally responsive, equity-oriented public health strategies that address broader social determinants of health.^{45,50}

All three socioeconomic indicators (parental education, household income, and food insecurity) were significantly associated with multiple eating behaviours, reflecting important socioeconomic differences in adolescents' dietary practices. Adolescents from lower socioeconomic backgrounds were more likely to skip breakfast, consume SSB frequently, and share fewer evening family meals than their more advantaged peers. These consistent patterns underscore the multidimensional nature of socioeconomic position, as each indicator reflects distinct but interrelated mechanisms shaping adolescents' dietary behaviours.¹⁶ Parental education was associated with breakfast and SSB consumption. Individuals whose parents had a high school education or less were more likely to skip breakfast and to consume SSB five or more days per week. These findings mirror international evidence that higher parental education promotes healthier dietary behaviours through greater nutritional knowledge, modelling, and structured routines.¹² Household income was another key determinant of eating behaviour. Adolescents from higher-income households were less likely to skip breakfast or consume SSB, and more likely to participate in frequent evening family meals compared to those from lower-income households. Although not all contrasts reached statistical significance, the trends were consistently in the expected direction. These results suggest that Canadian adolescents are not insulated from household income insecurity; rather, economic disadvantage continues to influence everyday eating routines. This contrasts with earlier evidence indicating weaker income–diet relationships among adolescents compared to adults,⁵¹ suggesting that while food quantity may be buffered within households, the structure and regularity of eating behaviours remain

sensitive to financial strain. Food insecurity was the most robust predictor across outcomes, being associated with infrequent breakfast, fewer evening family meals and higher SSB consumption. Despite parental efforts to shield children from the effects of food insecurity,⁵² these associations indicate that current efforts are insufficient. Food insecurity thus represents not only an indicator of material deprivation but a direct social determinant of adolescent health. Overall, these findings highlight persistent socioeconomic inequities in Canadian adolescents' eating behaviours. These socioeconomic disparities underscore the need for upstream, structural interventions addressing income insecurity, parental work conditions, and access to nutritious food to foster equitable environments that support healthy eating among adolescents.

Strengths and limitations

A key strength of this study is the use of a large, nationally representative sample of Canadian adolescents from all provinces and territories, enhancing the generalizability of the findings. The study also examined four distinct eating behaviours simultaneously within a single dataset, allowing for a more comprehensive assessment of social patterning in adolescent eating practices than studies focussed on a single behaviour alone. However, several limitations must be acknowledged. First, self-reported eating behaviours are subject to recall and social desirability bias, which may lead to underreporting of behaviours perceived as unhealthy, particularly among girls or also overreporting of evening family meals and breakfast consumption. Second, while Statistics Canada used items with demonstrated validity, only a limited subset of questions from the Eating Attitudes Test-26 (EAT-26) was included, restricting the ability to capture the full complexity of restrictive eating.⁵³ Third, the CHSCY lacked validated youth-reported indicators of perceived social status or affluence, which are increasingly recognized as important predictors of adolescent health. Fourth, despite national representativeness, some populations, such as individuals living on First Nations reserves, in foster care, or institutional settings, were excluded in the CHSCY. In addition, gender-diverse youth could not be examined separately because the small sample size yielded unreliable estimates under Statistics Canada data quality guidelines. This is an important

limitation, as gender-diverse adolescents may experience distinct and potentially elevated risks related to restrictive eating and food insecurity. Finally, as the data were collected in 2019, before COVID-19, future research should examine how pandemic-related changes may have affected adolescent eating behaviours and socioeconomic inequalities. Although more recent data from the 2023 CHSCY cycle are available, several methodological considerations justified the use of the 2019 cycle for this study. First, the 2023 cycle had a substantially lower response rate (19%), which considerably limits external validity. Second, the reference period for eating behaviours differed between cycles, where the 2019 survey used a 7-day recall period, whereas the 2023 survey used a 30-day period. Longer recall periods are more prone to recall error, which may reduce the accuracy and reliability of self-reported eating behaviours.⁵⁴ Lastly, the 2023 cycle did not include a variable of breakfast consumption, an important measure of adolescent eating behaviours. For these reasons, the 2019 CHSCY cycle was deemed more appropriate for the objectives of the present study.

Conclusion

This study showed that sociodemographic disparities in eating behaviours among Canadian adolescents exist. Older adolescents and girls were more likely to report suboptimal patterns, such as skipping breakfast, eating fewer evening family meals, and engaging in restrictive eating behaviours. Racial and cultural differences were also evident, with Black adolescents showing higher risk for unhealthy eating patterns, while Asian adolescents reported more structured meal routines. Socioeconomic position emerged as a strong determinant of breakfast frequency and SSB consumption, underscoring persistent inequities in access to healthy eating environments.

These findings reinforce the importance of addressing the social determinants of adolescent eating behaviours through targeted, equity-oriented public health strategies. Although interaction terms and formal intersectional analyses were not examined in the present study, future research should explicitly test how gender, race, and socioeconomic factors interact to shape eating behaviours among adolescents.^{16,55} Developing validated youth-reported measures of both eating behaviours and perceived

social status would enhance construct validity. Longitudinal and qualitative studies are also needed to capture trajectories and contextual influences over time. Finally, addressing upstream determinants through structural interventions, such as policies to reduce income inequality, food insecurity, and educational barriers, will be essential to promoting healthier and more equitable eating behaviours among Canadian adolescents.

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Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions and statement

GDG: Conceptualization, data curation, formal analysis, methodology, validation, visualization, writing—original draft, writing—review and editing.

JPC: Conceptualization, methodology, writing—review and editing.

RAK: Data curation, writing—review and editing.

CTL: Supervision, conceptualization, methodology, project administration writing—review and editing.

All authors have read and approved the final manuscript.

Because of the confidential nature of these microdata, they cannot be shared. Researchers in Canada working at one of the CRDCN's member institutions can access the data at no additional cost to the researcher. Other researchers will have to pay cost-recovery to access the data. Access to the data is subject to a background check and research approval process. The protocols for data access, including fees for researchers at non-CRDCN institutions, can be found on the CRDCN website.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

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Original quantitative research

Disordered eating profiles and associations with student sociodemographic characteristics: a latent class analysis among adolescents in Canada

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Abstract

Introduction: Despite its importance to health and well-being, evidence on disordered eating (DE) patterns among Canadian adolescents remains limited. This study aimed to (1) identify latent DE classes among adolescents in Canada; and (2) investigate whether students' sociodemographic characteristics predict DE class membership.

Methods: Student-level survey data were obtained from the 2021–2022 COMPASS study. The sample included 24 639 students in grades 9 to 12 from 69 secondary schools in Alberta, British Columbia, and Ontario. Latent class analysis was applied to explore DE profiles based on six items assessing weight concern, restrictive or binge eating, purging, and compensatory behaviours. Logistic regression was conducted to examine associations between DE class membership and sociodemographic characteristics (grade, gender, race and ethnicity, family affluence, and weight status).

Results: Five distinct DE classes were identified: no-to-mild DE (32.5%), changed eating with weight concern (30.7%), binge eating with weight concern (25.7%), binge eating without weight concern (7.3%), and complex DE (3.7%). Cisgender girls, transgender and gender-diverse youth, adolescents from less affluent households, and those with very high weight were at greater risk of belonging to classes with higher symptom engagement compared to the no-to-mild DE class and cisgender boys, more affluent peers, and those with healthy weight, respectively.

Conclusion: Findings indicate that Canadian adolescents exhibit heterogeneous DE patterns, with pronounced disparities by gender, family affluence, and weight status. Recognizing equity-related disparities in DE patterns highlights the importance of future longitudinal research to examine developmental trajectories of DE, and to inform tailored prevention and early intervention strategies that address the needs of diverse adolescent populations.

Keywords: adolescents, disordered eating, latent class analysis, patterns, youth

Introduction

Disordered eating (DE) refers to maladaptive eating thoughts and behaviours, including weight or shape preoccupation, restrictive or binge eating, purging, and misuse of laxatives, diuretics, diet pills, or

steroids.¹ DE thoughts and behaviours are eating disorder (ED) symptoms that do not meet clinical diagnostic criteria but are recognized as risk factors for ED development.² A 2023 systematic review and meta-analysis reported that approximately 22% of youth globally engaged in DE.³

Highlights

- We identified five distinct disordered eating (DE) patterns among over 24 000 Canadian adolescents, ranging from mild concerns to more complex symptoms.
- Results uncovered heterogeneity in adolescents' eating-related thoughts and behaviours, including weight concern, binge eating, restrictive practices, and compensatory behaviours.
- Cisgender girls, transgender and gender-diverse youth, adolescents from less affluent households, and those with very high weight were at greater risk of belonging to DE classes with higher symptom engagement.
- Findings highlighted the need for equity-informed, gender-aware, and tailored prevention and early intervention strategies, along with future longitudinal research to understand DE developmental trajectories.

The high prevalence of DE is a significant public health concern due to its associations with adverse health outcomes, such as psychological distress, depression, and suicide ideation.^{4,5} In some individuals,

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DE behaviours may progress to clinically diagnosable EDs.^{6,7} Without appropriate treatment, EDs can become persistent, severe, and recurrent, with the second-highest mortality rate among all mental disorders, surpassed only by opioid dependence.⁸⁻¹⁰ Given these serious consequences, understanding DE patterns and risk factors among youth is essential for developing effective prevention and early intervention strategies.

Emerging evidence indicates that DE thoughts and behaviours form diverse, co-occurring patterns, rather than existing along a single continuum of frequency/severity.¹¹⁻²⁰ Consequently, researchers have applied latent class analysis (LCA) or latent profile analysis (LPA) to identify distinct DE/ED profiles among youth, primarily in the USA^{11-13,17} and Europe.^{16,19} LCA is a statistical method used to identify latent subgroups within a population based on individuals' response patterns to observed variables (indicators).^{21,22} Unlike traditional variable-centred methods, which assume the same effects across the population and treat DE as a continuous/unidimensional construct, potentially masking important subtypes of risk, LCA adopts a person-centred approach.^{21,22} It enables researchers to uncover distinct behavioural patterns and gain nuanced insights into DE manifestations across populations.^{21,22} For example, Cain et al. identified five clusters of eating, weight, and shape concerns among US young women, reflecting restrictive eating, overeating, and bulimic-like symptoms.¹¹ Similarly, another US study of male youth revealed five DE clusters, characterized by body-image disturbance, binge eating/purging, and muscularity concerns.¹² While several LCAs/LPAs have examined DE patterns, important gaps remain in the literature. First, many existing person-centred studies focus on young adults^{11,13,17} or adult samples²⁰ rather than adolescents, despite adolescence being a critical developmental period for the emergence of DE behaviours.^{6,7} Moreover, several adolescent LCAs were conducted about a decade ago,¹⁴⁻¹⁶ prior to some major societal shifts—including the COVID-19 pandemic—that have altered food environments,²³ social media exposure,²⁴ mental health stressors,²⁵ and access to supportive resources.²⁶ Given evidence that DE behaviours are sensitive to social and contextual influences,²⁷ updated population-based analyses are needed to assess whether previously

identified DE profiles remain applicable to adolescents in the contemporary context.

Second, existing LCAs/LPAs were limited by modest sample sizes^{15,18} or restricted demographic scope,^{11,13} constraining their ability to identify stable latent classes and to capture heterogeneity among equity-deserving populations. Growing evidence shows that transgender and gender-diverse (TGD) youth,²⁸ individuals from lower socioeconomic-status (SES) families,²⁹ racialized and ethnic minority groups,³⁰ and adolescents with larger body sizes³¹ may face greater DE risk and increased barriers to protective resources. Thus, larger and more diverse samples are essential to adequately characterize DE profiles and to examine sociodemographic predictors of class membership with sufficient statistical power.

Third, some recent work has applied intensive longitudinal methods such as ecological momentary assessment (EMA) to examine eating-related processes and to address complementary research questions.¹⁹ In contrast, survey-based LCA is uniquely suited to identifying population-level DE profiles and their sociodemographic correlates, which are critical for public health surveillance and the development of scalable prevention and early intervention strategies.

To address these critical gaps, the current study aims to (1) identify DE profiles in a large, contemporary, population-based sample of secondary school students in Canada; and (2) investigate how students' sociodemographic characteristics predict DE class membership. By identifying DE patterns and predictors, this study seeks to capture disparities in DE behaviours and risk factors to help inform more tailored and equitable prevention and intervention strategies for diverse adolescent populations.

Methods

Study design and sample

This cross-sectional study used student-level data from the 2021–22 wave of the COMPASS study (2012–2027), a prospective cohort study designed to collect hierarchical and longitudinal data from secondary school students in Canada.³² Schools were intentionally selected if allowing active-information passive-consent parental permission protocols.³³ All adolescents in participating schools were

eligible unless withdrawn by a parent/guardian and could decline participation at any time. An in-class, online questionnaire was administered to assess sociodemographic characteristics (e.g. age, gender), health behaviours (e.g. physical activity), and correlates (e.g. bullying). Ethics approval was obtained from the University of Waterloo (ORE#30118), Brock University (REB#23-087), University of Alberta (#RES0050375; Pro00129206), and participating school boards. Full COMPASS protocols are available in print³² or online.³⁴

Questions assessing DE were first introduced in the COMPASS student questionnaire (Cq) during the 2021–22 school year and administered in participating schools across Alberta, British Columbia, and Ontario. In total, 27 003 students from 69 high schools completed the survey; 2364 participants had missing responses to one or more DE items, yielding a final analytic sample of 24 639 adolescents with complete DE data.

Measures

Disordered eating

The COMPASS researchers developed a six-item DE scale adapted from existing instruments, such as the Eating Attitudes Test,³⁵ Eating Disorder Examination Questionnaire,³⁶ and Sick-Control-One-Fat-Food questionnaire,³⁷ to capture key DE thoughts and behaviours. Students were asked how often over the past 12 months they had experienced the following: 1) been preoccupied with a desire to be thinner; 2) made yourself throw up (vomit) on purpose after eating; 3) used laxatives, diet pills, diuretics (water pills), or steroids to control your weight or shape; 4) changed your eating habits in order to manage your weight or shape; 5) ate much more than most people would under the same circumstances and felt that you could not stop; and 6) had a definite fear of gaining weight or being overweight. Responses were recorded on a five-point scale: 0 = never, 1 = a few times, 2 = monthly, 3 = weekly, and 4 = daily. Total scores ranged from 0 to 24, with higher scores indicating greater DE engagement. The internal consistency of all DE items was $\alpha = 0.79$. The scale's clarity, comprehensibility, and measurement invariance across sociodemographic groups have been previously demonstrated.³⁸ Preliminary data analyses indicated small cell sizes in the “weekly” to “daily” response categories, limiting further

analysis. To address this issue while considering response frequency and clinical relevance, we dichotomized the five response options as: 1 = yes (combined reports of “a few times,” “monthly,” “weekly,” and “daily”), and 2 = no (reports of “never”).

Sociodemographic characteristics

Student sociodemographic characteristics were self-reported in the Cq, including grade (9–12), race and ethnicity (“White,” “Black,” “East Asian,” “Latino,” “Middle Eastern,” “South Asian,” “Southeast Asian,” “multiethnic,” “another category”), and perceived family affluence (“more comfortable,” “as comfortable,” “less comfortable”). Gender identity (“girl/woman,” “boy/man,” “nonbinary person,” “Two-Spirit,” “I describe my gender differently”) and sex assigned at birth (“female,” “male”) were combined to classify participants as: “cisgender girls,” “cisgender boys,” or “TGD youth.” Self-reported height and weight were used to calculate body mass index (BMI) categories following World Health Organization (WHO) age- and sex-specific guidelines (“underweight,” “healthy weight,” “overweight,” and “obesity”).³⁹ To avoid stigmatizing language, the weight categories were hereby referred to as “lower weight,” “healthy weight,” “high weight,” and “very high weight,” respectively.⁴⁰

Statistical analysis

Descriptive statistics

Prior to latent class modelling, one-way ANOVA tests were used to descriptively compare mean ordinal DE item scores overall and across sociodemographic subgroups to characterize the distribution and engagement in DE thoughts and behaviours, and to provide contextual information for subsequent analyses.

Latent class analysis

LCA was conducted in SAS using the “PROC LCA” procedure with maximum-likelihood estimation to identify classes of students with similar DE response patterns.²¹ We systematically fitted LCA models from one-to-six classes, comparing fit statistics at each step to determine the best-fitting solution. To address class membership instability, we ran each model with 50 random sets of starting values to ensure the global rather than local maximums were identified during parameter estimation.²¹ Additionally, school-level clustering was accounted for by adjusting standard errors for within-school

correlation, such that clustering influenced variance estimation but not the DE class identification.²¹

Two sets of model fit indices were used to determine the optimal number of DE classes. We started by examining primary indices. First, the corrected Akaike Information Criterion (cAIC) and adjusted Bayesian Information Criterion (aBIC) were examined, with smaller values indicating better fit.^{21,22} Second, we assessed the likelihood ratio G-square value, considering substantial relative reductions between successive class solutions as indicative of improved model fit, rather than applying a fixed numerical threshold.^{21,22} We also used the bootstrap likelihood ratio test (BLRT) *p* value (< 0.05) to determine if the model with more classes fit significantly better.^{21,22} Third, entropy (range: 0–1) was used to evaluate classification certainty, with higher values indicating better accuracy.^{21,22} Secondary indices included the class size, percentage of seeds associated with the best-fitting model, and number of iterations required for model convergence. Adequate class size (very small classes may indicate overfitting) ensured substantive meaning and parsimony,^{41,42} while higher percentages of seeds and fewer iterations indicated better fit.^{41,42} These criteria, along with model interpretability, guided the selection of the final DE classes.^{41,42}

After identifying DE classes, we conducted multinomial logistic regression to investigate associations between five sociodemographic predictors and DE class membership.²¹ Due to sparse cell sizes arising from overlap across DE classes, single-predictor (unadjusted) models were fitted for each variable separately within the LCA framework. Partially adjusted models including selected predictors were conducted as supplementary analyses (available from authors upon request). All analyses were conducted in SAS version 9.4 (SAS Institute Inc., Cary, NC, US), with the significance level set at $\alpha = 0.05$.

Missing data handling

In the COMPASS 2021–2022 sample receiving DE items, 8.8% ($n = 2364$) of students had missing/incomplete DE responses. Among students with complete DE data, item non-response occurred for grade ($< 1\%$), gender (4.3%), race and ethnicity (5.5%), family affluence ($< 1\%$), and weight status (40.7%). Students missing DE data or the relevant sociodemographic variable were excluded from ANOVA tests

on a per-analysis basis. LCA was conducted among students with complete DE responses only. In multinomial logistic regression models, students with complete DE responses were included, and missing sociodemographic values (e.g. weight status) were retained as separate categories to preserve sample size and class stability.

This approach is supported by prior analyses demonstrating that mean DE scores and subgroup differences were highly similar before and after excluding students with missing DE responses.³⁸ Additional COMPASS research shows that non-reporting of self-reported weight is systematically associated with weight perceptions and related behaviours,⁴³ suggesting that missingness may be dependent on weight values themselves, i.e. not missing at random.

Results

Sample characteristics

Mean (SD) scores of DE items overall and by sociodemographic subgroups are presented in Table 1. Overall, weight preoccupation had the highest mean score, followed by changed eating habits and fear of weight gain, whereas pills/steroid use showed the lowest score, with purging and binge eating scores also comparatively low. Significant differences in mean scores were observed across all subgroups for all items ($p < 0.01$), except for purging among grade subgroups. Grade 12 participants had higher means than those in lower grades for weight preoccupation, pills/steroid use, changed eating habits, and fear of weight gain. Across gender, TGD youth had the highest means for purging, pills/steroid use, and binge eating, while cisgender girls scored highest for weight preoccupation and fear of weight gain. Cisgender boys showed the lowest scores across all items. By race and ethnicity, Black students demonstrated the highest means for purging, pills/steroid use, and binge eating, while another ethnicity/multiethnic, Middle Eastern, and Latino students scored highest for weight preoccupation, changed eating habits, and fear of weight gain, respectively. In contrast, East Asian students reported the lowest scores for purging, changed eating habits, binge eating, and fear of weight gain. Students with perceived less affluent households had higher means across all items than their more affluent peers.

TABLE 1
Mean scores (SDs) of disordered eating items among adolescents participating in year 10 (2021–2022) of the COMPASS study (n = 24 639)

Group	Item 1 Weight preoccupation	Item 2 Purging	Item 3 Pills or steroids use	Item 4 Changed eating habits	Item 5 Binge eating	Item 6 Fear of weight gain
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Analytical sample	1.45 (1.51)	0.22 (0.69)	0.13 (0.58)	1.39 (1.43)	0.65 (1.08)	1.26 (1.51)
Grade						
9	1.37 (1.50)***	0.22 (0.70)	0.12 (0.56)**	1.25 (1.40)***	0.60 (1.05)***	1.19 (1.48)***
10	1.42 (1.51)	0.22 (0.67)	0.13 (0.56)	1.36 (1.42)	0.63 (1.06)	1.24 (1.51)
11	1.50 (1.51)	0.23 (0.70)	0.14 (0.60)	1.50 (1.44)	0.71 (1.11)	1.31 (1.52)
12	1.53 (1.52)	0.22 (0.69)	0.15 (0.62)	1.52 (1.44)	0.69 (1.10)	1.32 (1.52)
Missing (n = 52, 0.2%)	–	–	–	–	–	–
Gender						
Cisgender girl	2.02 (1.51)***	0.30 (0.77)***	0.16 (0.60)***	1.62 (1.42)***	0.76 (1.12)***	1.79 (1.58)***
Cisgender boy	0.80 (1.21)	0.08 (0.42)	0.06 (0.42)	1.13 (1.38)	0.47 (0.94)	0.63 (1.12)
TGD youth	1.88 (1.57)	0.55 (1.10)	0.32 (0.92)	1.62 (1.53)	1.08 (1.35)	1.77 (1.63)
Missing (n = 1046, 4.3%)	–	–	–	–	–	–
Race & ethnicity						
White	1.47 (1.52)***	0.21 (0.65)***	0.11 (0.53)***	1.41 (1.44)***	0.64 (1.07)***	1.29 (1.53)***
Black	1.28 (1.53)	0.35 (0.99)	0.31 (0.96)	1.41 (1.47)	0.76 (1.24)	1.14 (1.52)
East Asian	1.31 (1.43)	0.14 (0.55)	0.08 (0.40)	1.19 (1.33)	0.53 (0.96)	1.06 (1.40)
South Asian	1.42 (1.49)	0.16 (0.56)	0.07 (0.39)	1.39 (1.40)	0.57 (1.01)	1.19 (1.43)
Southeast Asian	1.47 (1.44)	0.17 (0.57)	0.10 (0.49)	1.33 (1.29)	0.73 (1.07)	1.27 (1.43)
Latino	1.52 (1.57)	0.21 (0.65)	0.15 (0.62)	1.55 (1.48)	0.68 (1.10)	1.36 (1.54)
Middle Eastern	1.42 (1.51)	0.24 (0.75)	0.17 (0.66)	1.57 (1.48)	0.70 (1.10)	1.28 (1.51)
Another/multiethnic	1.57 (1.52)	0.30 (0.81)	0.17 (0.66)	1.50 (1.45)	0.73 (1.14)	1.35 (1.53)
Missing (n = 1353, 5.5%)	–	–	–	–	–	–

Continued on the next page

TABLE 1 (continued)
Mean scores (SDs) of disordered eating items among adolescents participating in year 10 (2021–2022) of the COMPASS study (n = 24 639)

Group	Item 1 Weight preoccupation	Item 2 Purging	Item 3 Pills or steroids use	Item 4 Changed eating habits	Item 5 Binge eating	Item 6 Fear of weight gain
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Family affluence						
More comfortable	1.37 (1.50) ^{***}	0.20 (0.67) ^{***}	0.14 (0.61) ^{***}	1.43 (1.46) ^{***}	0.60 (1.06) ^{***}	1.17 (1.49) ^{***}
As comfortable	1.42 (1.48)	0.20 (0.63)	0.10 (0.49)	1.33 (1.39)	0.62 (1.04)	1.23 (1.48)
Less comfortable	1.91 (1.63)	0.47 (1.02)	0.31 (0.92)	1.76 (1.51)	1.03 (1.31)	1.77 (1.66)
Missing (n = 122, 0.5%)	–	–	–	–	–	–
Weight status						
Lower weight	0.51 (1.07) ^{***}	0.14 (0.56) ^{***}	0.07 (0.44) ^{***}	0.95 (1.30) ^{***}	0.39 (0.86) ^{***}	0.66 (1.22) ^{***}
Healthy weight	1.27 (1.46)	0.17 (0.57)	0.08 (0.44)	1.39 (1.43)	0.57 (1.00)	1.14 (1.46)
High weight	1.88 (1.52)	0.25 (0.71)	0.13 (0.56)	1.80 (1.48)	0.77 (1.15)	1.49 (1.56)
Very high weight	2.26 (1.49)	0.28 (0.79)	0.18 (0.65)	1.92 (1.45)	1.10 (1.30)	1.77 (1.59)
Missing (n = 10 019, 40.7%)	–	–	–	–	–	–

Abbreviations: BMI, body mass index; SD, standard deviation; TGD, transgender and gender diverse.

Notes: A total of 27 003 students completed the survey; 2364 did not respond to some or all disordered eating (DE) items, yielding an analytical sample of 24 639 adolescents with complete DE data.

The missingness reflects sociodemographic variables only. Weight status was calculated using the World Health Organization (WHO) guidelines for BMI by age and sex. Respondents must have a valid response for BMI, sex and age to be able to calculate this variable. If any of these values were missing, then this variable of a certain respondent was considered missing.

Values 0, 1, 2, 3 and 4 were assigned for original five DE response options respectively, and the sum score range for each DE item is 0–4. Higher scores indicate greater engagement in DE thoughts or behaviours.

Mean scores are presented for descriptive purposes only. One-way ANOVA tests were conducted to compare subgroup differences and provide epidemiologic context; these analyses did not inform latent class enumeration or regression modelling.

Statistical significance is indicated as * for $p < 0.05$, ** for $p < 0.01$, *** for $p < 0.001$.

Additionally, very-high-weight adolescents scored highest across all items, followed by adolescents with high-weight status, while lower-weight students scored lowest.

Latent DE classes

A series of LCA models ranging from one to six classes were fitted to identify the optimal number of DE classes. Primary fit statistics (Table 2) initially indicated that the six-class model provided the best fit, as supported by a substantial drop in the likelihood ratio G-square value, the lowest cAIC and aBIC values, and a significant BLRT *p* value. However, secondary fit indices (Table 3) suggested potential overfitting and convergence issues. Specifically, the six-class model included a class comprising only 1% of the sample, had the lowest proportion of seeds associated with the best-fitting solution, and required over 5000 iterations to converge. Given these concerns, the five-class model was ultimately selected as the most parsimonious and interpretable solution.

Figure 1 displays the class-membership probabilities and item-response probabilities for each DE item. Based on these probabilities, five distinct DE patterns were identified. The first and largest class (32.5%) was labelled “no-to-mild DE,” characterized by low response probabilities (< 0.3) across all items. The second class (30.7%) was labelled “changed eating with weight concern,” as students showed a high likelihood of changing their eating habits to manage weight/shape, along with weight preoccupation

and fear of weight gain. The third class (25.7%) was labelled “binge eating with weight concern,” as students exhibited a pattern of binge eating, accompanied by weight-related concerns. The fourth class (7.3%) was labelled “binge eating without weight concern,” due to the highest response probabilities for binge-related item, but without weight preoccupation or fear of weight gain. The fifth and smallest class (3.7%) was labelled “complex DE,” with students showing high probabilities (> 0.8) across all DE items.

DE class membership by sociodemographic predictors

Table 4 represents the associations between DE class membership and five sociodemographic characteristics (grade, gender, race and ethnicity, family affluence, and weight status), each analyzed separately. All factors significantly predicted overall DE class membership, with gender, family affluence, and weight status showing the strongest associations. Specifically, cisgender girls were 4.74 times (95% CI: 4.15–5.41) and 15.34 times (95% CI: 12.54–18.77) more likely to belong to the “changed eating with weight concern” and “complex DE” classes, respectively, compared to cisgender boys and the “no-to-mild DE” class. TGD youth had about 8-fold (95% CI: 5.72–11.16) and 15-fold (95% CI: 11.83–20.08) higher odds of belonging to the “binge eating with weight concern” and “complex DE” classes, respectively, compared to the same reference categories. Students from less affluent households

were more likely to belong to the “binge eating with weight concern” (OR = 2.46; 95% CI: 2.11–2.88), “binge eating without weight concern” (OR = 2.82; 95% CI: 2.22–3.58), and “complex DE” class (OR = 5.48; 95% CI: 4.27–7.04), relative to their affluent peers and the reference class. Additionally, adolescents with very-high-weight status had increased odds of belonging to three classes with comparison to their healthy-weight peers and the reference class: 3.58, 4.87, and 6.01 times for “changed eating with weight concern” (95% CI: 2.65–4.82), “binge eating with weight concern” (95% CI: 3.70–6.41), and “complex DE” class (95% CI: 3.69–9.79), respectively.

Notably, the “binge eating without weight concern” class demonstrated a distinct sociodemographic pattern compared with other classes. In contrast to weight-concerned and “complex DE” classes, cisgender girls had lower odds of belonging to this class (OR = 0.34; 95% CI: 0.16–0.71), and adolescents with lower-weight status had higher odds of membership (OR = 1.26; 95% CI: 0.94–1.69). These divergent patterns further support the interpretation of this class as a behaviourally distinct profile rather than an extension of symptom severity.

Discussion

This study identified five distinct profiles of DE thoughts and behaviours among Canadian secondary school students and examined their associations

TABLE 2
Primary fit indices for one through six latent class models of disordered eating among adolescents participating in year 10 (2021–2022) of the COMPASS study (n = 24 639)

No. of classes	Likelihood ratio G ²	df	cAIC	aBIC	Entropy	BLRT <i>p</i> value
1	28 336.84	57	28 403.51	28 378.44	1.00	–
2	3485.63	50	3630.08	3575.77	0.79	0.002
3	1101.68	43	1323.92	1240.36	0.73	0.002
4	460.32	36	760.35	647.54	0.70	0.002
5	122.51	29	500.32	358.27	0.69	0.002
6	26.28	22	481.88	310.58	0.71	0.01

Abbreviations: aBIC, adjusted Bayesian Information Criterion; BLRT, bootstrap likelihood ratio test; cAIC, corrected Akaike Information Criterion; df, degrees of freedom; No., number.

Notes: The original five response options were dichotomized as: 1 = yes (combined records of “a few times,” “monthly,” “weekly,” and “daily”); 2 = no (records of “never”).

First, we examined cAIC and aBIC values, with smaller values indicating a better fit. Second, we assessed the likelihood ratio G² value, considering a large drop from the previous model as an improvement. We also checked the BLRT *p* value (< 0.05) to determine if the latter model was significantly better than the former model. Third, entropy (range 0–1) was used to evaluate classification certainty and model quality, with higher values indicating better accuracy.

TABLE 3
Secondary fit indices for one through six latent class models of disordered eating among adolescents participating in year 10 (2021–2022) of the COMPASS study (n = 24 639)

No. of classes	% of seeds associated with best-fitted model	No. of iterations the model converged in	Class membership probabilities: gamma estimates					
1	100.00%	2	1					
			1.0000					
2	100.00%	58	1			2		
			0.4965			0.5035		
3	92.00%	260	1		2		3	
			0.1556		0.4129		0.4315	
4	50.00%	723	1		2		3	
			0.3144		0.2287		0.1465	
5	62.00%	1346	1		2		3	
			0.0731		0.2574		0.0371	
6	26.00%	The model did not converge in 5000 iterations	1		2		3	
			0.2586		0.0110		0.3081	

Abbreviation: No., number.

Notes: A higher percentage of seeds and fewer iterations indicated a better model fit.

Adequate class size (very small classes may indicate overfitting) ensured substantive meaning and parsimony.

with sociodemographic characteristics. Using LCA, we derived five classes: no-to-mild DE, changed eating with weight concern, binge eating with weight concern, binge eating without weight concern, and complex DE. Significant differences in class membership were observed across sociodemographic groups. Notably, cisgender girls and TGD youth, adolescents from less affluent households, and those with very high weight were more likely to belong to classes characterized by higher symptom engagement and multiple behaviours. These findings highlight the heterogeneity of DE experiences in youth and underscore the importance of considering sociocultural and contextual factors when interpreting DE patterns. They also emphasize the need for longitudinal research to examine developmental trajectories and to inform tailored prevention and early intervention strategies.

The five-class DE patterns align broadly with prior international research, which consistently identifies multiple, hierarchically ordered DE profiles ranging from low-risk to complex symptoms.^{11–20} This convergence suggests that core symptom dimensions—such as weight and shape concern, binge eating, and compensatory behaviours—may reflect common underlying processes across cultural contexts. Accordingly, prevention efforts targeting

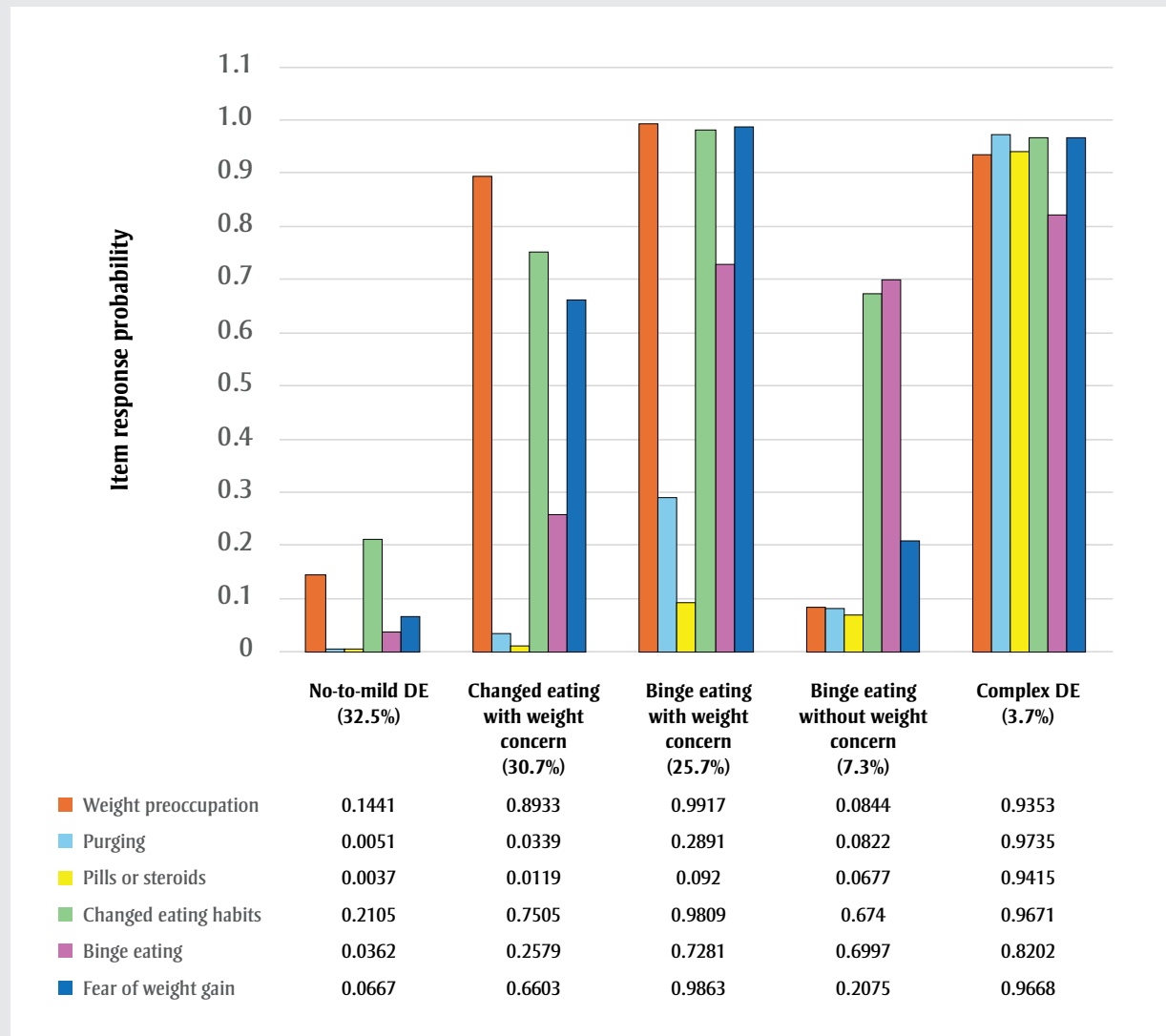
shared risk factors, including body dissatisfaction and unhealthy weight-control behaviours, may have cross-national relevance. However, some differences emerged. European studies have identified more differentiated subtypes based on restraint or symptom severity,^{14,15} while US and UK studies have highlighted gendered or muscularity-related subtypes, particularly among males.^{12,16} In contrast, the Canadian pattern emphasized classes combining weight concern with behavioural symptoms. Some of these variations may reflect methodological differences. For example, prior studies have included items assessing muscularity-related concerns or conducted gender-stratified LCAs,^{12,16} which may facilitate the identification of gender-specific DE patterns. Therefore, differences between studies likely reflect a combination of methodological factors and potential sociocultural variation in DE manifestation across populations.

Of the five sociodemographic factors, gender, family affluence, and weight status demonstrated the strongest associations with DE class membership. Importantly, these associations varied across specific DE profiles rather than reflecting a simple distinction between DE and non-DE. Cisgender girls were more likely than cisgender boys to belong to classes characterized by weight concerns, binge eating, and multibehaviour DE, consistent with prior

research.^{14,16,18} These gender-specific patterns likely reflect sociocultural norms emphasizing thinness for girls and muscularity for boys,⁴⁴ which may drive behaviours such as dieting or purging among girls and excessive exercise or supplement use among boys.⁴⁴ These findings support the need for gender-responsive prevention efforts that address appearance-related pressures and promote inclusive body ideals.

The inclusion of TGD youth extends the literature by demonstrating that these adolescents are at even greater risk of belonging to the complex DE class compared to cisgender girls. TGD youth may experience unique stressors related to gender incongruence, particularly when physical characteristics conflict with their gender identity.⁴⁵ This can contribute to psychological distress and the use of DE behaviours to modify or suppress secondary sex characteristics.⁴⁵ For example, transfeminine youth may restrict intake to align with feminine ideals, while transmasculine youth may pursue intensive exercise or supplement use to meet masculine standards.⁴⁶ Nonbinary youth may engage in restrictive eating or purging aimed at reducing gendered traits.⁴⁶ These findings underscore the importance of gender-affirming and tailored prevention strategies for TGD populations.

FIGURE 1
The item-response probabilities of five latent disorder eating classes among adolescents participating in year 10 (2021–2022) of the COMPASS study (n = 24 639)



Beyond gender, socioeconomic and weight-related disparities were also evident. Adolescents who perceived their households as less affluent were more likely to belong to classes characterized by binge eating and multiple DE behaviours. Perceived lower SES may heighten vulnerability to DE through pressures for social acceptance and idealized body standards, consistent with prior research.^{29,47} Household food insecurity may further contribute to this relationship by creating cycles of food restriction and overeating, disrupting appetite regulation and increasing risk for binge eating.⁴⁸ These findings highlight

the importance of addressing broader structural and economic factors in DE prevention.

Our findings also revealed that adolescents with very-high-weight status were at the greatest risk of belonging to the complex DE class. This aligns with growing evidence that very-high-weight youth face elevated DE risk,⁴⁹ challenging longstanding assumptions that DE/ED primarily affect thin/low-weight individuals.⁵⁰ Such misconceptions may contribute to under-recognition of DE among very-high-weight adolescents. Very-high-weight youth are

more frequently subjected to teasing and bullying from peers and family members, compared to their healthy-weight counterparts.⁴⁹ Experiences of weight-based stigma and discrimination may, in turn, exacerbate body dissatisfaction and promote maladaptive eating behaviours.⁴⁹ These results underscore the need for prevention strategies that address weight-related stigma and improve recognition of DE across diverse body sizes.

Strengths and limitations

This study has several strengths. First, it is among the largest investigations of DE

TABLE 4
Disordered eating class membership predicted by student sociodemographic characteristics,
among adolescents participating in year 10 (2021–2022) of the COMPASS study

Measures	Disordered eating class								<i>p</i>
	2		3		4		5		
	Changed eating with weight concern		Binge eating with weight concern		Binge eating without weight concern		Complex DE		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Grade									
9 (<i>ref.</i>)	–	–	–	–	–	–	–	–	–
10	1.02	(0.91, 1.15)	1.21	(1.05, 1.39)	1.20	(0.94, 1.53)	1.18	(0.95, 1.47)	*
11	1.22	(1.06, 1.41)	1.60	(1.40, 1.82)	1.65	(1.32, 2.06)	1.35	(1.06, 1.73)	***
12	1.24	(1.08, 1.43)	1.58	(1.35, 1.86)	1.49	(1.12, 2.00)	1.44	(1.12, 1.86)	***
Missing (n = 52, 0.2%)	1.17	(0.57, 2.39)	1.68	(0.77, 3.68)	1.28	(0.14, 11.42)	4.35	(1.22, 15.58)	
Gender									
Cisgender boy (<i>ref.</i>)	–	–	–	–	–	–	–	–	–
Cisgender girl	4.74	(4.15, 5.41)	0.84	(0.50, 1.40)	0.34	(0.16, 0.71)	15.34	(12.54, 18.77)	***
TGD youth	2.77	(2.19, 3.51)	7.99	(5.72, 11.16)	0.31	(0.17, 0.57)	15.41	(11.83, 20.08)	***
Missing (n = 1046, 4.3%)	1.62	(1.34, 1.97)	7.75	(5.43, 11.05)	0.43	(0.26, 0.70)	10.25	(7.96, 13.20)	***
Race and ethnicity									
White (<i>ref.</i>)	–	–	–	–	–	–	–	–	–
Black	0.81	(0.63, 1.04)	0.62	(0.46, 0.83)	1.93	(1.37, 2.73)	2.14	(1.58, 2.89)	***
East Asian	1.07	(0.95, 1.22)	0.74	(0.62, 0.89)	0.86	(0.62, 1.19)	0.55	(0.38, 0.81)	***
South Asian	1.42	(1.12, 1.80)	1.04	(0.79, 1.35)	1.44	(0.87, 2.39)	0.66	(0.41, 1.08)	**
Southeast Asian	1.73	(1.42, 2.10)	1.90	(1.47, 2.45)	2.47	(1.66, 3.69)	0.86	(0.54, 1.38)	***
Latino	1.38	(1.06, 1.80)	1.24	(0.95, 1.63)	2.25	(1.54, 3.30)	1.71	(1.06, 2.78)	***
Middle Eastern	1.22	(0.88, 1.70)	1.23	(0.90, 1.68)	2.67	(1.74, 4.12)	1.62	(1.04, 2.54)	***
Another/multiethnic	1.28	(1.10, 1.48)	1.27	(1.12, 1.45)	1.54	(1.14, 2.08)	2.04	(1.65, 2.52)	***
Missing (n = 1353, 5.5%)	0.74	(0.60, 0.91)	0.54	(0.43, 0.68)	1.03	(0.66, 1.61)	1.44	(1.10, 1.89)	***
Family affluence									
As comfortable (<i>ref.</i>)	–	–	–	–	–	–	–	–	–
More comfortable	0.83	(0.76, 0.91)	0.84	(0.76, 0.93)	1.09	(0.91, 1.30)	1.03	(0.82, 1.28)	***
Less comfortable	1.20	(0.96, 1.50)	2.46	(2.11, 2.88)	2.82	(2.22, 3.58)	5.48	(4.27, 7.04)	***
Missing (n = 122, 0.5%)	0.48	(0.26, 0.88)	0.21	(0.08, 0.55)	0.53	(0.18, 1.54)	0.95	(0.36, 2.47)	***
Weight status									
Healthy weight (<i>ref.</i>)	–	–	–	–	–	–	–	–	–
Lower weight	0.35	(0.22, 0.55)	0.20	(0.11, 0.36)	1.26	(0.94, 1.69)	0.57	(0.25, 1.30)	***
High weight	2.31	(1.92, 2.79)	2.47	(2.03, 3.00)	0.71	(0.49, 1.03)	2.95	(2.04, 4.25)	***
Very high weight	3.58	(2.65, 4.82)	4.87	(3.70, 6.41)	0.43	(0.23, 0.79)	6.01	(3.69, 9.79)	***
Missing (n = 10 019, 40.7%)	0.87	(0.78, 0.97)	0.94	(0.83, 1.06)	0.36	(0.31, 0.43)	2.24	(1.85, 2.70)	***

Abbreviations: CI, confidence interval; DE, disordered eating; OR, odds ratio; *ref.*, reference category; TGD, transgender and gender diverse.

Notes: The “no-to-mild DE” class (class 1) was used as the reference category for comparisons.

The *p* value indicates whether a certain variable statistically significantly predicted overall DE class membership relative to its reference categories, using * for *p* < 0.05, ** for *p* < 0.01 and *** for *p* < 0.001. CIs were further checked to determine whether the variable predicted membership in one or more DE classes.

Parameter estimates of each predictor were calculated separately, as the overlap between and within groups across DE classes resulted in very small sample sizes in certain cells, which limited the feasibility of multivariable analysis.

patterns in Canadian adolescents, with over 24 000 participants across three provinces, allowing for robust identification of latent classes and inclusion of equity-deserving groups such as TGD and racially

diverse youth. Second, the use of LCA enabled a person-centred approach to capture heterogeneity in DE patterns. Third, the inclusion of a brief DE scale, developed with youth input and demonstrating

measurement invariance across subgroups, enhances methodological rigour.

Several limitations should be acknowledged. First, all measures were self-reported,

introducing potential recall and social desirability bias, particularly for sensitive behaviours (purging or laxative use). Second, the adapted DE scale combined items from multiple instruments, each with known limitations in adolescent populations (e.g. brief screening tools, low-prevalence compensatory behaviours, and the absence of ARFID-related content), which may constrain the clinical interpretability of the latent DE classes while still allowing the identification of population-level symptom profiles. Third, missing data—especially for weight status—may have influenced results despite retaining missing responses as a separate category. Fourth, the sample was limited to schools in three provinces and those permitting passive consent, which may affect generalizability. Finally, regression analyses were conducted separately for each predictor due to sparse subgroup data, limiting the assessment of interactions or cumulative effects.

Conclusion

This study identified five distinct DE profiles among Canadian adolescents, revealing significant disparities in DE class membership by gender, family affluence, and weight status. Cisgender girls and TGD youth, individuals from less affluent households, and those with very high weight were at increased risk for more complex DE patterns. These findings underscore the need for gender-responsive and equity-oriented public health interventions addressing sociocultural pressures, economic disadvantage, and weight-related stigma. Future longitudinal research is warranted to elucidate developmental pathways and guide targeted prevention efforts for diverse adolescent populations.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethics approval

The current study received ethics approval from Brock University (REB#23-280). The host COMPASS study received ethics approval from the University of Waterloo (ORE#30118), Brock University (REB#18-099; 23-087), CIUSSS de la Capitale-Nationale–Université Laval (#MP-13-2017-1264) and participating school boards.

Consent to participate

All students had parental/guardian consent to participate in the study. Students attending participating schools were invited to participate using active-information passive-consent parental permission protocols. Parents were informed of the study and could withdraw their child

by contacting study staff. Students not withdrawn from the study by their parents were considered eligible to participate. Under passive-consent protocols, parental informed consent is assumed for all students whose parents that did not contact COMPASS staff to withdraw their child from the study, and this pertained to all participating students.

Availability of data and material

COMPASS study data is available upon request through completion and approval of an online form: <https://uwaterloo.ca/compass-system/information-researchers/data-usage-application>. The datasets used during the current study are available from the corresponding author on reasonable request.

Authors' contributions and statement

LZ: Conceptualization, formal analysis, writing—original draft.

KB: Supervision, writing—review and editing.

WP: Supervision, writing—review and editing.

JL: Supervision, writing—review and editing.

STL: Funding acquisition, project administration, resources, writing—review and editing.

KAP: Conceptualization, supervision, funding acquisition, project administration, writing—review and editing.

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Original quantitative research

Examining the grading process for the Government indicator of the 2024 ParticipACTION Report Card on Physical Activity for Children and Youth

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This article has been peer reviewed.

Abstract

Introduction: The ParticipACTION Report Card on Physical Activity for Children and Youth is the national assessment of children and youth's physical activity and related behaviours. Traditionally, the Government indicator was graded through a subjective process, but the 2024 Report Card applied a more systematic and objective scoring rubric. This manuscript describes the process and results of using this rubric to grade the Government indicator.

Methods: National, provincial, and territorial physical activity-related policies, budget items, and initiatives from 2022 to 2024 were gathered. This collated document was shared with the Federal-Provincial/Territorial Sport, Physical Activity and Recreation Council (SPARC), a group of government officials from the public health and sport sectors. After SPARC feedback, a score was calculated for the Government indicator.

Results: A total score of 67.7/100% was calculated, and a B grade was assigned for the Government indicator. The score was based on the number of policies (score: 4/5), breadth of policies (score: 4/5), and identified supporting actions (score: 14.7/20), accountable organizations (score: 15/25), reporting structures (score: 10/15), funding (score: 15/20), and monitoring and evaluation plans (score: 5/10).

Conclusion: The B grade in 2024 is slightly higher than the B- in 2020 and 2022. It is unknown whether this represents true positive change in Canada or a measurement artifact from the new scoring rubric. Canadian Report Card researchers will continue to employ this more objective rubric, and we encourage other Global Report Card leaders to do the same.

Keywords: *physical activity, sedentary behaviour, policy, active healthy kids, assessment*

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Highlights

- The ParticipACTION Report Card on Physical Activity for Children and Youth is Canada's national assessment of children and youth's physical activity and related behaviours.
- Traditionally, the Government indicator was graded through a subjective process, but the 2024 Report Card applied a more systematic and objective scoring rubric using the Health Enhancing Physical Activity Policy Audit Tool Version 2.
- A total score of 67.7/100% was calculated, and a B grade was assigned for the Government indicator.
- Canadian Report Card researchers will continue to employ this more objective rubric, and we encourage other Global Report Card leaders to do the same.

Introduction

The benefits of physical activity for children and youth are far-reaching, including the promotion of healthy physical, cognitive, and social-emotional health and development.¹ In Canada, the economic burden of physical inactivity on health among adults alone is estimated at \$3.9 billion per year. Conversely, the positive economic impact generated by sport, physical activity, and recreation has been estimated at \$37.2 billion per year.² Thus, many public health efforts have been employed to improve the physical activity levels of children and youth and promote the importance of intervening in early life.³⁻⁶ Despite these efforts, most children and youth in Canada are failing to accumulate adequate levels of physical activity for health benefits. For instance, it is estimated that 48% of children and 79% of youth in Canada are not meeting the Canadian 24-Hour Movement Guidelines' physical activity recommendation of ≥ 60 minutes/day of moderate-to-vigorous physical activity.⁷ Further, gender and age differences in physical activity levels are becoming increasingly evident. From childhood to adolescence, the percentage of boys meeting the physical activity recommendation drops from 66% to 33%, while for girls it drops from 37% to 8%.⁷

Guiding and facilitating an improvement in physical activity levels requires understanding Bronfenbrenner's ecological systems theory⁸ and physical activity and related behaviours, opportunities, characteristics, and determinants at the individual, interpersonal, organizational, community, and policy levels.⁹ This need was the impetus for the creation of the Active Healthy Kids Global Alliance (AHKGA), a multinational coalition committed to powering the global movement to get children and youth moving through thought leadership, knowledge translation and mobilization, capacity building, and advocacy.¹⁰ The flagship product of this group is the Global Matrix—a comprehensive assessment of global variation in child and youth physical activity and related variables.¹⁰ Modelled after the Canadian Report Card on Physical Activity in Children and Youth,¹¹ the Global Matrix 4.0 included 57 countries,¹² and 69 countries are participating in the next iteration, scheduled to be released in 2026.¹³ The Global Matrix includes 10 common indicators across participating countries: Overall Physical Activity, Organized Sport and Physical Activity, Active Play, Active Transportation,

Sedentary Behaviour, Physical Fitness, School, Family and Peers, Community and Environment, and Government.¹² The Global Matrix has led to many successes in powering the momentum to get kids moving across the world.^{10,12,14} In Canada, the ParticipACTION Report Card on Physical Activity for Children and Youth is the national contribution to the Global Matrix, and has demonstrated impact, especially in the academic and government sectors.^{15,16}

Specific to the Government indicator of the Report Card, strategies, policies, investments, and leadership related to physical activity are assessed. Within Canada, assessment of the Government indicator has historically relied on a subjective process informed by expert consensus.¹⁷ However, Ward et al.¹⁸ developed and implemented a more objective Report Card scoring rubric for the Government indicator of the 2018 Wales Report Card, based on the Health Enhancing Physical Activity Policy Audit Tool Version 2 (HEPA PAT V2).¹⁹ The development of this more objective process addressed an important limitation for assessing government influence on physical activity, and for the Global Matrix 4.0 in 2022, 12 participating countries adopted this Report Card scoring rubric. While Canada's general Global Matrix and Report Card did not introduce the use of this Report Card scoring rubric until 2024, it was used in the 2022 Canadian Para Report Card on Physical Activity for Children and Adolescents with Disabilities.²⁰ Adopting this Report Card scoring rubric not only provides a more objective assessment of government influence on physical activity in Canada, but it also allows for better global comparisons of government strategies and investments to evaluate variation across countries. Therefore, the Welsh Report Card scoring rubric was adopted with some modifications for the 2024 ParticipACTION Report Card on Physical Activity for Children and Youth.²¹ The purpose of this manuscript is to describe the process and results of using the Welsh Report Card scoring rubric to assign a grade to the 2024 ParticipACTION Report Card Government indicator. The description and reporting of this process outlines the evidence underlying the Government grade in Canada, highlights the strengths and limitations of the approach, and may help guide other countries considering the adoption of this grading method.

Methods

Scoring the Government indicator within the 2024 ParticipACTION Report Card on

Physical Activity for Children and Youth happens as a component of the overall Report Card grading process.²¹ Briefly, the ParticipACTION Report Card is a comprehensive assessment of child and youth physical activity in Canada that synthesizes multiple data sources across 14 physical activity and related indicators (e.g. Overall Physical Activity, Organized Sport, Government).^{15,17,21} The synthesis of data and assigning grades to the 14 indicators is based on established benchmarks within a grading scheme.²¹ Grading is conducted by the Report Card Research Committee (RCRC), a group comprised of the chief scientific officer, research manager, ParticipACTION staff content experts (2024, $n = 2$), and Canadian researchers with expertise in children's physical activity (2024, $n = 13$) across multiple sectors (e.g. academic, government, policy, practice), geographic regions (e.g. Atlantic Canada, Ontario, Prairies), and career stages (e.g. early, mid, senior).²¹ Since 2005, 16 Canadian children and youth report cards have been produced.¹⁵

Development of the Government indicator scoring approach

A non-experimental quantitative, stakeholder-informed study design was adopted. At the first RCRC meeting for the 2024 Report Card, members discussed the idea of moving away from entirely qualitative grading for the Government indicator toward a more quantitative and standardized approach. A subcommittee ($n = 9$) was formed to explore adopting the scoring rubric developed by Ward et al.¹⁸ based on the Health Enhancing Physical Activity Policy Audit Tool Version 2 (HEPA PAT V2).¹⁹ This approach involves identifying relevant policies, budget items, and initiatives and scoring them using a predefined rubric.¹⁸ The process involved four key stages: (1) policy identification and compilation by the government subcommittee; (2) stakeholder validation with the Federal-Provincial/Territorial Sport, Physical Activity and Recreation Council (SPARC); (3) scoring using the Report Card rubric; and (4) final grade assignment by the RCRC.

Policy identification and data sources

Relevant policies, strategies, budget documents, and initiatives were identified through structured searches of publicly available federal, provincial, and territorial government sources. These included ministry and agency websites (e.g. health, sport, recreation, education, transportation,

infrastructure), strategic plans, legislative documents, and budget announcements. Targeted keyword searches (e.g. “physical activity,” “sport,” “recreation,” “active transportation,” “parks,” “wellness”) were used within jurisdictional websites. Grey literature (e.g. government reports and action plans) was included where publicly accessible.

Documents were limited to those published or active between 2022 and 2024. Policies were included if they were government-led (federal, provincial, territorial) and had a direct or indirect relationship to physical activity. Direct relationships explicitly referenced physical activity or related behaviours, while indirect relationships reflected plausible influence (e.g. parks or active transportation infrastructure). Policies were excluded if they were municipal only, not government-led, or focussed exclusively on clinical or therapeutic interventions without population-level relevance.

Data extraction and policy inventory development

Identified policies were extracted into a standardized Excel-based inventory, organized by jurisdiction. Each policy was treated as a single unit of analysis. Extracted fields included policy title, jurisdiction, year, sector (e.g. health, education, transportation), policy type (e.g. strategy, funding initiative, legislation), and target population where specified.

Variables aligned with the scoring rubric were also captured, including the presence or absence of: (1) supporting actions; (2) accountable organizations; (3) reporting structures; (4) identifiable funding; and (5) monitoring and evaluation plans. For the purposes of this scoring process, relevant policies, budget items, and initiatives had to have a direct or indirect link to physical activity (e.g. reference to sport, recreation, active transportation).

To enhance completeness and accuracy, the inventory was shared with the SPARC, a stakeholder group of government officials from the public health and sport sectors representing all jurisdictions. Members reviewed jurisdiction-specific entries for accuracy, omissions, and additional input.

Scoring procedures

The finalized inventory was used to determine a score from 0% to 100%, with higher scores indicating stronger policy support for physical activity. Scoring

followed the Report Card rubric by Ward et al.,¹⁸ which includes seven domains: (1) number of policies (5%); (2) breadth across sectors (5%); (3) supporting actions (20%); (4) accountable organizations (25%); (5) reporting structures (15%); (6) funding (20%); and (7) monitoring and evaluation plans (10%).

Domains were assessed based on explicit evidence within policy documents (e.g. named responsible organizations, defined funding, or reporting mechanisms). Domain scores were calculated according to rubric criteria and summed to produce a total score.

To reflect Canada’s multilevel governance structure, provincial and territorial scores were weighted by population relative to the national total (Table 1).²² For example, Alberta’s score was multiplied by 0.1152, reflecting 11.52% of the population.

Two researchers (BAB, NK) collaboratively conducted the initial scoring, and this score was reviewed by the government subcommittee for resolution of disagreements and approval. Once approved, the findings were presented to the broader RCRC at a grade-assigning meeting for the full Report Card, where the Government

indicator was assigned a letter grade from F (0%–19%) to A+ (94%–100%).²¹

Data availability

The policy inventory was developed using jurisdiction-specific information that was compiled, verified, and, in some cases, supplemented through consultation with government representatives. Due to data-sharing constraints and the inclusion of information stemming from the stakeholder validation that is not currently available in the public domain, the full dataset cannot be shared. However, detailed descriptions of the identification, extraction, and scoring procedures are provided to support transparency and reproducibility.

Results

When seeking feedback from SPARC, the number of representatives who provided input from each federal, provincial, and territorial jurisdiction was 2 out of 2 federally, 9 out of 10 provincially, and 3 out of 3 territorially. One province chose not to participate. A total of 3 provinces returned edited scorecards, highlighting a small number of programs that were missed by the research team in their initial searches. However, the individual scores for the

TABLE 1
Proportional weighting score modifiers based on the percent of the total population in Canada

Region	Percent of population
Ontario	38.45%
Quebec	22.98%
British Columbia	13.52%
Alberta	11.52%
Manitoba	3.63%
Saskatchewan	3.06%
Nova Scotia	2.62%
New Brunswick	2.09%
Newfoundland and Labrador	1.38%
Prince Edward Island	0.42%
Northwest Territories	0.11%
Yukon	0.11%
Nunavut	0.10%
Federal	100.00%

3 provinces as well as the total overall score remained unchanged despite the new programmatic additions.

A total of 61 policy items (i.e. documented policies, budget items, initiatives) were identified: 13 at the federal level, 42 at the provincial level (range: 2–8), and 6 at the territorial level (range: 2). Additionally, 16/61 policies mentioned children and youth, 4/61 policies mentioned those with disabilities, and 3/61 policies overlapped by mentioning children and youth with disabilities. When comparing the proportion of direct versus indirect policies, 69% were direct at the federal level, 77% at the provincial level, and 100% at the territorial level. The breadth of policies spanned the following sectors: community wellness, culture and recreation, education, environment, health, heritage, Indigenous relations and reconciliation, Indigenous sports and recreation, infrastructure and communities, media and advertising, parks, physical activity, recreation, sport, sustainability, transportation, and urban and rural planning. The mean number of sectors was 5 at the federal level, 4 at the provincial level (range: 2–10), and 3 at the territorial level (range: 2–4).

The proportion of policies with specific actions to support physical activity, accountable organization(s), reporting structures, funding, and monitoring and evaluation plans ranged from an average of 16.7% (1 of 6 territorial-level policies) to 84.6% (11 of 13 federal-level policies; Table 2). The proportions were higher in all categories at the federal level, except for monitoring and evaluation, which was highest at the provincial level. Overall, the cumulative

score for the Government indicator was 68% (Table 3), which equates to a B grade (67%–73%).²¹

Discussion

Canada received a grade of B (68%) when scoring the 2024 ParticipACTION Report Card Government indicator using the Welsh Report Card scoring rubric,¹⁸ which is slightly higher than the B– assigned in 2020 and 2022, and the median B– assigned from 2014 to 2024.¹⁷ It is not possible to say whether this represents progress in policy or funding of physical activity in Canada, or is simply a measurement artifact from using a different scoring technique. Further, it would not be feasible to examine changes in Report Cards by rescored old timepoints with the Welsh Report Card scoring rubric, especially considering the addition of consulting the SPARC. Nonetheless, using a more objective Report Card scoring rubric will standardize the Government indicator scoring in future Report Cards and will facilitate the analysis of trends over time. This is particularly important as RCRC member turnover can result in a loss of continuity when key individuals who previously guided the subjective Government indicator scoring are no longer involved. Onboarding new members of the RCRC tasked with scoring the Government indicator could be enhanced if they accessed the data from the present study to calibrate their scoring. Adopting and documenting a more quantitative approach may facilitate the accurate assessment of changes in government policy and funding over time. Implementing this methodology within the 2025 Canadian Adult

Report Card²³ was an important step toward assessing policy influences across the lifespan. Further, the updated approach to scoring the Government indicator could be a useful tool for assessing progress on national strategies such as the Common Vision for Increasing Physical Activity and Reducing Sedentary Living in Canada,²⁴ Framework for Recreation in Canada 2015,²⁵ 2025–2035 Canadian Sport Policy,²⁶ National Active Transportation Strategy,²⁷ and Canada’s efforts to address the UN’s Sustainable Development Goals via sport, physical activity, and recreation promotion.²⁸ Nevertheless, it is notable that the previous qualitative/subjective scoring method resulted in very similar results, suggesting that the expert consensus for interpreting the evidence gathered was reasonably accurate.

Interestingly, the B grade from the 2024 ParticipACTION Report Card differs when compared to the C– in the 2022 Canadian Para Report Card on Physical Activity for Children and Adolescents with Disabilities.²⁰ While both assessments examined the federal, provincial, and territorial policy influence on physical activity in Canada in a relatively similar time frame, the Para Report Card made concerted efforts to examine disability-specific physical activity policies and funding initiatives. To that point, only 4/61 policies in this study mentioned those with disabilities. Clearly, efforts are needed to bridge the gap between these two grades by creating more accessibility policies and disability-specific funding at the national, provincial, and territorial levels. Outside the intra-Canadian comparison, the Canadian ParticipACTION Report Card had a higher

TABLE 2
Federal, provincial and territorial proportion of policies meeting specific domains

Policies with...	Region		
	Federal (n = 13 policies)	Provincial (n = 42 total policies across 10 provinces)	Territorial (n = 6 total policies across 3 territories)
Supporting actions	84.6% ^a	60.9% (0.0–100.0%)	50.0% (50.0–50.0%)
Accountable organizations	76.9% ^a	51.7% (0.0–100.0%)	33.3% (0.0–50.0%)
Reporting structures	69.2% ^a	59.8% (0.0–100.0%)	16.7% (0.0–50.0%)
Funding	84.6% ^a	68.1% (0.0–100.0%)	66.7% (50.0–100.0%)
Monitoring and evaluation	46.2% ^a	59.8% (25.0–100.0%)	33.3% (0.0–50.0%)

Note: Values represent the mean (min-max) proportion of policies with specific aspects that could improve the likelihood of successfully implementing a policy and, by extension, improving physical activity.

^a No range presented as only one jurisdiction is represented.

TABLE 3
Overall and domain scores for the Government indicator

Domain	Narrative	Score/Total (%)
Number of policies	In Canada, 13 policies were identified at the federal level and a proportional average of 4.2 policies were identified at the provincial/territorial level (range: 2–8) for a total of 17.2 (15 to 19 category).	4/5%
Breadth of policies – number of sectors	Among the identified policies, the number of sectors was 5 at the federal level and a proportional average of 3.6 at the provincial/territorial level (range: 2–10) for a total of 8.6 (8 to 9 category). Six provinces'/territories' policies stayed within the sport, physical activity and recreation sectors, while others extended beyond these sectors (e.g. urban and rural planning, heritage).	4/5%
Identified supporting actions	A total of 11 of the 13 federal policies and 30 of 48 provincial/territorial policies (proportional average 87.0%) identified supporting actions for a total of 14.7. Some policy initiatives included comprehensive action plans nested within key initiative goals, while others only included broad statements with limited accountability.	15/20%
Identified accountable organization(s)	A total of 10 of the 13 federal policies (76.9%) and 29 of 48 provincial/territorial policies (proportional average 74.6%) identified lead organizations who were responsible for the delivery of the policies (total score of 76.4%). Some policy initiatives included specific groups (e.g. community groups, non-profits) responsible for the delivery of actions, while others simply referenced the government ministries/departments responsible for enacting policy actions.	15/25%
Identified reporting structures	A total of 9 of the 13 federal policies (69.2%) and 26 of 48 provincial/territorial policies (proportional average 74.1%) referenced reporting structures (total score of 70.5%).	10/15%
Identified funding	A total of 11 of the 13 federal policies (84.6%) and 32 of 48 provincial/territorial policies (49.8%) included specific references to funding (total score of 76.2%). The proportional difference in federal and provincial/territorial policies with funding structures is worth noting; most federal government policy initiatives were line items in the federal budget, whereas provincial and territorial policy initiatives often included references to funding by way of grant programs and tax incentives. ^a	15/20%
Monitoring and evaluation plan	A total of 6 of the 13 federal policies (46.2%) and 27 of 48 provincial/territorial policies (proportional average 72.9%) included reference to monitoring and evaluation plans (total score of 52.7%). At the provincial/territorial level, most policies that included reporting structures also included monitoring and evaluation plans; however, fewer policies had both at the federal level.	5/10%
Total score		68/100%

Notes: Benchmark scores were weighted proportionally as recommended by Ward et al.;¹⁸ proportional average refers to the process of proportionally weighting scores for each province/territory by the population size in comparison to the total Canadian population (see Table 1).

^a It is possible that policy initiatives without explicit reference to funding will work within their existing departmental budgets to carry out policy actions.

grade for the Government indicator (B; 68%) when compared to the 2018 Welsh Report Card (C+; 54%).¹⁸ The areas where Canada appeared to outperform Wales were in the Identified Reporting Structures (Canada: 10/15, Wales: 5/15) and Identified Funding (Canada: 15/20, Wales: 8/20). Direct comparisons, such as those between Canada and Wales, are a core aspect of the Global Matrix ethos, where countries learn from one another as a means of working toward improving global levels of children's physical activity.¹⁰

An alternative explanation for the ParticipACTION Report Card scoring the Government indicator higher when compared to the Canadian Para Report Card and Welsh Report Card could be attributed to the additional step of collaborating with the SPARC. While the SPARC was not involved in grading the indicator, their

review and confirmation of included jurisdiction-specific policy and funding initiatives helped ensure that our data were complete, current, and accurate. Thus, our collaborative process likely enhanced our ability to identify reporting structures and funding, ultimately contributing to a higher grade. Beyond methodological improvements, engaging with groups like the SPARC throughout the grading process may yield broad and unintended benefits. Collaborating with government officials could create a sense of shared ownership with the Report Card, leading to enhanced legitimacy, buy-in, trust, and promotion of physical activity at various levels of government. Additionally, this collaboration could help build key relationships between researchers and government officials, strengthening policy-research feedback loops. Alternatively, familiarization with a Report Card scoring rubric could help

government officials alter policy language to maximize the scores while taking no concrete steps to genuinely improve physical activity in Canada. Further, there were some concerns that this activity created inter-jurisdictional comparisons that could be conceived as shaming and unmotivating, potentially undermining relationship building. Thus, future Report Cards will need to continue balancing the benefits of governmental collaboration with the need for critical independence, ultimately ensuring that improvements in grades reflect meaningful actions rather than superficial policy language.

Strengths and limitations

The primary holistic strength of this process, for Canada and other Global Matrix countries adopting the Welsh Report Card scoring rubric, is the shift from a

consensus-based approach toward a quantitative, stakeholder-informed assessment of the Government indicator. Moving to a more objective approach enhances transparency and replicability of scoring for year-to-year comparisons within a country, and consistency of scoring when different countries compare scores with one another. The main strength of the current project was including the SPARC to ensure the full and accurate scope of policies and funding were evaluated. While it is important that government collaboration does not influence the critical appraisal necessary to remain objective, the potential intended and unintended benefits remain a major strength. Future applications of this approach could consider engaging non-government stakeholders (e.g. researchers, practitioners, or civil society organizations) to complement government input, broaden interpretation of policy context, and strengthen accountability.

Some important limitations also need to be considered. First, the previous subjective scoring of the Government indicator included the benchmark evidence of leadership and commitment in providing physical activity opportunities for all children and youth,¹⁷ which is absent in the updated Report Card scoring rubric. While evidence of leadership may be a difficult concept to objectively score, it may be an important contributor to children's physical activity in Canada. Further, despite the rigour and comprehensiveness of adopting a more objective process, the resulting grades in Canada for 2020 and 2022 were similar to those produced using the subjective process. Thus, some may question if the additional time and resources are worth the effort. Future initiatives should evaluate the costs and benefits of the objective scoring from an international perspective. If the benefits outweigh the costs, an international consensus should be reached to determine which aspects of the Report Card scoring rubric should be added or subtracted. For instance, the Global Observatory for Physical Activity (GoPA) employs a less involved process for assessing the policy context for countries.²⁹ Finally, due to the multilevel government structure in Canada, the final score produced may not be an accurate reflection of what government policies each child in Canada benefits from. Although measures were taken, such as weighting policies proportionally by province or territory population size, to reflect what the average child in Canada would

experience, some provinces and territories have more or fewer policies that would explicitly benefit children compared to what was represented in the scoring framework.

In undertaking this objective scoring process for the Government indicator for the 2024 ParticipACTION Report Card on Physical Activity for Children and Youth, adjustments to the process must be considered for future applications of the Report Card scoring rubric. First, engaging with the SPARC earlier in the process is recommended to ensure all provincial, territorial, and federal officials have sufficient time to review and contribute to the policy audit. Second, given the current Report Card scoring rubric does not assess policies specific to certain age or population groups, the addition of contextual information regarding each policy's target population would be beneficial to provide a more robust assessment of who benefits from each policy's actions (e.g. age range [i.e. children, youth, adults, older adults], equity-denied groups). This would be particularly useful in repurposing the scoring framework for other age groups (e.g. for the ParticipACTION Report Card on Physical Activity for Adults) and for advocating for increased, targeted supports for specific equity-denied groups (e.g. persons with disabilities, racialized groups). Finally, future RCRC members tasked with scoring the Government indicator should access data from the present study to calibrate their scoring to ensure consistency from year to year. While some aspects of the rubric may change over time, it could still provide some key reliability from year to year that would be essential to determining changes in the Government indicator.

Conclusion

The adoption of a non-experimental quantitative data collection process, utilizing the Welsh Report Card scoring rubric and supported by stakeholder engagement, for the 2024 ParticipACTION Report Card on Physical Activity for Children and Youth represents a meaningful step toward a more consistent, transparent, and objective approach to evaluating the government's influence on children's physical activity in Canada. Collaborating with the SPARC was a meaningful expansion to the Welsh approach that introduced direct benefits to data quality and quantity and may produce some indirect benefits that improve physical activity participation in

Canada. Despite the benefits of adopting this more objective scoring approach, future research is needed to ensure international consensus on the key aspects of the Report Card scoring rubric. For now, the benefits of employing a more objective scoring approach appear to outweigh the limitations. Canadian Report Card researchers will continue to employ the Welsh Report Card scoring rubric, and we encourage other Report Card leaders to do the same.

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Conflicts of interest

All authors are members of the ParticipACTION Report Card Research Committee. LMV and BAB are employees of ParticipACTION. Mark Tremblay is an editorial board member of the HPCDP Journal.

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Authors' contributions and statement

NK, BAB: conceptualization, methodology, formal analysis, writing—original draft.

CC, JD, EP, JCS, ES, LMV, MST: conceptualization, writing—original draft.

KAN, VC, JPC, RC, GF, IJ, EYL, TS, PT: conceptualization, writing—review and editing.

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At-a-glance

Sex-based differences in heavy episodic drinking among adults in Canada, 2017–2023: a repeated cross-sectional analysis

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Abstract

Heavy episodic drinking (HED) is a key population indicator for harmful alcohol consumption. We used data from the Canadian Community Health Survey to examine recent trends in sex-based differences in HED among adults by age group from 2017 to 2019 and 2022 to 2023. The overall prevalence of HED was 20.5% (95% CI: 20.1, 20.8) in 2017 to 2019 and 20.3% (95% CI: 19.9, 20.8) in 2022 to 2023. Overall, males had a higher HED prevalence than females; however, sex-based differences narrowed in 2022 to 2023 compared to 2017 to 2019. Among those aged 18 to 25 years, females reported a higher HED prevalence than males in 2022 to 2023 (prevalence: 27.9% vs. 24.2%), yielding a prevalence difference of –3.7% (95% CI: –9.4, 1.9), although the confidence interval includes zero, indicating uncertainty about whether a meaningful difference exists. From 2017 to 2019 and 2022 to 2023, the prevalence of HED in Canada remained high, and sex-based differences narrowed across all age groups, particularly among young adults, where rates converged.

Keywords: alcohol drinking prevention & control, binge drinking, chronic disease, adult health behaviour, sex factors, Canada

Introduction

Regularly consuming a high volume of alcohol in a single occasion is associated with an increased risk of dependence, violence, and premature mortality and disability from both acute and chronic conditions.^{1,2} In Canada, heavy episodic drinking (HED) is prevalent, with 20% of individuals 12 years and older reporting this behaviour in 2022.³ Historically, males have reported higher prevalence of HED across all age groups in Canada; however, emerging evidence suggests a narrowing sex gap.^{3,4} The COVID-19 pandemic, commencing in March 2020, and ensuing lockdown restrictions introduced significant changes in lifestyle, stress, and alcohol consumption patterns in some populations.^{5,6} Examining pre-pandemic and early post-pandemic periods can provide valuable insights into shifts in alcohol consumption behaviours. A recent

United States study found that from 2017 to 2019 and 2021 to 2023, sex-based differences in HED narrowed in all age groups, with HED prevalence among young adult females surpassing males.⁷ The current study examined recent trends in sex-based differences in HED by age group in Canada and hypothesized that the male-female gap has narrowed among young and middle-aged adults.

Methods

We performed a repeated cross-sectional analysis among individuals 18 years and older in the annual Canadian Community Health Surveys (CCHS) from 2017 to 2023.

The CCHS is a population-representative survey conducted by Statistics Canada that targets individuals 12 years and older, or 18 years and older as of 2023, living in private dwellings, representing more than

Highlights

- We analyzed Canadian Community Health Survey data to assess sex-based differences in heavy episodic drinking (HED) by age group among adults from 2017 to 2023.
- HED remained prevalent in Canada at 20%, with males reporting higher HED overall, but sex-based differences appeared smaller across all age groups.
- Among ages 18 to 25, females reported higher HED than males in 2022 to 2023, indicating a convergence and potential reversal in sex-based differences from 2017 to 2019.
- Increasing HED among adult females may reflect longer-term alcohol consumption trends, targeted marketing, stress coping, and reduced stigma.
- Females face greater physical health risks at lower levels of alcohol than males, including liver disease and breast cancer, underscoring the value of sex-specific and gender-responsive public health strategies.

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96% of the population in Canada.⁸ The CCHS does not survey Indigenous Peoples living on reserves, members of the Canadian Armed Forces, people living in institutions, children in foster care, and people living in northern Quebec and the Canadian territories. We excluded individuals younger than 18 years, respondents who were pregnant or breastfeeding, and those who did not provide responses to questions on alcohol consumption.

Consistent with Canadian public health surveillance, including the CCHS, HED was defined as binge drinking at least once per month in the past 12 months.³ Binge drinking was defined as five or more standard drinks for males and four or more for females on the same occasion.⁹ HED was derived from a question on the frequency of binge drinking in the past 12 months and was categorized as HED (once a month, 2 to 3 times a month, once a week, more than once a week) or no HED (less than once a month or never). Before 2019, sex was measured based on respondents' self-report as being "male or female," representing sex-at-birth. Starting in 2019, CCHS introduced questions allowing for the separation of sex (assigned at birth) and gender (man, woman, or non-binary). Consistent with CCHS guidance for analyses spanning before and after 2019, we used the sex variable. Age group was defined as ages 18 to 25, 26 to 49, 50 to 64, and 65 years and older.

We used logistic regression models to examine associations between HED and sex in pooled 2017 to 2019 (pre-COVID-19) and 2022 to 2023 (post-COVID-19) CCHS data across age groups. Three-way interactions across sex, age group, and time period (pre- or post-COVID-19) were modelled. We estimated predicted prevalence and prevalence differences using marginal effects. Data from 2020 and 2021 were included in the results describing the prevalence of HED over time yet excluded from model-based analyses due to lockdowns and disruptions to CCHS data collection during the COVID-19 pandemic. CCHS survey weights (divided by the corresponding number of years in the time period) were used for all models, and 95% confidence intervals (CI) were estimated using bootstrap survey weights with 1000 replicate weights. All analyses were conducted using R Version 4.4.2 (R Foundation for Statistical Computing, Vienna, AT).

In sensitivity analyses, we additionally adjusted for education (less than secondary school graduation, secondary school graduation, postsecondary certificate/diploma/university degree; at the household level for individuals younger than 30 years, otherwise individual-level), rurality (population centre vs. rural area), and immigration status (citizen by birth vs. landed/non-permanent resident).

This study did not require a research ethics board review as it relied exclusively on secondary use of anonymous information as per Article 2.4 of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.

Results

The unweighted sample included 150 630 respondents in 2017 to 2019 and 87 227 in 2022 to 2023. The overall prevalence of HED in Canada was 20.5% (95% CI: 20.1, 20.8) in 2017 to 2019 and 20.3% (95% CI: 19.9, 20.8) in 2022 to 2023. As shown in Figure 1, HED prevalence remained relatively stable across age groups for both sexes in 2017 to 2019. However, declines were observed in 2020 to 2021 among males and females aged 18 to 25 and 26 to 49 years. Rates rebounded in 2022 to levels comparable to 2017 to 2019, before softening again among males. Among older age groups, HED prevalence was stable, with a slight increase noted in 2022. Across the study period, the most pronounced decline occurred among males aged 18 to 25 years, with prevalence dropping from 33.7% (95% CI: 30.6, 36.7) in 2017 to 22.0% (95% CI: 18.5, 25.4) in 2023. In contrast, females in the same age group experienced a slight decrease in HED prevalence from 28.7% (95% CI: 25.9, 31.6) in 2017 to 27.8% (95% CI: 23.2, 32.4) in 2023.

Table 1 presents model-based prevalence estimates in HED. In 2017 to 2019, males had a higher HED prevalence than females overall (24.2% vs. 16.5%) with a sex-based prevalence difference of 7.7% (95% CI: 5.6, 9.7) (Table 1). Males had higher HED prevalence across all age groups including among adults aged 18 to 25 years (prevalence: 31.8% vs. 26.5%; prevalence difference: 5.3%, 95% CI: 1.6, 8.9).

In 2022 to 2023, males continued to have a higher HED prevalence than females overall (22.2% vs. 18.4%; prevalence difference: 3.8%, 95% CI: 0.9, 6.6); however,

sex differences in HED appeared smaller across all age groups compared to 2017 to 2019. Notably, among those aged 18 to 25 years, males had a lower HED prevalence than females (prevalence: 24.2% vs. 27.9%) with a prevalence difference of -3.7% (95% CI: -9.4, 1.9; Table 1), although the confidence interval includes zero, indicating uncertainty about whether a meaningful difference exists.

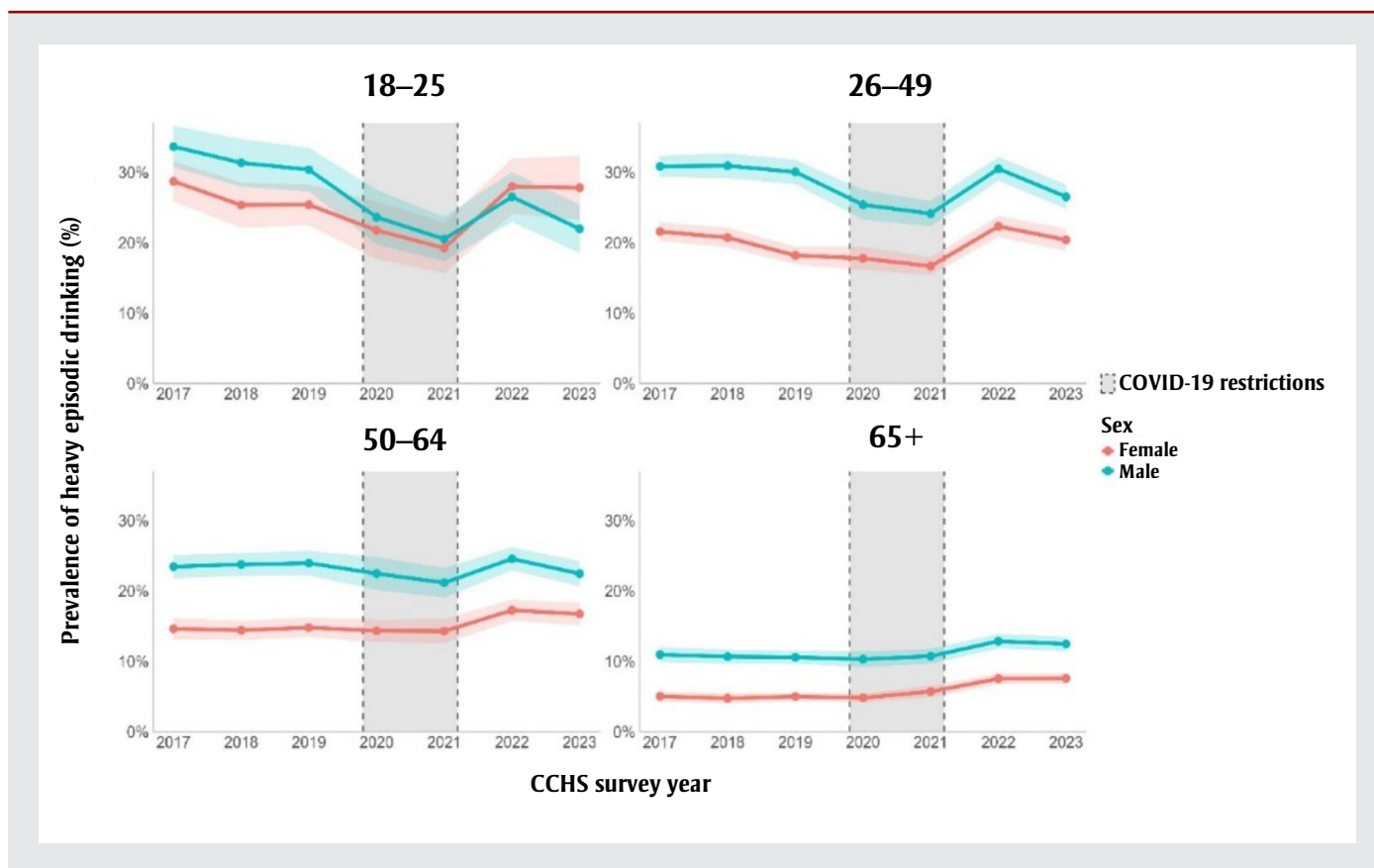
Similar results were observed in sensitivity analyses in models adjusting for education, rurality, and immigration status (Appendix 1—available upon request from corresponding author).

Discussion

HED is a key indicator of harmful alcohol consumption and an important marker for alcohol-related health risks. This analysis identified a narrowing of sex-based differences in the prevalence of HED in Canada across all age groups, including a convergence and possible reversal among young adults. In 2022 to 2023, females aged 18 to 25 years exhibited a higher observed prevalence of HED than males; however, the confidence interval for this difference included zero, leaving the true magnitude and direction of the sex-based difference uncertain. Further research is needed to clarify whether HED among young adult females is indeed surpassing that of males in Canada.

In young adults, the observed shifts from 2017 to 2023 were driven by declines in HED among both sexes from 2017 through 2021. This was followed by a rebound in 2022 to levels comparable to those observed in 2017 to 2019, with a subsequent softening in 2023 among males relative to females. These findings align with recent data from the United States and Canada which also found a convergence of sex-based differences in HED among young adults driven by both declining rates in HED post-pandemic among young adult males and increasing rates among females.^{4,7,10} Similar sex-based trends in HED have been observed internationally, including recent data from Europe showing that adolescent girls are now equalling or surpassing boys in alcohol use, and OECD reports indicating rising rates of high-volume use among young, highly educated women in high-income countries.^{11,12} These findings point to a global shift in alcohol consumption patterns, characterized by diminishing sex-based

FIGURE 1
Sex-based prevalence of heavy episodic drinking by age group and year, CCHS, 2017 to 2023



Abbreviation: CCHS, Canadian Community Health Survey.

differences and emerging evidence of a potential sex-based reversal in HED among young people.

The high sustained prevalence of HED in young adult females in this study reflects longer-term secular shifts in alcohol use and shorter-term pandemic-related disruptions. Over the past 15 years, increases in alcohol consumption and HED in Canada and internationally have been largely attributable to rising rates among women.^{4, 13–15} Several factors likely contribute to this pattern, including intensified alcohol industry marketing directed toward women—particularly for ready-to-drink beverages, flavoured coolers, and certain wines—which frequently emphasize social identity, lifestyle appeal, and the normalization of heavier drinking.^{16,17} In parallel, traditional social sanctions discouraging female HED have weakened.¹⁸ Emerging evidence also suggests that, relative to men, women may be more likely to report alcohol use during and after the pandemic as a strategy to cope with stress, anxiety, depression, or experiences of trauma.^{17,19,20} These social and contextual factors may

help explain the observed shifts in HED among young adult females in Canada.

In contrast, HED remains prevalent among young adult males in Canada, yet overall patterns during the study period indicate a decline. The factors contributing to this decline are not fully understood, but several plausible mechanisms warrant consideration. One possibility is substitution toward cannabis, as population-level cannabis use in Canada has increased since legalization and remains more prevalent and frequent among young adult males than females.^{21,22} In addition, alcohol consumption is highly sensitive to affordability and disposable income. Broader affordability pressures may therefore be constraining discretionary spending among both sexes, particularly among young adult males, who are more likely to drink in social settings (e.g. bars, restaurants).²³ Taken together, these findings suggest that the observed convergence in HED reflects both modest increases in young adult females alongside declining trends among young adult males, shaped by evolving gender norms, market forces, substitution

effects, and economic conditions. Qualitative research could be valuable in understanding sex- and gender-related differences and the intersections of these identities in HED patterns, views and attitudes toward alcohol.

Although the Guidance on Alcohol and Health adopts a universal risk-based approach, the 2023 report highlights the importance of sex-based differences in alcohol consumption as alcohol affects female and male bodies differently.²⁴ Females are biologically more susceptible to alcohol-related health harms—both acute and chronic—at lower levels of consumption and more rapidly than males.^{25,26} In Canada, rates of alcohol-associated liver disease and alcohol-attributable hospitalizations have increased more sharply among young adult females than males in recent years.^{27,28,29} HED is also a well-established risk factor for female breast cancer, even after accounting for cumulative alcohol intake, with exposures between menarche and first full-term pregnancy more strongly linked to premenopausal breast cancer.³⁰ These trends in HED

TABLE 1
Estimated prevalence of heavy episodic drinking and sex-based prevalence differences^a

Time period 1: 2017–2019				
Age group (years)	Unweighted sample size	Mean predicted prevalence % (95% CI) Males	Mean predicted prevalence % (95% CI) Females	Prevalence difference % (95% CI) (males to females)
Overall	150 630	24.2 (23.1, 25.3)	16.5 (15.6, 17.5)	7.7 (5.6, 9.7)
18–25	10 890	31.8 (29.9, 33.6)	26.5 (24.7, 28.3)	5.3 (1.6, 8.9)
26–49	47 225	30.6 (29.6, 31.6)	20.1 (19.4, 20.9)	10.5 (8.8, 12.2)
50–64	38 214	23.7 (22.7, 24.7)	14.6 (13.8, 15.4)	9.1 (7.3, 10.9)
65+	54 301	10.7 (10.1, 11.3)	4.9 (4.5, 5.3)	5.8 (4.8, 6.8)
Time period 2: 2022–2023				
Age group (years)	Unweighted sample size	Mean predicted prevalence % (95% CI) Males	Mean predicted prevalence % (95% CI) Females	Prevalence difference % (95% CI) (males to females)
Overall	87 227	22.2 (20.8, 23.6)	18.4 (17.0, 19.9)	3.8 (0.9, 6.6)
18–25	4 502	24.2 (21.8, 26.7)	27.9 (24.9, 31.1)	–3.7 (–9.4, 1.9)
26–49	25 270	28.5 (27.2, 29.7)	21.3 (20.3, 22.4)	7.2 (4.8, 9.5)
50–64	21 655	23.5 (22.4, 24.7)	17.0 (15.9, 18.1)	6.5 (4.2, 8.8)
65+	35 800	12.7 (12.0, 13.4)	7.6 (7.0, 8.1)	5.1 (3.9, 6.3)

Abbreviation: CI, confidence interval.

^a Includes three-way interaction of sex, age group and time period.

underscore the urgent need for comprehensive sex-specific and gender-responsive strategies to prevent and manage alcohol use. Population-level strategies that address alcohol price, availability, and marketing are critical for reducing per capita alcohol consumption and HED and minimizing alcohol-related harms.³¹ Integrating routine alcohol screening and brief interventions—including personalized feedback and information on alcohol and health—into family, community, and postsecondary campus health settings offers a feasible and impactful approach for identifying and reducing consumption, particularly for young adult females who may present for other health concerns.^{32,33} Mandatory health warning labels on alcohol containers have also demonstrated effectiveness in increasing consumer knowledge of alcohol-caused health risks, reducing alcohol consumption, and countering industry

marketing efforts.^{34–36} Finally, strengthening surveillance of alcohol consumption across demographic groups will further enable the development of targeted, equitable public health policies and practices.

Strengths and limitations

Our study has limitations. First, the reliance on self-reported HED introduces the potential for recall and social desirability bias.^{37,38} However, this bias is expected to be relatively consistent across survey cycles and unlikely to affect comparisons across time. Second, nonresponse bias (which may be larger among individuals with HED) and selection bias (due to the exclusion of high-risk populations such as those institutionalized or homeless) are possible in the CCHS.³⁹ While we used survey weights to address these biases, our results may underestimate HED and

are only generalizable to the CCHS target population. Third, prior to 2019, the CCHS did not distinguish between sex and gender, as respondents were only asked to self-identify as male or female. This single item likely captures a mix of biological and sociocultural factors.⁴⁰

Conclusion

National data indicate that the prevalence of HED among adults in Canada remained stable at approximately 20% from 2017 to 2023. Adult males consistently reported higher HED prevalence than females. However, sex-based differences narrowed in 2022 to 2023 compared with 2017 to 2019 across age groups, including evidence of convergence—and possible reversal—in young adults. The narrowing sex-based differences are driven both by increasing rates in HED among adult females,

alongside stable or declining rates in males overall and in most age groups. Future research should further examine HED using both sex and gender variables to better capture heterogeneity in alcohol consumption patterns, experiences, and associated needs and to inform more targeted and equitable public health policies and practices.

Conflicts of interest

None.

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Authors' contributions and statement

EH conceptualized the study, organized resources, supervised trainees and staff, and wrote the original draft. LB led the formal analysis, contributed to writing the original draft, and reviewed and edited the manuscript. NS contributed to the analysis, contributed to writing the original draft, and reviewed and edited the manuscript. SHF, SF, and BS contributed to the conceptualization and analysis, and reviewed and edited the manuscript.

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