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Original quantitative research

Body-related shame and authentic pride are independently associated with self-rated health in young adults

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Abstract

Introduction: Although body weight has been positioned as a strong predictor of physical and mental health, positive and negative body-related psychosocial factors may also be important. Further, both theoretical tenets and empirical evidence suggest that these associations may differ by gender. Our objectives were to examine the associations between body-related self-conscious emotions (body shame, body authentic pride) and physical and mental health in young adults, and to identify potential differences in these associations by gender.

Methods: Data for this cross-sectional study were drawn from the Nicotine Dependence in Teens (NDIT) study for 799 young adults (M [SD] age = 33.6 y [0.5]; 43.9% male). We estimated the associations between each of body shame and body authentic pride (i.e. the exposures) and both self-rated physical and self-rated mental health (i.e. the outcomes) in linear regression models that controlled for age, education and body mass index, and we examined potential gender differences in these associations by conducting gender-stratified analyses.

Results: In females, self-rated health and mental health decreased by 0.37 and 0.38, respectively, with each unit increase in body shame. Self-rated health and mental health increased by 0.25 and 0.23, respectively, for each unit increase in body authentic pride. In males, self-rated health and mental health decreased by 0.35 and 0.45, respectively, with each unit increase in body shame, and increased by 0.32 and 0.21, respectively, with each unit increase in body authentic pride.

Conclusion: Interventions that focus on body weight to the exclusion of body-related self-conscious emotions may side-step a key contributor to self-rated health.

Keywords: *self-conscious emotions, young adults, body mass index, body shame, body pride, health, weight*

Introduction

The weight-normative approach to health, which dominates Western society, is driven by numerous assumptions, including that weight alone is a key indicator of health, that weight is controllable and that

weight loss is sustainable and safe.¹ At its core, the normative approach views weight as a central consideration in health and health care,² using the terms “overweight” and “obese” widely and equating “obesity” to a disease that needs to be eradicated.³ Aligned with this terminology

Highlights

- The weight-normative approach to health assumes that body weight is a stand-alone indicator of health.
- We assessed whether body-related self-conscious emotions are independently associated with self-rated health and mental health in young adults.
- Both females and males who reported greater body shame and lower body authentic pride perceived their health and mental health more negatively, even after adjusting for body mass index (BMI).
- The findings underscore the importance of considering psychosocial contributors to self-rated health, in addition to physical attributes such as BMI.
- Interventions that focus on weight to the exclusion of body-related self-conscious emotions may side-step a key contributor to self-rated health and mental health.

is the common use of body mass index (BMI) as an indicator of “overweight” in clinical practice and research, despite criticism of the BMI indicator for its inability to discriminate lean mass from body fat percentage,⁴ and its disregard of race, gender and age.^{5,6}

The relationship between BMI and health is generally difficult to study because it

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may be confounded or mediated by multiple adiposity-related factors that can also impact health, including socioeconomic status, weight cycling, physical activity and weight bias.^{3,7} Further, reliance on BMI (and, implicitly, the weight-normative approach) is criticized on the basis that the narratives and stereotypes perpetuated by reliance on BMI have negative effects on health, perhaps even more so than the physical challenges associated with excess weight.^{1,2}

It is broadly recognized that weight is a critical component of an individual's social status and acceptance by others. Higher-weight individuals are often perceived as sloppy, lazy, less likable, less kind, less successful, less attractive and as having lower self-esteem.^{8,9} The notion that thinness is superior is propagated through numerous sociocultural channels, including traditional and social media, government policy, environment and space design and interpersonal conversations and relationships.⁹⁻¹¹ Individuals recognize that being higher-weight is a social identity that is devalued by society. Viewing oneself as a member of this higher-weight group may trigger psychosocial (e.g. need for belonging) and biological (e.g. hypothalamic-pituitary adrenal axis) processes that diminish health.^{12,13} Simply the perception of being higher-weight, independent of actual BMI, is associated with higher levels of depressive symptoms, suicidality¹⁴ and poorer perceived health.¹⁵ Therefore, a more nuanced understanding of psychosocial factors related to weight is needed to inform effective, ethically sound weight- and health-related practices and policy.^{2,16}

Body-related shame is a psychosocial factor related to weight that may contribute to diminished health. Specifically, body shame is an intense self-conscious emotion experienced when people feel that they do not meet a societal or personal body shape, weight or appearance ideal because of an uncontrollable and fundamental personal flaw (e.g. I am an unattractive person^{17,18}). Prominent theories suggest that both social and evaluative threats from others¹² and negative self-evaluations¹⁸ can elicit body-related shame. Being higher-weight,¹⁹ perceiving oneself as higher-weight²⁰ and perceiving large discrepancies between one's actual and ideal weight²¹ are all associated with greater body shame.

Shame is recognized as a powerful emotion that diminishes physical and mental health,^{2,13,22} as evidenced by its association with physiological indicators (e.g. cortisol reactivity,²³ depressive symptoms,^{24,25} self-esteem²⁴). Further, body shame may also indirectly impact physical and mental health through avoidance of physical activity,^{20,26} social withdrawal,²⁶ elevated health care-related stress²⁷ and prioritizing improvements in appearance at the expense of health.²⁸ Body shame may therefore have a significant influence on perceived health.

Positive body-related emotions may also influence physical and mental health. More positive body-related emotions are associated with a lower risk of mortality²⁹ and higher levels of well-being.³⁰ Body authentic pride (henceforth referred to as "body pride") is a positively valenced self-conscious emotion that occurs when people attribute a positive achievement to their own efforts.^{17,18} Related to the body, it can involve efforts that lead to congruence between one's perceived appearance with a personal or societal ideal (e.g. being proud of efforts to maintain one's appearance).^{17,31}

Being higher-weight¹⁹ and perceiving a discrepancy between actual and idealized weight are associated with lower body pride in men and women.^{21,31} Since perceived acceptance by others fosters positive body emotions,³² socially perpetuated strict body ideals and ingrained biases against higher-weight bodies may diminish feelings of body pride through a lack of acceptance by others or perceived deviation from the societal ideal.¹⁸ Higher body pride is associated with higher self-esteem, flourishing, and lower depressive, anxiety and disordered eating symptoms,^{24,33} and higher engagement in positive health behaviours.³⁴ Therefore, body pride may underpin perceptions of health.

Our objectives in this study were to assess whether body shame or body pride is independently associated with self-rated health in young adults after taking BMI into account. Young adults constitute an age group of considerable interest in health-related research because they experience numerous major life transitions as they establish their social, educational and work identities, and yet they may still be highly amenable to lifestyle and health-related intervention.³⁵ We conducted gender-stratified

analyses in part because males are rarely studied in this realm of research, and in part because of documented differences in body shame¹⁹ and perceived health³⁶ across gender. Consistent with theoretical tenets,^{13,18,31} we hypothesized that higher body shame and lower body pride are associated with lower self-rated health and mental health in both females and males.

Methods

Ethics approval

The Nicotine Dependence in Teens (NDIT) study was approved by ethics committees at the Montréal Department of Public Health and McGill University (2007-2384, 2017-6895). Informed parental consent and participant assent were obtained in cycle 1 of the NDIT study (described later). Participants (who had attained legal age) provided consent in the post-high school data collections, including the data collection that generated data for the current analysis. The NDIT study is currently approved by the Centre de recherche du centre hospitalier de l'Université de Montréal (CRCHUM) Ethics Committee (ND 06.087). Participants provided informed consent in cycle 23.

Study sample

Data were drawn from the NDIT study,³⁷ for which 1294 participants aged 12 to 13 years in Grade 7 were recruited in 1999 to 2000 using a school-based sampling strategy. Specifically, 13 high schools in or near Montréal were selected in consultation with local school boards and school principals to include a mix of (i) French- and English-language schools; (ii) urban, suburban and rural schools; and (iii) schools located in neighbourhoods of high, moderate and low socioeconomic status. All students in Grade 7 were considered eligible to participate, and data were collected in 20 cycles from Grades 7 to 11 among those who agreed to participate. Post-high school data were collected in 2007 to 2008 (cycle 21), 2010 to 2012 (cycle 22), 2017 to 2020 (cycle 23) and 2020 to 2021 (cycle 24), when the mean age of participants was 20.4, 24.0, 30.5 and 33.6 years, respectively. In cycle 1 (i.e. at NDIT inception), several participant characteristics were comparable to those reported for same-age students participating in the 1999 provincially representative Québec

Child and Adolescent Health and Social Survey.³⁷

Except for BMI, all data for the current analyses were collected from 2017 to 2020 in cycle 23 (i.e. the only cycle to date in which body-related self-conscious emotions were measured), when the mean age of participants was 30.5 years. A total of 799 participants (43.9% male) completed the cycle 23 questionnaire. To avoid using a value of BMI that was on the causal pathway between the “exposures” (i.e. body shame, body pride) and the “outcomes” (i.e. self-rated health, self-rated mental health), we used BMI data from cycle 22. Overall, however, we consider this study to be cross-sectional, since most data were drawn from cycle 23.

Measures

Body shame and body pride

Body shame and body pride were measured with subscales of the Body and Appearance Self-Conscious Emotions Scale (BASES).²⁴ Evidence of concurrent, convergent, incremental and discriminant validity have been reported for the BASES.²⁴ In addition, both measures are relatively stable over time—the intraclass correlation coefficients (95% confidence intervals [CIs]) assessing two-week test-retest reliability were 0.93 (0.85, 0.97) for body shame, and 0.88 (0.72, 0.95) for body pride. In the NDIT sample, internal consistency was $\alpha = 0.88$ for body shame and $\alpha = 0.91$ for body pride. The four items in the body shame subscale (e.g. questions such as, “How often do you feel ... ashamed of the way you look?”) and the four items in the body pride subscale (e.g. questions such as, “How often do you feel ... proud that you have achieved your appearance goals?”) were scored from 1 (never) to 5 (always). Items in each subscale were averaged to create continuous scores ranging from 1 to 5.

Self-rated health

Self-rated health was measured by asking, “In general, how would you rate your health?” Response options were “poor,” “fair,” “good,” “very good” and “excellent” (scored 1 to 5). This item was used as a continuous variable in the analyses. Self-rated health has been consistently associated with objective health status³⁸ and is a strong predictor of mortality.³⁹

Self-rated mental health

Self-rated mental health was measured by asking, “In general, how would you rate

your mental health?” Response options were “poor,” “fair,” “good,” “very good” and “excellent” (scored 1 to 5), and this item was also considered continuous in the analyses. Self-rated mental health was moderately correlated ($r = 0.45$ – 0.48) with several well-known mental health measures,⁴⁰ and higher self-rated mental health scores are associated with higher mental health functioning and fewer symptoms of psychological distress.⁴¹

BMI

Height and weight were measured by trained technicians according to a standardized protocol,³⁷ either onsite in the NDIT offices in Montréal, Canada, or in participants’ homes. BMI was computed as weight in kilograms divided by height in metres, squared ($BMI = kg/m^2$) and was used as a continuous variable in the analyses. We used the value of BMI in cycle 22, rather than in cycle 23, to ensure that BMI (which could be a mediator of the associations of interest in addition to a potential confounder) did not block the associations of interest. In females, the mean BMI was 23.8 (standard deviation [SD] 4.7) in cycle 22 and 25.4 (SD 5.8) in cycle 23 ($r = 0.80$). In males, the mean BMI was 25.1 (SD 4.4) in cycle 22 and 26.3 (SD 4.6) in cycle 23 ($r = 0.80$). The correlation between BMI in cycle 22 and cycle 23 was 0.80 in females and 0.80 in males.

Sociodemographic characteristics

Participants reported their age, gender, whether they were born in Canada (“yes,” “no”), language spoken most often at home in cycle 1 (French, English, other), whether their mother was university-educated (“yes,” “no”) and whether participants were university-educated in cycle 23 (“yes,” “no”). We used the value of participant education in cycle 23 because education is relatively time-invariant at age 31.

Data analysis

Preliminary analyses

The data were screened for normality, outliers⁴² and missing data. Descriptive data for continuous variables were reported as means and SDs, and categorical variables were reported as frequencies and percentages. Pearson product moment correlation coefficients were computed to describe the associations among the main study variables. Although the correlation between body shame and body pride was low (i.e. $r = -0.179$ in females and $r = -0.009$ in

males), we developed models for each exposure separately to avoid overadjustment related to possible mediation of one variable by the other.

Univariable and multivariable analyses

All modelling was undertaken separately in gender-stratified models. We first modelled the association between each exposure variable (body shame, body pride) and each outcome variable (self-reported health, self-reported mental health) in unadjusted (i.e. univariable) linear regression models. We then conducted multivariable linear regression models adjusting for age, participant education and BMI. The parameters of interest were the beta coefficients for body shame and body pride, for which the 95% CIs excluded the null value in the multivariable models.

Results

Table 1 compares selected characteristics of participants retained and not retained (i.e. lost to follow-up, did not provide data in 2017–2020) for analysis. Of 670 females in cycle 1, 448 (66.9%) provided data in cycle 23. Of 623 males in cycle 1, 351 (56.3%) provided data in cycle 23. Participants retained were younger on average than those not retained, relatively more were born in Canada and more had university-educated mothers. BMI and speaking French were similar among those retained compared to those not retained for analysis.

Table 2 reports values for the main study variables in females and males in cycle 23. Females had higher scores for body shame than males (mean [SD] = 2.1 [0.8] vs. 1.8 [0.8]). Self-rated mental health scores were higher in males than females (mean [SD] = 3.4 [0.9] vs. 3.2 [0.9]). There was little difference in body pride scores or in self-rated health across gender.

Table 3 shows Pearson correlation coefficients between the main study variables in females and in males. Results from the univariable and multivariable linear regression models are shown in Table 4 for females and Table 5 for males, and the findings are reported below.

Body-related emotions and self-rated health in females

Body shame and self-rated health were moderately negatively correlated ($r = -0.366$) in females (Table 3), suggesting that as

TABLE 1
Selected characteristics of participants retained and not retained for analysis, by gender, NDIT study, 1999 to 2020

	Females		Males	
	Retained (n = 448)	Not retained ^a (n = 222)	Retained (n = 351)	Not retained ^a (n = 272)
Age at cycle 1, mean (SD)	12.6 (0.5)	12.9 (0.7)	12.7 (0.5)	12.9 (0.6)
Born in Canada, %	94.0	88.7	93.4	90.1
French-speaking, %	31.7	32.0	29.3	26.8
Mother university-educated, %	42.6	34.2	50.6	44.1
BMI, ^b mean (SD)	19.9 (3.9)	20.4 (4.0)	20.1 (3.8)	20.2 (3.8)

Abbreviations: BMI, body mass index; NDIT, Nicotine Dependence in Teens; SD, standard deviation.

^a Includes participants lost to follow-up between cycles 1 and 23 and participants with missing data in cycle 23.

^b At NDIT inception, in 1999 to 2000.

body shame increased, self-rated health decreased. Similarly, as shown in Table 4, Model 1, body shame was negatively associated with self-rated health in the unadjusted linear regression model ($b_{\text{crude}} = -0.42$, 95% CI: $-0.51, -0.32$). In Table 4, Model 2, the beta remained relatively stable after adjustment for age, participant education and BMI ($b_{\text{adj}} = -0.37$, 95% CI: $-0.48, -0.26$), suggesting that with each unit increase in body shame, there was a 0.37 decrease in the self-rated health score.

Body pride and self-rated health were weakly positively correlated ($r = 0.230$) in females (Table 3), suggesting that as body pride increased, self-rated health also increased. Similarly, as shown in Table 4, Model 3, body pride was positively associated with self-rated health in the unadjusted linear regression model ($b_{\text{crude}} = 0.23$, 95% CI: $0.14, 0.33$). In

Table 4, Model 4, the interpretation of the findings was not altered by adjusting for age, education and BMI ($b_{\text{adj}} = 0.25$, 95% CI: $0.15, 0.35$), suggesting that with each unit increase in the body pride score, the self-rated health score increased by 0.25.

Body-related emotions and self-rated mental health in females

Body shame and self-rated mental health were moderately negatively correlated ($r = -0.329$) in females (Table 3), suggesting that as body shame increased, self-rated mental health decreased. Similarly, as shown in Table 4, Model 5, body shame was negatively associated with self-rated mental health in the unadjusted linear regression model ($b_{\text{crude}} = -0.38$, 95% CI: $-0.48, -0.28$). In Table 4, Model 6, the beta remained relatively stable after adjustment for age, participant education and BMI ($b_{\text{adj}} = -0.38$, 95% CI: $-0.49, -0.26$), suggesting that with each unit

increase in body shame, there was a 0.38 decrease in the self-rated mental health score.

Body pride and self-rated mental health were weakly positively correlated ($r = 0.222$) in females (Table 3), suggesting that as body pride increased, self-rated mental health also increased. Similarly, as shown in Table 4, Model 7, body pride was positively associated with self-rated health in the unadjusted linear regression model ($b_{\text{crude}} = 0.23$, 95% CI: $0.13, 0.32$). In Table 4, Model 8, the interpretation of the findings was not altered by adjusting for age, participant education and BMI ($b_{\text{adj}} = 0.23$, 95% CI: $0.13, 0.33$), suggesting that with each unit increase in the body pride score, the self-rated health score increased by 0.23.

Body-related emotions and self-rated health in males

Body shame and self-rated health were moderately negatively correlated ($r = -0.327$)

TABLE 2
Selected characteristics^a of study participants, by gender, NDIT study, 2017 to 2020

	Females			Males		
	Total n ^b	Mean (SD) or % yes	Range	Total n ^b	Mean (SD) or % yes	Range
Age, y	448	30.6 (1.0)	28.5–34.1	351	30.6 (1.0)	28.2–34.6
Participant university-educated	447	62.4%	—	349	56.4%	—
Body shame ^c	447	2.1 (0.8)	1.0–5.0	350	1.8 (0.8)	1.0–4.8
Body pride ^c	447	2.3 (0.9)	1.0–5.0	350	2.4 (1.0)	1.0–5.0
Self-rated health	446	3.2 (0.9)	1.0–5.0	350	3.3 (0.9)	1.0–5.0
Self-rated mental health	445	3.2 (0.9)	1.0–5.0	349	3.4 (0.9)	1.0–5.0
BMI (cycle 22) ^d	384	23.8 (4.7)	16.3–45.4	298	25.1 (4.4)	18.1–46.0
BMI (cycle 23)	379	25.4 (5.8)	15.9–50.9	296	26.3 (4.6)	18.3–47.8

Abbreviations: BMI, body mass index; NDIT, Nicotine Dependence in Teens; SD, standard deviation.

^a As measured in cycle 23, unless otherwise indicated.

^b Totals differ due to missing data.

^c Measured using subscales of the Body and Appearance Self-Conscious Emotions Scale.

^d BMI cycle 22 data were used to avoid using a value of BMI that was on the causal pathway between exposure variables and outcome variables.

TABLE 3
Correlation coefficients between age, BMI, participant education, body shame, body pride, self-rated health and self-rated mental health among females (n = 384–448^a) and males (n = 298–351^a), NDIT study, 2017 to 2020

	Age	BMI (cycle 22) ^b	Participant education	Body shame	Body pride	Self-rated health	Self-rated mental health
Age		0.048	-0.196*	0.062	0.090	-0.076	-0.048
BMI (cycle 22) ^b	0.090		-0.205*	0.289*	0.034	-0.192*	0.013
Participant education	-0.201*	-0.072		-0.141*	0.015	0.236*	0.119*
Body shame	0.024	0.183*	-0.001		-0.179*	-0.366*	-0.329*
Body pride	0.046	0.062	0.025	-0.009		0.230*	0.222*
Self-rated health	0.001	-0.159*	0.117*	-0.327*	0.340*		0.432*
Self-rated mental health	-0.007	-0.167*	0.060	-0.350*	0.212*	0.510*	

Abbreviations: BMI, body mass index; NDIT, Nicotine Dependence in Teens.

Note: Data for males are presented in shaded cells. Correlation coefficients are Pearson product moment correlation coefficients.

^a Totals differ due to missing data.

^b BMI cycle 22 data were used to avoid using a value of BMI that was on the causal pathway between exposure variables and outcome variables.

* Significant at $p \leq 0.05$

in males (Table 3), suggesting that as body shame increased, self-rated health decreased. Similarly, as shown in Table 5, Model 1, body shame was negatively associated with self-rated health in the unadjusted linear regression model ($b_{\text{crude}} = -0.38$, 95% CI: -0.49 , -0.26). In Table 5, Model 2, the beta remained relatively stable after adjustment for age, participant

education and BMI ($b_{\text{adj}} = -0.35$, 95% CI: -0.47 , -0.22), suggesting that with each unit increase in body shame, there was a 0.35 decrease in the self-rated health score.

Body pride and self-rated health were moderately positively correlated ($r = 0.340$) in males (Table 3), suggesting that as body

pride increased, self-rated health also increased. Similarly, as shown in Table 5, Model 3, body pride was positively associated with self-rated health in the unadjusted linear regression model ($b_{\text{crude}} = 0.29$, 95% CI: 0.20 , 0.37). In Table 5, Model 4, the interpretation of the findings was not altered by adjusting for age, education and BMI ($b_{\text{adj}} = 0.32$, 95% CI: 0.23 ,

TABLE 4
Crude and adjusted beta coefficients (b) and 95% CIs from linear regression models for the association between body shame and body pride and each of self-rated health and self-rated mental health in females, NDIT study, 2017 to 2020

Model	Self-rated health		Self-rated mental health	
	β_{crude} (95% CI)	β_{adj}^a (95% CI)	β_{crude} (95% CI)	β_{adj}^a (95% CI)
Model	1 n = 445	2 n = 381 ^b	5 n = 445	6 n = 381 ^b
Body shame	-0.42 (-0.51, -0.32)	-0.37 (-0.48, -0.26)	-0.38 (-0.48, -0.28)	-0.38 (-0.49, -0.26)
Age	—	-0.04 (-0.13, 0.06)	—	-0.05 (-0.14, 0.05)
Participant education	—	0.33 (0.15, 0.52)	—	0.22 (0.03, 0.41)
BMI ^c	—	-0.01 (-0.03, 0.01)	—	0.03 (0.01, 0.05)
R ²	0.13	0.18	0.11	0.12
F	68.5	19.6	53.8	13.1
Model	3 n = 444	4 n = 381 ^b	7 n = 444	8 n = 381 ^b
Body pride	0.23 (0.14, 0.33)	0.25 (0.15, 0.35)	0.23 (0.13, 0.32)	0.23 (0.13, 0.33)
Age	—	-0.07 (-0.16, 0.02)	—	-0.08 (-0.18, 0.02)
Participant education	—	0.35 (0.16, 0.54)	—	0.24 (0.04, 0.44)
BMI ^c	—	-0.03 (-0.05, -0.01)	—	0.01 (-0.01, 0.03)
R ²	0.05	0.14	0.10	0.10
F	24.8	14.9	22.9	7.5

Abbreviations: BMI, body mass index; CI, confidence interval; NDIT, Nicotine Dependence in Teens.

Note: Bold indicates that the 95% CI excluded the null value for the exposure variable of interest.

^a Model adjusted for age, participant education (in cycle 23) and BMI (in cycle 22).

^b Totals for adjusted models differ from totals for unadjusted models due to missing data on participant education and/or BMI.

^c BMI cycle 22 data were used to avoid using a value of BMI that was on the causal pathway between exposure variables and outcome variables.

TABLE 5
Crude and adjusted beta coefficients (b) and 95% CIs from linear regression models for the association between body shame and body pride and each of self-rated health and self-rated mental health in males, NDIT study, 2017 to 2020

Model	Self-rated health		Self-rated mental health	
	β_{crude} (95% CI)	β_{adj}^a (95% CI)	β_{crude} (95% CI)	β_{adj}^a (95% CI)
Model	1 n = 349	2 n = 295 ^b	5 n = 349	6 n = 295 ^b
Body shame	-0.38 (-0.49, -0.26)	-0.35 (-0.47, -0.22)	-0.47 (-0.60, -0.33)	-0.45 (-0.60, -0.30)
Age	—	0.04 (-0.07, 0.14)	—	0.06 (-0.06, 0.18)
Participant education	—	0.25 (0.06, 0.45)	—	0.14 (-0.09, 0.37)
BMI ^c	—	-0.02 (-0.04, 0.002)	—	-0.03 (-0.05, 0.001)
R ²	0.11	0.13	0.12	0.14
F	41.8	11.0	48.6	11.6
Model	3 n = 348	4 n = 294 ^b	7 n = 348	8 n = 294 ^b
Body pride	0.29 (0.20, 0.37)	0.32 (0.23, 0.41)	0.21 (0.12, 0.30)	0.21 (0.10, 0.32)
Age	—	-0.01 (-0.11, 0.19)	—	0.02 (-0.11, 0.14)
Participant education	—	0.22 (0.03, 0.41)	—	0.12 (-0.11, 0.36)
BMI ^c	—	-0.04 (-0.06, -0.01)	—	-0.04 (-0.07, -0.02)
R ²	0.12	0.18	0.10	0.10
F	45.5	16.2	16.3	6.1

Abbreviations: BMI, body mass index; CI, confidence interval; NDIT, Nicotine Dependence in Teens.

Note: Bold indicates that the 95% CI excluded the null value for the exposure variable of interest.

^a Model adjusted for age, participant education (in cycle 23) and BMI (in cycle 22).

^b Totals for adjusted models differ from totals for unadjusted models due to missing data on participant education and/or BMI.

^c BMI cycle 22 data were used to avoid using a value of BMI that was on the causal pathway between exposure variables and outcome variables.

0.41), suggesting that with each unit increase in the body pride score, the self-rated health score increased by 0.32.

Body-related emotions and self-rated mental health in males

Body shame and self-rated mental health were moderately negatively correlated ($r = -0.350$) in males (Table 3), suggesting that as body shame increased, self-rated mental health decreased. Similarly, as shown in Table 5, Model 5, body shame was negatively associated with self-rated mental health in the unadjusted linear regression model ($b_{\text{crude}} = -0.47$, 95% CI: -0.60, -0.33). In Table 5, Model 6, the beta remained relatively stable after adjustment for age, participant education and BMI ($b_{\text{adj}} = -0.45$, 95% CI: -0.60, -0.30), suggesting that with each unit increase in body shame, there was a 0.45 decrease in the self-rated mental health score.

Body pride and self-rated mental health were weakly positively correlated ($r = 0.212$) in males (Table 3), suggesting that as body pride increased, self-rated mental health also increased. Similarly, as shown

in Table 5, Model 7, body pride was positively associated with self-rated mental health in the unadjusted linear regression model ($b_{\text{crude}} = 0.21$, 95% CI: 0.12, 0.30). In Table 5, Model 8, the interpretation of the findings was not altered by adjusting for age, participant education and BMI ($b_{\text{adj}} = 0.21$, 95% CI: 0.10, 0.32), suggesting that with each unit increase in the body pride score, the self-rated health score increased by 0.21.

Discussion

A dominant focus of health in Western social systems emphasizes the pursuit of weight loss, despite substantial evidence that weight loss is unsustainable for most people, and that weight cycling has adverse health effects.^{2,3,43} This study examined the associations among body-related self-conscious emotions—body shame and body pride—and each of self-rated health and self-rated mental health in young adults. The findings suggest that both males and females who reported greater body-related shame and lower body pride perceived their overall health more negatively, even after BMI was taken into account. These findings underscore

the importance of considering psychosocial contributors to self-rated health in young adults, in addition to physical attributes such as BMI.

That higher levels of body-related shame relate to lower self-rated health is consistent with theoretical tenets^{2,13,22} as well as with empirical evidence of elevated cortisol²³ and symptoms of mental illness.²⁵ Our findings also align with associations noted between higher levels of body pride and both fewer symptoms of mental illness and higher reported levels of well-being.^{24,33} While associations between global self-conscious emotions and indicators of health have been observed in past studies,^{22,25} our findings highlight the importance of assessing these emotions contextualized to the body and its appearance. Given the emphasis Western society places on appearance, and the pressure to uphold the strict standards both men and women are subject to with respect to weight,¹¹ as well as evidence that the appearance domain of one's identity strongly predicts global self-worth,⁴⁴ it is not surprising that how people feel about their body has a robust impact on their global perceptions of health. These findings

have important practical implications, and suggest that interventions that aim to mitigate emotions to promote perceived overall health (e.g. weight-neutral health-behaviour programs) should specifically target the established antecedents and experiences of body shame and body pride.¹⁸

For both males and females, the associations between BMI and self-rated mental health in the adjusted models were inconsistent; they remained significant only in the body shame model for females and the body pride model for males. These findings add to an inconsistent literature on the association between higher body weight and symptoms of mental illness. At least one study⁴⁵ demonstrated a positive association, whereas null associations have been noted after controlling for psychosocial variables (e.g. weight perceptions).¹⁴ Another study reported associations in women only.⁴⁶

Overall, our findings on body-related self-conscious emotions are consistent with weight bias theories and models¹³ as well as with empirical evidence,⁴⁷ supporting that the psychological responses to weight-based identities and stigma (e.g. interpersonal mistreatment, bias) contribute to diminished mental health. Our findings extend recent research demonstrating the associations among body shame, body pride and symptoms of mental illness in young adults⁴⁸ by highlighting that emotional responses to body appearance may be a more important consideration than weight status itself. Since mental illness in young adulthood is predictive of cardiovascular disease and an elevated risk of mortality into middle and late adulthood,⁴⁹ body-related self-conscious emotions may be an important target for mitigating symptoms of mental illness and fostering well-being in young adults.

Although our findings support that body-related self-conscious emotions are associated with self-rated health, the mechanisms underpinning the associations are not known. Multiple pathways may be important. In addition to physiological dysregulation over time due to cumulative experiences of self-conscious emotions,²² self-conscious emotions may indirectly impact perceived health through their ability to motivate or deter health behaviours. Self-conscious emotions motivate perceived moral and socially acceptable health behaviours;¹⁸ weight-normative

approaches to health have perpetuated the notion that health behaviours are moral through healthism (i.e. the discourse that health can be achieved through discipline and effort, and that health is something moral citizens should strive for).^{1,3} More specifically, body shame promotes avoidance of contexts in which one feels vulnerable to experiencing shame, whereas body pride reinforces engagement in activities that elicit feelings of pride.¹⁸ Higher levels of body shame and lower levels of body pride have been consistently associated with lower levels of physical activity,^{17,20,34} while body shame relates to greater health care avoidance in women.²⁷ Longitudinal studies investigating the mechanisms that underpin this association are an important avenue for future research.

Implications

These findings assess individual-level emotions, but also have implications regarding the importance of social narratives around weight implicit in health care, education and government policies that contribute to eliciting these emotions. For example, school-based BMI screening programs sometimes use this metric as the sole indicator of health and reinforce habitual monitoring of weight in young people. Government policies in Canada have strongly promoted that weight is entirely controllable and that individuals should actively aim to control their weight.⁵⁰ Health care experiences are often described as stigmatizing and elicitors of shame, and shame is the most common motivator of health care avoidance.¹⁶ Therefore, system-level changes that recognize the importance of weight inclusivity and aim to mitigate feelings of body shame and foster positive body-related self-conscious emotions are essential. Consistent with weight-inclusive approaches to health,^{2,51} policies and programs that promote sustainable engagement in health behaviours and well-being across the weight spectrum are essential. These policies and programs must be developed with ongoing recognition that there are larger, uncontrollable factors (e.g. food access, genetics) that also play a role in weight and health.

Strengths and limitations

Strengths of this study include its focus on young adults, who are understudied in this realm, and its consideration of both

positive and negative body-related emotions as exposure variables. In addition, the data provide a basis for discussion about how to reorient health practice and policy that is overly focussed on weight. Finally, the analyses were conducted separately in males and females.

Limitations include that the cross-sectional study design precludes causal inference. Future studies should be longitudinal and establish the temporality of the exposures and outcomes. Residual confounding could be an issue due to poorly measured potential confounders or missing data on potential confounders.⁵² Loss to follow-up since inception could have introduced selection bias. Recall error related to self-report data could have introduced misclassification bias. Use of a purposive sample of schools to recruit participants could have rendered the findings less generalizable. Finally, it is possible that limited power reduced our ability to detect some associations.

Conclusion

This study examined the associations among body-related self-conscious emotions and self-reported health in young adults. In both males and females, both body shame and body pride were associated with self-rated health even after taking BMI into account. Although BMI and body-related self-conscious emotions are likely inextricably linked in complex ways, these findings highlight the importance of considering psychosocial contributors to health in young adults, and raise concerns that preventive interventions focussed primarily on BMI may side-step a key contributor to self-rated health in excluding consideration of body-related self-conscious emotions.

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Conflicts of interest

None to declare.

Authors' contributions and statement

KML, EOL, CMS, SM, RHO, JOL—conceptualization. EOL, KML, JOL—analysis. KML, EOL—writing—original draft. JOL—funding acquisition. JOL—methodology, including study design and data collection. CMS, JOL—supervision. KML, EOL, CMS, SM, RHO, JOL—writing—review & editing.

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Original quantitative research

Associations between social determinants of health and weight status in preschool children: a population-based study

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Abstract

Introduction: Social determinants of health (SDH) may influence children's weight status. Our objective was to examine relationships between SDH and preschoolers' weight status.

Methods: This retrospective cohort study included 169 465 children (aged 4–6 years) with anthropometric measurements taken at immunization visits from 2009 to 2017 in Edmonton and Calgary, Canada. Children were categorized by weight status based on WHO criteria. Maternal data were linked to child data. The Pampalon Material and Social Deprivation Indexes were used to assess deprivation. We used multinomial logistic regression to generate relative risk ratios (RRRs) to examine associations between ethnicity, maternal immigrant status, neighbourhood-level household income, urban/rural residence and material and social deprivation with child weight status.

Results: Children of Chinese ethnicity were less likely than those in the General Population to have overweight (RRR = 0.64, 95% CI: 0.61–0.69) and obesity (RRR = 0.51, 0.42–0.62). Children of South Asian ethnicity were more likely than those in the General Population to have underweight (RRR = 4.14, 3.54–4.84) and more likely to have obesity (RRR = 1.39, 1.22–1.60). Children with maternal immigrant status were less likely than those without maternal immigrant status to have underweight (RRR = 0.72, 0.63–0.82) and obesity (RRR = 0.71, 0.66–0.77). Children were less likely to have overweight (RRR = 0.95, 0.94–0.95) and obesity (RRR = 0.88, 0.86–0.90) for every CAD 10 000 increase in income. Relative to the least deprived quintile, children in the most materially deprived quintile were more likely to have underweight (RRR = 1.36, 1.13–1.62), overweight (RRR = 1.52, 1.46–1.58) and obesity (RRR = 2.83, 2.54–3.15). Relative to the least deprived quintile, children in the most socially deprived quintile were more likely to have overweight (RRR = 1.21, 1.17–1.26) and obesity (RRR = 1.40, 1.26–1.56). All results are significant to $p < 0.001$.

Conclusion: Our findings suggest the need for interventions and policies to address SDH in preschoolers to optimize their weight and health.

Keywords: *social determinants of health, child malnutrition, childhood overweight, population health*

Introduction

A healthy childhood is essential for optimal development and well-being across the lifespan.¹ Many conditions such as obesity,

heart disease and mental illness have roots in childhood.² Since chronic health conditions can hinder economic potential and societal participation throughout life, interventions during early childhood can

Highlights

- We found associations between key social determinants of health and unhealthy weight status in preschoolers.
- Children of Chinese ethnicity were less likely to have overweight and obesity, and children of South Asian ethnicity were more likely to have underweight and obesity.
- Children with maternal immigrant status were less likely to have underweight and obesity.
- Children were less likely to have overweight and obesity for every CAD 10 000 increase in income.
- Children in the most materially deprived quintile were more likely to have underweight, overweight and obesity. Children in the most socially deprived quintile were more likely to have overweight and obesity.

enhance physical, emotional and social development.³

Millions of children worldwide suffer from underweight, overweight and obesity. Underweight is a critical factor for preschool children, due to its association with delayed cognitive development and poorer academic performance.^{4,5} Overweight and obesity can increase the risk of chronic diseases (e.g. type 2 diabetes, heart disease) and impair psychological health and well-being.^{6,7} The impact of overweight and obesity on health and

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well-being has been heightened with the emergence of the coronavirus pandemic, since excess weight appears to increase risk of respiratory complications that accompany COVID-19.⁸

The World Health Organization (WHO) defines social determinants of health (SDH) as conditions in which people are born, grow, live, work and age.⁹ Several studies have documented important relationships between SDH and weight status in children. For example, ethnic minorities are disproportionately affected by child obesity in the United States.¹⁰ A Canadian report noted that the mean body mass index (BMI) z-scores of second-generation immigrant children (parents born in Canada) were higher than those of first-generation immigrants (parents born outside Canada) and children of grandparents born in Canada.¹¹ Children were at increased odds of child obesity if they resided in neighbourhoods with low income, according to a Toronto-based study.¹² Although there are few data on neighbourhood deprivation or urban or rural residence and their associations with the weight status of Canadian children, a longitudinal study by Carter et al.¹³ found a positive association between neighbourhood material deprivation and weight gain in children.

The mechanism by which SDH influence child weight status involves a variety of factors ([Appendix S1](#) in the supplementary material) such as cultural or income-based differences in weight perception, food parenting (i.e. parent-child feeding practices) and physical activity practices. These differences may protect children from or predispose them to unhealthy weights.

There are several limitations in the literature about the influence of SDH on weight status in preschoolers. First, some reports include self- or proxy-reported anthropometric data, which are prone to bias.^{14,15} Second, there is limited research on underweight children in developed countries; underweight may disproportionately impact specific demographic or socioeconomic groups. Finally, there is scant literature on the links between ethnicity, having maternal immigrant status and social and material deprivation and weight status in Canadian preschool children. An improved understanding of environmental contexts can better inform targeted health interventions and policies.¹⁶ With these issues in

mind, our objective was to examine the associations between SDH—including ethnicity, maternal immigrant status, neighbourhood-level household income, urban/rural residency and material and social deprivation—and weight status in preschool children in Alberta, Canada.

Methods

Ethics approval

This study was approved by the University of Alberta Research Ethics Board (Pro00020230). The ethics panel determined that the research is a retrospective database review for which participant consent for access to personally identifiable health information would not be reasonable, feasible or practical.

Study population

This study included children born in Alberta, Canada, between 1 January 2005 and 29 November 2013, who had visited public health units in Edmonton and Calgary to receive immunizations during their preschool years (age range: 4–6 y) between January 2009 and November 2017. According to the Statistics Canada 2016 Census,¹⁷ relative to the national statistics, Edmonton and Calgary had a greater proportion of individuals of Chinese origin, South Asian origin and immigrant status. The mean 2015 household income in Edmonton and Calgary was also greater than that of Canada ([Appendix S2](#) in the supplementary material).

SDH data sources and linkage

Anthropometric data from children were taken from the Alberta public health immunization records database. Public health nurses used standardized protocol¹⁸ (e.g. measuring weight with child standing in the centre of the scale, measuring height with child's heels together) and equipment (e.g. child and adolescent scale, wheelchair scale) to collect child and parent data. Information on children's date of birth, sex, age at measurement, measured height (to the nearest 0.1 cm) and measured weight (to the nearest 0.1 kg) was collected during immunization visits.

During the study period, data availability ranged from 17.6% in 2013 to 67.7% in 2008. An identical linking strategy was used throughout the study. BMI data were collected anywhere between children's

fourth and seventh birthdays; data availability was lower specifically towards the end of the study (birth years 2012 and 2013), as the children born in these years had not turned seven by November 2017 (the last month when BMI data were available). As shown in a previous study,¹⁹ we found some differences in demographic characteristics between mothers of children with and without BMI data; mothers with available child BMI data were slightly older, were of higher socioeconomic status, were more likely to be nulliparous and had slightly higher rates of gestational diabetes and hypertension during pregnancy when compared to mothers without available child BMI data. However, we do not believe that the missing BMI data impacted the internal validity of the study.

When weight or height data were available, erroneous values (i.e. implausible values such as 0 cm height, 0 kg weight, or weight and height values that resulted in a BMI of less than 10 or greater than 50) were assumed in 0.9% of measurements. The weight range in our study cohort was 9 kg to 78 kg and the height range was 62 cm to 156 cm.

Birth and infancy characteristics (date of birth, birth weight, gestational age at birth) were retrieved from the Alberta Vital Statistics Birth Registry. Child ethnicity, assumed to be equivalent to maternal ethnicity, was identified using surname algorithms from the University of Calgary Ethnicity Program and the Institute for Clinical Evaluative Studies Ethnicity Program. Child ethnicity was trichotomized into the following mutually exclusive categories: “Chinese” “South Asian,” and “General Population.”^{20–22} These algorithms were run on the earliest maternal surname in the Alberta Health Care Insurance Plan Registry. Maternal data (postal code, immigrant status, household income at the neighbourhood level, ethnicity) were also included. Postal codes were obtained from the Alberta Health Care Insurance Plan Registry. Urban/rural residency was determined using the Postal Code Translator File disseminated by Alberta Health. Maternal immigration status was determined using the Alberta Health Care Insurance Plan Central Stakeholder Registry, which has identified mothers entering Alberta from another country or province since 1984. Census data from Statistics Canada (2011) were linked at the Forward Sortation Area level, which was used to

determine household income (in CAD) in 2010 at the neighbourhood level as a measure of neighbourhood socioeconomic status.

Material and social deprivation

The Pampalon Deprivation Indexes, two Quebec-based measures of social inequity, were used in this study to assess social and material deprivation.²³ The material deprivation index accounts for relative differences in education, employment and income; the social deprivation index accounts for maternal marriage status, solitary living and single parenthood. Greater values signify greater deprivation. The indexes, which have been validated as adequate predictors of health outcomes,²⁴ are based on Canadian dissemination areas and cover approximately 98% of Canada's population. For our purposes, Pampalon material and social deprivation index data were retrieved using dissemination areas linked to maternal postal code data at childbirth and categorized into quintiles.²⁵

Preschool child weight status

The outcome of interest was child weight status at preschool immunization visit, which occurred when children were aged 4 to 6 years. For children with multiple visits, we included only the last measurements in our study. Consistent with Canadian recommendations,²⁶ the WHO body mass index (BMI) growth charts for Canada were used to categorize children's weight status ([Appendix S3](#) in the supplementary material). BMI was calculated by dividing weight (in kg) by height (in m²).

The WHO uses different terms to describe weight status categories based on age. For children under 5 years of age, "overweight" and "obesity" are defined as BMI > 2 and > 3 standard deviations (SDs) above the median, respectively. For children aged 5 years and older, "overweight" and "obesity" are defined as BMI > 1 and > 2 SDs above the median, respectively. For our study, which included children both above and below 5 years of age, we defined our weight status categories in BMI z-scores (i.e. comparing children's BMI to the national average, adjusted for age) as follows: "underweight" (zBMI < -2), "normal weight" (zBMI > -2 to ≤ 1), "overweight" (zBMI > 1 to ≤ 3) and "obese" (zBMI > 3), irrespective of the child's age at measurement. We also defined "excess

weight" as a combination of the overweight and obese categories. This was done to ensure simplicity and consistency across age groups. A distribution of our study population z-scores can be found in [Appendix S4](#) in the supplementary material.

Statistical analysis

For each weight category, we presented the child's sex, anthropometric measurements at preschool age, age at measurement and SDH variables (ethnicity, maternal immigrant status, urban/rural residence, household income at neighbourhood level, material and social deprivation indexes). To assess the independent association of SDH factors and preschool weight, we used multinomial logistic regression models, yielding relative risk ratios (RRRs), with weight status at preschool age as a four-category outcome (i.e. underweight, normal weight, overweight, obese). The reference category was the normal weight category. The models estimated RRRs and 95% confidence intervals (95% CIs) of developing unhealthy weight status for each variable. We fit data on three models via generalized estimating equations with exchangeable correlation matrix. This was done to adjust for potential clustering and correlation with respect to multiple children of the same mother.

The first model ($R^2 = 0.014$) included ethnicity, maternal immigrant status, household income at neighbourhood level and urban/rural residence. The second ($R^2 = 0.0075$) and third ($R^2 = 0.0047$) models studied the material deprivation index and social deprivation index separately with the first quintile (least deprived) as the reference category. All models were adjusted for child sex and age at preschool weight measurement. Deprivation indexes were additionally adjusted for ethnicity, but were separately modelled, in recognition of the possible correlation between them and the other SDH variables. R^2 values were calculated as proposed by Zheng²⁷ to measure proportional reduction in variation and assess goodness of fit for marginal models.

To validate each model's results, we assessed each model's ability to discriminate between our child weight status outcome categories. This was done by estimating the polytomous discrimination index (PDI) of Van Calster et al. using the SAS macro of Dover et al.^{28,29} All multinomial models displayed discrimination

abilities better than those of a classifier that selects at random among four categories, as all models had a PDI greater than the 25% threshold. The multinomial model that included individual SDH and the model that included the quintiles of the material deprivation index had the largest PDI, of 0.324 (95% CI: 0.318–0.331) and 0.326 (0.319–0.332), respectively. The model that included the quintiles of the social deprivation index had a lower PDI: 0.315 (0.309–0.322). This result showed that modelling using individual SDH had discrimination abilities superior to modelling using the social deprivation index on its own; the same is true for modelling using the material deprivation index and ethnicity compared to modelling using the deprivation index on its own.

The unit of analysis was the child. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, US). Parameters of multinomial logistic marginal models with correlated responses were estimated in SAS using the procedures proposed by Kuss and McLerran.³⁰ Given the large sample size, we defined statistical significance at $p < 0.001$.

Results

Our initial study population included 177 284 records, but decreased because of missing child identification numbers, missing height and weight data, calculated BMI values of < 10 kg/m² or > 50 kg/m² and repeat height and weight measurements. Our first model included 168 387 children and 125 778 mothers due to additional missing maternal neighbourhood income and residence data (urban or rural). Descriptive characteristics of our excluded population can be found in [Appendix S5](#) in the supplementary material. Out of the 169 465 children studied in models 2 and 3, there were 5558 children with missing deprivation indexes (due to missing dissemination area or missing maternal neighbourhood income data), leaving a population of 163 907 children and 122 773 mothers.

Descriptive characteristics of our complete population of children and mothers are presented in Table 1. There was a significantly greater proportion of males than females in the overweight (55.9%) and obese (64.0%) categories (both $p < 0.001$).

TABLE 1
Child and maternal descriptive characteristics across weight status categories (n = 169 465)

	Total sample	Underweight	Normal weight	Overweight	Obesity
		zBMI < -2	zBMI ≥ -2 to ≤ 1	zBMI > 1 to ≤ 3	zBMI > 3
Child characteristics					
Total, n	169465	1415	128951	35426	3673
Female, n (%)	82860 (48.9)	676 (47.8)	65249 (50.6)	15613 (44.1)	1322 (36.0)
Male, n (%)	86605 (51.1)	739 (52.2)	63702 (49.4)	19813 (55.9)	2351 (64.0)
Weight in kg, mean (SD)	19.0 (3.4)	15.0 (1.9)	18.0 (2.2)	21.7 (3.0)	30.4 (6.4)
Height in cm, mean (SD)	109.0 (6.0)	109.5 (7.1)	108.6 (5.8)	110.1 (6.2)	113.5 (6.9)
BMI in kg/m ² , mean (SD)	15.9 (1.9)	12.4 (0.5)	15.2 (0.9)	17.8 (1.0)	23.5 (4.2)
BMI z-score, mean (SD)	0.4 (1.4)	-2.1 (0.3)	-0.1 (0.6)	1.8 (0.7)	6.0 (3.1)
Child age at measurement					
≤ 4.99 y, n (%)	103611 (61.1)	750 (53.0)	78569 (60.9)	22189 (62.6)*	2103 (57.3)
5.00–5.99 y, n (%)	58425 (34.5)	580 (41.0)	44707 (34.7)	11770 (33.2)	1368 (37.2)
≥ 6.00 y, n (%)	7429 (4.3)	85 (6.0)	5675 (4.4)	1467 (4.1)	202 (5.5)
Birth and infancy characteristics					
Small-for-gestational age (SGA) status, n (%)	17243 (10.2)	407 (28.8)	14393 (11.2)	2179 (6.2)*	264 (7.2)*
Appropriate-for-gestational age (AGA) status, n (%)	138200 (81.6)	973 (68.8)	105841 (82.1)	28519 (80.5)	2867 (78.1)
Large-for-gestational age (LGA) status, n (%)	14022 (8.3)	35 (2.5)	8717 (6.8)	4728 (13.3)	542 (14.8)
Birth weight, g, mean (SD)	3311.4 (563.0)	2894.9 (685.8)	3272.3 (556.5)	3455.4 (548.2)	3457.9 (575.4)
Child ethnicity^a					
General Population, n (%)	152479 (90.0)	1092 (77.2)	115467 (89.5)	32625 (92.1)	3295 (89.7)
South Asian, n (%)	7784 (4.6)	245 (17.3)	5854 (4.5)	1417 (4.0)	268 (7.3)
Chinese, n (%)	8202 (5.4)	78 (5.5)	7630 (5.9)	1384 (3.9)	110 (3.0)
Maternal immigrant status					
Born in Canada, n (%)	129500 (76.4)	929 (65.7)	99011 (76.8)	27020 (76.3)	2540 (69.2)
Not born in Canada, n (%)	39965 (23.6)	486 (34.3)	29940 (23.2)	8406 (23.7)	1133 (30.8)
Setting					
Urban residence, n (%)	130982 (77.3)	1158 (82.4)	99616 (77.7)	27303 (77.7)	2905/3641 (79.8)
Suburban residence, n (%)	28550 (16.9)	179 (12.7)	22014 (17.2)	5816 (16.5)	541/3641 (14.9)
Rural ^b , n (%)	8877 (5.2)	69 (4.9)	6576 (5.1)	2037 (5.8)	195/3641 (5.4)
Neighbourhood-level household income, CAD, mean (SD)	85551 (20945)	84176 (19677)	86247 (20917)	83620 (20929)	80211 (20567)
Pampalon material deprivation data (quintiles^c)					
Q1, n (%)	57003 (33.6)	354 (25.7)	45543 (36.5)	10385 (30.4)	721 (20.4)
Q2, n (%)	37688 (22.2)	314 (22.8)	28944 (23.2)	7695 (22.5)	735 (20.8)
Q3, n (%)	28389 (16.8)	261 (19.0)	21164 (17.0)	6275 (18.3)	689 (19.5)
Q4, n (%)	20753 (12.2)	233 (16.9)	15033 (12.0)	4809 (14.1)	656 (18.5)
Q5, n (%)	20103 (11.9)	215 (15.6)	14111 (11.3)	5040 (14.7)	737 (20.8)
Pampalon social deprivation data (quintiles^c)					
Q1, n (%)	37793 (22.3)	398 (28.9)	29437 (23.6)	7231 (21.1)	727 (20.5)
Q2, n (%)	31057 (18.3)	245 (17.8)	23947 (19.2)	6272 (18.3)	593 (16.8)
Q3, n (%)	32596 (19.2)	273 (19.8)	24653 (19.8)	6958 (20.3)	712 (20.1)
Q4, n (%)	34495 (20.4)	226 (16.4)	26075 (20.9)	7403 (21.6)	791 (22.4)
Q5, n (%)	27973 (16.5)	235 (17.1)	20683 (16.6)	6340 (18.5)	715 (20.2)

Abbreviations: BMI, body mass index; CAD, Canadian dollars; Q, quintile; SD, standard deviation; y, year; zBMI, BMI z-score.

Notes: Weight status categories were defined as shown, irrespective of child age at measurement, for simplicity and consistency.

^a The ethnicity categories shown are mutually exclusive. Individuals not included in the “Chinese” or “South Asian” ethnicity categories are included in the “General Population” category.

^b Residences that were not designated as urban or suburban were analyzed as the “rural” category.

^c Based on Statistics Canada’s dissemination areas. Q1, the first quintile, is the most advantaged. Q5, the fifth quintile, is the most disadvantaged.

* $p < 0.001$

With regard to ethnicity and maternal immigrant status, our first model (Table 2) demonstrated that children of Chinese ethnicity (vs. General Population) were less likely to have overweight (RRR = 0.64, 95% CI: 0.61–0.69) and obesity (RRR = 0.51, 0.42–0.62; both $p < 0.001$). Children of South Asian ethnicity (vs. General Population) were more likely to have underweight (RRR = 4.14, 3.54–4.84), less likely to have overweight (RRR = 0.80, 0.75–0.85) and more likely to have obesity (RRR = 1.39, 1.22–1.60; all $p < 0.001$). Children with maternal immigrant status (vs. Canadian-born status) were less likely to have underweight (RRR = 0.72, 0.63–0.82) and obesity (RRR = 0.71, 0.66–0.77; both $p < 0.001$).

Our analyses related to neighbourhood-level household income revealed that children were less likely to have overweight (RRR = 0.95, 95% CI: 0.94–0.95) and obesity (RRR = 0.88, 0.86–0.90) with every CAD 10 000 increase in income ($p < 0.001$). There was no statistically significant association between urban/rural residence and child weight status risk in our first model.

In Table 3, data are presented showing the associations between material deprivation and child weight status. Children in the most materially deprived quintile (vs. the least deprived quintile) were more likely to have underweight (RRR = 1.36, 95% CI: 1.13–1.62), overweight (RRR = 1.52, 1.46–1.58) and obesity (RRR = 2.83, 2.54–3.15; all $p < 0.001$). The risk of having overweight and obesity increased as material deprivation increased across all

quintiles. The greatest risks and risk changes per quintile were with respect to risk of obesity.

Data in Table 4 show the associations between social deprivation and child weight status. Children in the most socially deprived quintile (vs. the least deprived quintile) were more likely to have overweight (RRR = 1.21, 95% CI: 1.17–1.26) and obesity (RRR = 1.40, 1.26–1.56; both $p < 0.001$). Those in the second and third most deprived quintiles (Q3 and Q4) had identical risk of having overweight. Although not all of the RRRs were statistically significant, the risk of having obesity increased as social deprivation increased across all quintiles.

Discussion

The purpose of our study was to examine associations between key SDH and weight status in a large population of preschoolers. Our analyses revealed several notable findings. We found that, compared with the General Population group, children of Chinese ethnicity were less likely to have overweight and obesity, while children of South Asian ethnicity were more likely to have either underweight or obesity. Children with maternal immigrant status were less likely to have both underweight and obesity compared to their peers with mothers born in Canada. Children were less likely to be in the overweight and obese categories as neighbourhood-level household income increased. Children in the most materially deprived quintile were more likely to have underweight, overweight and obese status. Finally, children in the most socially deprived quintile were

more likely to have overweight and obesity relative to the least deprived category. Overall, this study adds to the limited literature on the influence of SDH on weight status of preschoolers.

Chinese ethnicity was associated with lower risk of excess weight among children; this aligns with existing findings of lower excess weight among children of Chinese ethnicity in America and children and youth of East Asian descent in Canada.^{31,32} However, our finding that South Asian ethnicity was associated with increased risk for both child underweight and child obesity is noteworthy and novel. While a similar trend was observed for children living in South Asian countries, the populations studied were low- to middle-income.³³ To our knowledge, there is limited literature focussing on South Asian ethnicity and child underweight in high-income countries such as Canada.

We may have found an increased risk of child underweight associated with South Asian ethnicity because our study did not apply ethnicity-specific BMI cut-offs to define child weight status. These cut-offs can account for unique ethnicity-specific differences in body type; for example, a UK-based study reported increased body fat in South Asian (vs. White) child populations and called for lowered BMI cut-offs to categorize South Asian children.³⁴ However, we are confident in WHO criteria, which are based on the WHO guidelines, which were developed using large samples of children raised in optimal environments from various regions, including India.³⁵ The Dietitians of Canada, who

TABLE 2
Multinomial regression findings examining social determinants of health in relation to child weight status categories

	Underweight (n = 1406)		Overweight (n = 35 152)		Obesity (n = 3 641)	
	RRR (95% CI)	<i>p</i>	RRR (95% CI)	<i>p</i>	RRR (95% CI)	<i>p</i>
Sex (male vs. female)	1.03 (0.93–1.15)	0.525	1.28 (1.25–1.31)	< 0.001	1.70 (1.59–1.82)	< 0.001
Age at BMI measurement (per 1 month increase)	1.03 (1.02–1.03)	< 0.001	0.99 (0.99–1.00)	< 0.001	1.01 (1.01–1.02)	< 0.001
Chinese ethnicity vs. General Population ^a	1.14 (0.89–1.45)	0.312	0.64 (0.61–0.69)	< 0.001	0.51 (0.42–0.62)	< 0.001
South Asian ethnicity vs. General Population ^a	4.14 (3.54–4.84)	< 0.001	0.80 (0.75–0.85)	< 0.001	1.39 (1.22–1.60)	< 0.001
Maternal immigrant vs. non-immigrant status	0.72 (0.63–0.82)	< 0.001	0.97 (0.95–1.00)	0.097	0.71 (0.66–0.77)	< 0.001
Neighbourhood-level income (per CAD 10 000 increase)	0.98 (0.95–1.00)	0.103	0.95 (0.94–0.95)	< 0.001	0.88 (0.86–0.90)	< 0.001
Rural vs. urban residence	1.03 (0.80–1.33)	0.808	1.04 (0.99–1.10)	0.117	0.91 (0.78–1.06)	0.233

Abbreviations: BMI, body mass index; CAD, Canadian dollars; CI, confidence intervals; RRR, relative risk ratio.

Notes: Weight status categories were defined as shown, irrespective of child age at measurement, for simplicity and consistency. Relative risk ratios are computed for each weight status relative to the normal weight status category.

^aThe ethnicity categories shown are mutually exclusive. Individuals not included in the “Chinese” or “South Asian” ethnicity categories are included in the “General Population” category.

TABLE 3
Associations between material deprivation quintile and child weight status categories

	Underweight (n = 1 415)		Overweight (n = 28 128)		Obesity (n = 7 298)	
	RRR (95% CI)	p	RRR (95% CI)	p	RRR (95% CI)	p
Q2 vs. Q1	1.31 (1.12–1.53)	0.001	1.15 (1.11–1.19)	< 0.001	1.53 (1.38–1.70)	< 0.001
Q3 vs. Q1	1.38 (1.17–1.62)	< 0.001	1.29 (1.24–1.33)	< 0.001	1.90 (1.70–2.11)	< 0.001
Q4 vs. Q1	1.53 (1.29–1.82)	< 0.001	1.37 (1.32–1.43)	< 0.001	2.42 (2.17–2.70)	< 0.001
Q5 vs. Q1	1.36 (1.13–1.62)	0.001	1.52 (1.46–1.58)	< 0.001	2.83 (2.54–3.15)	< 0.001

Abbreviations: CI, confidence interval; Q, quintile; RRR, relative risk ratio.

Notes: Weight status categories were defined as shown, irrespective of child age at measurement, for simplicity and consistency. Relative risk ratios are computed for each weight status relative to the normal weight status category. Q1, the first quintile, is the most advantaged. Q5, the fifth quintile, is the most disadvantaged.

have taken similar ethnicity-specific differences into consideration, still recommend the WHO charts as the best available reference for monitoring growth.²⁶ Overall, further qualitative research may provide insight into the differences in outcomes with respect to ethnicity.

Our findings suggest a protective effect of maternal immigrant status against child underweight and obesity, which may be explained by new immigrants' retention of healthier eating habits.³⁶ Our findings contrast with a previous report that second-generation immigrant children (parents born in Canada but grandparents born outside Canada) had higher mean BMI z-scores relative to first-generation (parents born outside Canada) and to other children of parents born in Canada, although this is likely due to the older populations that were included in the report.¹¹ Given the lack of published data on the association between maternal immigrant status and child underweight in high-income countries such as Canada, our findings provide a unique perspective on this issue.

Our observation that increased neighbourhood-level household income was associated with lower risk of excess weight

aligns with the existing literature. For instance, Fiechtner et al.³⁷ included a wide age range (4–18 years) in their study of neighbourhood median income and child weight status, finding that lower neighbourhood-level income amplified detrimental effects of food environment (e.g. close proximity to convenience stores) on increased child BMI z-score. Based on data collected from children (aged 2–11 years) from Canada, Oliver and Hayes³⁸ reported similar findings, with higher BMI percentile values for children living in low-income neighbourhoods. The association between neighbourhood-level income and child weight status may be related to differences in neighbourhood structure, which may pose barriers to maintaining a healthy diet (e.g. grocery store³⁹ and fast food outlet access⁴⁰) and physical activity (e.g. increased screen time⁴¹) in children.

Our finding that increased material deprivation was associated with greater risk of overweight and obesity aligns with findings by Carter et al.,¹³ who reported a positive association between neighbourhood material deprivation and weight gain in children aged 4 to 10 years. The influence of material deprivation on children's weight status may operate through parental income- or employment-related

barriers to healthy lifestyle habits (e.g. limited time, limited funds), which manifest as overweight or obesity in children. Interestingly, we found that increased material deprivation was associated with greater risk of child underweight as well. There is currently scant literature on associations between material deprivation and child underweight in high-income countries. However, one study in the UK did not find an association between deprivation and underweight prevalence in children.⁴² Given that our study is the first to suggest an association between material deprivation and underweight in a high-income country, further study into the mechanism by which material deprivation affects weight status is needed to offer insight into this association.

We also found some increased risk of excess weight in children associated with social deprivation. Our findings contrast with Carter et al.,¹³ who found an inverse association between social deprivation and child weight gain. However, the study included a smaller cohort (n = 1580) and broader age range (4–10 years of age), whereas our findings illustrate a more comprehensive picture of our population's specific age range. A possible explanation for the association we found is that

TABLE 4
Associations between social deprivation quintile and child weight status categories

	Underweight (n = 1 415)		Overweight (n = 28 128)		Obesity (n = 7 298)	
	RRR (95% CI)	p	RRR (95% CI)	p	RRR (95% CI)	p
Q2 vs. Q1	0.87 (0.74–1.02)	0.094	1.05 (1.01–1.09)	0.011	1.03 (0.92–1.15)	0.604
Q3 vs. Q1	0.94 (0.80–1.10)	0.449	1.13 (1.09–1.17)	< 0.001	1.18 (1.06–1.31)	0.003
Q4 vs. Q1	0.76 (0.64–0.90)	0.002	1.13 (1.09–1.17)	< 0.001	1.25 (1.12–1.38)	< 0.001
Q5 vs. Q1	0.98 (0.83–1.16)	0.832	1.21 (1.17–1.26)	< 0.001	1.40 (1.26–1.56)	< 0.001

Abbreviations: CI, confidence interval; Q, quintile; RRR, relative risk ratio.

Notes: Weight status categories were defined as shown, irrespective of child age at measurement, for simplicity and consistency. Relative risk ratios are computed for each weight status relative to the normal weight status category. Q1, the first quintile, is the most advantaged. Q5, the fifth quintile, is the most disadvantaged.

socially deprived parents may be more prone to stress and depression, which compromise their motivation to encourage healthy eating and physical activity in children. Positive associations have been noted between maternal chronic depression and increased risk of child overweight.⁴³

Strengths and limitations

Our study contributes to the limited literature on determinants of preschool child weight status in Canada by highlighting some of the complex associations between social determinants of health and child weight status. This project used a large database of children and objective variable measures that were collected and analyzed using uniform procedures.

Despite these strengths, we acknowledge certain limitations. First, the ethnicity algorithm employed in our study only classified data into three categories, which limits the generalizability and precision of our findings towards ethnicities that are not South Asian or Chinese. Since children were only classified based on surnames, it is also possible that children of mixed ethnicity may have been misclassified. Nevertheless, the algorithm generated a high-level ethnicity categorization, and we were still able to detect varying risks between each of the ethnicity categories. Second, this study had a range of data availability over the years of data collection, although we still were able to work with a large and informative dataset. Third, the study lacked data on children beyond Edmonton and Calgary, which limited our perspective on rural and remote communities, where excess weight may be more prevalent. Fourth, the Alberta Health Care Insurance Plan Central Stakeholder Registry used to determine maternal immigrant status was unable to capture secondary migration (i.e. prior residence in a different province) and duration of residence in Alberta, which might have provided additional perspective on associations between having mothers that immigrated to Canada and child weight. Fifth, given that this cohort does not include homeschooled children or children who were not vaccinated, there is potential bias due to the absence of representation of this population.

Our study suggests that policies and interventions intended to maintain healthy weight in children should target populations based on SDH. Policies designed to

reduce obesogenic factors related to low income (e.g. food accessibility, recreational opportunities) or interventions that adopt culturally sensitive approaches to at-risk populations (e.g. South Asian ethnicity) may be beneficial.

Conclusion

In a large, retrospective, population-based cohort study, we found significant associations between ethnicity, maternal immigrant status, neighbourhood-level household income, deprivation and child weight status. Our findings suggest a burden of malnutrition in the South Asian ethnic population, a protective effect of maternal immigrant status on unhealthy child weight, associations between increased material deprivation and child underweight and associations between increased social deprivation and child excess weight. Further research into the mechanisms behind these associations is required to inform policy planning and targeted interventions.

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Data availability statement

The data underlying this article were provided by the Government of Alberta under the terms of a research agreement. Inquiries respecting access to the data can be made to health.resdata@gov.ab.ca.

Conflicts of interest

GDCB served as a member of the Novo Nordisk Canada Pediatric Expert Obesity National Advisory Board. The other authors have no conflicts of interest to declare.

Authors' contributions and statement

JW, GDCB—conceptualization. JW, DCD, AS, GDCB—methodology. AS, JW—formal analysis. JW—writing—original draft. JW, PK, AS, SI, DCD, LEM, AMH, GDCB—writing—review & editing.

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Original quantitative research

A cross-sectional study of mental health and well-being among youth in military-connected families

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Abstract

Introduction: The study objective was to compare the mental health and risk-taking behaviour of Canadian youth in military-connected families to those not in military-connected families in a contemporary sample. We hypothesized that youth in military-connected families have worse mental health, lower life satisfaction and greater engagement in risk-taking behaviours than those not in military-connected families.

Methods: This cross-sectional study used 2017/18 Health Behaviour in School-aged Children in Canada survey data, a representative sample of youth attending Grades 6 to 10. Questionnaires collected information on parental service and six indicators of mental health, life satisfaction and risk-taking behaviour. Multivariable Poisson regression models with robust error variance were implemented, applying survey weights and accounting for clustering by school.

Results: This sample included 16 737 students; 9.5% reported that a parent and/or guardian served in the Canadian military. After adjusting for grade, sex and family affluence, youth with a family connection to the military were 28% more likely to report low well-being (95% CI: 1.17–1.40), 32% more likely to report persistent feelings of hopelessness (1.22–1.43), 22% more likely to report emotional problems (1.13–1.32), 42% more likely to report low life satisfaction (1.27–1.59) and 37% more likely to report frequent engagement in overt risk-taking (1.21–1.55).

Conclusion: Youth in military-connected families reported worse mental health and more risk-taking behaviours than youth not in military-connected families. The results suggest a need for additional mental health and well-being supports for youth in Canadian military-connected families and longitudinal research to understand underlying determinants that contribute to these differences.

Keywords: *military families, adolescents, mental health, life satisfaction, risk-taking behaviour*

Introduction

Youth in military-connected families experience a unique set of stressors. Prolonged absences from the serving parent(s) during training or deployment, the inherent

risk of the parent's injury or death and frequent geographical relocations that disrupt education, extracurricular activities and peer groups can all negatively impact youth mental health and well-being.^{1,2} In addition, compared to nonmilitary personnel,

Highlights

- Youth in military-connected families experience unique stressors related to a parent's military career that may negatively impact their mental health and well-being. Existing research is limited primarily to cohorts of children and youth in US military families.
- Canadian youth in military-connected families reported worse mental health and life satisfaction and greater risk-taking behaviours than youth not in military-connected families.
- International focus on the consequences of parental military careers and the best means of addressing these risks for their children is needed.

military personnel are more likely to report their own adverse childhood experiences and trauma, which may impact parenting.^{3,4}

Growing up in a military family also demands adaptive social networks and may affect youths' sense of belonging and access to community support.^{1,2,5} The pathways that underlie this risk may be understood using the family stress model.^{6,7} This model describes how distress and feelings of insecurity shared among family members adversely affect parenting practices and dyadic adjustment, with subsequent risks for children's maladjustment.⁸

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For instance, maternal depression, a robust risk factor for emotional and behavioural problems in youth,⁹ is prevalent among nonserving spouses in military families^{10,11} particularly around the time of deployment.¹² Other research has found that parental posttraumatic stress disorder in military families is also associated with poorer mental health in children.^{7,13}

Although there is a substantive literature documenting poor mental health among children and youth in military families, most epidemiological research has been carried out in the US.¹⁴ The experience of military-connected families in the US might not represent families in other countries, given differences in military lifestyle (i.e. conflicts, geographical relocations, deployments, rhythm and intensity of operations) as well as differences in how the military is perceived and valued in other countries.¹⁵⁻²¹ In addition, previous research has focussed on comparisons among youth from military-connected families and examined the impact of deployment, parental combat or parental posttraumatic stress disorder on youth mental health.^{1,13,22-25} While these pathways and determinants of worse mental health in US military families likely hold true in other countries, this information does not provide families, advocates and policy makers with knowledge of the direct or indirect impact a parent's military career has on child health and well-being. There is a need to estimate the burden of poor mental health and well-being among youth in military-connected families relative to youth not in military-connected families across many countries to understand the consistency of the relationship across contexts.

The objective of this study was to investigate the association between membership in a military-connected family and indicators of mental health, positive emotions and behaviours, life satisfaction and risk-taking behaviours in a representative sample of Canadian youth.

Methods

Ethics approval

The Health Behaviour in School-aged Children in Canada survey was granted ethics approval from the General Research Ethics Board at Queen's University, as well as the Health Canada and Public Health Agency of Canada Research Ethics Board. Active or passive consent, depending

on individual school board practices, was obtained from the participating pupils, their parents or guardians and schools.

Study design and population

This study was cross-sectional, using data from the 2017/18 (8th cycle) Health Behaviour in School-aged Children (HBSC) in Canada study.²⁶ The Canadian HBSC is conducted every four years in collaboration with the World Health Organization,²⁷ and is a nationally representative, school-based survey of youth in Grades 6 to 10 (Grade 6 to Secondary 4 in Quebec). Sampling of schools was stratified by province/territory, language of instruction, public/Roman Catholic designation and community size, with replacement. Children attending private schools (in Quebec, this includes Catholic schools), learning at home or on First Nation or Inuit reserves, street youth not in school and incarcerated youth, all of whom together make up less than 7% of Canadian youth, were not eligible to participate.²⁸ Sampling weights were created within grades to ensure that each province and territory was proportionally represented.

Students completed a questionnaire using either paper and pencil or online software, dependent upon the preferences of the local school board, that was typically administered by a teacher in a classroom setting in a single session lasting 40 to 75 minutes. The sample included 21 541 students in Grades 6 to 10 (typically aged 11–15 y) from 287 schools representing all provinces and two territories (Yukon and the Northwest Territories). Survey weights were created to ensure that each province and territory was proportionally represented by grade.

Study measures

The survey included internationally standardized mandatory and optional questions.²⁶ Military connection was measured as a dichotomous variable. Students were asked to respond “yes,” “no” or “I don't know” to the question: “Does one of your parents/guardians currently serve, or have they served, in the Canadian Armed Forces military (i.e. Army, Navy, Air Force)?” Students responding “yes” were categorized as being military-connected. Students who indicated they did not know or who did not answer the question were excluded.

Three indicators of poor mental health, one indicator of positive emotions and behaviours, one measure of life satisfaction and one measure of risk-taking behaviour were studied. Low well-being was measured using the 5-item World Health Organization Well-Being Index (WHO-5).²⁷ Lower scores are related to lower well-being. The items asked, “How often over the past two weeks have you: felt cheerful and in good spirits; felt calm and relaxed; felt active and energetic; woken up feeling fresh and rested; and had your daily life filled with things that interest you?” There were six response options, ranging from “All of the time” (value = 1) to “At no time” (value = 6). The items were summed and rescaled from 0 to 25, then multiplied by 4, for a range of 0 to 100. A score ≤ 50 indicated low well-being.^{29,30}

Feelings of hopelessness were measured using the item, “During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?” Response options were “yes” and “no.” Persistent sadness or hopelessness is a criterion for and predictor of clinically significant depression and suicide ideation.³¹

Emotional problems were assessed using the following eight items: “How often have you felt low or depressed?”; “How often have you felt nervous?”; “How often have you had difficulties getting to sleep” (5 response options: 1 = “About every day” to 5 = “Rarely or never”); and “I have trouble making decisions”; “I often wish I were someone else”; “I often feel helpless”; “I often feel left out of things”; “I often feel lonely” (5 response options: 1 = “Strongly agree” to 5 = “Strongly disagree”).³⁰ The items were summed (range 8–40; $\alpha = 0.86$), and the presence of high levels of emotional problems was defined as being in the bottom tertile.

Prosocial behaviour, indicative of positive emotions and behaviours, was measured using five items describing whether the student helps out or is kind to others without being asked.³⁰ Responses ranging from “Definitely not like me” (value = 1) to “Definitely like me” (value = 6) were summed, and being in the top third was taken to indicate high prosocial behaviour.

Life satisfaction was measured using the Cantril ladder.³² For this measure, a

picture of a ladder is presented, and students are asked to rate where they feel they currently stand (from 0 = “Worst possible life” to 10 = “Best possible life”). Low life satisfaction was defined as 5 or less.

Finally, “overt risk-taking” combined items describing the frequency of engagement in the following behaviours: lifetime alcohol consumption, lifetime drunkenness history, alternative tobacco use, lifetime smoking history and caffeinated energy drink consumption.³³

Sociodemographic data included age, sex and grade. Age in years was calculated using self-reported date of birth and the date of survey completion. Sex (“Male,” “Female,” “Neither term describes me”) and current grade were self-reported. Cultural and racial backgrounds* were selected from a list of options reproduced from Statistics Canada. Family affluence was measured using the 6-item Family Affluence Scale (FAS III), an index of material assets in the home, and categorized into approximate quintiles based on the full sample distribution.³⁴ Urban versus rural status was defined according to the geographical location of the student’s school, based on Statistics Canada categories of community size.³⁵ Students missing data on grade, sex or family affluence were excluded from the sample.

Analysis

Students with complete responses to all items used in the multivariable models were included in each analysis. In previous experiences using HBSC data, imputed and complete case analyses have had substantively similar results in most cases, with some gains in statistical efficiency,³⁶ which is consistent with the findings of other Canadian youth surveys reporting on mental health.³⁷ The demographic characteristics of military-connected students and those not connected to the military were described and compared using Rao-Scott chi-square tests that adjusted for clustering by school.

Bivariate and multivariable modified Poisson regression models with robust error variance were used to estimate relative risks (RR) and associated 95% confidence intervals (CIs) examining the

associations between having a military connection and mental health. Multivariable models adjusted for sex, grade and family affluence. Models were estimated for the overall sample, and in strata defined by grade group (Grades 6–8 vs. 9–10) and sex (male vs. female). All models were adjusted for school-level clustering using generalized estimating equations. Analyses were 80% powered to detect relative risks of 1.10 to 1.18 in the overall sample, 1.17 to 1.31 in boys, 1.14 to 1.25 in girls, 1.14 to 1.34 in the younger grade group and 1.12 to 1.25 in the older grade group ($\alpha = 0.05$, two-sided). The HBSC sample weights were applied only to those not connected to the military. All analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC, US).

Results

Overall, 21 541 youth in Grades 6 to 10 responded to the survey. The final weighted sample included 16 737 students after excluding students who did not know if their family had a military connection ($n = 2573$; weighted $n = 2111$) and students with missing data on key baseline variables ($n = 3544$; weighted $n = 2693$). Students who were excluded were more likely to be male (53% vs. 47%) and in Grades 6 to 8 (67% vs. 58%), and less likely to have a family military connection (5.7% vs. 9.5%) compared to those included in this study. Approximately 9.5% of the full unweighted sample (1470 students) reported having a military connection. Students with a military connection were slightly more likely to identify as boys (51% vs. 45%) and were significantly more likely to be White (76% vs. 71%), from a rural or small centre (57% vs. 46%), and in the highest affluence quintile (24% vs. 19%; Table 1).

Overall, 29.5% of youth in military-connected families reported low well-being, 37.5% reported feelings of hopelessness, 38.4% were in the top third of the sample distribution for emotional problems, 22.7% reported low life satisfaction, 31.5% were in the top third for demonstrating prosocial behaviour and 22.4% reported engaging in overt risk-taking behaviour (Table 2).

After adjusting for grade, sex and family affluence, youth with a connection to the

military were significantly more likely to report negative indicators of mental health than those without a military connection. Youth in military-connected families were 28% more likely to report low well-being (RR = 1.28, 95% CI: 1.17–1.40), 32% more likely to report hopelessness (RR = 1.32, 1.22–1.43), 22% more likely to report the presence of emotional problems (RR = 1.22, 1.13–1.32) and 42% more likely to report low life satisfaction (RR = 1.42, 1.27–1.59).

The associations between being connected to the military, low well-being and low life satisfaction were stronger in younger students (Grades 6–8) compared to students in Grades 9 to 10 (Table 3). For example, military-connected youth in Grades 6 to 8 were 42% more likely to report low well-being than those without a military connection (RR = 1.42, 1.24–1.62), compared with 15% in those in Grades 9 to 10 (RR = 1.15, 1.03–1.30). The associations between being connected to the military and other mental health outcomes were generally similar for students in Grades 6 to 8 versus 9 to 10. The associations between being connected to the military and negative mental health were generally similar in boys and girls (Table 4).

After adjusting for covariates, we did not detect a difference in the likelihood of reporting high prosocial behaviour between youth in military-connected families and those not in military-connected families (Table 2). The likelihood of demonstrating prosocial behaviour for youth in military-connected families relative to those not in military-connected families was consistent across school grades (Table 3) and between girls and boys (Table 4).

Youth in military-connected families were 37% more likely to report engaging in overt risk-taking behaviours relative to those not in military-connected families, after adjusting for covariates (RR = 1.37, 1.21–1.55; Table 2). These associations were also consistent across grades (Table 3) and between boys and girls (Table 4).

Discussion

This study examined emotional and behavioural health in youth of military families in Canada in comparison with their nonmilitary counterparts in a national school-based health survey. We observed

* Terminology used in the study.

TABLE 1
Demographic characteristics of students with and without a military connection

	Military-connected students		Students without a military connection ^a		p ^b
	n	(%)	n	(%)	
Total	1 470	(100)	15 267	(100)	
Sex					
Boys	750	(51.0)	6 931	(45.4)	
Girls	692	(47.1)	8 161	(53.5)	< 0.001
“Neither term describes me”	28	(1.9)	175	(1.1)	
Grade					
6–8	881	(59.9)	8 872	(58.1)	
9–10	589	(40.1)	6 394	(41.9)	0.64
Cultural and racial^c background					
White	1 096	(76.0)	10 634	(70.6)	
Black	39	(2.7)	664	(4.4)	
Latin American	13	(0.9)	217	(1.4)	
Indigenous	74	(5.1)	410	(2.7)	
East & Southeast Asian	18	(1.3)	496	(3.3)	< 0.001
South Asian	11	(0.8)	574	(3.8)	
West Asian	8	(0.6)	283	(1.9)	
Other (including multiple responses)	184	(12.8)	1 790	(11.9)	
Missing	27		200		
Urban/rural status					
Rural area (< 1000)	43	(2.9)	124	(0.8)	
Small centre (1000–29 999)	795	(54.1)	6 836	(44.8)	
Medium centre (30 000–99 999)	288	(19.6)	2 717	(17.8)	< 0.001
Large urban centre (≥ 100 000)	344	(23.4)	5 589	(36.6)	
Family affluence					
Quintile 1 (lowest)	242	(16.5)	2 856	(18.7)	
Quintile 2	327	(22.2)	3 340	(21.9)	
Quintile 3	279	(19.0)	2 369	(15.5)	< 0.001
Quintile 4	267	(18.2)	3 867	(25.3)	
Quintile 5 (highest)	355	(24.2)	2 845	(18.6)	

Data source: Health Behaviour in School-aged Children study in Canada, 2017/18.²⁶

^a All values are weighted.

^b p value from Rao-Scott chi-square test comparing overall distribution in students with and without a military connection, and adjusted for clustering by school.

^c Terminology used in the HBSC study.

that youth in military-connected families were more likely to report scores consistent with low well-being, hopelessness, low life satisfaction and frequent engagement in overt risk-taking behaviours compared to youth not in military-connected families. These findings support the hypothesis that the exposure of children to the triad of military family lifestyle dimensions—risk, protracted absence and relocation—may have a negative impact on mental health and well-being.³⁸ Our findings also support the strengths and resiliency of military-connected youth. We observed similar rates of prosocial

behaviour in youth in military-connected families and not in military-connected families, suggesting comparable socio-emotional development despite the increased risks of emotional and behavioural problems.

Our results are consistent with the international literature documenting worse mental health and well-being among children and youth in military-connected families.^{1,24,25,39-41} Children and youth in Canadian military families had a higher risk of seeing a physician for outpatient mental health services, specifically for

visits related to nonpsychotic disorders (e.g. depression), pervasive developmental disorders (e.g. autism) and disruptive behaviour disorders (e.g. attention deficit disorder).⁴² Relative to the general population, children and youth in military families outside of Canada were more likely to report higher mean emotional and behavioural difficulties scores, higher rates of externalizing and internalizing behaviours and high rates of suicidal ideation or attempts.^{1,24,25,39-41}

Our study also supports research from the United States showing a greater engagement

TABLE 2
Associations between being connected to the military and mental health indicators

Outcome	Military connection		No military connection		Crude RR ^a (95% CI)	Adjusted RR ^{a,b} (95% CI)
	n Total	% Yes	n Total	% Yes		
Well-being, low	1422	(29.5)	14 883	(24.5)	1.24 (1.13–1.35)	1.28 (1.17–1.40)
Hopelessness, yes	1423	(37.5)	14 941	(29.3)	1.28 (1.18–1.39)	1.32 (1.22–1.43)
Emotional problems, high	1378	(38.4)	14 494	(32.8)	1.17 (1.08–1.27)	1.22 (1.13–1.32)
Life satisfaction, low	1437	(22.7)	15 070	(16.6)	1.37 (1.22–1.53)	1.42 (1.27–1.59)
Prosocial behaviour, high	1421	(31.5)	14 877	(31.9)	0.98 (0.90–1.07)	1.00 (0.92–1.09)
Overt risk-taking, high	1385	(22.4)	14 564	(17.2)	1.42 (1.21–1.66)	1.37 (1.21–1.55)

Data source: Health Behaviour in School-aged Children study in Canada, 2017/18.²⁶

Abbreviations: CI, confidence interval; RR, relative risk.

^a Adjusted for clustering by school and weighted; relative risk estimated using modified Poisson regression with robust error variance.

^b Adjusted for sex, grade and family affluence scale.

of children and youth in military-connected families in risk-taking behaviours.^{40,43} Qualitative and quantitative studies focussed on the mechanisms contributing to these differences in mental health and risk-taking behaviour, including highlighting which pathways have facilitated families in successfully meeting these occupational challenges, are needed to develop programs and services to effectively address root causes. Learning how military-connected youth define good mental health and how they situate their parent's or caregiver's career in their overall health and well-being is critical.

The dimensions of a parent's military career may contribute stressors resulting in poor mental health and well-being in youth relative to their peers. Canadian

military families report three common challenges: geographical relocations, absences from serving family members and their risk of illness, injury and death.⁴⁴ Within Canada, surveys of military relocation experiences have highlighted the impact of moves on children's education and may be a rationale for requesting a posting to a particular location or for the military parent to relocate unaccompanied.⁴⁵ Studies within populations of children and youth connected to military families in the United States and United Kingdom have documented worse mental health for those with a parent who is currently or recently deployed, experiencing posttraumatic stress disorder (PTSD) or misusing alcohol, and following geographical relocations.^{11,24,46-48}

Depending on the context and composition of the family, these stressors may

have differing intensities of impact on youth mental health.⁴⁵ They may compound or interact for a family over time during the trajectory of the parent's military career, over the life course of the family and around key milestones such as parental deployment or geographical relocations.³⁸ As a result, these stressors and experiences are also dynamic, both within and across families, as well as within and across children and youth.

A parent's military career also provides many benefits for youth and their families, as well as occasions to adapt and grow in response to these same occupational lifestyle dimensions.⁴⁹ A military parent or caregiver is employed, which has important advantages economically for families. For example, youth in

TABLE 3
Associations between being connected to the military and mental health indicators, by grade group

Outcome	Grades 6–8		Grades 9–10	
	Crude RR (95% CI)	Adjusted RR ^a (95% CI)	Crude RR (95% CI)	Adjusted RR ^{a,b} (95% CI)
Well-being, low	1.36 (1.18–1.56)	1.42 (1.24–1.62)	1.13 (1.01–1.27)	1.15 (1.03–1.30)
Hopelessness, yes	1.25 (1.11–1.40)	1.29 (1.15–1.44)	1.33 (1.19–1.48)	1.36 (1.22–1.52)
Emotional problems, high	1.23 (1.09–1.37)	1.28 (1.14–1.43)	1.13 (1.03–1.24)	1.16 (1.06–1.28)
Life satisfaction, low	1.46 (1.27–1.69)	1.54 (1.34–1.77)	1.26 (1.07–1.48)	1.28 (1.09–1.51)
Prosocial behaviour, high	0.97 (0.87–1.08)	0.98 (0.88–1.10)	1.00 (0.88–1.15)	1.02 (0.90–1.16)
Overt risk-taking, high	1.39 (1.11–1.74)	1.35 (1.08–1.69)	1.35 (1.18–1.54)	1.34 (1.17–1.53)

Data source: Health Behaviour in School-aged Children study in Canada, 2017/18.²⁶

Abbreviations: CI, confidence interval; RR, relative risk.

^a Adjusted for clustering by school and weighted; relative risk estimated using modified Poisson regression with robust error variance.

^b Adjusted for sex, grade and family affluence scale.

TABLE 4
Associations between being connected to the military and mental health indicators, by sex

Outcome	Boys		Girls	
	Crude RR (95% CI)	Adjusted RR ^a (95% CI)	Crude RR (95% CI)	Adjusted RR ^{a,b} (95% CI)
Well-being, low	1.20 (1.02–1.41)	1.24 (1.05–1.47)	1.30 (1.16–1.46)	1.30 (1.17–1.46)
Hopelessness, yes	1.41 (1.22–1.63)	1.43 (1.24–1.65)	1.28 (1.16–1.40)	1.29 (1.17–1.41)
Emotional problems, high	1.15 (0.99–1.35)	1.18 (1.01–1.38)	1.25 (1.13–1.38)	1.26 (1.14–1.39)
Life satisfaction, low	1.40 (1.17–1.68)	1.45 (1.21–1.74)	1.43 (1.25–1.64)	1.46 (1.27–1.67)
Prosocial behaviour, high	1.00 (0.87–1.15)	0.98 (0.85–1.12)	1.02 (0.90–1.14)	1.01 (0.90–1.14)
Overt risk-taking, high	1.35 (1.13–1.62)	1.37 (1.17–1.60)	1.36 (1.08–1.70)	1.31 (1.09–1.57)

Data source: Health Behaviour in School-aged Children study in Canada, 2017/18.²⁶

Abbreviations: CI, confidence interval; RR, relative risk.

^a Adjusted for clustering by school and weighted; relative risk estimated using modified Poisson regression with robust error variance.

^b Adjusted for sex, grade and family affluence scale.

Canadian military-connected families live in higher-income areas than those who are not connected to the military.⁵⁰ In addition, for some youth, moving frequently will allow them to see more of the world or their own country, enjoy new experiences, learn how to adapt to new and different learning and social situations, enhance their relationship building skills, expand their social network across provinces and territories and strengthen family bonds.^{14,49} While Canadian military families report being generally strong and adaptive,⁴⁴ there is little research into the mechanisms of positive interaction and outcomes of these stressors, and further exploration is needed.⁴⁹

In Canada, previous work documenting outpatient mental health visits and delays in specialist care from psychiatrists and pediatricians, alongside the findings of our study, suggests possible unmet mental health care needs for youth in military families.^{42,51} In addition to publicly or privately funded civilian mental health services and programs, families have access to specialized supports and services offered by the Canadian Armed Forces, such as the counselling and crisis services at Military Family Resource Centres, telehealth and other virtual mental health supports. To date, there are no Canadian evaluations of the effectiveness or sufficiency of mental health care services for children and youth in military families or barriers to engaging in care. Studies of military families in the United States have identified barriers to engaging military-connected adolescents in mental health care.^{1,24,25,39-41} The national availability of culturally competent mental health care and accessible supports and services is

critical to ensure that children and youth are not “paying a price for their parent’s service to the nation”^{5,p.8} with their own mental health and well-being.

Strengths and limitations

Our results reflect the largest Canadian sample of youth in military families studied to date, covering all provinces and two territories, and include broad assessments of mental health, well-being and risk-taking. While the measures of mental health were brief and not diagnostic, these measures have been validated and tested for face validity, and are used across multiple cycles of national and international research using the HBSC data to understand the mental health and well-being of youth. We do not anticipate differences in the use of these scales between youth in and not in military-connected families. Different measures that apply validated screens for psychiatric disorders using diagnostic criteria are needed to address remaining gaps in the epidemiology of mental illness among children and youth in military-connected families. This study did not explore possible military-specific and core explanations for differences in mental health and risk-taking behaviour engagement, such as parental absences or risk of parental harm, family or peer relationships, school performance or experiences of bullying.

In addition, our survey did not collect information on length of parental military service, deployments or number of military-related relocations. Having this additional information would help policy makers understand how these complex relationships are mediated or modified by

variables such as parental risk-taking behaviour, history of parental adverse childhood experiences or other characteristics of military and public safety personnel that contribute to the health and well-being of their children. Both qualitative and quantitative studies, including studies comparing the experiences of youth in military and public safety sector families, are needed to provide a more nuanced understanding of youth in military-connected families and inform policy makers where resources could be directed to improve mental health and well-being.

Conclusion

It is critical that we continue to consider the family alongside the serving member, as well as the dynamic and complex nature of military and family life trajectories and their impact on youth, both during and following parental military service. Youth in military-connected families were more likely to report hopelessness, low well-being, low life satisfaction and greater engagement in risk-taking behaviours than youth not in military-connected families, while also demonstrating similar rates of prosocial behaviour despite the increased risks of emotional and behavioural problems. Understanding the key mechanisms by which these mental health differences emerge and translate into medical diagnoses is needed. In addition, it is necessary that we discern the long-term trajectories of youth in military-connected families experiencing poor mental health and well-being to determine how best to intervene. Future research focussing on these hypothesized etiological pathways, as well as on better understanding resiliency and adaptation among

those who meet these challenges differently, is necessary to allow the developing and testing of interventions to address excess mental health risks in youth associated with a parent's military career.

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Conflicts of interest

The authors have no conflicts of interest relevant to this article to disclose.

Authors' contributions and statement

AM—conceptualization, data curation, methodology, writing – original draft. HC—methodology, writing – review and editing. MK—data curation, formal analysis, writing—review and editing. NK—formal analysis, writing—review and editing. FE—methodology, writing—review and editing. WC—data curation, methodology, writing—review and editing. WP—data curation, methodology, supervision, writing—review and editing.

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At-a-glance

Gender identity and sexual attraction among Canadian youth: findings from the 2019 Canadian Health Survey on Children and Youth

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Abstract

Gender identity and sexual attraction are important determinants of health. This study reports distributions of gender identity and sexual attraction among Canadian youth using data from the 2019 Canadian Health Survey on Children and Youth. Among youth aged 12 to 17, 0.2% are nonbinary and 0.2% are transgender. Among youth aged 15 to 17, 21.0%, comprising more females than males, report attraction not exclusive to the opposite gender. Given known associations between health and gender and sexual attraction, oversampling of sexual minority groups is recommended in future studies to obtain reliable estimates for identifying inequities and informing policy.

Keywords: *gender identity, sexual orientation, youth, transgender persons, sexual and gender minorities, Canada*

Introduction

Gender and sexual orientation are important determinants of health among adults¹⁻⁵ and youth,⁶⁻¹⁰ and data for these variables should be collected routinely in public health surveillance to identify inequities and inform policy.

Statistics Canada has recently developed data standards for sex and gender,¹¹ and undertaken consultations for similar standards for sexual orientation.¹² Gender refers to “a person’s social or personal identity as a man [male], woman [female] or non-binary person.”¹³ Gender categories and normative expressions of gender vary across historical, cultural and social contexts. Sex at birth, meanwhile, is assigned based on a collection of anatomical and physiological characteristics.¹³ The term “cisgender” encompasses those whose gender identity corresponds to their sex at birth. “Transgender” encompasses those

whose gender identity does not correspond to their sex at birth.¹⁴ “Nonbinary” encompasses those whose gender identity is not exclusively male or female.¹⁴ “Nonbinary” is often used as an umbrella term for gender identities outside the gender binary of male/female, including persons identifying as agender, genderqueer and gender fluid.^{14,15} Nonbinary persons may or may not identify themselves as transgender.¹⁴

Sexual orientation comprises three dimensions: sexual attraction (the sexes or genders of people to whom an individual is attracted), sexual identity (the term that one assigns oneself; e.g. heterosexual, bisexual, lesbian, gay) and sexual behaviour (the sexes or genders of people with whom an individual has sexual experiences).^{16,17} So-called “sexual minorities” are typically those with nonheterosexual attraction, identity or behaviour (i.e. not only attracted to the opposite sex/gender; identifying as nonheterosexual; having had

Highlights

- Gender and sexual attraction as a dimension of sexual orientation are important determinants of health among youth.
- Collecting gender and sexual attraction information as a routine part of public health surveillance is important for identifying inequities and informing policy.
- This study provides nationally representative estimates for the distribution of gender and sexual attraction among Canadian youth.
- This study identifies populations (nonbinary, transgender and same gender-attracted youth) that require oversampling or other approaches to ensure that reliable estimates can be obtained in public health surveillance.

same-sex/gender sexual experiences).¹⁷ Sexual orientation is distinct from “romantic orientation,” which refers to the sexes or genders of those with whom an individual desires to have romantic relationships.¹⁸ Finally, “Two-Spirit” is a term used by Indigenous peoples across North America that encompasses a broad range of gender and sexual identities, as well as a diversity of terms from a number of Indigenous languages.¹⁹

Studies have found that nonbinary, transgender, Two-Spirit and sexual minority persons in Canada face a broad range of

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health and social inequities compared to cisgender and heterosexual persons,^{1-5,19,20} including poorer mental health outcomes among youth.^{6,7}

The distribution of sexual orientation can vary depending on which dimension is examined. Data collection for each dimension is not always possible due to practical constraints, and not all dimensions may be relevant or appropriate to measure, depending on the population being studied. For example, sexual identity develops over time and is subject to change, especially during adolescence and young adulthood.^{17,21} Sexual behaviour is also subject to change—many youth have not yet had sexual experiences,¹⁷ and behaviours are affected by opportunity as well as identity and attraction.²² While sexual attraction is also subject to change, studies have found that sexual attraction questions are the easiest to understand among youth and that youth consider attraction to be the principal element of sexual orientation.^{23,24}

Few studies have examined the distribution of gender and sexual attraction (or other dimensions of sexual orientation) among Canadian youth.^{1,25,26} This is a major gap, given the known health and social inequities associated with nonbinary gender, transgender, Two-Spirit and minority sexual attraction among youth. This study reports distributions for gender identity and sexual attraction among a nationally representative sample of Canadian youth.

Methods

Data source

This study used data from the 2019 Canadian Health Survey on Children and Youth (CHSCY), a cross-sectional survey conducted by Statistics Canada.²⁷ Data collection occurred between 11 February and 2 August 2019. The CHSCY covered a nationally representative sample of children and youth aged 1 to 17 years, excluding those living on First Nation reserves and other Aboriginal settlements, those living in foster homes and the institutionalized population. The sampling frame consisted of beneficiaries of the Canada Child Benefit, covering 98% of the population aged 1 to 17 in all provinces and 96% in all territories. The CHSCY is a Statistics Canada survey conducted under the authority of the *Statistics Act*, and

informed consent and assent were obtained from all participants. The CHSCY and its methodology are further described elsewhere.²⁷

This study focusses on youth aged 12 to 17 years. Data were collected by electronic questionnaire or telephone interview. All youth were asked about gender identity, while only youth aged 15 to 17 were asked about sexual attraction. Other dimensions of sexual orientation (i.e. sexual identity and behaviour) were not included in the CHSCY.

There were 11 077 respondents aged 12 to 17 in the 2019 CHSCY (5301 aged 15 to 17; response rate: 41.3%). Survey weights were provided by Statistics Canada to account for sampling and nonresponse and generate nationally representative estimates. Analyses were restricted to those with available data, totalling 11 064 respondents (99.9%) for gender identity, and 5254 respondents (99.1%) for sexual attraction.

Measures

Sex

Youth were asked, “What was your sex at birth? Sex refers to sex assigned at birth.” Response options were “male” and “female.”

Gender identity

Youth were asked, “Gender refers to current gender which may be different from sex assigned at birth and may be different from what is indicated on legal documents. What is your gender?” Response options were “male,” “female,” “or please specify.” Youth who identified as a gender other than male or female were classified as “nonbinary.”

Cisgender or non-cisgender

Youth whose gender corresponded with their sex at birth were classified as “cisgender.” Youth who identified as a gender other than male or female were classified as “nonbinary.” Youth who identified as the opposite gender to their sex at birth were classified as “transgender.” While nonbinary persons may or may not identify themselves as transgender, Statistics Canada data standards consider nonbinary and transgender persons as constituting different categories, with transgender persons identifying as part of the gender binary of male/female.¹⁴ Since not all categories were reportable due to low sample sizes and high sampling variability,

nonbinary and transgender youth were grouped together as “non-cisgender”

Sexual attraction

Youth aged 15 to 17 were asked whether they were “only attracted to males”; “mostly attracted to males”; “equally attracted to females and males”; “mostly attracted to females”; “only attracted to females”; or “not sure.” Cisgender and transgender youth were classified as “only attracted to the opposite gender”; “attracted to both genders”; “only attracted to the same gender”; or “not sure” based on their reported sexual attraction and self-identified gender. Nonbinary youth were classified as “attracted to both genders”; “only attracted to one gender”; or “not sure.”

Males and females classified as “attracted to both genders” were further disaggregated as: “mostly attracted to the opposite gender”; “equally attracted to both genders”; or “mostly attracted to the same gender,” where there was sufficient sample size.

Analyses by sexual attraction, particularly for the inclusion of nonbinary youth, were not always possible due to insufficient sample size. Therefore, for the current analysis, all youth were classified as having “attraction exclusive to the opposite gender”; or “attraction not exclusive to the opposite gender” if they were attracted to both genders, the same gender, not sure or if they self-identified as nonbinary gender. Similar classifications have been used in other studies.^{28,29} Those reporting “not sure” were excluded as a sensitivity analysis.

Statistical analyses

Descriptive statistics were used to calculate percentages and 95% confidence intervals (95% CIs) for gender identity measures overall and stratified by age group (12–14 and 15–17 years). Descriptive statistics were used to calculate percentages and 95% CIs for sexual attraction measures overall and stratified by gender (male/female). All statistics were calculated using survey weights provided by Statistics Canada to be nationally representative. We calculated 95% CIs using bootstrap weights. Two-tailed hypothesis tests were used to assess differences in gender by age and sexual attraction by gender under a significance level of 0.05.

Analyses were conducted in SAS EG 7.1 (SAS Institute, Inc., Cary, NC, US).

Results

Gender identity

Among Canadian youth aged 12 to 17 years, approximately 0.5% were classified as non-cisgender, with 0.2% identifying as nonbinary and 0.2% transgender (Table 1). The percentage of youth classified as non-cisgender did not differ by age group.

Sexual attraction

Among all youth aged 15 to 17 years, 79.0% reported attraction exclusive to the opposite gender, whereas 21.0% reported attraction not exclusive to the opposite gender (attracted to both genders, not sure of their sexual attraction, or nonbinary). When youth who were not sure of their sexual attraction (n = 190, 3.6%) were excluded in a sensitivity analysis, 17.8% of youth reported attraction not exclusive to the opposite gender (23.7% of females, 11.9% of males).

Among cisgender and transgender youth aged 15 to 17 years who identified as male or female, 79.3% were only attracted to the opposite gender, 15.9% were attracted to both genders, 1.0% were only attracted

to the same gender and 3.8% were not sure (Table 2). The majority of youth attracted to both genders were mostly attracted to the opposite gender. Females were less likely to only be attracted to the opposite gender than males. All transgender youth reported attraction to both genders or only to the same gender (percentage unreportable due to small sample size). Among nonbinary youth aged 15 to 17 years, 69.9% reported attraction to both genders. The remainder were attracted to one gender or not sure of their sexual attraction (percentages unreportable due to small sample size).

Discussion

This study provides the first nationally representative estimates of the distribution of gender identity and sexual attraction among Canadian youth aged 12 to 17 years.

Gender identity

Of the youth in this study, 0.2% identified as nonbinary, and 0.2% as a gender different than their sex assigned at birth (i.e. transgender). These estimates are generally consistent with the recent 2021 Census, in which 0.79% of Canadians aged 15 to 24 identified as nonbinary or transgender,²⁵ as well as results from the 2013 BC

Adolescent Health Survey, in which fewer than 1% of respondents identified as transgender.²⁶ Similarly, 1.2% of respondents identified as transgender in a population-based survey of New Zealand secondary students,³⁰ and 1.1% in a nationally representative survey of US youth aged 14 to 17.³¹ While constituting a small proportion of the population, nonbinary and transgender persons face a broad range of inequities.¹⁻⁷ Oversampling of these groups should be considered when designing surveillance and research studies to obtain reliable estimates and make inferences on their health and the inequities they experience.³²

Sexual attraction

A considerable percentage of youth (21.0%) reported attractions not exclusive to the opposite gender. This was similar to the percentage reporting sexual identities other than heterosexual in the 2013 BC Adolescent Health Survey (19%),²⁶ and considerably higher than the 2015 Canadian Community Health Survey for ages 15 to 24 years (5.6%).¹ Differences in estimates may be due to differences in the dimensions of sexual orientation and the population assessed, response options and trends over time. Gay, lesbian and bisexual identification has been increasing over time, particularly among younger

TABLE 1
Gender identities of Canadian youth aged 12 to 17 years overall and by age, 2019 Canadian Health Survey on Children and Youth

	Overall (N = 11 063) % (95% CI)	Ages 12–14 years (n = 5770) % (95% CI)	Ages 15–17 years (n = 5293) % (95% CI)
Gender			
Female	48.5 (43.4–53.6)	48.1 (46.8–49.4)	49.0 (47.6–50.3)
Male	51.2 (46.9–55.6)	51.7 (50.4–53.0)	50.8 (49.4–52.2)
Nonbinary	0.2 ^E (0.0–3.6)	^F	0.2 ^E (0.1–0.4)
Total^b	100	100	100
Cisgender/non-cisgender			
Cisgender	99.5 (99.3–99.7)	99.5 (99.3–99.8)	99.5 (99.3–99.7)
Non-cisgender ^a	0.5 ^E (0.0–5.7)	0.5 ^E (0.2–0.8)	0.5 ^E (0.3–0.7)
Nonbinary	0.2 ^E (0.0–3.6)	^F	0.2 ^E (0.1–0.4)
Transgender	0.2 ^E (0.1–3.7)	^F	0.3 ^E (0.1–0.5)
Total^b	0.5 ^E	0.5 ^E	0.5 ^E
Total^b	100	100	100

Abbreviation: CI, confidence interval.

^a The following three rows provide further breakdowns for non-cisgender youth where possible.

^b The sum of the categories may not equal the total due to rounding or unreportable numbers.

^E Estimates should be interpreted with caution due to high coefficient of variation.

^F Estimate unreportable due to high coefficient of variation.

TABLE 2
Sexual attraction of Canadian male and female youth aged 15 to 17 years, overall and by gender, 2019 Canadian Health Survey on Children and Youth

	Overall ^a (N = 5254)	Male (n = 2571)	Female (n = 2683)	Gender comparison (significance level)
	% (95% CI)	% (95% CI)	% (95% CI)	
Sexual attraction				
Only attracted to the opposite gender	79.3 (77.8–80.7)	85.7 (83.8–87.5)	72.7 (70.4–75.0)	*
Attracted to both genders ^b	15.9 (14.6–17.3)	10.5 (8.9–12.2)	21.5 (19.4–23.7)	*
Mostly attracted to the opposite gender	10.2 (9.0–11.3)	7.3 (5.9–8.8)	13.1 (11.3–14.9)	*
Equally attracted to both genders	4.7 (3.9–5.5)	2.5 (1.7–3.3)	7.0 (5.6–8.3)	*
Mostly attracted to the same gender	1.1 ^f (0.7–1.4)	^f	1.4 ^f (0.8–2.1)	
Total^c	15.9	10.5	21.5	
Only attracted to the same gender	1.0 ^e (0.7–1.4)	1.1 ^e (0.6–1.6)	1.0 ^e (0.5–1.4)	
Not sure	3.8 (3.1–4.5)	2.7 (2.0–3.5)	4.8 (3.6–6.0)	*
Total^c	100	100	100	

Abbreviation: CI, confidence interval.

^a Overall estimates include youth identifying as male or female, excluding nonbinary youth.

^b The following four rows provide further breakdowns for those attracted to both genders, where possible.

^c The sum of the categories may not equal the total due to rounding or unreportable numbers.

^e Estimates should be interpreted with caution due to high coefficient of variation.

^f Estimate unreportable due to high coefficient of variation.

* Significant difference between males and females, $p < 0.001$

generations.³³ In non-Canadian contexts, 25.6% of US youth aged 14 to 17 reported attractions not exclusive to the opposite gender in a nationally representative survey,³¹ compared to only 11.1% of Australian youth aged 14 to 15.³⁴

Similar to studies examining sexual identity among Canadian youth and adults,^{1,26} females were more likely than males to report attraction not exclusive to the opposite gender. This difference was largely driven by more females reporting attraction to both genders or being unsure of their attraction.

Sampling variability was high for the percentage of youth “mostly attracted” and “only attracted” to the same gender. The percentage of males who were “mostly attracted” to the same gender could not be reported, nor could sexual attraction distributions among nonbinary or transgender youth. In general, it is advisable to report estimates for all sexual attraction categories where possible, as health status can differ between each group,⁸ and this should be taken into consideration in the sampling design for surveillance studies.

Evaluating differences in health status by sexual attraction using existing data may require grouping categories together (e.g. attraction exclusive to the opposite gender

vs. attraction not exclusive to the opposite gender) in order to report reliable estimates. Most youth who were not exclusively attracted to the opposite gender were “mostly attracted” to the opposite gender. Studies have suggested that some of these individuals may have a heterosexual sexual identity or engage in heterosexual sexual behaviour.³⁵ While youth who were not sure of their sexual attraction were classified as not exclusively attracted to the opposite gender, some of these youth may develop a heterosexual orientation later on.³⁶ Attraction to the opposite gender has been found to be relatively stable throughout adolescence and young adulthood compared to same- or both-gender attraction and being unsure of attraction, although studies have suggested gender differences in stability of sexual orientation.^{21,36,37} It may be reasonable, therefore, to compare individuals only attracted to the opposite gender with those reporting any other attraction, particularly for cross-sectional analyses.

Strengths and limitations

This is the first study to describe distributions of both gender and sexual attraction among Canadian youth aged 12 to 17 years, and makes a significant contribution to the evolving understanding of the extent of gender and sexual diversity in this

population. These findings point to the necessity of increasing research on the effectiveness of policies and interventions to minimize health inequities by gender and sexual attraction or orientation. Existing studies include interventions to minimize substance use, social stressors and mental health concerns,³⁸⁻⁴⁰ with one intervention study specifically targeting suicidal same gender-attracted youth.⁴¹ However, research is limited thus far, particularly among youth.

This study had several limitations. Despite the large sample size, there was large sampling variability for the reporting of percentages of certain groups. It was not possible to determine breakdowns for specific gender identities, including Two-Spirit.

The questionnaire did not specify whether sexual attraction towards males and females was based on gender or sex. This study assumed that attraction was based on gender rather than sex, which may not be the case for all respondents.

Non-cisgender identities and nonheterosexual orientations often carry social stigmas, which vary by societal and cultural contexts.^{24,42} These stigmas may lead to social desirability bias in reporting, whereby percentages for non-cisgender identities and sexual attractions not exclusive to the

opposite gender are underestimated. These biases may lessen over time with increasing recognition, visibility and acceptance of gender and sexual diversity.⁴²

Finally, this study was limited to sexual attraction as a dimension of sexual orientation. Although sexual attraction is regarded as a more appropriate dimension to measure in youth than sexual identity or behaviour, it is not always concordant with the other dimensions and can have different health implications.^{23,24} Surveillance would ideally encompass all three dimensions to monitor inequalities, facilitate research and target groups for public health needs.

Conclusion

Based on self-reported data, 0.2% of Canadian youth aged 12 to 17 years identify as nonbinary and 0.2% as transgender. Among Canadian youth aged 15 to 17 identifying as male, female or nonbinary, 79.0% report attraction exclusive to the opposite gender, whereas 21.0% report attraction not exclusive to the opposite gender. Previous research has shown significant health and social inequities for the latter group and other minorities in this study. Conducting surveillance and research is a necessary step in reducing inequities, and researchers should consider oversampling or other approaches to ensure that reliable estimates can be obtained for nonbinary and transgender youth and youth with same-gender attraction.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Authors' contributions and statement

CW, GB, SLW, CS, BJ, MTB, KCR—conceptualization, writing—reviewing & editing. CW, GB—methodology. CW—formal analysis; writing—original draft.

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At-a-glance

“I just got tired of their healthy tips”: health promotion during public health crises

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Abstract

This qualitative study highlights parents' perspectives on pandemic-related changes to health promotion programming. We conducted 60-minute, semi-structured telephone interviews with 15 parents (all mothers) of children in Grades 4 to 6 between December 2020 and February 2021 in two western Canadian provinces. Transcripts were analyzed through thematic analysis. While some parents found the health promotion materials helpful, most were overwhelmed and did not access the materials, finding them intrusive, being preoccupied with other things and facing their own personal stressors. This study highlights key factors to be addressed and further investigated to ensure the successful delivery of health promotion programming during future crises.

Keywords: *health promotion, children, public health crisis, school closures, COVID-19, qualitative research, Canada*

Introduction

Establishing and maintaining healthy lifestyle behaviours in childhood is critical for growth, development and preventing chronic disease.¹ Before the COVID-19 pandemic, schools were the key setting for delivering health promotion programming to children. During the COVID-19 pandemic, countries imposed prolonged lockdowns² and school closures, leading to the collapse of school-based health promotion programming. Therefore, the responsibility for health promotion shifted to parents. In Canada, schools disseminated health promotion materials (e.g. weekly wellness emails containing healthy recipes, family-friendly activities and exercise suggestions, mindfulness practices) to parents, who were tasked with relaying the information to their children and/or implementing health promotion activities in the home environment (e.g. cooking with healthy recipes).

It is important to understand how parents perceived health promotion materials from schools and to identify strategies to increase parental engagement to facilitate health promotion during health crises. This qualitative study explored parents' perspectives on (1) pandemic-related changes to health promotion programming, and (2) how they could be better supported in facilitating health promotion at home.

Methods

Ethics approval

The Health Research Ethics Board of the University of Alberta (Pro00061528) and participating school boards approved all study procedures.

Study design and procedures

This research is part of a multimethod study (i.e. one using complementary

Highlights

- Schools modified health promotion programming in response to the COVID-19 pandemic lockdowns and relied on parents to facilitate health promotion at home.
- Qualitative interviews with parents of children in Grades 4 to 6 revealed that parents were overwhelmed and often did not access health promotion materials.
- In the event of a future public health crisis, we identified strategies that can be used to increase parental engagement in facilitating health promotion at home.

methodologies to achieve a common overall research goal³) that examined parents' and children's perceptions of the impacts of COVID-19 on elementary school children in 20 APPLE (A Project Promoting healthy Living for Everyone) Schools in western Canada. School lockdowns in Canada were implemented in March 2020 and continued into the 2020/21 school year, with remote learning replacing in-person learning for this duration. Fluctuating provincial restrictions, such as the reopening of schools in September 2020 and repeated suspensions throughout the 2020/21 school year, led to the delivery of school-based health promotion programming in an online format, with a focus on children's mental health and psychological well-being.

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We interviewed 15 parents whose children attended Grades 4 to 6 in one of the six APPLE Schools in six small and mid-sized communities (population < 15 000) in the provinces of Alberta and Manitoba, Canada, between December 2020 and February 2021.⁴ We used purposive, snowball and convenience sampling techniques to recruit participants for 60-minute, semi-structured telephone interviews that were audio-recorded, transcribed verbatim and analyzed using thematic analysis. All participants were mothers. Participants received a CAD 30 gift card to compensate them for their time.

Results

Participants were, on average, 46 years of age and had one to four children. Most participants were above the low-income cut-off (CAD 50 000/y; 93.3%), were married or living common-law (86.6%), had at least a community or technical college education (93.4%) and had not had their (or their partner's) employment affected by the pandemic (86.7%). Two main themes emerged from the thematic analyses: (1) "Oh my god, there's too much in [this email]": parents overwhelmed with health promotion materials; and (2) "We really liked that": tips for increased parental engagement with health promotion materials.

"Oh my god, there's too much in [this email]": parents overwhelmed with health promotion materials

Although parents expressed concerns about the negative changes to their children's lifestyle behaviours and mental health because of the pandemic,⁴ most parents did not access health promotion materials made available to them. When prompted to expand on the reasons for not accessing these resources, some participants described them as intrusive ("I just want to be left alone by somebody else telling me what I have to do during my day with my kids" [Parent 4a]) or explained that they were too preoccupied with other things (Table 1, Quote 1.1). Most participants also spoke of their own pandemic-related mental health stressors, such as unexpected family circumstances, changes to routines, the inability to rely on social support networks and being overwhelmed by the pandemic (Table 1, Quotes 1.2 and 1.3).

Considering more immediate pandemic-related stressors, health promotion materials

were viewed as "extra stuff" (Parent 11a) when compared to keeping up with educational requirements for school (Table 1, Quotes 1.4 and 1.5).

Some parents who accessed the resources described their loss of interest in health promotion materials from schools amidst the abundance of pandemic-related messaging from the media, work and other sources (Table 1, Quotes 1.6 and 1.7).

"We really liked that": tips for increased parental engagement with health promotion materials

Those parents who accessed the health promotion materials found those targeting mental health and well-being particularly helpful (e.g. journaling and meditation). Indeed, mental health appeared to be a more salient concern than other lifestyle behaviours for parents during the COVID-19 pandemic.⁴ Mindfulness "was definitely a coping strategy and something that helped identify some feelings that [the child was] having" and was easy to implement at home since the child was able to "link it to what [the child] had done in school" (Parent 5a). One parent commented that quiet activities potentially contributed to their children's ability to better self-regulate their behaviour (Table 1, Quote 2.1). Another parent noted that schools provided reflective journals, allowing children to reflect on and process their feelings.

When probed to discuss the health promotion supports that would be helpful in future lockdowns, parents commented on the benefit of personal interaction from teachers or other school staff (e.g. school health facilitator), both for parents and children, compared to impersonal communications such as newsletters, emails and brochures (Table 1, Quotes 2.2 and 2.3).

Parents also spoke about more tangible supports to encourage healthy lifestyles for children, such as food basket distribution through collaboration between schools and community centres. This was particularly appreciated by the families affected by pandemic-related stressors such as job losses (Table 1, Quotes 2.4 and 2.5).

Parents suggested putting short health promotion materials (e.g. "a three-minute video" [Parent 13a]) on social media that

are "easy to browse through at night when you have some down time" (Parent 6a); including more activities that are easy to do at home and that are engaging and competitive ("Maybe they could challenge other kids in their class or have [certain] amount of outside time and [...] documenting that and what they did outside." [Parent 1a]); and providing equipment to keep children engaged ("Skipping rope would have been awesome, 'cause my kids would have loved that" [Parent 5a]).

Discussion

We summarized parents' perceptions of health promotion materials during the COVID-19 pandemic. Although some parents accessed and appreciated suggestions on maintaining healthy lifestyle behaviours while students were learning remotely, most were too overwhelmed to review or utilize these health promotion materials. This finding is consistent with existing research on health promotion communication during health crises,⁵ when most parents are preoccupied with more immediate concerns (e.g. ensuring economic stability, keeping up with the educational requirements). Thus, unhealthy lifestyle behaviours of children lose their saliency, and health promotion becomes just "one more thing" placed on parents' shoulders.

To prevent this outcome during crises, UNICEF⁶ emphasizes the importance of schools assessing communication needs, identifying multiple communication channels (e.g. online parent conferences, phone calls, messaging groups, social media platforms and school websites) and specific frequency of communications, as well as strategies that have the biggest potential to establish and maintain parents' engagement. As exemplified in our study, some parents expressed interest in receiving health promotion materials in an alternative format (e.g. short videos) on social media platforms. Moreover, given the perceived importance of meeting educational requirements, it might be helpful to contextualize health promotion as an important contributor to children's academic success. For example, rather than using prescriptive language (e.g. "Your children need to eat healthy and exercise"), health promotion materials could emphasize the importance of healthy lifestyle behaviours for children's ability to learn and concentrate better (e.g. "Healthier kids are better learners").

TABLE 1
Select quotes from parents of children in Grades 4 to 6 attending APPLE Schools^a in Alberta and Manitoba, December 2020 to February 2021, on school-based health promotion during the pandemic

Quote #	Quote
1.1	“Because we were so into what we were doing, we didn’t probably pay attention to what they were suggesting.” (Parent 2a)
1.2	“I was getting emails left, right and centre, just trying to keep up with my kids’ academics.” (Parent 6a)
1.3	“I’m going to be honest, I didn’t really read [health promotion materials], because it was this really lengthy email most of the time. [...] There was almost too much stuff in it. I’d open it and I’d be like ‘Oh my god, there’s too much in it,’ and I wouldn’t even look at it.” (Parent 3a)
1.4	“I do know that [health promotion materials] came home, but to be honest, there was so much that I literally just took out the math and the spelling, and I just pushed the other stuff away because it was just too overwhelming.” (Parent 12a)
1.5	“When it’s not important it just gets skimmed over and it’s like ‘yeah, okay, whatever.’” (Parent 13a)
1.6	“Well [laughs], I’ve been having a hard time myself with the whole COVID thing ... I kind of go ‘yeah, yeah, yeah, okay.’ You know when you see something so much you just stop seeing it, or you stop caring about it.” (Parent 13a)
1.7	“I got tired of their healthy tips.” (Parent 9a)
2.1	“[Doing these quieter activities] just calms down their level of energy, definitely calms down a notch. They get along better, they aren’t so reactive to each other.” (Parent 5a)
2.2	“The teachers had phoned me just personally, ‘How are you doing, we’re just checking in.’ And they did that for the kids too, just to make sure we’re not losing our minds. They were watching out for everybody.” (Parent 4a)
2.3	“[The APPLE School Health Facilitator] was sending emails and phoning. [...] She was following up and checking in with both kids. She was really great at that, actually.” (Parent 10a)
2.4	“[The school was putting together food baskets] and a lot of families really needed it. [City name] is an oil and gas town, and a military town as well, so a lot of families were already going through a lot of hardship, and then add the pandemic onto that as well. It’s really been tough for a lot of families, so [food baskets] was a really awesome thing that [the school] did.” (Parent 6a)
2.5	“We got free lunches from one of the [community centres that] provided bag lunches for all the schools in the valley, which was wonderful. I think that happened a couple of times. And then even the education assistants and teachers made pizzas and gave them out to the families. [...] When we would drop off homework and pick up the new envelopes, they had pizzas for us to cook at home [, which] was really nice.” (Parent 10a)

Abbreviation: APPLE Schools, A Project Promoting healthy Living for Everyone in schools.

^a For more information on APPLE Schools, see www.APPLESchools.ca

Given that parents struggled to facilitate health promotion during COVID-19, it is imperative that alternative ways for health promotion delivery are sought. The partnerships and services component of the Comprehensive School Health framework⁷ outlines that all schools should explore ways to create tighter connections with community organizations and co-create opportunities for kids to engage in healthier lifestyle behaviours, while also giving parents time to recharge and take care of their own physical and mental health needs.

While virtual delivery of programming by schools served during the acute, pre-vaccine phase of the pandemic, evidence shows that outdoor activities with added layers of protection against COVID-19 (e.g. masking, distancing), such as community walks and evening bike rides, are another safe option to keep children active.⁸ Moreover, additional funding to ensure the distribution of equipment (e.g. skipping ropes, bubble-blowing solution, soccer balls, family games to promote positive family experiences) and food (e.g. food hampers, gift cards for groceries), as well as access

to individual and family counselling and other community resources that focus on mental health and well-being are warranted in case of future lockdowns.

Conclusion

We found that most parents did not access health promotion materials during school closures due to the health crisis and associated challenges. We identified strategies to increase parental engagement in facilitating health promotion at home during health crises to keep students engaged in healthy lifestyles. Future research should investigate student outcomes of health promotion during health crises to ensure that health promotion is implemented in a meaningful and efficient way.

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Conflicts of interest

The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Authors’ contributions and statement

JD, NW, LM, PJV, KM—conceptualization. JD, LM, BAM, SS—data curation. NW, LM, BAM, SS—formal analysis. PJV, KM—funding acquisition. NW—methodology.

PJV, KM—supervision. JD—project administration. JD, BAM, SS—writing—original draft. JD, NW, LM, BAM, SS, PJV, KM—writing—review & editing.

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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Call for Papers: Social Prescribing in Canada

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Social prescribing (SP) is a practical tool for addressing the social determinants of health through supported referrals to community services. This globally spreading intervention aims to promote health and prevent chronic disease by supporting individual and community self-determination and connecting participants to nonclinical supports in their communities, such as food and income support, parks and walking groups, arts and cultural activities or friendly visiting.¹

Global evidence demonstrates that SP can support individual and population health, build the evidence base on the impacts of social interventions for health promotion and chronic disease prevention and integrate health and social care at the community level.² However, while SP practices continue to scale and spread across Canada, and knowledge mobilization is underway through the new Canadian Institute for Social Prescribing,³ there is relatively little published literature on this novel intervention in Canadian contexts and by Canadian researchers, practitioners and participants.

The objective of this special issue is to identify and share the most current research and practice on SP by and for residents of Canada, particularly those facing inequities in access to health and its social and structural determinants. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice* therefore seeks relevant qualitative and quantitative research articles, as well as commentaries, that present new findings, synthesize existing evidence or imagine new ways forward on (for example)

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