

Association Between Peer Victimization, Gender Diversity, Mental Health, and Recurrent Headaches in Adolescents

A Canadian Population-Based Study

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Abstract

Background and Objectives

It is unknown whether bullying and gender diversity are associated with increased headache frequency in adolescents. Our study aimed to assess the association between peer victimization, gender diversity, and frequent recurrent headaches in adolescents, while controlling for age, sex, socioeconomic status, and potential confounders (mood and anxiety disorders, suicidality).

Methods

This was a cross-sectional observational study of adolescents aged 12–17 years using data from a Canadian population-based health survey. Headache frequency was dichotomized into “≤once/wk” or “>once/wk” (i.e., frequent recurrent headaches). Logistic regression was used to quantify the association between frequent peer victimization (overt or relational), gender diversity (female sex at birth + male gender, male sex at birth + female gender, or gender diverse), mood/anxiety disorder, suicidality, and the odds of frequent recurrent headaches. The fully adjusted multivariable logistic regression model included all exposures and was controlled for age, sex, and socioeconomic status. Bootstrap replicate weighting was used to account for survey design effects.

Results

There were an estimated 2,268,840 eligible participants (weighted sample size) (mean age = 14.4 years, 48.8% female, 0.5% gender diverse), and 11.2% reported frequent recurrent headaches. Frequent recurrent headaches were associated with older age (odds ratio [OR] = 1.26 per year of age, 95% CI 1.20–1.31), female sex (OR = 2.89, 95% CI 2.47–3.37), and being gender diverse (OR = 3.30, 95% CI 1.64–6.63, adjusted for age/sex). Youth with frequent headaches had higher odds of experiencing both overt and relational bullying compared with peers (OR = 2.69, 95% CI 2.31–3.14, and OR = 3.03, 95% CI 2.58–3.54, adjusted for age/sex). In the fully adjusted model, frequent headaches were no longer associated with gender diversity (OR = 1.53, 95% CI 0.63–3.69) but were still associated with frequent overt and relational peer victimization (OR = 1.82, 95% CI 1.41–2.34, and OR = 1.54, 95% CI 1.17–2.03, respectively), suicidality (OR = 1.83, 95% CI 1.44–2.32), and having a mood or anxiety disorder (OR = 1.50, 95% CI 1.01–2.21, and OR = 1.74, 95% CI 1.24–2.45, respectively). In a model adjusted for age, sex, and mood/anxiety disorders, the risk of suicidality increased incrementally with headache frequency.

Discussion

Peer victimization and suicidality may be associated with higher headache frequency in adolescents with headaches, independently of mood and anxiety symptoms. Gender-diverse

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Glossary

aOR = adjusted odds ratio; CHSCY = Canadian Health Survey on Children and Youth.

adolescents may have a higher risk of experiencing frequent headaches when compared with cisgender peers, and this may be explained by associated psychosocial factors (anxiety, depression, suicidality, and peer victimization).

Introduction

Most children and adolescents experience headaches, with a reported prevalence of approximately 60% based on systematic review–level data.¹ Frequent recurrent headaches (≥ 1 headache day/wk) occur in approximately 8%–30% of children and adolescents,^{1–6} most commonly due to a primary headache disorder such as migraine or tension-type headache. Primary headache disorders can have a substantial impact on functioning and quality of life,⁷ with disability affecting home,^{8–10} school,^{8–11} and extracurricular activities.^{8–10}

To truly understand the experience of chronic pain, including primary headache disorders, a biopsychosocial lens must be adopted^{12,13}; the 2020 revised definition of pain from the International Association for the Study of Pain underlines the importance of considering not only biological, but also psychological and social factors in defining pain.¹⁴ While most population-based studies of children and adolescents with headache have focused on defining incidence and prevalence of primary headache disorders,¹ there is a clear gap in the literature regarding understanding social factors that may influence the experience of pain in this population.

Prior work supports an association between peer victimization (i.e., bullying) and headaches in children and adolescents,^{15–20} but few of the existing studies have adjusted for important confounders such as age, sex, and socioeconomic status. In addition, none of the existing studies have considered the potential role of suicidality, anxiety, and depressive disorders, which are known comorbidities in children and adolescents with headache^{21,22} and are also associated with peer victimization,^{23,24} rendering them important potential confounders. Furthermore, prior work in children and adolescents has not yet explored the relationship between headaches and gender diversity. Gender diversity has been defined as having a gender identity (including gender expression) that is different from what is perceived to be the gender norm in a particular context and point in time.²⁵ Gender diversity may be an important confounder to consider in the relationship between headaches and peer victimization, given that data in adults suggest that being gender diverse is associated with both a high risk of headache and a high risk of discrimination.^{26,27} Given potential confounding bias in prior studies, it remains unclear whether peer victimization is associated with headache

frequency in children and adolescents, independent of shared psychological and social vulnerabilities.

To address this gap in the literature, we aimed to assess the association between peer victimization, gender diversity, and frequent recurrent headaches in adolescents, while controlling for key covariates (age, sex, and socioeconomic status) and potential confounders to these associations (anxiety, depression, and suicidality). We hypothesized that peer victimization and being gender diverse would be associated with frequent recurrent headaches in adolescents, even after controlling for anxiety, depression, suicidality, and key baseline demographic variables.

Methods

This was a cross-sectional observational study of adolescents aged 12–17 years using data from a large Canadian population-based health survey.

Data Source and Population

This study used data from the 2019 Canadian Health Survey on Children and Youth (CHSCY), which is a cross-sectional health survey conducted by Statistics Canada with a focus on youth mental and physical health. The CHSCY study's sampling frame aimed to encompass the entire Canadian population aged 1–17 years, as of January 31, 2019, with the exception of children and adolescents living on First Nation reserves and other Indigenous settlements, in foster homes, and in institutions. The overall response rate of the survey was 52%.²⁸ This study used a complex sampling frame that used geographic and age-based stratification applied to a sample of 92,170 raw units to create a weighted sample that is representative of the population of Canadian youth as described earlier ($N_{\text{weighted}} = 6,568,470$).

Data were collected through questionnaires developed and field tested by Statistics Canada and administered to the youth or the person most knowledgeable (about the youth) in the household depending on the age of participant and the content of the question. Questionnaires were initially sent in e-survey format, and when responses were not obtained by the deadline, a Statistics Canada interviewer contacted the respondent and asked them to complete the questionnaires over the telephone.

For the purposes of this study, we excluded individuals who had missing data within the final study variables using case-wise deletion because missing information was <5% in the target population (i.e., adolescents who answered questions on the variables of interest). Given that children younger than 5 years were not asked about headaches, they were excluded ($n_{\text{weighted}} = 1,536,095$ excluded), and a further 0.82% of the sample ($n_{\text{weighted}} = 54,000$) was excluded because of missing headache data. The original study sample was further reduced to those aged 12–17 years ($n_{\text{weighted}} = 2,268,840$) because the questions regarding gender, peer victimization, and suicidality were only asked in this subpopulation (Figure).

Measures

Primary Outcome (Frequent Recurrent Headaches)

Respondents were asked whether they had headaches in the past 6 months and at which frequency: “rarely or never,” “approximately once a month,” “approximately once a week,” “more than once a week” or “most days.” Headache frequency was dichotomized into “approximately once a week or less” or “more than once a week” (defined as frequent recurrent headaches), as per prior published work.^{2–6}

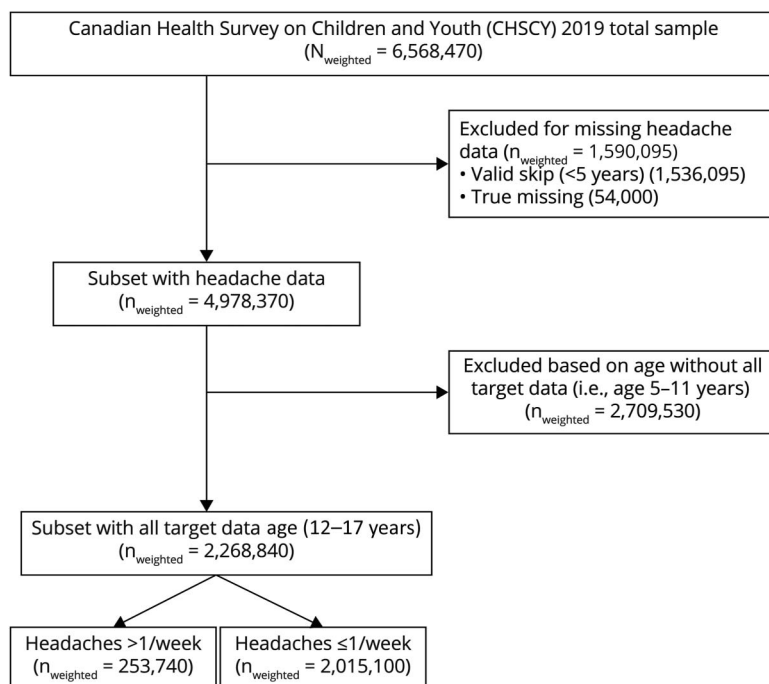
Covariates

Age (ranging from 12 to 17 years), sex assigned at birth (female or male), and socioeconomic status were included given that they are key covariates with established associations with recurrent headaches in youth.^{1,29–31} Socioeconomic status was based on annual household income and was discretized into quartiles.

Exposures

Peer victimization (i.e., bullying) was included in the models and was reported by adolescent respondents with a question asking whether they were bullied in the past 12 months and if they were, at what frequency. Frequency of victimization was dichotomized as “never/a few times a year” or “at least monthly” (defined as frequent victimization). We further dichotomized peer victimization into overt victimization (including physical and verbal aggression, calling names or insulting, threatening with harm, pushing/shoving/tripping/spitting on, destroying property on purpose, and threatening or insulting through email, instant messaging, text messaging, or online game) and relational victimization (including threat by peers to damage social status, spreading rumors about the respondent, trying to make the respondent do things he/she does not want to, excluding from activities on purpose, excluding from an online community, and posting hurtful information about the respondent on the internet).³² Gender as related to social norms and as self-reported by the adolescent respondents was included in the models using a derived variable; sex at birth (response options = male or female) and gender (response options = male, female, or gender diverse) in the 12- to 17-year-old population were cross-classified and used to create a derived variable, where options were cis-gender (youth self-reported female sex at birth + female gender, or male sex at birth + male gender) or gender diverse (youth self-reported female sex at birth + male gender, male sex at birth + female gender, or self-reported as gender diverse). We also included the presence of diagnosed mood disorder (including depression, bipolar disorder, mania, or

Figure Flowchart of the Study



Data are rounded to the nearest 10.

dysthymia) and anxiety disorder (including phobia, obsessive-compulsive disorder or a panic disorder) because they are established comorbidities in children and adolescents with primary headache disorders.²¹ Finally, given some existing literature on suicidality and headaches in youth,^{22,33} we included a variable reported among adolescents aged 15–17 years, which reflected the respondent's answer to a question on suicidal ideation in the past 12 months and suicide attempts in their lifetime.

Statistical Analyses

Descriptive analyses were conducted to examine demographic characteristics, the frequency of headaches, overt and relational victimization, gender diversity, the presence of mood and anxiety disorder diagnoses, and suicidality among Canadian adolescents. All estimates were weighted to be representative of the Canadian population aged 12–17 years, and we used bootstrapping to calculate variance estimates, including 95% CIs. No sample size calculations were completed a priori; the sample size was determined by available existing data.

Initial logistic regression models, unadjusted and adjusted for age and sex, were used to quantify the association between the odds of frequent headaches and each exposure separately: gender diversity, overt or relational peer victimization occurring at least monthly, and mood and anxiety disorders. We also performed multivariable analyses to examine the association between headaches and the presence of suicidal ideation or attempts in adolescents aged 15–17 years (unadjusted and adjusted for age, sex, and mood/anxiety disorders). Finally, a fully adjusted multivariable logistic regression model was used to examine the odds of frequent recurrent headaches with all exposures included and was controlled for age, sex, and household income.

Bootstrap replicate weighting was used to account for survey design effects. All analyses were conducted using the statistical software Stata (Stata/SE 16.0 for Windows, revision 01 August 2019). *p* Values <0.05 were considered statistically significant.

Standard Protocol Approvals, Registrations, and Patient Consents

This study used data from a national Statistics Canada survey that has strict policies around data confidentiality and ensures that only aggregated de-identified data can be released to qualified investigators within the context of an approved research proposal; data were accessed in a secure facility commissioned by Statistics Canada for this purpose (i.e., Research Data Center). As per the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans,³⁴ research ethics board approval is not required for this study.

Data Availability

Given the confidential and legally protected nature of the CHSCY data that are regulated by the Statistics Act,³⁵ it

cannot be deposited into a public use repository. Investigators with an approved proposal may access the data through Research Data Centers.

Results

Description of the Population

There were an estimated 2,268,840 eligible participants in the population (weighted sample size), with 48.82% (95% CI 48.73–48.90) of the sample reporting female sex assigned at birth, and 0.50% (95% CI 0.35–0.64) reporting being gender diverse. The mean age was 14.42 years (95% CI 14.38–14.46). A total of 11.2% (95% CI 10.45–11.92) reported experiencing frequent recurrent headaches.

A total of 24.77% (95% CI 23.81–25.72) of the adolescents reported being the victims of frequent overt bullying and 16.63% (95% CI 15.84–17.42) of frequent relational bullying. Mood and anxiety disorders were diagnosed in 3.81% (95% CI 3.39–4.23) and 7.38% (95% CI 6.79–7.97) of respondents, respectively. In youth aged 15–17 years, 16.51% (95% CI 15.34–17.69) reported having considered or attempted suicide in their lifetime. Table 1 summarizes all sample characteristics.

Risk Factors for Frequent Recurrent Headaches in Preliminary Models

In univariate logistic regression models (Table 2), frequent recurrent headaches were significantly associated with older age (OR = 1.26 per year of age, 95% CI 1.20–1.31, *p* < 0.0001) and female sex (OR = 2.89, 95% CI 2.47–3.37, *p* < 0.0001).

In models adjusted for age and sex (Table 2), being gender diverse was significantly associated with frequent recurrent headaches (adjusted odds ratio [aOR] = 3.30, 95% CI 1.64–6.63, *p* = 0.001). Youth with frequent headaches had higher odds of experiencing both frequent overt and relational victimization compared with their peers (aOR = 2.69, 95% CI 2.31–3.14, *p* < 0.0001, and aOR = 3.03, 95% CI 2.58–3.54, *p* < 0.0001, respectively). Diagnosed mood and anxiety disorders were also significantly associated with frequent recurrent headaches (aOR = 3.54, 95% CI 2.73–4.60, *p* < 0.0001, and aOR = 2.79, 95% CI 2.27–3.42, *p* < 0.0001, respectively). Household income was not significantly associated with frequent recurrent headaches.

Fully Adjusted Multivariable Logistic Regression Model

In the fully adjusted multivariable model (Table 3), the relationship between frequent recurrent headaches and being gender diverse weakened and was no longer statistically significant (aOR = 1.53, 95% CI 0.63–3.69, *p* = 0.349). Frequent overt and relational peer victimization were still associated with higher odds of frequent recurrent headaches (aOR = 1.82, 95% CI 1.41–2.34, *p* < 0.0001, and aOR = 1.54, 95% CI 1.17–2.03, *p* = 0.002, respectively), as did suicidality (aOR =

Table 1 Characteristics of Study Sample and Differences Between Adolescents With Frequent Recurrent Headaches and Their Peers

	All adolescents % or mean (95% CI) N = 2,268,840	In adolescents with headaches > once/wk % or mean (95% CI) N = 253,740	In adolescents with headaches ≤ once/wk % or mean (95% CI) N = 2,015,100
Age, y	14.42 (14.38–14.46)	14.99 (14.89–15.10)	14.35 (14.31–14.39)
Sex			
Female	48.82 (48.73–48.90)	71.10 (68.20–74.00)	46.01 (45.56–46.44)
Male	51.18 (51.10–51.27)	28.90 (26.00–31.80)	53.99 (53.56–54.42)
Gender			
Cisgender	99.50 (99.36–99.65)	98.59 (97.84–99.35)	99.62 (99.48–99.75)
Gender diverse	0.50 (0.35–0.64)	1.41 (0.65–2.16)	0.38 (0.25–0.52)
Household income			
4th quartile	24.92 (24.00–25.84)	23.68 (20.96–26.40)	25.08 (24.09–26.06)
3rd quartile	24.44 (23.44–25.45)	26.00 (23.05–28.96)	24.25 (23.18–25.31)
2nd quartile	24.99 (23.99–26.00)	24.60 (21.68–27.53)	25.04 (23.99–26.10)
1st quartile	25.64 (24.65–26.64)	25.71 (22.78–28.64)	25.64 (24.57–26.70)
Headaches			
Rarely or never	43.76 (42.65–44.86)	NA	NA
Approximately once/mo	29.82 (28.77–30.86)	NA	NA
Approximately once/wk	15.24 (14.42–16.07)	NA	NA
>Once/wk	06.58 (06.01–07.15)	NA	NA
Most d	4.61 (4.11–5.10)	NA	NA
Headaches			
≤Once/wk	88.82 (88.08–89.55)	NA	NA
>Once/wk	11.18 (10.45–11.92)	NA	NA
Bullied			
Overt victimization			
Never/few times a year	75.23 (74.28–76.19)	58.94 (55.63–62.25)	77.29 (76.31–78.26)
At least monthly	24.77 (23.81–25.72)	41.06 (37.75–44.37)	22.71 (21.74–23.69)
Relational victimization			
Never/few times a year	83.37 (82.58–84.16)	66.27 (63.14–69.39)	85.52 (84.72–86.32)
At least monthly	16.63 (15.84–17.42)	33.73 (30.61–36.86)	14.48 (13.68–15.28)
Suicidality (in 15- to 17-year olds)			
Attempted suicide in lifetime	6.77 (5.98–7.55)	17.11 (13.87–20.34)	5.03 (4.32–5.75)
Considered attempting suicide in the past 12 mo	14.09 (13.01–15.17)	28.52 (24.80–32.24)	11.66 (10.56–12.77)
Suicide attempt or ideation	16.51 (15.34–17.69)	33.56 (29.53–37.59)	13.65 (12.47–14.83)
Mood disorder			
No	96.19 (95.77–96.61)	87.84 (85.73–89.95)	97.24 (96.87–97.62)
Yes	3.81 (3.39–4.23)	12.16 (10.05–14.27)	2.76 (2.38–3.13)

Continued

Table 1 Characteristics of Study Sample and Differences Between Adolescents With Frequent Recurrent Headaches and Their Peers (*continued*)

	All adolescents % or mean (95% CI) N = 2,268,840	In adolescents with headaches > once/wk % or mean (95% CI) N = 253,740	In adolescents with headaches ≤ once/wk % or mean (95% CI) N = 2,015,100
Anxiety disorder			
No	92.62 (92.03–93.21)	81.65 (79.01–84.30)	94.00 (93.45–94.54)
Yes	7.38 (6.79–7.97)	18.35 (15.70–20.99)	6.00 (5.46–6.55)

Abbreviation: NA = not applicable.

1.83, 95% CI 1.44–2.32, $p < 0.0001$) and having a mood or anxiety disorder (aOR = 1.50, 95% CI 1.01–2.21, $p = 0.043$, and aOR = 1.74, 95% CI 1.24–2.45, $p = 0.001$, respectively).

Prevalence of Suicidality in Adolescents With Headaches

In a model adjusted for age, sex, and mood/anxiety disorders (Table 4), the odds of suicidality (ideation or suicide attempts) increased incrementally with headache frequency (aOR = 1.62, 95% CI 1.27–2.07, $p < 0.0001$, for monthly headaches; aOR = 2.73, 95% CI 1.98–3.78, $p < 0.0001$, for >1 headache day/wk; and aOR = 4.68, 95% CI 3.36–6.50, $p < 0.0001$, for daily headaches).

Discussion

In this large population-based observational study, both overt and relational peer victimization were associated with frequent recurrent headaches in adolescents after controlling for age, sex, socioeconomic status, suicidality, gender diversity, and mood and anxiety disorders. The association between being gender diverse and having frequent recurrent headaches that was observed in more parsimonious models disappeared in the fully adjusted multivariable model. In addition, suicidality increased incrementally with frequent recurrent headaches.

Prior work has also corroborated a relationship between peer victimization and headaches, among other somatic symptoms, in children and adolescents.^{15–20} In fact, there are high-level data from a meta-analysis of 20 published studies to show that children and adolescents who experience peer victimization have approximately twice the odds of experiencing headache when compared with peers who have not been victimized.¹⁵ Though the authors of the published meta-analysis were able to show that female sex was a key moderator in the relationship between peer victimization and headaches, they were limited in their ability to adjust for other important confounders or explore other moderators, given limitations of existing published data. This potential for unmeasured confounders puts existing literature at risk of significant confounding bias. Our study helps us to get closer to concluding that there is a true association between frequent recurrent headaches and peer victimization in children and adolescents

that is independent of mental health profile and gender diversity. These data should compel policymakers to increase efforts toward bullying prevention and should encourage clinicians to screen children and adolescents with headache disorders for bullying during diagnosis.

In our study, there was an incremental association between suicidality and frequent recurrent headaches, with higher-frequency headaches being more strongly associated with suicidality when compared with lower-frequency headaches. Though there is a clear established relationship between anxiety, mood disorders, and primary headache disorders in children and adolescents,²¹ the association between suicidality and headache disorders in this age group is less well defined in the literature. A published cross-sectional community-based study of youth in the Taitung County of Taiwan has previously shown that adolescents with headaches are at higher risk of suicidal ideation, with an incremental positive relationship whereby higher headache frequencies were associated with higher risk.²² There are also data from a longitudinal community-based study of adolescents in Nord-Trøndelag County in Norway that suggest that adolescents with migraine are at a higher risk of subsequent hospitalization for self-harm (which is associated with suicide risk) when compared with adolescents without a headache disorder.³³ Similarly to these data and to data from a systematic review on the association between pain and suicidality in adolescents,³⁶ we found an association between suicidality and frequent headaches that remained after controlling for depression, suggesting a relationship between the 2 that is not fully explained by mood symptoms. This should compel clinicians to screen children and adolescents with headache disorders for suicidality in practice and to focus not only on treating comorbid depression but also on optimizing headache treatment as a potential means to mitigate the risk of death by suicide. To this end, screening tools such as the Columbia-Suicide Severity Rating Scale³⁷ may be useful in practice, and where concerns are identified, referral to a psychologist, psychiatrist,³⁸ or to the emergency department (for immediate safety concerns) should be considered.

In models adjusted for only age and sex, gender-diverse youth had approximately 3.3 times higher odds of frequent recurrent headaches when compared with cisgender youth. However,

Table 2 Univariable and Multivariable Model (Adjusted for Age and Sex) Results Exploring the Association Between the Exposures and Frequent Recurrent Headaches in Adolescents

	Unadjusted OR (95% CI), <i>p</i> value for >1 headache/wk	Adjusted for age and sex OR (95% CI), <i>p</i> value for >1 headache/wk
Age	1.26 (1.20–1.31), <i>p</i> < 0.0001	NA
Sex		
Male	Referent	NA
Female	2.89 (2.47–3.37), <i>p</i> < 0.0001	NA
Gender		
Cisgender	Referent	Referent
Gender diverse	3.69 (1.86–7.34), <i>p</i> < 0.0001	3.30 (1.64–6.63), <i>p</i> = 0.001
Household income		
4th quartile	Referent	Referent
3rd quartile	1.14 (0.93–1.38), <i>p</i> = 0.209	1.14 (0.93–1.39), <i>p</i> = 0.212
2nd quartile	1.04 (0.85–1.27), <i>p</i> = 0.699	1.03 (0.84–1.26), <i>p</i> = 0.785
1st quartile	1.06 (0.87–1.30), <i>p</i> = 0.558	1.05 (0.85–1.29), <i>p</i> = 0.662
Bullied		
Overt victimization		
Never/few times a y	Referent	Referent
At least monthly	2.37 (2.05–2.75), <i>p</i> < 0.0001	2.69 (2.31–3.14), <i>p</i> < 0.0001
Relational victimization		
Never/few times a y	Referent	Referent
At least monthly	3.01 (2.57–3.51), <i>p</i> < 0.0001	3.03 (2.58–3.54), <i>p</i> < 0.0001
Attempted or considered suicide (in 15- to 17-y olds)		
No	Referent	Referent
Yes	3.19 (2.60–3.93), <i>p</i> < 0.0001	2.79 (2.25–3.45), <i>p</i> < 0.0001
Mood disorder		
No	Referent	Referent
Yes	4.88 (3.83–6.22), <i>p</i> < 0.0001	3.54 (2.73–4.60), <i>p</i> < 0.0001
Anxiety disorder		
No	Referent	Referent
Yes	3.52 (2.88–4.29), <i>p</i> < 0.0001	2.79 (2.27–3.42), <i>p</i> < 0.0001

Abbreviations: NA = not applicable; OR = odds ratio.
Data are rounded to the nearest 10.

while suicidality, mood disorders, and anxiety disorders were still associated with the outcome in the fully adjusted multivariable model, in this final model, the association between being gender diverse and frequent recurrent headaches weakened, and its CIs crossed the null. Our data suggest that gender-diverse adolescents may be at higher risk of frequent recurrent headaches and that this association may be explained by mediating psychosocial factors including anxiety,

depression, suicidality, and peer victimization, as opposed to a direct effect of being gender diverse. Recent data from a sample of sexual minority and/or gender-diverse adults similarly found that migraine was more prevalent among gender-diverse adults when compared with sexual minority adults, though it did not directly address the question of confounding by mental health variables.²⁶ High rates of suicide attempts,³⁹ self-harm, and suicidal thoughts⁴⁰ have been previously

Table 3 Fully Adjusted Multivariable Logistic Regression Model Results Exploring the Association Between Exposures and the Presence of Frequent Recurrent Headaches in Adolescents

	OR (95% CI), <i>p</i> value unweighted	OR (95% CI), <i>p</i> value weighted and bootstrapped
Age	1.08 (0.99–1.18) <i>p</i> = 0.069	1.16 (1.03–1.31), <i>p</i> = 0.013
Sex		
Male	Referent	Referent
Female	3.06 (2.62–3.58), <i>p</i> < 0.0001	3.01 (2.44–3.71), <i>p</i> < 0.0001
Gender		
Cisgender	Referent	Referent
Gender diverse	0.95 (0.50–1.82) <i>p</i> = 0.887	1.53 (0.63–3.69), <i>p</i> = 0.349
Household income		
4th quartile	Referent	Referent
3rd quartile	1.28 (1.05–1.56), <i>p</i> = 0.014	1.30 (0.98–1.73), <i>p</i> = 0.068
2nd quartile	1.20 (0.98–1.46), <i>p</i> = 0.080	1.20 (0.91–1.59), <i>p</i> = 0.196
1st quartile	1.27 (1.04–1.55), <i>p</i> = 0.020	1.08 (0.82–1.42), <i>p</i> = 0.587
Bullied		
Overt victimization		
Never/few times a y	Referent	Referent
At least monthly	1.64 (1.38–1.96), <i>p</i> < 0.0001	1.82 (1.41–2.34), <i>p</i> < 0.0001
Relational victimization		
Never/few times a y	Referent	Referent
At least monthly	1.65 (1.37–1.98), <i>p</i> < 0.0001	1.54 (1.17–2.03), <i>p</i> = 0.002
Attempted or considered suicide (in 15- to 17-y olds)		
No	Referent	Referent
Yes	2.11 (1.78–2.50), <i>p</i> < 0.0001	1.83 (1.44–2.32), <i>p</i> < 0.0001
Mood disorder		
No	Referent	Referent
Yes	1.43 (1.08–1.89) <i>p</i> = 0.012	1.50 (1.01–2.21), <i>p</i> = 0.043
Anxiety disorder		
No	Referent	Referent
Yes	1.34 (1.07–1.69), <i>p</i> = 0.013	1.74 (1.24–2.45), <i>p</i> = 0.001

Peer victimization, gender diversity, mental health and recurrent headaches, Nilles et al.

reported among transgender and nonbinary youth. Of importance, suicidality has been also shown to be positively associated with victimization in this population.^{41,42} Thus, based on our observations and these data, we hypothesize that gender-diverse youth may be at higher risk of frequent headaches than their cisgender peers in the context of their experiences with bullying and mental health symptoms, rather than gender diversity itself. Future work should measure and control for the possible roles of mental health, peer victimization, and other forms of discrimination when trying to

better understand the relationship between gender diversity and risk of frequent recurrent headaches in adolescents. Prospective data collection would also be valuable.

Strengths of this work include the fact that data were derived from a large, population-based study, which enhances the external validity of the results. We were also able to control for a large number of important potential confounders in the relationship between peer victimization and frequent recurrent headaches, which enhances our confidence in the

Table 4 Univariable and Multivariable Model Results Exploring the Association Between Suicidality and Headaches in the Subsample of Adolescents Aged 15 to 17 Years Old

	Unadjusted OR (95% CI)	Adjusted for age and sex OR (95% CI)	Adjusted for age, sex, depression, and anxiety disorders OR (95% CI)
Headache frequency			
Rarely or never	Referent	Referent	Referent
Approximately once/mo	1.79 (1.41–2.28) ^a	1.69 (1.33–2.15) ^a	1.62 (1.27–2.07) ^a
Approximately once/wk	2.81 (2.16–3.66) ^a	2.50 (1.92–3.26) ^a	2.23 (1.70–2.94) ^a
>Once/wk	4.16 (3.11–5.55) ^a	3.60 (2.68–4.84) ^a	2.73 (1.98–3.78) ^a
Most days	6.57 (4.77–9.05) ^a	5.63 (4.07–7.79) ^a	4.68 (3.36–6.50) ^a

Abbreviation: OR = odds ratio.

^a *p* Value <0.0001.

existence of a true association. Data on the relationship between gender diversity and frequent recurrent headaches add a novel contribution to the literature that will be hypothesis generating for future work. Limitations include the fact that this was a cross-sectional study, and the lack of temporality in the data precludes drawing conclusions on causality. Children and adolescents living on First Nation reserves and other Indigenous settlements, in foster homes, and in institutions were excluded from the CHSCY, which prevents generalization to this understudied population. Data were collected using retrospective self-report, which introduces risk of measurement bias. There were several unmeasured potential confounders including genetic factors and secondary headache causes that were not accounted for in this study because this was not the objective of our work. The large sample size and lack of a priori sample size calculations also introduce a risk of finding associations that are not clinically meaningful. However, we feel that the magnitudes of the associations highlighted here are large enough to be relevant to patients, clinicians, and researchers. Though our fully adjusted model had many variables and while this could raise concerns around overadjustment, all variables were carefully selected based on their known association with the outcome as per prior publications, and we therefore feel that the risk of bias related to overadjustment is low.

In conclusion, there is an association between peer victimization and frequent recurrent headaches in adolescents. Adolescents with frequent recurrent headaches are also more likely to experience suicidality, with an incremental relationship observed whereby more frequent headaches are associated with higher risk. Though gender-diverse adolescents seem to have higher risk of frequent recurrent headaches, this association disappears after controlling for peer victimization, anxiety, depression, and suicidality, suggesting that perhaps gender diversity is not in and of itself related to frequent recurrent headaches, but that the psychosocial factors associated with it may explain the association. This is important information because these psychosocial factors are accessible

to prevention and treatment, and as such, must be examined further. The results of this study should compel future research into interventions for peer victimization and future work aimed at better understanding whether and how gender-diverse youth are at higher risk of headache disorders. Clinicians should not only screen children and adolescents with headache disorders for anxiety and depression as suggested in prior work^{21,43} but also for peer victimization and suicidality, which may be independently associated with headache risk and possibly with worse headache-related outcomes such as higher headache frequency.

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Jeanne V.A. Williams, MSc	Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada	Major role in the acquisition of data; drafting/revision of the article for content, including medical writing for content; and analysis or interpretation of data
Scott Patten, MD, PhD	Department of Clinical Neurosciences, Psychiatry, Pediatrics and Community Health Sciences, University of Calgary; Mathison Centre for Mental Health Research and Education, Calgary, Alberta, Canada	Drafting/revision of the article for content, including medical writing for content
Tamara Pringsheim	Department of Clinical Neurosciences, Psychiatry, Pediatrics and Community Health Sciences, University of Calgary; Department of Clinical Neurosciences, University of Calgary; Mathison Centre for Mental Health Research and Education; Hotchkiss Brain Institute, University of Calgary, Calgary, Alberta, Canada	Analysis or interpretation of data; drafting/revision of the article for content, including medical writing for content; and study concept or design
Serena L. Orr, MD, MSc, FRCPC	Department of Clinical Neurosciences, University of Calgary, Calgary, Alberta, Canada; Mathison Centre for Mental Health Research and Education; Hotchkiss Brain Institute, University of Calgary; Departments of Pediatrics and Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada	Analysis or interpretation of data; drafting/revision of the article for content, including medical writing for content; study concept or design; and major role in the acquisition of data

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Association Between Peer Victimization, Gender Diversity, Mental Health, and Recurrent Headaches in Adolescents: A Canadian Population-Based Study

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