BMJ Open Psychological correlates and binge drinking behaviours among Canadian youth: a cross-sectional analysis of the mental health pilot data from the COMPASS study

Alexandra Butler,¹ Isabella Romano,¹ Karen Patte,² Mark A Ferro,¹ Margaret de Groh,³ Ying Jiang,³ Scott T Leatherdale¹

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¹School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, Canada

²Department of Health Sciences, Brock University, St Catharines, Ontario, Canada

³Applied Research Division, Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence to

Alexandra Butler;
alle.butler@uwaterloo.ca

ABSTRACT

Objective The objective of this study was to examine associations between depression, anxiety and binge drinking among a large sample of Canadian youth, while testing the moderating effect of flourishing. This research uses data from the Cannabis, Obesity, Mental health, Physical activity, Alcohol, Smoking, Sedentary Behaviour (COMPASS) study (2012–2021) with a large sample size collecting data on youth health behaviours within Canadian secondary schools.

Design Cross-sectional

Setting 14 secondary schools across Ontario and British Columbia, Canada.

Participants A sample of grade 9–12 students (n=6570) who participated in the Mental Health pilot of the COMPASS study

Primary and secondary outcome measures Self-reported questionnaires assessed student binge drinking behaviours (5≥drinks), symptoms of depression (Center for Epidemiologic Studies Depression Scale (Revised)—10 scores≥10) and anxiety (Generalised Anxiety Disorder 7-item Scale scores≥10), and flourishing (Diener's Flourishing Scale: 8–40).

Results In our sample of 6570 students, 37.0% of students reported binge drinking in the last year, and 41.4% and 31.7% of students report clinically-relevant symptoms of depression and anxiety, respectively. Anxiety (adjusted OR (AOR): 0.57, (99% CI 0.15 to 2.22)) and depression (AOR: 1.98, (99% CI 0.76 to 5.13)) symptoms were not found to be associated with binge drinking and we did not detect any moderating role of flourishing.

Rather, factors that were associated with increased odds of binge drinking included sports team participation (AOR: 1.67, (99% CI 1.37 to 2.03)) and use of other substances (tobacco (AOR: 3.00, (99% CI 2.12 to 4.25)) and cannabis (AOR: 7.76, (99% CI 6.36 to 9.46))). Similar associations were found for frequency of binge drinking.

Conclusions Consistent with existing literature, binge drinking behaviours were problematic, as well as clinically-relevant symptoms of depression and anxiety. However, mental health problems and well-being may not be responsible for explaining patterns of binge drinking in youth. Targeted intervention efforts towards student

Strengths and limitations of this study

- The COMPASS (Cannabis, Obesity, Mental health, Physical activity, Alcohol, Smoking, Sedentary Behaviour) project is a unique data system that provides an ideal platform to evaluate multiple co-occurring behavioural trajectories among a large sample of Canadian youth.
- Only cross-sectional results are reported as this study used first year pilot data for a mental health module to examine associations between mental health problems and binge drinking; future waves of COMPASS will allow mental health trajectories to be explored.
- Purposive sampling methods were used and results may not be representative of all Ontario and British Columbia secondary schools.
- Although findings may be subject to reporting or recall bias as data were self-reported, passive permission protocols and unique self-generated identification codes have been implemented to preserve anonymity.
- This study was unable to examine broader social environments (eg, social acceptability of alcohol, sport team dynamics) that may be associated with alcohol consumption patterns.

athletes and concurrent substance users are necessary for addressing binge drinking in youth populations.

INTRODUCTION

Although federal and provincial legislations in Canada prohibit alcohol consumption for those under the age of 18 or 19, about 25% of Canadian students in grade 7–12 report past-year binge drinking, which has been previously operationalised as consuming five or more drinks on one occasion.^{1 2} In comparison, 17% of youth report past-year cannabis use and 10% report using tobacco products

in the past 30 days.² Acute and chronic health risks of early-onset alcohol use can be severe, including potential neurological and psychosocial concerns. As brain development continues throughout adolescence, youth are especially vulnerable to the effects of alcohol, particularly in high volumes and frequent doses.^{3,4} Alcohol consumption during adolescence may contribute to future experiences of psychiatric and substance use disorders,^{3,5} and youth who partake in binge drinking are at increased risk for such adverse health outcomes compared with youth who do not.^{6–9} Binge drinking^{10,11} and frequency of drunkenness¹² during adolescence have been linked to negative psychological outcomes including conduct disorder, anxiety, depression and suicidal behaviour.

Binge drinking has many negative physiological effects on the brain¹³ and may lead to impaired mood and symptoms of depression among youth.^{14,15} Longitudinal research has found problem-use of alcohol during adolescence to be predictive of depression in young adulthood.¹⁴ Alternatively, depression has been found to predict subsequent alcohol use, and research suggests that youth who experience depressive symptoms may binge drink in an attempt to reduce negative affect.^{16,17} Negative affect is a strong predictor of harmful drinking and may distinguish between customary or social drinking behaviours and abusive drinking trajectories.¹⁸ Males and females demonstrate unique vulnerabilities to binge drinking in relation to biopsychosocial functioning.¹⁹ However, consequences from binge drinking may be more severe or prevalent in females considering they are at an increased risk of experiencing symptoms of mental health problems.¹⁹ Although adolescent males have previously been at greater risk for alcohol use and use at higher frequencies, this gender gap has gradually lessened where binge drinking among adolescent females has become more common.^{20,21} Previous studies have cited risk-taking behaviour²² including tobacco and cannabis use,²³ participation in team sports,^{24,25} being of white ethnicity^{25,26} and having higher amounts of spending money²⁵ as common risk factors for binge drinking among secondary school students.

Widespread alcohol use among youth may also be explained by the *Theory of Planned Behaviour*.²⁷ The Theory of Planned Behaviour is a psychosocial model that has been effectively applied to the prediction of many health behaviours by considering an individual's attitude, subjective norms and perceived behavioural control.²⁷ Within Canada, alcohol is generally recognised as a socially acceptable and popular substance.¹ Research suggests normative social influences and cultural norms may also play an important role in explaining drinking patterns.^{28,29} Given this, behaviours may result from interactions with surrounding social environments and contribute to the development of positive perceptions of drinking.^{30–32} These positive perceptions can create an environment where drinking behaviour is both accepted and encouraged socially, and may contribute to increased alcohol consumption and binge drinking.^{30,33,34} Despite

the potential hazardous health outcomes and biopsychosocial problems associated with binge drinking,¹³ it is often viewed as a positive social activity; an important aspect to consider when exploring the relationship between drinking and mental well-being. One study found that drinking with friends is protective against alcohol-related problems (eg, physical fights or injuries, driving under the influence, hangovers or vomiting).³⁵ As such, research has suggested that social drinking may coincide with aspects of positive psychosocial well-being such as social participation, enhanced self-esteem and autonomy, coping strategies and accountability.³⁶

Flourishing is the presence of positive mental health, inclusive of emotional, psychological, and social prosperity, and often used as an indicator of overall psychosocial well-being.^{37–39} Flourishing incorporates contemporary theories of well-being, acknowledging the importance of social relationships, not just for pleasure but self-perceived interest and engagement, and meaning and purpose in life. Given that flourishing represents a modernised concept in the field of psychology, limited research currently exists exploring the impact positive well-being may have on overall substance use behaviours. However, recent findings examining the association between mental health problems and cannabis use demonstrated that after controlling for depression and anxiety, youth who reported flourishing were found to be less likely to have used cannabis and less likely to have used at higher frequencies.⁴⁰ As flourishing may offer protective effects against cannabis,⁴⁰ additional research on the influence of overall well-being within other substance use domains (eg, alcohol and tobacco use) is necessary to inform strategies for youth prevention or intervention programming.

The authors are unaware of existing research that has evaluated indicators of mental well-being, such as flourishing, as a protective factor against binge drinking and mental health problems among youth. In response to this gap, the objective of the current study was to examine the association between binge drinking and depression and anxiety symptoms among a large sample of Canadian youth. Our analysis is intended as a follow-up to novel findings between cannabis and flourishing⁴⁰ and we aim to contribute to the literature by examining whether flourishing moderates the association between depression, anxiety, and binge drinking behaviour within Canadian secondary school students.

METHODS

The COMPASS (Cannabis, Obesity, Mental health, Physical activity, Alcohol, Smoking, Sedentary Behaviour) Study is a prospective cohort study (2012–2021) that collects data from full school samples of students in grades 9 through 12 attending participating secondary schools across Canada.⁴¹ A new COMPASS mental health module (MH-M) was piloted in year 5 COMPASS data collections (Y_5 (2016–2017)), as students' mental health

was identified by stakeholders as a priority area for study.⁴² This paper uses the data collected from students attending the 14 COMPASS schools that were selected to participate in the MH-M pilot via the COMPASS student questionnaire.⁴² The original COMPASS study protocol was maintained with the exception of the eight new subsections about youth mental health that were added to supplement the original student questionnaire.^{41 43 44} A complete description of COMPASS methods is available in print⁴¹ or online (www.compass.uwaterloo.ca). This study received ethics approval from the University of Waterloo Human Research Ethics Committee and all participating school boards.

Data were collected from 8344 students attending selected secondary schools in British Columbia (n=5) and Ontario (n=9), Canada. Specific schools were recruited to participate in the pilot stage of the mental health module during year 5 of the COMPASS data collection based on expressed interest in the mental health data. Students were recruited using a parental active-information passive-consent permission protocol,⁴¹ a strategy shown to be important for collecting robust data on self-reported risk behaviours such as substance use among youth.^{45–47} A complete-case analysis was used for this manuscript (n=8344), resulting in a final analytic sample of 6570 students.

Patient and public involvement

There were no patients involved in the development of the research study. School board stakeholders were involved throughout the development of the pilot mental health module as part of the working research team. Anonymised school-level, board-level and province-level results were prepared for applicable stakeholders in the form of a report. See www.compass.uwaterloo.ca for protocol details.

MEASURES

Binge drinking

Consistent with previous research,⁴⁸ binge drinking was assessed by asking students 'In the last 12 months, how often did you have 5 drinks of alcohol or more on one occasion?' Responses were recoded into a binary measure of binge drinking, where students who indicated not having done this in the past 12 months, were classified as 'non-current binge drinkers' and all other responses were coded as 'current binge drinkers.' For ordinal responses, binge drinking frequency was collapsed into the following: 'non-current binge drinkers', consistent with the binary variable explained above; 'rare/sporadic', if respondents indicated binge drinking less than once a month; 'monthly', if reported use was once to three times per month, and; 'weekly', if use ranged from once a week to daily.

Mental health variables

Youth depressive symptoms were assessed using the *Center for Epidemiologic Studies Depression Scale (Revised)*–10

(CESD-R-10⁴⁹). This 10-item scale was designed to assess self-reported symptoms characteristic of depression such as feelings of sadness, hopelessness, apathy and motivation, irritability, and difficulties sleeping, making decisions, and concentrating over a 1 week period.^{49–51} Internal consistency of the CESD-R-10 scale was high ($\alpha=0.98$). Anxiety symptoms were measured using the *Generalised Anxiety Disorder 7-item Scale* (GAD-7⁵²). The GAD-7 assesses on difficulty controlling feelings of worry, trouble relaxing, nervousness, restlessness and irritability over a 2 week period of time and had high internal consistency ($\alpha=0.99$). Both scales have been validated for use in adolescent populations.^{50–52} The CESD-R-10 and GAD-7 scales were fit as dichotomous variables for each model; consistent with other research, this study applied a binary coding system to categorise students with and without clinically-relevant symptoms (control=0, depression and/or anxiety=1) using scores ≥ 10 for both the CESD-R-10^{49 51} and GAD-7⁵² to indicate risk of or probable depression and anxiety, respectively.

Levels of self-perceived psychosocial well-being among students was measured using *Diener's Flourishing Scale* (FS⁵³). This scale provides a score that represents overall psychological functioning on a flourishing-languishing continuum by assessing how students perceive their: relationships, life purpose and satisfaction, engagement with and interest in daily activities, self-esteem, competence, and optimism. To remain suitable for large, school-based studies,⁴⁴ the original 7-point Likert scale was reduced to a 5-point response option with total scores ranging from 8 to 40. All item statements are positively framed within the original FS.⁵³ However, to remain consistent with the other COMPASS MH-M measures, the FS was reverse coded where low scores represented flourishing (good overall well-being) and high scores represent languishing (an indication of poor overall psychosocial well-being). Internal consistency of the FS was high ($\alpha=0.98$).

Covariates

The following covariates were accounted for: grade^{9–12}; sex (female, male); ethnicity (White, Black, Asian, Indigenous (First Nations, Métis, Inuit), Latin American or Hispanic, Mixed/Other); weekly spending money (\$C0, \$C1–20, \$C21–100, more than \$C100, I don't know; as a proxy for socioeconomic status, as this is a more accessible value for youth to report on than household income); truancy (no skipped classes, one or more missed classes per week); cannabis use (never use, ever user (ever using marijuana)); smoking status (non-smoker (reported never smoking or non-current use of cigarettes), current smoker (reported smoking one or more cigarettes in the past month)) and team sport involvement (not involved, involved (school- or community-level)).

Analysis

Among our analytic sample, descriptive analyses were conducted using χ^2 and t-tests. Binge drinking status (non-current vs current binge drinker) was modelled

using a binary logistic regression (model 1) and binge drinking frequency was modelled using an ordinal logistic regression (model 2) which adjusted for relevant covariates. Given the large sample size, a CI of 99% was used. The frequency of binge drinking was modelled to examine if mental health problems were associated with increasing levels of binge drinking frequencies. To examine flourishing as a moderating variable, 2-way and 3-way interactions between flourishing, depression and anxiety were tested. Only complete-case analysis was conducted where 11% of GAD-7 data, 18% of CESD-R-10 data and less than 1% of binge drinking was missing. The impact of data was assessed and we found no meaningful difference among students with and without missing data. All analyses were conducted in SAS V.9.4.⁵⁴

RESULTS

Sample characteristics

Demographic characteristics for the total sample (n=6570) are presented in table 1. The majority of students reported their ethnicity as white (71.4%) and 51.6% were female. Overall, 37.0% of the sample reported binge drinking at least once within the past year and 20% indicated binge drinking at least once a month. Clinically-relevant symptoms (scores≥10) for depression were reported by 41.4% of students in the sample and 31.7% reported symptoms of anxiety above the threshold (scores≥10). The mean flourishing score was 16.66 (SD:5.87) and after examining descriptive results by sex, females (17.23 (SD:6.00)) reported greater languishing scores than males (15.99 (SD:5.65)). More females reported clinically-relevant symptoms of depression (51.9% vs 30.1%) and anxiety (43.5% vs 19.1%), compared with their male counterparts. Although the rate of binge drinking among females and males was similar, females were more likely to engage in sporadic (18.7% vs 15.3%) and monthly (15.2% vs 14.6%) binge drinking and less likely to binge drink weekly (3.9% vs 6.3%), compared with males.

Correlates of drinking behaviours

Table 2 demonstrates results of the regression models used for predicting binge drinking behaviours. Youth reporting current binge drinking were more likely to be in grade 12 (adjusted OR (AOR) 2.31, (99% CI 1.74 to 3.02)), grade 11 (AOR 1.69, (99% CI 1.29 to 2.20)), and grade 10 (AOR 1.56, (99% CI 1.21 to 2.00)) in Model 1. The same demographic trends were observed in Model 2 for binge drinking frequency, whereby students in older grades were more likely to report higher binge drinking frequencies. As seen in Model 1, cannabis use (AOR: 7.76, (99% CI 6.36 to 9.46)), tobacco smoking (AOR 3.00, (99% CI 2.12 to 4.25)), truancy (AOR 2.29, (99% CI 1.90 to 2.76)) and being involved with a sports team (AOR 1.67, (99% CI 1.37 to 2.03)) were significantly associated with an increased odds of binge drinking. Similarly, cannabis use (AOR 7.12, (99% CI 5.95 to 8.52)), tobacco smoking (AOR 3.94, (99% CI 3.11 to 4.99)), truancy (AOR 2.04,

(99% CI 1.73 to 2.41)) and being involved on a sports team (AOR 1.64, (99% CI 1.39 to 1.93)) were associated with increases in binge drinking frequency in Model 2. Compared with those who reported not having any spending money, youth with \$C1–20 of weekly spending money were 1.37 times more likely to binge drink and the odds of binge drinking doubled (AOR: 2.68) for youth with greater than \$C100 of weekly spending money (Model 1). Although mental health indicators were not found to be statistically significant, directionality of the AORs suggests a potentially positive association between depression and binge drinking (AOR: 1.98, (99% CI 0.76 to 5.13)), as well as a negative association between anxiety and binge drinking (AOR: 0.57, (99% CI 0.15 to 2.22)).

Moderating effects of flourishing

Above-threshold symptoms of depression and anxiety, and self-reported flourishing were not found to be significantly associated with binge drinking or binge drinking frequency within our sample. Moreover, the addition of interaction terms did not lead to any changes in estimations or significance; therefore, flourishing did not moderate the association between depression or anxiety symptoms and binge drinking behaviours as hypothesised.

DISCUSSION

Our findings correspond with previous surveillance research and national averages showing alcohol is the most common substance used among our sample of Canadian adolescents.^{1 2} This study identified that more than one-third of youth in Ontario and British Columbia, Canada who participated in the COMPASS MH-M pilot study, reported binge drinking within the past 12 months, and almost one in six students reported this behaviour monthly. Within our large sample of youth, nearly one-half of students indicated symptoms of clinically-relevant depression and one-third reported clinically-relevant symptoms of anxiety. Consistent with other research⁵⁵ as well as existing findings from the COMPASS MH-M pilot study,⁴⁰ neither depression nor anxiety were correlated with binge drinking. However, unlike previous COMPASS research that found flourishing may protect against cannabis use,⁴⁰ these corresponding associations were not observed within this study for binge drinking. Based on these findings, youth may use alcohol for different reasons than cannabis, suggesting the two substances may play distinct social and psychological roles.

As literature continues to present inconsistent findings between mental health and substance use, it is critical to acknowledge subgroups of consumers^{18 56} as underlying motives for alcohol consumption may represent important insight for intervention strategies.⁵⁷ In Canada, alcohol consumption exists as a normative social behaviour⁵⁸ that is common to many populations,¹ including youth.^{28 29 32} This custom may provide reason for the lack of associations observed in this study, and suggests that alcohol consumption may more commonly

Table 1 Sample descriptives by sex for grade 9–12 students in year 5 of the mental health pilot of COMPASS (2016–2017)

	Total n=6570 % (n)*	Female n=3389 % (n)*	Male n=3181 % (n)*	χ^2 (P value)
Grade				
9	27.9 (1833)	26.9 (913)	28.9 (920)	5.18 (0.16)
10	29.3 (1923)	30.1 (1021)	28.4 (902)	
11	24.3 (1597)	24.0 (812)	24.7 (785)	
12	18.5 (1217)	19.0 (643)	18.0 (574)	
Ethnicity				
White	71.4 (4476)	71.3 (2314)	71.5 (2162)	29.49 (<0.0001)
Indigenous	2.2 (135)	2.0 (66)	2.3 (69)	
Asian	10.3 (645)	10.6 (343)	9.9 (302)	
Black	2.5 (156)	1.9 (60)	3.2 (96)	
Latin American	2.6 (164)	2.0 (65)	3.3 (99)	
Other/Mixed	11.0 (694)	12.2 (396)	9.8 (298)	
Province				
Ontario	57.1 (3749)	56.7 (1920)	57.5 (1829)	0.48 (0.49)
British Columbia	42.9 (2821)	43.3 (1469)	42.5 (1352)	
Weekly spending money				
\$C0	15.3 (1004)	13.4 (451)	17.5 (553)	54.93 (<0.0001)
\$C1–20	26.8 (175)	27.4 (924)	26.2 (829)	
\$C21–100	25.2 (1650)	27.0 (913)	23.3 (737)	
>\$C100	20.1 (1318)	18.2 (614)	22.2 (704)	
I don't know	12.6 (820)	14.0 (476)	10.8 (344)	
Varsity/community sport involvement				
No	67.1 (4377)	71.4 (2398)	62.6 (1979)	56.92 (<0.0001)
Yes	32.9 (2145)	28.6 (962)	37.4 (1183)	
Truancy				
No skipped classes	59.8 (3898)	58.2 (1954)	61.6 (1944)	7.93 (0.005)
One or more	40.2 (2619)	41.8 (1406)	38.4 (1213)	
Depression				
No depression	58.6 (3852)	48.1 (1629)	69.9 (2223)	321.98 (<0.0001)
Depression (CESD-R-10≥10)	41.4 (2718)	51.9 (1760)	30.1 (958)	
Anxiety				
No anxiety	68.3 (4488)	56.5 (1915)	80.9 (2573)	450.55 (<0.0001)
Anxiety (GAD-7≥10)	31.7 (2082)	43.5 (1474)	19.1 (608)	
Flourishing ^{8–40}				
Mean score (SD)	16.63 (5.87)	17.23 (6.00)	15.99 (5.65)	t value=8.54 (<0.0001)
Smoking status				
Non-smoker	89.5 (5864)	89.8 (3036)	89.2 (2828)	0.65 (0.42)
Smoker	10.5 (688)	10.2 (345)	10.8 (343)	
Cannabis use				
Never used	67.6 (4421)	67.7 (2287)	67.5 (2134)	0.02 (0.88)
Ever used	32.4 (2117)	32.3 (1091)	32.5 (1026)	

Continued

Table 1 Continued

	Total n=6570 % (n)*	Female n=3389 % (n)*	Male n=3181 % (n)*	χ^2 (P value)
Binge drinking status				
Non-current binge drinker	63.0 (4137)	62.2 (2109)	63.7 (2028)	1.63 (0.20)
Binge drinker	37.0 (2433)	37.8 (1280)	36.3 (1153)	
Binge drinking frequency				
Non-current binge drinker	63.0 (4137)	62.2 (2109)	63.8 (2028)	29.27 (<0.0001)
Rare/sporadic	17.0 (1120)	18.7 (631)	15.3 (489)	
Monthly	14.9 (980)	15.2 (516)	14.6 (464)	
Weekly	5.1 (333)	3.9 (133)	6.3 (200)	

*Note: The numbers may not add up to the total due to missing values and rounding. Complete case analysis was conducted; 11% of GAD-7 data, 18% of CESD-R-10 data, and less than 1% of binge drinking data was missing.

CESD-R-10, Center for Epidemiologic Studies Depression Scale (Revised)-10; GAD-7, Generalised Anxiety Disorder 7-item Scale.

occur as a social activity rather than a coping mechanism for negative affect, attenuating potential associations between mental health problems and binge drinking. Such links between social influence and binge drinking have also been demonstrated elsewhere^{59–62} and ultimately provide support for the *Theory of Planned Behaviour*. Schlegel *et al*⁶² found attitudes towards binge drinking and perceived social norms all contributed to the intention and frequency of binge drinking. Moreover, binge drinking in youth has been shown to be associated with peer group influences, whereby peer alcohol use may be the strongest predictor of adolescent drinking behaviour, presenting important implications for intervention approaches.^{28 63} Distal components of this theory, such as socioeconomic status, were also found to be associated with binge drinking in our sample. We identified a strong dose-response relationship between binge drinking and weekly spending money, with greater amounts of weekly spending money predicting an increased likelihood of binge drinking and binge drinking frequency. Our results may reflect a correlation between socioeconomic status and alcohol consumption among youth, or at least appear to indicate that available spending money (eg, provided by parental, part-time employment or other sources) provides the means to purchase alcohol.

These findings supplement other substance use literature and identify that co-occurring substance use is common among students who binge drink.^{64–67} Youth engaging in current binge drinking were approximately three times more likely to smoke tobacco and almost eight times more likely to use cannabis. Sports team participation appeared to also be a strong predictor of binge drinking. Adding this variable improved the predictive accuracy of our logistic models, as demonstrated by the concordance statistic. While sports team participation can contribute to positive health behaviours among

youth (eg, physical activity), patterns of excessive alcohol consumption among school athletes has been previously observed in research.⁶⁸

The Canadian Centre on Substance Abuse recognises that sports participation is linked to decreases in illicit drug use among youth, but the use of alcohol increases.⁶⁹ Youth between the ages of 15 and 19 years have the highest participation rates in sports.⁷⁰ Athletic involvement presents an optimal opportunity to influence youth by leveraging their team sport environments and implementing targeted prevention strategies.⁶⁹ Substance use is commonly initiated during adolescence, where enrolment in sports is high, and as such, this is a critical period for substance use prevention efforts.⁷¹ For instance, public health authorities may consider limiting or restricting alcohol promotion during events that may be attended by youth. Continued research is necessary within this domain as there remains a paucity of evidence on the risk of binge drinking within a team dynamic.

Given the varied predictors for alcohol and cannabis use among youth in the COMPASS MH-M pilot study, tailored approaches for each individual substance may be necessary. Although statistically insignificant, our findings present interesting results that suggest depression and anxiety may have different outcomes for alcohol consumption, and the directionality of associations observed may provide insight to public health researchers. Based heavily on the *Theory of Planned Behaviour*, existing psychosocial research suggests that persuading attitudes and norms to influence behaviour may prove effective at producing long-term changes.⁷² Successful strategies may involve peer-to-peer mentoring or social norming campaigns given the influence peer groups have on attitudes towards alcohol consumption and, in turn, binge drinking behaviour.^{28 29 32} Also, targeted intervention efforts implemented within the environment of

Table 2 Binge drinking for grade 9–12 students in year 5 of the COMPASS MH-M (2016–2017)

	Model 1† AOR (99% CI)§	Model 2‡ AOR (99% CI) §
Sex		
Female	1	1
Male	0.94 (0.78 to 1.14)	1.09 (0.93 to 1.28)
Grade		
9	1	1
10	1.56 (1.21 to 2.00)**	1.51 (1.20 to 1.89)**
11	1.69 (1.29 to 2.20)**	1.62 (1.28 to 2.06)**
12	2.31 (1.74 to 3.07)**	2.13 (1.66 to 2.73)**
Ethnicity		
White	1	1
Indigenous	0.84 (0.45 to 1.57)	0.90 (0.55 to 1.47)
Asian	0.47 (0.33 to 0.68)*	0.53 (0.38 to 0.73)*
Black	0.63 (0.35 to 1.13)	1.07 (0.66 to 1.72)
Latin American	1.05 (0.60 to 1.14)	0.96 (0.59 to 1.56)
Other/Mixed	0.86 (0.64 to 1.14)	0.92 (0.72 to 1.17)
Province		
Ontario	1	1
British Columbia	0.81 (0.67 to 0.98)*	0.86 (0.73 to 1.01)
Weekly spending money		
\$C0	1	1
\$C1–20	1.37 (1.00 to 1.87)*	1.25 (0.94 to 1.67)
\$C21–100	2.45 (1.80 to 3.35)**	2.12 (1.60 to 2.80)**
>\$C100	2.68 (1.93 to 3.71)**	2.34 (1.88 to 2.90)**
I don't know	1.56 (1.08 to 2.25)*	1.50 (1.17 to 1.93)*
Varsity/community sport involvement		
No	1	1
Yes	1.67 (1.37 to 2.03)**	1.64 (1.39 to 1.93)**
Truancy		
No skipped classes	1	1
One or more	2.29 (1.90 to 2.76)**	2.04 (1.73 to 2.41)**
Smoking status		
Non-smoker	1	1
Smoker	3.00 (2.12 to 4.25)**	3.94 (3.11 to 4.99)**
Cannabis Use		
Never used	1	1
Ever used	7.76 (6.36 to 9.46)**	7.12 (5.95 to 8.52)**
Mental health factors		
Depression		
No depression	1	1
Depression (CESD-R-10≥10)	1.98 (0.76 to 5.13)	2.08 (0.92 to 4.69)
Anxiety		
No anxiety	1	1
Anxiety (GAD-7≥10)	0.57 (0.15 to 2.22)	0.66 (0.20 to 2.16)
Flourishing		
Flourishing Scale (continuous)	0.98 (0.95 to 1.01)	0.98 (0.96 to 1.00)

Continued

Table 2 Continued

	Model 1†	Model 2‡
	AOR (99% CI)§	AOR (99% CI) §
<i>Interactions</i>		
Depression*anxiety	0.49 (0.09 to 2.78)	0.43 (0.10 to 1.91)
Depression*flourishing	0.98 (0.92 to 1.03)	0.97 (0.92 to 1.01)
Anxiety*flourishing	1.05 (0.96 to 1.14)	1.04 (0.97 to 1.13)
Depression*anxiety*flourishing	1.02 (0.92 to 1.13)	1.03 (0.94 to 1.12)
Concordance statistic	0.862	0.836

* $p \leq 0.01$, ** $p < 0.001$.

†Note: model 1 is a logistic regression of mental health predictors and binge drinking status.

‡Note: model 2 is an ordinal logistic regression of mental health predictors and binge drinking frequency.

§Note: complete case analysis was conducted and 2395 observations were deleted due to missing data for the mental health and binge drinking variables.

AOR, adjusted OR; CESD-R-10, Center for Epidemiologic Studies Depression Scale (Revised)-10; GAD-7, Generalised Anxiety Disorder 7-item Scale; MH-M, mental health module.

a sports team dynamic may effectively influence health behaviours. Research should aim to examine substance use behaviours both separately and concurrently; further exploration may consider the possible association between mental health and co-occurring alcohol and cannabis use. Future waves of the COMPASS study will be able to test these correlations and temporal relationships.

Strengths and limitations

The COMPASS study is a unique data system that examines Canadian youth risk behaviours, and provides an ideal platform to evaluate multiple co-occurring behaviours and changes over time. Our results supplement existing evidence and advance knowledge on youth binge drinking behaviours. Important correlates identified in this study can be used to inform the creation of effective prevention and intervention programmes. While this study provides a novel contribution to the literature, it is not without limitations. COMPASS uses a purposeful sampling method, and results are not representative of all Ontario and British Columbia youth or secondary schools. Since student data are self-reported, findings may be subject to reporting or recall bias, however, passive permission protocols have been implemented to improve sample representativeness and preserve anonymity. By employing a complete-case analysis, associations observed within this study may be underestimated. Data appeared to missing at random and information bias from non-differential misclassification is possible. Mental health items were measured based on 1–2-week recall and although scales employed in this study have been widely validated, these measures cannot determine whether symptoms were chronic or acute. Moreover, depression and anxiety data were measured using scales and not diagnostic criteria. This study was unable to examine broader social environments (eg, social acceptability of alcohol, sport team dynamics) that may be associated with alcohol consumption patterns. Lastly, we were unable to establish binge drinking trajectories in relation to depression and

anxiety given the cross-sectional nature of the data. As COMPASS employs a longitudinal study design, follow-up research and examination of how behaviours evolve over time is possible once future waves of mental health data become available.

CONCLUSION

A large proportion of the study sample of grade 9 to 12 students reported binge drinking. About one-half and one-third of students reports clinically-relevant symptoms of depression and anxiety respectively, however, our research shows that mental health problems were likely not responsible for explaining patterns of alcohol consumption in our youth sample. Contrary to other COMPASS research on cannabis use, flourishing was not shown to moderate the relationship between depression or anxiety and binge drinking in secondary school students. This new analysis of the COMPASS mental health data and youth alcohol use suggests that binge drinking among youth may be a product of social acceptability and normalcy, as opposed to a coping mechanism or contributor to mental health problems. Future research should aim to consider the role of social environments and alcohol consumption among youth, and where data is available, targeting binge drinking within a team dynamic and among different types of sports.

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Data sharing statement A data request form to access to the COMPASS data can be found at: <https://uwaterloo.ca/compass-system/information-researchers/data-usage-application>

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