



High school sport participation and substance use: A cross-sectional analysis of students from the COMPASS study

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ARTICLE INFO

Keywords:

Adolescent
Sports
Binge drinking
Cannabis
Cigarettes
Vaping

ABSTRACT

Introduction: The objective of this study was to examine the association between participation in school sports and substance use behaviors in both male and female high school students.

Methods: The current study used cross-sectional data from 60,601 students from Year 6 (2017–2018) of the COMPASS study. Students reported their school physical activity participation (none, intramurals only, varsity only, both) and past 30-day substance use (binge drinking, cannabis use, cigarette use, e-cigarette use). Hierarchical logistic regression models predicted the odds of substance use, by sex.

Results: 55% of students did not participate in any school sports and 32% reported substance use. Intramurals were negatively associated with cannabis use and cigarette use among all students and e-cigarette use among females. Varsity sports were associated with lower odds of cigarette use among all students and cannabis use among males. In contrast, participating in varsity sports was associated with increased odds of binge drinking and e-cigarette use among all students. Participating in both intramurals and varsity sports was associated with increased odds of binge drinking and e-cigarette use but with decreased odds of cannabis use and cigarette use. **Conclusions:** Intramurals were found to be protective against cannabis use and cigarette use among all students and e-cigarette use among females. Although varsity sports were protective against cannabis and cigarette use, they were found to be a risk factor for binge drinking and e-cigarette use. Substance use prevention efforts should be a focus among school varsity sports teams, especially for binge drinking and e-cigarette use.

1. Introduction

There is evidence that participation in team sports is associated with substance use among high school students (Boyes, O'Sullivan, Linden, McIsaac, & Pickett, 2017; Denault & Poulin, 2018). For example, research has consistently found team sports to be a risk factor for alcohol use (Boyes et al., 2017; Denault & Poulin, 2018; Veliz, Schulenberg, Kloska, McCabe, & Zarrett, 2017). More promisingly, for cannabis (Boyes et al., 2017; Lane & DeCamp, 2017; Lau, Riaz, Qian, Leatherdale, & Faulkner, 2019) and tobacco use (Boyes et al., 2017; Lane & DeCamp, 2017; Veliz, McCabe, McCabe, & Boyd, 2017) results are mixed and some research has identified a protective effect of team sports. In contrast, e-cigarette use has been positively associated with team sports participation (Milicic, Piérard, Decicca, & Leatherdale, 2019) which is worrying as this behavior has increased substantially over the past few years (Zuckermann et al., 2019). Overall, these findings are concerning as sport participation is often encouraged

because of the many benefits of physical activity (Janssen & Leblanc, 2010).

However, students who play sports are not homogenous and certain types of sports may confer different risks for substance use. For example, some studies have differentiated between individual and team sports and identified some protective effect of individual sports on alcohol use (Denault & Poulin, 2018). In contrast, high contact sports (i.e., football, hockey, wrestling) have been identified as an increased risk factor for substance use (Veliz, Boyd, & McCabe, 2015).

There has been little investigation of how participation in diverse school athletics, such as intramurals in addition to varsity sports, may influence substance use behaviors. Schools typically offer a variety of athletic programming, including both varsity sports and intramurals or non-competitive athletic opportunities (e.g., yoga, fitness club). Varsity sports refers to competitive school sports teams that compete against other schools. There is usually a try-out process to be involved in varsity sports. In contrast, intramurals refer to sports competitions within one

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school that encourage participation from all students and no try-out process is required. While varsity programming is often only available to students with a higher level of athletic ability and the ability to pay any team fees, intramural programming typically serves the entire student population and makes participating in recreation more accessible (Edwards, Kanters, & Bocarro, 2014). Students at schools that offer a greater number of intramurals report higher physical activity, (Fuller, Sabiston, Karp, Barnett, & O'Loughlin, 2011; Hobin et al., 2012) however it is unclear how this participation may impact student substance use.

The objective of this study was to examine the association between participation in school sports (intramurals only, varsity only, or both) and substance use behaviors (past 30-day cannabis use, binge drinking, cigarette use, e-cigarette use, and total number of substances used) in both male and female high school students.

2. Materials and methods

The COMPASS study is a prospective cohort study that collects data from students in grades 9–12 (ages 14–18) in British Columbia, Alberta, Ontario, and Quebec, Canada (Leatherdale et al., 2014; Reel, Bredin, & Leatherdale, 2018). The current study is cross-sectional and uses student data from Year 6 (September 2017–June 2018 school year) of the COMPASS study. A full description of the COMPASS study methods can be found in print (Leatherdale et al., 2014) or online (www.compass.uwaterloo.ca). All procedures were approved by the University of Waterloo Office of Research Ethics (reference number 30118) and appropriate school board committees.

2.1. Participants

In Y6, 65,892 students participated in the COMPASS study. Student response rate was 81.8% and the primary reason for non-response was absenteeism at the time of data collection. Students with missing values for any variable ($n = 5291$; 8%) were excluded from this study. The current analyses used data from 60,601 students from 121 schools in Alberta ($n = 8$), British Columbia ($n = 16$), Ontario ($n = 60$), and Quebec ($n = 37$). Students who were missing outcome data ($n = 626$) were compared to those included in the complete case analysis using chi square (Appendix, Supplementary Table 1). There were no significant differences in sport participation among those who reported their substance use and those who did not.

2.2. Measures

2.2.1. School level data (Statistics Canada Data)

Data on schools' urbanicity was determined by using Geosearch lookup on city name based on 2016 census data (Statistics Canada, 2016b). Urban classifications were as follows: large urban (populations from 100,000 and greater and a population density of at least 400 per square kilometer), medium urban (populations between 30,000 and 99,999 and a population density of at least 400 per square kilometer), small urban (populations between 1000 and 29,000 and a population density of at least 400 per square kilometer), and rural (population less than 1000 or population density less than 400 per square kilometer). Small urban and rural schools were combined in these analyses. Differences substance use (Warren, Smalley, & Barefoot, 2017) and physical activity (Machado-Rodrigues et al., 2012) behaviors have been found between urban and rural youth. School neighborhood median household income was determined using school postal code forward sortation area to identify household median income in this area. Data from the 2016 census was used (Statistics Canada, 2016a). School median income was categorized into 4 groups: less than \$50,000, \$50,001–\$75,000, \$75,001–\$100,000, and greater than \$100,000.

2.2.2. Student level data (Student Questionnaire)

To assess student participation in school athletics students were asked "Do you participate in before-school, noon hour, or after-school physical activities organized by your school? (e.g. intramurals, non-competitive clubs)," and "Do you participate in competitive school sports teams that compete against other schools? (e.g., junior varsity or varsity sports)" with response options "Yes, No, or None available." Students answering "No" or "None available" were grouped together. Students were categorized in the following way: participating in no athletics, intramurals only, varsity sports only, or both.

School connectedness was measured using a six-item derived scale based on students' level of agreement with the questions: "I feel close to people at my school", "I feel I am a part of my school", "I am happy to be at my school", "I feel the teachers at my school treat me fairly", "I feel safe in my school" and "Getting good grades is important to me". Students could respond "Strongly agree," "Agree," "Disagree," or "Strongly disagree" to each statement. The school connectedness measures were derived from the National Longitudinal Study of Adolescent Health School Connectedness Scale and has produced acceptable reliability and validity across 18 sociocultural groups (Furlong, O'Brennan, & You, 2011; McNeely, Nonnemaker, & Blum, 2002). The school connectedness score ranges from 6 to 24, with higher scores indicating greater school connectedness. School connectedness is positively associated with physical activity (Morton, Atkin, Corder, Suhrcke, & van Sluijs, 2016) and negatively associated with substance use (Moore et al., 2018; Weatherson et al., 2018). Because of these associations, school connectedness was controlled for in the models examining the associations between sport participation and substance use.

To assess binge drinking students were asked, "In the last 12 months, how often did you have 5 drinks of alcohol or more on one occasion?" Response options ranged from "I did not drink alcohol in the last 12 months" to "Every day." This question was grouped into a binary variable indicating whether the student engaged in binge drinking "Once a month" or more. Cannabis use was determined by asking "In the last 12 months, how often did you use marijuana or cannabis? (a joint, pot, weed, hash)" Response options ranged from "I have never used marijuana" to "Every day." This question was grouped into a binary variable indicating whether the student engaged in cannabis use "Once a month" or more. To assess cigarette use students were asked "On how many of the last 30 days did you smoke one or more cigarettes?" Response options ranged from "None" to "30 days (every day)." This question was grouped into a binary variable indicating whether the student used cigarettes in the past 30 days. E-cigarette use was determined by the question "On how many of the last 30 days did you use an e-cigarette?" Response options ranged from "None" to "30 days (every day)." This question was grouped into a binary variable indicating whether the student used e-cigarettes in the past 30 days. Students' current binge drinking, cannabis use, cigarette use, and e-cigarette use were summed and categorized as a number ranging from 0 to 4 to determine multiple substance use.

Consistent with other youth health research (Elton-Marshall et al., 2011), the following demographic covariates (with their response values in brackets) were included in analyses: Grade, (9,10,11,12), sex (female, male), ethnicity (white, other), weekly spending money (Zero, \$1 to \$20, \$21 to \$100, More than \$100). Grades 9–12 in Canada encompass students aged 14–18 and median age is presented alongside each grade in Table 1.

2.3. Data analysis

All analyses were performed in SAS Studio (SAS Institute, Cary, NC). Descriptive characteristics at the student level ($n = 60,601$) were calculated and Chi-square was used to examine differences between male and female students in the sample. *T*-tests were used to compare continuous variables. Intraclass correlation (ICC) was calculated using

Table 1
Student level descriptive characteristics of youth from Y6 of the COMPASS Study (N = 60,601).

Variable		Total		Females (n = 30,840)		Males (n = 29,761)		Chi-square / T-test		
		Freq	%	Freq	%	Freq	%	DF	Value	P-value
Grade	9 (Median age 14)	14,524	24.0	7420	24.1	7104	23.9	4	4.2748	0.3701
	10 (Median age 15)	14,881	24.6	7604	24.7	7277	24.5			
	11 (Median age 16)	14,143	23.3	7233	23.5	6910	23.2			
	12 (Median age 17)	9229	15.2	4608	14.9	4621	15.5			
	Other (Median age 13)	7824	12.9	3975	12.9	3849	12.9			
Ethnicity	White	40,663	67.1	20,849	67.6	19,814	66.6	1	7.2318	0.0072
	Other	19,938	32.9	9991	32.4	9947	33.4			
Weekly Spending Money	Zero	9688	16.0	4381	14.2	5307	17.8	4	375.9206	< 0.0001
	\$1-\$20	15,399	25.4	7996	25.9	7403	24.9			
	\$21-\$100	14,433	23.9	7862	25.5	6571	22.1			
	\$100+	11,320	18.7	5224	16.9	6096	20.5			
	Don't Know	9761	16.0	5377	17.4	4384	14.7			
School Sport Participation	None	33,332	55.0	17,962	58.2	15,370	51.6	3	357.3623	< 0.0001
	Intramurals Only	6430	10.6	3366	10.9	3064	10.3			
	Varsity Only	6569	10.8	2944	9.6	3625	12.2			
	Both	14,270	23.6	6568	21.3	7702	25.9			
Binge drinking	No	49,904	82.4	25,907	84.0	23,997	80.6	1	118.4848	< 0.0001
	Yes	10,697	17.6	4933	16.0	5764	19.4			
Cannabis use	No	52,384	86.4	27,223	88.3	25,161	84.5	1	179.6085	< 0.0001
	Yes	8217	13.6	3617	11.7	4600	15.5			
Cigarette smoking	No	54,827	90.5	28,209	91.5	26,618	89.4	1	72.3806	< 0.0001
	Yes	5774	9.5	2631	8.5	3143	10.6			
E-cigarette use	No	47,290	78.0	25,306	82.1	21,984	73.9	1	592.2998	< 0.0001
	Yes	13,311	22.0	5534	17.9	7777	26.1			
Number of substances used	0	40,894	67.5	21,773	70.6	19,121	64.3	4	398.7820	< 0.0001
	1	8952	14.8	4397	14.3	4555	15.3			
	2	5282	8.7	2446	7.9	2836	9.5			
	3	3409	5.6	1470	4.8	1939	6.5			
	4	2064	3.4	754	2.4	1310	4.4			
School connectedness (Mean, SD)		18.3	3.4	18.2	3.3	18.5	3.4	60,197	-13.35	< 0.0001

PROC MIXED to estimate school variations in student-level substance use behaviors.

Generalized estimating equations via PROC GENMOD were used to build the logistic models predicting binge drinking, cannabis use, cigarette use, and e-cigarette use. Models were hierarchical with students clustered within schools. Demographic covariates, school connectedness, school urbanicity, and school neighborhood median household income were controlled for, as well as other substance use (i.e., Model 1 for binge drinking included cannabis use, cigarette use, and e-cigarette use as covariates etc.). Models were stratified by gender for ease of interpretability due to significant interactions with school athletics participation. Generalized estimating equations via PROC GENMOD were used to build the ordinal logistic models predicting multiple substance use. These models controlled for demographic covariates (grade, ethnicity, weekly spending money), school connectedness, school urbanicity, and school median income and were stratified by gender but were not hierarchical due to software constraints.

3. Results

3.1. Descriptive Statistics

The characteristics of the study sample are summarized in Table 1. Overall, 55% of the sample did not participate in any school sports, 11% participated in intramurals only, 11% in varsity sports only, and 24% in both. Males were more likely to report varsity only participation (Male: 12%; Female: 10%; $p < .0001$; see Table 1) and participation in both intramurals and varsity (Male: 26%; Female: 21%; $p < .0001$; see Table 1) by a small margin. Average school connectedness score was 18.3 with a standard deviation of 3.4.

In the past 30 days, 18% of students had engaged in binge drinking, 14% had engaged in cannabis use, 10% had smoked a cigarette, and 22% had used an e-cigarette. 67% of students had not used substances,

15% had used only 1 substance, and 18% reported multiple substance use. Male students were more likely than female students to engage in all forms of substance use as well as multiple substance use ($p < .0001$; see Table 1).

We also examined substance use by school sport participation descriptively (Table 2). Among students who did not participate in any school sports, 16% engaged in binge drinking, 15% in cannabis use, 11% reported cigarette smoking, and 21% reported e-cigarette use. Among these students 69% reported not using any substances. In comparison, among students who participated in intramurals 76% reported no substance use. This number was lower among varsity only participants (61%), and those who participated in both (64%). Chi square tests (unshown) indicated significant differences for all substances ($p < .0001$).

3.2. Regression models

The intraclass correlation coefficient (ICC) estimating the school variation in current student substance use was evident but modest (binge drinking: 2.7%; cannabis use: 2.2%; cigarette use 4.1%; e-cigarette use: 2.1%; multiple substance use: 1.7%) suggesting only modest differences between schools in terms of substance use.

Regression model results can be found in Table 3. Participating in intramurals only was not significantly associated with binge drinking among female or male students. Female and male students who participated in intramurals had lower odds of both cannabis (Female: OR 0.77 [95% CI 0.70–0.85]; Male: OR 0.78 [95% CI 0.71–0.86]) and cigarette use (Female: OR 0.78 [95% CI 0.68–0.91]; Male: OR 0.72 [95% CI 0.64–0.82]). Intramural participation among female students was associated with 13% lower odds of e-cigarette use (OR 0.87 [95% CI 0.76–0.99]) but no significant relationship was identified for male students. Finally, intramurals were associated with lower odds of using a greater number of substances among both female (OR 0.71 [95% CI

Table 2

Descriptive breakdown of substance use by school sport participation of youth from Y6 of the COMPASS Study (N = 60,601).

Substance use		School sport participation n (%)							
		None (n = 33,332)		Intramurals only (n = 6430)		Varsity only (n = 6569)		Both (n = 14,270)	
		n	%	n	%	n	%	n	%
Binge drinking	No	27,865	83.6	5617	87.4	5088	77.5	11,334	79.4
	Yes	5467	16.4	813	12.6	1481	22.5	2936	20.6
Cannabis use	No	28,512	85.5	5909	91.9	5532	84.2	12,431	87.1
	Yes	4820	14.5	521	8.1	1037	15.8	1839	12.9
Cigarette smoking	No	29,687	89.1	6037	93.9	5900	89.8	13,203	92.5
	Yes	3645	10.9	393	6.1	669	10.2	1067	7.5
E-cigarette use	No	26,397	79.2	5359	83.3	4777	72.7	10,757	75.4
	Yes	6935	20.8	1071	16.7	1792	27.3	3513	24.6
Multiple substance use	0	22,815	68.5	4891	76.1	4017	61.2	9171	64.3
	1	4611	13.8	763	11.9	1114	17.0	2464	17.3
	2	2714	8.1	411	6.4	730	11.1	1427	10.0
	3	1940	5.8	247	3.8	427	6.5	795	5.6
	4	1252	3.8	118	1.8	281	4.3	413	2.9

Table 3

Logistic GEE models of the association between participation in sports and binge drinking, cannabis use, cigarette use, e-cigarette use and multiple substance use from Y6 of the COMPASS Study (N = 60,601).

School sports participation	Female	Male
Model 1: Binge drinking	OR (95% CI)	OR (95% CI)
None (ref)	–	–
Intramurals only	0.96 (0.84–1.09)	1.11 (0.98–1.26)
Varsity only	1.48 (1.34–1.65)	1.63 (1.47–1.81)
Both	1.50 (1.37–1.63)	1.71 (1.55–1.89)
Model 2: Cannabis Use		
None (ref)	–	–
Intramurals only	0.77 (0.70–0.85)	0.78 (0.71–0.86)
Varsity only	0.97 (0.88–1.07)	0.91 (0.82–0.99)
Both	0.85 (0.78–0.92)	0.91 (0.82–0.99)
Model 3: Cigarette use		
None (ref)	–	–
Intramurals only	0.78 (0.68–0.91)	0.72 (0.64–0.82)
Varsity only	0.70 (0.61–0.81)	0.72 (0.63–0.82)
Both	0.59 (0.52–0.67)	0.62 (0.55–0.69)
Model 4: E-cigarette use		
None (ref)	–	–
Intramurals only	0.87 (0.76–0.99)	1.05 (0.93–1.20)
Varsity only	1.37 (1.23–1.53)	1.57 (1.41–1.73)
Both	1.34 (1.25–1.44)	1.46 (1.33–1.60)
Model 5: Multiple substance use		
None (ref)	–	–
Intramurals only	0.71 (0.65–0.78)	0.84 (0.77–0.91)
Varsity only	1.36 (1.25–1.48)	1.52 (1.41–1.64)
Both	1.19 (1.11–1.27)	1.42 (1.34–1.50)

Models controlled for: school median income, school urbanicity, province, grade, ethnicity, weekly spending money, school connectedness, and other substance use (models 1–4).

Bolded p < .05.

0.65–0.78]) and male (0.84 [95% CI 0.77–0.91]) students.

Among students who participated in varsity sports only, female students had 48% greater odds of binge drinking (OR 1.48 [95% CI 1.34–1.65]) and male students had 63% greater odds of binge drinking (OR 1.63 [95% CI 1.47–1.81]). Varsity participation was not significantly associated with cannabis use among female students but was associated with lower odds of using cannabis among male students (OR 0.91 [95% CI 0.82–0.99]). Varsity participation was also associated with lower odds of cigarette use (Female OR 0.70 [95% CI 0.61–0.81]; Male: 0.72 [95% CI 0.63–0.82]). Lastly, varsity sports were associated with higher odds of both e-cigarette use (Female: OR 1.37 [95% CI 1.23–1.53]; Male: 1.57 [95% CI 1.41–1.73]) and increased odds of using more substances (Female: OR 1.36 [95% CI 1.25–1.48]; Male: 1.52 [95% CI 1.41–1.64]).

Participation in both intramurals and varsity sports was associated with increased odds of binge drinking (Female OR 1.50 [95% CI 1.37–1.63]; Male OR 1.71 [95% CI 1.55–1.89]), e-cigarette use (Female: OR 1.34 [95% CI 1.25–1.44]; Male: 1.46 [95% CI 1.33–1.60]), and using more substances (Female: OR 1.19 [95% CI 1.11–1.27]; Male: 1.42 [95% CI 1.34–1.50]). Conversely, participation in both was protective against cannabis use (Female OR 0.85 [95% CI 0.78–0.92]; Male OR 0.91 [95% CI 0.82–0.99]) and cigarette use (Female OR 0.59 [95% CI 0.52–0.67]; Male OR 0.62 [95% CI 0.55–0.69]).

4. Discussion

This study investigated the association between school sport participation (intramurals, varsity sports, both) and binge drinking, cannabis use, cigarette use, e-cigarette use, and multiple substance use. Overall, over half of students did not participate in any school sports and over 3 in 5 did not use any substances. Males were more likely to report participation in varsity sports and a combination of varsity and intramural sports. This is in line with past Canadian research that has found males more likely to participate in all forms of sport (Kurc & Leatherdale, 2009). In contrast to our findings, other research has also identified males as more likely to participate in intramural sports compared to females. This difference is likely due to the fact that we considered whether students were participating exclusively in intramurals or a combination of sport types (Hobin et al., 2012; Kurc & Leatherdale, 2009).

Participating in intramurals was found to be protective against cannabis use, cigarette use and multiple substance use among all students. This is consistent with previous research which has identified sport to be protective against cigarette use among all adolescents and against cannabis among females (Boyes et al., 2017; Dunn, 2014). This is likely due to the well-known negative health effects of cigarette use and the immediate physical impairments (i.e., shortness of breath) that negatively impact physical activity (US Department of Health and Human Services, 2014). Similarly, most youth who use cannabis report smoking (Doggett, Battista, & Leatherdale, 2020) which also has negative respiratory consequences (Gates, Jaffe, & Copeland, 2014). Results from research evaluating the Icelandic Model indicate that having access to regularly programmed youth activities such as intramurals result in decreases in substance use (Sigfúsdóttir, Thorlindsson, Kristjánsson, Roe, & Allegrante, 2009). Additionally, intramural participation was negatively associated with e-cigarette use among female students. This is promising due to the increasing rates of e-cigarette use among youth (Zuckermann et al., 2019). Based on these findings, schools offering intramurals should continue to do so. Offering female only intramurals has been associated with increased participation

among female students (Williams, Burns, Battista, de Groh, Jiang, & Leatherdale, 2020) and may offer a way for schools to indirectly reduce substance use among this group as well. Participating in intramurals only was not significantly associated with binge drinking. The lack of protective association between intramurals and binge drinking may be due to alcohol being heavily marketed in sports and may be perceived as less harmful than cigarettes or cannabis. Studies have consistently linked exposure to alcohol marketing to adolescent alcohol use (Anderson, Bruijn, Angus, Gordon, & Hastings, 2009; Brown, 2016; Morojele et al., 2018).

In contrast, students who participated in varsity sports were at increased risk for binge drinking, e-cigarette use, and multiple substance use. Like intramurals, varsity sports were also found to be protective against cigarette use among all students and cannabis use among male students. The increased risk for binge drinking that is exclusive to varsity players could be due to a variety of factors. There is the perception that athletes consume more alcohol than their peers and this often drives personal use in an attempt to align with this perceived norm and fit in with peers (Connor, Martin, & Martens, 2007). There is also evidence that varsity athletes are more likely to use alcohol for sport-related positive reinforcement motives (e.g., drinking due to a win) and sport-related coping motives (e.g., drinking after a loss) compared to their intramural-playing counterparts (Martens, Pedersen, Smith, Stewart, & Brien, 2011; Wahesh et al., 2013). While these findings around binge drinking, cannabis, and cigarettes have been previously identified (Boyes et al., 2017; Denault & Poulin, 2018; Veliz et al., 2017), the link between varsity sports and e-cigarette use is novel. This finding is concerning as varsity sports were found to be protective against both other forms of inhaled substances investigated in this study, cannabis and cigarettes. This suggests that health conscious youth who are physically active and avoid combustible products may be viewing e-cigarettes as a safer alternative. This is worrying given the unknown long-term effects of e-cigarettes (US Department of Health and Human Services, 2016). As e-cigarette use has increased drastically among high school students (Zuckermann et al., 2019) and the results from this study indicate that students who participate in varsity sports may be at increased risk for use, secondary schools should implement education around the risks of e-cigarettes for both male and female varsity sports teams.

Finally, participating in a combination of intramurals and varsity sports was associated with increased risk for binge drinking, e-cigarette use, and multiple substance use but was protective against cannabis use and cigarette use. This is in contrast with the finding that intramurals only were found to be protective against e-cigarette use and multiple substance use and have no effect on binge drinking. This difference between students who participate in intramurals only and students who participate in a combination of intramural and varsity sports could be explained by the differences in team culture and the identities that these athletes may align themselves with. For example, students who are more involved in athletics (i.e., participating in a combination of intramurals and varsity sports) may be more likely to self-identify as a “student athlete” or “jock”, which has been associated with increased risk of alcohol use regardless of their physical activity level (Miller et al., 2003). Students who participate in intramurals only may be less likely to identify as a “student athlete” or “jock”, which may explain the protective effect of intramural only participation on e-cigarette and multiple substance use.

To date, attempts to reduce substance use through interventions targeted to sports teams have been limited (Kwan, Bobko, Faulkner, Donnelly, & Cairney, 2014). Programs are often targeted for elite athletes and focus on performance enhancing substances (Canadian Centre on Substance Use and Addiction, 2017; Hurst, Ring, & Kavussanu, 2020). However, the ‘Cool and Clean’ program has been implemented in Switzerland since 2003 and has seen some success in reducing cannabis use frequency, although no significant results for alcohol and tobacco have been found (Balthasar, 2017; Wicki & Kuntsche, 2018).

This program targets youth participating in sports organizations and focuses on teaching life skills such as dealing with success and failure and committing to saying no to substances (ages 10–15) or using substances safely (ages 16–20) (Balthasar, 2017; Wicki & Kuntsche, 2018). Coaches and team personnel receive training to deliver messaging which has been shown to be critical to delivering effective health education to sports participants otherwise their efforts may have the opposite intended effect (Ng, Mäkelä, Parkkari, Kannas, Vasankari, Heinonen, & Selänne, 2017). Other sports intervention components that have shown promise include peer-to-peer programming and providing alternative healthy behaviors (McKiernan, 2016). Intervening on substance use through sport presents a unique opportunity to reach a large proportion of youth. If such interventions are able to have a lasting impact on risk factors such as substance use throughout adolescence and young adulthood, they have potential to have a large public health impact.

4.1. Limitations

The first limitation is that the COMPASS study does not distinguish between individual and team sports which have been found to have differential effects on alcohol use among adolescents and future work should consider these differences (Denault & Poulin, 2018). Secondly, this study is cross-sectional and temporal conclusions cannot be made and further longitudinal work should examine substance use over time. Finally, schools were recruited using purposive sampling, potentially limiting the generalizability of results. However, the COMPASS study has a large sample size and uses an active-information, passive-consent protocol to encourage participation and honest reporting (Thompson-Haile, Bredin, & Leatherdale, 2013). This has been shown to be particularly important for producing robust results that limit self-selection and response bias, particularly for measures of substance use behaviors (Leatherdale et al., 2014; Rojas, Sherrit, Harris, & Knight, 2008; White, Hill, & Effendi, 2004).

5. Conclusions

The results of this research highlight the important role that intramurals may have in high schools. Intramurals were found to be protective against cannabis use, cigarette use, and multiple substance use among all students and e-cigarette use among female students. In contrast, varsity sports participation was a risk factor for binge drinking, e-cigarette use, and multiple substance use. Our study builds on the literature around e-cigarette use, as although varsity sports were protective against cannabis and cigarette use, they were found to be a risk factor for e-cigarette use. Substance use prevention efforts should be a focus among school varsity sports teams, especially for binge drinking and e-cigarette use.

6. Role of funding sources

The COMPASS study has been supported by a bridge grant from the Canadian Institutes of Health Research (CIHR) Institute of Nutrition, Metabolism and Diabetes (INMD) through the “Obesity – Interventions to Prevent or Treat” priority funding awards (OOP-110788; grant awarded to SL), an operating grant from the CIHR Institute of Population and Public Health (IPPH) (MOP-114875; grant awarded to SL), a CIHR Project Grant (PJT-148562; grant awarded to SL), a CIHR Project Grant (PJT-149092; grant awarded to Dr. Karen Patte), and by a research funding arrangement with Health Canada (#1617-HQ-000012; contract awarded to SL). GW is funded by the Ontario Graduate Scholarship (OGS) and by the Public Health Agency of Canada through the Federal Student Work Experience Program.

7. Contributors

All authors contributed to the conception of the study research questions. GCW performed the statistical analysis, with the guidance of KB. GCW and KEB wrote the manuscript and KB, MdG, YJ, and STL revised the manuscript for important intellectual content. STL conceived of the COMPASS study and wrote the funding proposal, developed the study tools, and is leading the study implementation and coordination. All authors read and approved of the final manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Data availability statement

The datasets generated and analyzed during the current study will not currently be shared because this is an ongoing study; however, access to the data supporting the findings of the study can be requested at <https://uwaterloo.ca/compass-system/information-researchers>.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.abrep.2020.100298>.

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