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Exploring the Association Between Sport Participation and Symptoms of Anxiety and Depression in a Sample of Canadian High School Students

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The mental health benefits of physical activity may relate more to the context of the behavior, rather than the behavior of being active itself. The association between varsity sport (VS) participation, depression, and anxiety symptoms was explored using data from 70,449 high school students from the Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior study. The model adjusted for potential covariates; interactions by sex and participation in outside of school sport (OSS) were explored. Overall, 70% and 24% of respondents met or exceeded cutoff values for depression and anxiety, respectively. Students participating in VS had lower symptoms of anxiety and depression compared with nonparticipants. Results were consistent regardless of OSS participation; associations were strongest among students who participated in both VS and OSS and males. Participation in VS may prove beneficial for the prevention and/or management of depression or anxiety symptoms, particularly among males. An additive beneficial effect of OSS on depression and anxiety scores may exist.

Keywords: CESD-R-10, GAD-7, mental health, student-athlete

Mental illnesses are among the leading causes of burden across the lifespan (Vigo, Thornicroft, & Atun, 2016). Adolescence is a critical period of development, with numerous physiological, social, and lifestyle changes. It is during this transitional life stage that many mental illnesses have their onset, or existing symptoms are exacerbated (Remschmidt, 2013). Based on U.S. epidemiological survey data, the 12-month prevalence of any DSM-IV (Diagnostic and Statistical Manual of Mental

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Disorders—4th Edition) disorder among U.S. adolescents aged 13–17 years old was 40.3%; anxiety disorders were the most common, followed by behavioral (e.g., attention-deficit/hyperactivity disorder, oppositional-defiant disorder) and mood (e.g., major depressive disorder, bipolar I or II disorder) disorders (Kessler et al., 2012). The prevention and early intervention of mental illness among youth is a public health priority given their short- and long-term negative repercussions. During adolescence, depression can contribute to academic underachievement (Fergusson & Woodward, 2002), risky behaviors, and self-harm (Auerbach, Tsai, & Abela, 2010; Auerbach et al., 2014) and, in the long term, lead to premature mortality (Archer, Kuh, Hotopf, Stafford, & Richards, 2018), subsequent mental illness, and suicidality (Clayborne, Varin, & Colman, 2019; Fergusson, Boden, & Horwood, 2007).

Physical activity is often suggested as an economical strategy for the prevention and management of depression and anxiety at the population level (Carek, Laibstain, & Carek, 2011; Gaudlitz, von Lindenberger, Zschucke, & Ströhle, 2013; Pelletier, Shanmugasegaram, Patten, & Demers, 2017). In adolescent populations, physical activity has been shown to have numerous positive effects, including improvements in sleep, self-esteem, and psychological distress (Barth Vedøy, Anderssen, Tjomsland, Skulberg, & Thurston, 2020; Biddle, Ciaccioni, Thomas, & Vergeer, 2019; Dale, Vanderloo, Moore, & Faulkner, 2019; Poitras et al., 2016). Recent reviews support the benefits of physical activity for youth mental health, particularly depressive symptoms and self-concept (Biddle et al., 2019; Dale et al., 2019). However, several prospective studies of nonclinical populations have found weak or null effects for physical activity on depressive symptoms, and the evidence supporting anxiety is limited and inconsistent (Biddle et al., 2019; Dale et al., 2019; Patte, Faulkner, Qian, Duncan, & Leatherdale, 2020).

Some research indicates that mental health benefits may relate more to the context of physical activity, rather than the behavior of being active itself (Brunet et al., 2014; Doré, O'Loughlin, Beauchamp, Martineau, & Fournier, 2016; Evans et al., 2017; Lubans et al., 2016). For instance, participation in team-sport and informal group activities was found to be inversely associated with depressive symptoms relative to individual physical activity (Doré, O'Loughlin, Schnitzer, Datta, & Fournier, 2018). Furthermore, Doré et al. (2018) identified that there was a controlled direct effect of physical activity volume on the association between participation in team sport and positive mental health, suggesting that there is no benefit of increasing the volume of physical activity and that it is the context of team sport that provides the benefits to mental health. The context of team sport is believed to be beneficial to mental health as it offers an opportunity for social interaction, thereby strengthening social networks and perceived feelings of support and integration (Doré et al., 2018; Eime, Harvey, Brown, & Payne, 2010; Eime, Young, Harvey, Charity, & Payne, 2013).

The effects of physical activity on mental health have also been explored in the context of sport. Existing research suggests a beneficial effect of sport on anxiety, depression, and general mental health and well-being (Breistøl, Clench-Aas, Van Roy, & Kjærsti Raanaas, 2017; Doré et al., 2016; McMahon et al., 2017). However, research indicates that this relationship may vary by factors such as sport type and level. For instance, Breistøl et al. (2017) found Norwegian students participating in sport to have fewer mental health symptoms (emotional, conduct, hyperactivity, and peer problems) than those who did not participate in sport.

This beneficial relationship was present for both competitive and noncompetitive sport but was stronger among youth participating at a competitive level (Breistøl et al., 2017). When comparing sport type, regardless of competitive level, Breistøl et al. (2017) found that team-sport participation was associated with fewer mental health symptoms as compared with individual sport. A similar conclusion was drawn by McMahon et al. (2017) in a representative sample of European adolescents; those in team sport had the lowest anxiety and depression symptoms and the highest well-being scores. However, a significant difference in anxiety and depression symptoms between team and individual sport participation existed in female athletes only (McMahon et al., 2017). In addition to sex, the relationship between team sport, anxiety, and depression may be influenced by the total volume of moderate to vigorous physical activity (MVPA; Doré et al., 2016, 2020) and age (Doré et al., 2016).

Similar to cross-sectional research, results from longitudinal studies suggest a complex relationship between adolescent sport participation and mental health later in life. Participation in sport as an adolescent was associated with a significant decrease in symptoms of social anxiety and loneliness 1 year later (Brière et al., 2018). A decrease in these symptoms, as well as depressive symptoms, were greater in adolescents who had high baseline values for these variables (Brière et al., 2018). These beneficial effects of sport participation did not differ by sociodemographic characteristics, sport type, or frequency of participation (Brière et al., 2018). Conversely, Jewett et al. (2014) found a positive effect of sport participation on depressive symptoms, perceived stress, and self-rated mental health 3 years later. After controlling for baseline mood disorders, sex, age, extracurricular sport participation, and parental education, participation in high school sport predicted significant improvements in all three mental health measures (Jewett et al., 2014). In the same sample, Sabiston et al. (2016) found that the association between high school sport participation and depressive symptoms may be influenced by sport type. After controlling for age, baseline depression, sex, and parental education, it was found that years of involvement in team sport, but not individual sport, was associated with lower depressive symptoms 3 years later (Sabiston et al., 2016).

The short- and long-term relationship between adolescent sport participation and mental health appears to be influenced by several factors. It remains unclear how age, sex, sport type, competitive level, environment, and intensity of physical activity impact this relationship (Doré et al., 2016). Some of these questions could be answered if common study limitations were addressed. For instance, samples are often restricted to single geographic or sociodemographic areas, preventing generalization of results to a wider population (Brière et al., 2018; Doré et al., 2016; Jewett et al., 2014; Sabiston et al., 2016; Snyder et al., 2010). Furthermore, the data used in previous studies were collected in 2002 (Breistøl et al., 2017), 2006–2008 (Guddal et al., 2019), and 2008/2009 (Jewett et al., 2014; Sabiston et al., 2016); as such, these data may be considered out of date. To better explore the complex relationship between adolescent sport participation and mental health, large population-level research using modern data is needed. As such, the objective of this study is to explore the association between sport participation and symptoms of depression and anxiety in a large cohort of Canadian high school students. This association will be determined after controlling for relevant confounders, including

sleep, MVPA, screen time, and age. In addition, given the disparities in internalized symptoms (Garnefski & Kraaij, 2018; Guddal et al., 2019; Kessler et al., 2012) and sport participation (Slater & Tiggeman, 2011), sex differences in the relationship between sport involvement and mental health will be examined.

Methods

Design

Cross-sectional student data were used from Year 7 (2018/2019) of the COMPASS (Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior) study (Leatherdale et al., 2014). Year 7 data were used as this year had the largest student-level sample and the most recent complete wave of data available from the COMPASS host study. The COMPASS study is an ongoing (2012–2021) prospective study designed to collect hierarchical longitudinal data from students in Grades 9 through 12 and the secondary schools they attend (Leatherdale et al., 2014). School boards and schools were purposefully selected based on whether they permitted active-information passive-consent parental permission protocols (Leatherdale et al., 2014), which are critical for collecting robust mental health data among youth (Chartier et al., 2008; White, Hill, & Effendi, 2004). All students attending the participating secondary schools were eligible to participate and could decline at any time. Once annually, COMPASS student questionnaires are completed by whole-school samples during class time. Further details of COMPASS methods are available online (https://uwaterloo.ca/compass-system/) or in print (Leatherdale et al., 2014). All procedures were approved by the University of Waterloo (ORE 30118) and all appropriate school board ethics committees as required.

In Year 7, data were collected from 74,501 students in 136 secondary schools in Ontario ($n = 61$), Alberta ($n = 8$), Quebec ($n = 52$), and British Columbia ($n = 15$). The participation rate for Year 7 was 84.2%, with missing respondents primarily a result of scheduled study periods or absenteeism on the day of data collection.

Measures

Depression symptoms. Symptoms of depression were measured using the 10-item Center for Epidemiologic Studies Depression scale-Revised (CESD-R-10; Andresen, Malmgren, Carter, & Patrick, 1994; Radloff, 1977; Zhang et al., 2012). Items assessed characteristics of clinical depression, including negative affect, anhedonia, and somatic symptoms, such as "I felt everything I did was an effort," "I could not get 'going,'" difficulty concentrating, sleeplessness, and feelings of hopelessness. Students were asked how often they experienced each symptom within the last 7 days, with the response options "none or less than 1 day," "1–2 days," "3–4 days," or "5–7 days." Responses were scored from 0 to 3, respectively, and summed. Higher total scores indicate greater depressive symptoms. The scale has demonstrated validity in adolescent populations (Bradley, Bagnell, & Brannen, 2010; Haroz, Ybarra, & Eaton, 2014). Internal consistency in the current study was acceptable ($\alpha = .746$). A score of 10 or more is indicative of clinically relevant depression symptoms (Radloff, 1977).

Anxiety symptoms. Symptoms of generalized anxiety were measured using the 7-item Generalized Anxiety Disorder scale (GAD-7; Spitzer, Kroenki, Williams, & Löwe, 2006). The seven items consisted of symptoms of "feeling nervous, anxious, or on edge," "trouble relaxing," "not being able to stop or control worrying," "feeling so restless that it is unable to sit still," "becoming easily annoyed or irritable," and "feeling afraid as if something awful might happen." Students were asked how often they experienced each symptom in the last 2 weeks, with the response options "not at all," "several days," "over half the days," or "nearly every day." Responses were scored from 0 to 3, respectively, and summed. Internal consistency in the current sample was very good ($\alpha = .907$). As per Spitzer et al. (2006), cutoff scores of 5, 10, and 15 indicated mild, moderate, and severe anxiety, respectively.

Sports participation. Varsity sport (VS) was assessed by asking students if they participated in "competitive school sports teams that compete against other schools (e.g., junior varsity or varsity sports)" (*yes, no, not available at my school*). Outside of school sport (OSS) participation was determined by asking whether students participated in "league or team sports outside of school" (*yes, no, not available where I live*). For both VS and OSS, responses were expressed as binary codes. The response "*yes*" was coded as 1; *"no"* or *"not available where I live"* were combined and considered *"no"* and coded as 2. Both VS and OSS would be considered competitive sport; however, the level of competition may vary between sport groups. For example, in VS, the competitive level would be considered high, and athletes may be selected or deselected from a team based on skill. The competitive level of OSS could vary, from recreational athletes placed on teams through signing up for leagues, to highly competitive athletes selected for teams based on skill. The importance of this measure lies in the context of the sport (within or outside of school).

Covariates. Sleep, MVPA, screen time, and age were considered covariates. Sleep has been shown to have a bidirectional relationship with anxiety and depression (Shanahan, Copeland, Angold, Bondy, & Costello, 2014). Sleep duration was assessed by asking students how much time they usually spend sleeping per day in hours (0–9) and minutes (0, 15, 30, and 45). Similarly, physical activity, specifically MVPA, was controlled for given its aforementioned inverse relationship with anxiety and depression (Doré et al., 2016). Using previously validated measures, students were asked to indicate how many minutes of moderate (i.e., lower intensity activities "such as walking, biking to school, and recreational swimming") and hard (i.e., "jogging, team sports, fast dancing, jump-rope, and any other physical activities that increase your heart rate and make you breathe hard and sweat") physical activity they accumulated on each of the last 7 days to calculate a daily average (Leatherdale, Laxer, & Faulkner, 2014; Wong, Leatherdale, & Manske, 2006). Screen time has been shown to have a negative relationship with adolescent mental health (Twenge & Campbell, 2018). Students were asked to identify, in hours and minutes, the length of time, each day, they spend on a screen. These measures were broken down into categories, including video/computer games, surfing the internet, texting/messaging/email, and watching/streaming TV shows/movies/videos. Total screen time was calculated by finding the sum of the length of time for all screen time categories. To

control for school clustering, information regarding the students' schools was coded prior to data analysis; the data were then nested by school for analysis.

Statistical Analysis

Both CESD-R-10 and GAD-7 scores were expressed as continuous variables. Prior to hypothesis testing, the data were examined to ensure they upheld the assumptions for data analyses. Levene's tests of both CESD-R-10 and GAD-7 scores by VS status showed that the data violated the assumption of homogeneity of variance. Log-transformed scores upheld this assumption, but given that the results of the raw and transformed data were similar, raw scores were used due to their interpretability. The intraclass correlation coefficient (ICC) and design effect were calculated for CESD-R-10 and GAD-7 scores to assess the impact of shared variance in the nested data and the appropriateness of multilevel modeling (MLM). The ICCs were .02 and .03 for CESD-R-10 and GAD-7, respectively, and design effects were 10.94 and 18.53. Typically, ICCs closer to 1.0 and design effects over 2.0 are understood to be indicative of high levels of within-group variability and, therefore, require MLM, although it has been noted that values that do not reach these thresholds should still be analyzed by MLM (Huang, 2018; Tabachnick & Fidell, 2019). Finally, average hours of sleep per day, MVPA per day, and total screen time per day were assessed as potential covariates. Sleep and total screen time significantly differed between the independent variable (varsity status; $p < .05$); as such, these variables were not used as covariates (Field, 2018).

The MLM procedures followed the hierarchical protocol of Field (2018), including: (a) a baseline model with the dependent variable scores (i.e., CESD-R-10 or GAD-7) and factor of VS participation; (b) the addition of average daily MVPA as a covariate, followed by the inclusion of the Level 2 variable of school in terms of (c) random intercepts, and (d) random slopes; and, finally, (e) the potential interactions of the factors of sex and OSS. Each subsequent model was assessed via the change in −2Log Likelihood. All analyses were conducted using IBM SPSS (version 25.0; IBM, 2020). The maximum likelihood method of extraction was employed.

Results

A total of 70,449 students provided information on VS participation status and completed either one or both the GAD-7 and CESD-R-10 scales. Table 1 summarizes demographic information for the total sample. Without considering level of sport participation, significant differences between sexes were detected for sleep and MVPA. Males had lower levels of sleep and higher levels of MVPA, as compared with females ($p < .001$). Table 2 summarizes CESD-R-10 and GAD-7 scores by VS participation and sex. Males had significantly lower depression and anxiety scores, as compared with females ($p < .001$). Approximately 13.3% and 18.3% of students participated in only VS and only OSS, respectively; 22.4% participated in both VS and OSS. Therefore, approximately 54% of the sample participated in either VS or OSS. Varsity athletes had significantly lower scores for both depression and anxiety when compared with nonvarsity athletes, regardless of

Table 1 Descriptive Statistics Among Secondary School Students in Year 7 (2018/2019) of the COMPASS Study

	Total sample		Male		Female	
Characteristics	***n***	$\bar{x}$ (***SD***)	***n***	$\bar{x}$ (***SD***)	***n***	$\bar{x}$ (***SD***)
Age (years)	70,077	15.2 (1.5)	34,728	15.2 (1.5)	35,038	15.1 (1.5)
MVPA/day (min)	70,449	121.9 (137.3)	34,782	134.8 (143.8)	35,060	108.3 (127.4)
Sleep duration (hr)	68,057	7.0 (1.8)	33,471	7.5 (1.6)*	34,006	6.6 (2.0)
	n	**%**	**n**	**%**	**n**	**%**
Province						
Ontario	28,892	41	14,335	41.2	14,264	40.7
Alberta	3,129	4.4	1,532	4.4	1,567	4.5
British Columbia	9,702	13.8	4,861	14.0	4,721	13.5
Quebec	28,726	40.8	14,054	40.4	14,508	41.4
Sport participation						
Only VS	9,385	13.3	4,599	13.2	4,719	13.5
Only OSS	12,872	18.3	6,379	18.4	6,408	18.3
None	32,179	45.7	14,592	42.1	17,282	49.4
Both VS and OSS	15,814	22.4	9,101	26.2	6,571	18.8

Note. n = number of athletes; x = average; COMPASS = Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior; MVPA = moderate to vigorous physical activity; VS = varsity sport; OSS = outside school sport.
*Significantly different from females ($p < .001$).

Table 2 CESD-R-10 and GAD-7 Scores by Sex and Sport Participation Status Among Secondary School Students in Year 7 (2018/2019) of the COMPASS Study

	CESD-R-10		GAD-7	
Sex and sport participation	***n***	$\bar{x}$ (***SD***)	***n***	$\bar{x}$ (***SD***)
Total sample	63,280	8.79 (6.04)	67,850	6.15 (5.58)
Varsity	22,641	8.01 (5.64)*	24,331	5.50 (5.28)*
Not varsity	40,463	9.23 (6.21)	43,323	6.51 (5.72)
Males	31,080	7.38 (5.29)**	33,692	4.58 (4.90)**
Varsity	12,211	6.77 (4.83)*	13,282	4.08 (4.50)*
Not varsity	18,765	7.77 (5.53)	20,295	4.92 (5.13)
Females	31,665	10.14 (.38)	33,579	7.69 (5.76)
Varsity	10,240	9.46 (6.14)*	10,851	7.23 (5.61)*
Not varsity	21,355	10.47 (6.47)	22,650	7.91 (5.82)

Note. n = number of athletes; x = average; CESD-R-10 = the 10-item Center for Epidemiologic Studies Depression scale-Revised; GAD-7 = 7-item Generalized Anxiety Disorder scale; COMPASS = Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior.
*Significant difference ($p < .001$) as compared with nonvarsity athletes. **Significant difference ($p < .001$) from females.

sex ($p < .001$). Table 3 further breaks down the analysis into subgroups, showing CESD-R-10 and GAD-7 scores for VS and OSS participants and nonparticipants. In most cases, students who participated in VS and OSS had significantly lower scores than students who only participated in VS ($p < .001$). This relationship was seen in all subgroups with the exception of GAD-7 scores in female varsity athletes.

For both depression and anxiety scores, the baseline models comprised a significant effect for VS and significant variance of slopes and intercept; each subsequent model was a significant improvement on the previous model. The ultimate result of each analysis was a significant three-way interaction between VS participation, sex, and OSS participation on the dependent variables (Figures 1 and 2). Specifically, the model for depression revealed a significant effect for the covariate of MVPA, $t(1, 62321.62) = 4.71$, $p < .001$, and a three-way interaction

Table 3 CESD-R-10 and GAD-7 Scores for All Sport Participation Subgroups Among Secondary School Students in Year 7 (2018/2019) of the COMPASS Study

	CESD-R-10		GAD-7	
Sex and sport participation	***n***	$\bar{x}$ (***SD***)	***n***	$\bar{x}$ (***SD***)
Varsity				
Total				
OSS	14,171	7.70 (5.50)[#]	15,231	5.30 (5.30)[#]
No OSS	8417	8.50 (5.80)	9042	5.80 (5.30)
Male				
OSS	8,088	6.58 (4.75)[#]	8,796	3.95 (4.46)[#]
No OSS	4,091	7.12 (4.98)	4,451	4.35 (4.56)
Female				
OSS	5,950	9.27 (6.12)[#]	6,303	7.23 (5.66)
No OSS	4,270	9.73 (6.16)	4,526	7.24 (5.55)
Nonvarsity				
Total				
OSS	11,519	8.10 (5.90)[#]	12,380	5.70 (5.40)[#]
No OSS	28,840	9.70 (6.30)	30,818	6.80 (5.80)
Male				
OSS	5,654	6.78 (5.01)[#]	6,174	4.17 (4.69)[#]
No OSS	13,053	8.20 (5.69)	14,053	5.24 (5.27)
Female				
OSS	5,785	9.44 (6.28)[#]	6,125	7.24 (5.61)[#]
No OSS	15,529	10.85 (6.49)	16,474	8.16 (5.86)

Note. n = number of athletes; x = average; CESD-R-10 = the 10-item Center for Epidemiologic Studies Depression scale-Revised; GAD-7 = 7-item Generalized Anxiety Disorder scale; COMPASS = Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior; OSS = Outside School Sport.

[#]Significant difference ($p < .001$) from no OSS.

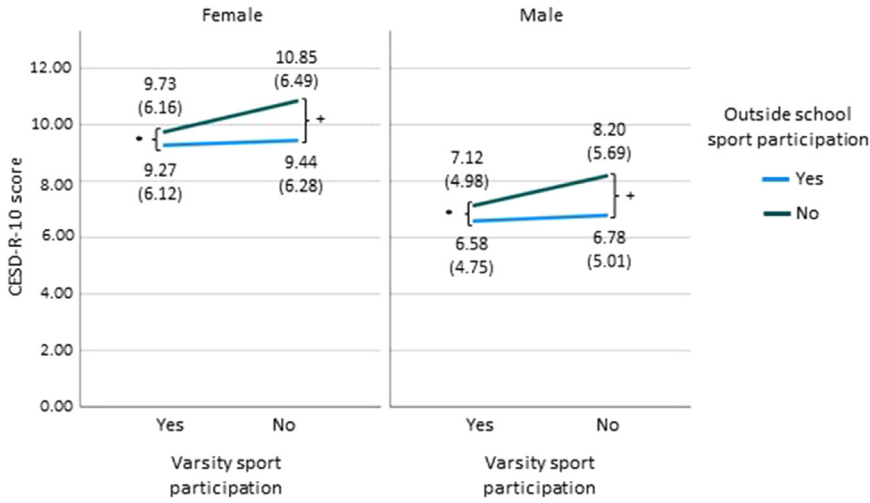

Figure 1 — Depressive symptoms (CESD-R-10) by sex and sport participation among youth participating in Year 7 (2018/2019) of the COMPASS study. *Significant difference ($p < .001$) in CESD scores between varsity sport participants who also participated in outside school sport (VS + OSS) and those who participated in only varsity sport (VS). +Significant difference ($p < .001$) in CESD scores between those students who do not participate in varsity sport but do participate in OSS (OSS) and those who participate in neither VS or OSS (no sport). CESD-R-10 = 10-item Center for Epidemiologic Studies Depression scale-Revised; COMPASS = Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior.

between sex, OSS, and VS on depression $t(1, 61378.57) = 2.95$, $p < .05$. Furthermore, the variances for both the intercept and slope in the model varied significantly, indicating that both parameters varied by school. Similarly, for anxiety, the effect for both the covariate $t(1, 66784.08] = 2.28$, $p < .05$, and interaction $t(1, 65413.8) = 5.26$, $p < .001$, were significant, and, again, slope and intercept varied significantly within the model.

These significant interactions were analyzed by examining two-way interactions and then main effects, within designated factors. Specifically, independent models for males and females revealed a significant interaction for VS and OSS participation on depression and anxiety scores (Figures 1 and 2; $p < .05$). These significant two-way interactions were followed by separate samples according to sex and OSS status to see if there was a significant effect for VS participation in each of these four groups on depression and anxiety. In other words, the analysis proceeded to MLM models for the effect of VS participation on depression and anxiety scores for four samples: males who did, and did not, participate in OSS and females who did, and did not, participate in OSS. The results of these models are given in Table 4; results show the effect of VS on CESD-R-10 or GAD-7, after statistically controlling for average MVPA. In each of the four independent models for both depression and anxiety, VS had a significant effect after statistically controlling for the effect of MVPA ($p < .05$). However, in 6 of the 8 models, the

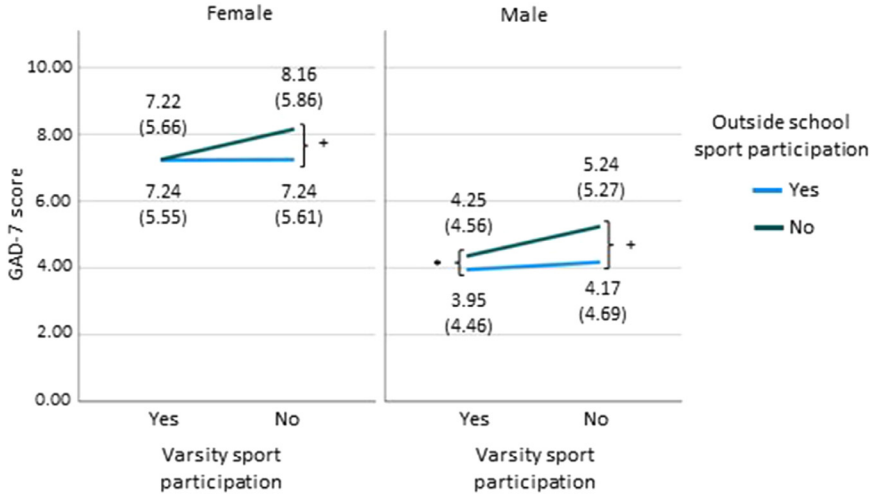

Figure 2 — Anxiety symptoms (GAD-7) by sex and sport participation among youth participating in Year 7 (2018/2019) of the COMPASS study. *Significant difference ($p < .001$) in GAD-7 scores between varsity sport participants who also participated in outside school sport (VS + OSS) and those who participated in only varsity sport (VS). +Significant difference ($p < .001$) in GAD-7 scores between those students who do not participate in varsity sport but do participate in OSS (OSS) and those who participate in neither VS or OSS (no sport). GAD-7 = 7-item Generalized Anxiety Disorder scale; COMPASS = Cannabis use, Obesity, Mental health, Physical activity, Alcohol use, Smoking, and Sedentary behavior.

variance for slope and intercept was not significant. This result indicates that, although the three-way models varied significantly by school, once we examine these interactions in individual analyses by groups of sex and OSS conditions, the significant effect of VS on mental health is not nested within schools.

Discussion

The purpose of this study was to explore the relationship between athletic status and symptoms of depression and anxiety in a large sample of Canadian high school students. Just over half of the sample (54%) participated in organized sport. A recent report found that, based on self-reported data, 66% of students, Grades 6–10, participate in individual and/or team sport (ParticipACTION, 2020). The slightly lower percentage of involvement in the current sample is expected as sport participation drops with age, especially during the transition to high school (Eime, Harvey, Charity, & Payne, 2016; Zimmerman-Sloutskis, Wanner, Zimmermann, & Martin, 2010). Our results support earlier work, concluding that sport participation has beneficial effect on adolescent mental health (Breistøl et al., 2017; Doré et al., 2016; Jewett et al., 2014; McMahon et al., 2017; Sabiston et al., 2016). Results indicated a significant association between VS participation and symptoms of depression and anxiety in the sampled adolescents. In both males and females,

Table 4 Summary of Multilevel Modeling Exploring the Effects of Varsity Sport Participation on CESD-R-10 and GAD-7 Scores

			Intercept		Slope	
DV	**Model**	***F* (df)**	**Estimate**	**Variance**	**Estimate**	**Variance**
CESD-R-10	Female OSS	10.53* (1, 102.22)	8.77*	0.49	0.40*	0.19
	Female no OSS	78.26* (1, 189.67)	8.77*	0.43	1.09*	0.34
	Male OSS	13.09* (1, 70.37)	6.25*	0.23	0.32*	0.05
	Male no OSS	81.14* (1, 107.85)	6.30*	1.22*	0.99*	0.21
GAD-7	Female OSS	9.54* (1, 90.09)	6.81*	1.07	0.36*	0.30
	Female no OSS	68.80* (1, 71.55)	6.67*	1.17	0.82*	0.05
	Male OSS	9.99* (1, 104.55)	3.66*	0.58*	0.30*	0.33*
	Male no OSS	77.64* (1, 103.99)	3.63*	0.69	0.86*	0.18

Note. CESD-R-10 = 10-item Center for Epidemiologic Studies Depression scale-Revised; GAD-7 = 7-item Generalized Anxiety Disorder scale; DV = dependent variable; OSS = Outside School Sport.
*$p < .05$.

those who participated in VS had lower anxiety and depression scores than those who did not participate in VS. This effect held true regardless of participation status in OSS; however, the effect was stronger among those who participated in both VS and OSS. Such results suggest an additive effect of sport participation, in that more sport participation is associated with lower depression and anxiety scores. Although the beneficial effect of VS participation was seen across sexes, the relationship between VS participation and anxiety and depression scores was stronger in males.

This study reported a positive additive effect of sport participation on symptoms of depression and anxiety; earlier research on adolescent extracurricular involvement supports this claim. More involvement in organized activities is associated with positive youth development (Busseri, Rose-Krasnor, Willoughby, & Chalmers, 2006; Linver, Roth, & Brooks-Gun, 2009; Zarrett et al., 2009), future risk behaviors, interpersonal functioning (Busseri et al., 2006), perceived value, usefulness, and safety (Forneris, Camiré, & Williamson, 2015), as well as depression and contribution to the community (Zarrett et al., 2009). It has been suggested that the breadth (number) of activities that one participates in may have a unique effect on positive outcomes due to the increased opportunity for developmental advancement (Busseri et al., 2006; Fredricks & Eccles, 2006). Research has found that when youth participate in many activities within different contexts, they have more opportunities to grow. For instance, if one particular activity or context does not provide a specific "feature" needed for development, they can draw on

the others to fill that void (Baltes, 1997; Baltes, Lindenberger, & Staudinger, 1999; Busseri et al., 2006; Fredricks & Eccles, 2006). Therefore, it is possible that students participating in both VS and OSS had lower depression and anxiety symptoms, as they were able to "draw" from both contexts to optimize positive development.

The current study found beneficial additive effects of sport participation on symptoms of anxiety and depression. However, some researchers have voiced concerns about how parental pressures to participate, and the over scheduling of such activities, may influence adolescent mental health (Randall & Bohert, 2009; Zarrett et al., 2009). Mahoney and colleagues (Mahoney, Harris, & Eccles, 2006; Mahoney & Vest, 2012) reported that most sport participation is intrinsically motivated and that there is little support for the "over-scheduling hypothesis." While adolescents may not be "over-scheduled," there are still recommendations in place to reduce the risk of injury, burnout, and attrition caused by high frequency/high rate of participation in sporting activities. Such recommendations include a maximum of 5 days per week of sport participation (Brenner & The Council on Sports Medicine and Fitness, 2016), limiting hours per week of participation to the age of the adolescent in years (Jayanthi, LaBella, Fischer, Pasulka, & Dugas, 2015) and less than 16 hr per week (Rose, Emery, & Meeuwisse, 2008). When looking specifically at participation frequency and adolescent well-being, Merglen, Flatz, Belanger, Michaud, and Suris (2013) found that adolescents who participated in sport less than 14 hr per week maintained the beneficial effects of sport participation. Future researchers should consider collecting frequency-specific data (time per day and/or time per week) to explore any mediating effects of participation frequency on sport and mental health.

Researchers have explored the effects of young athletes dedicating their time to one sport and avoiding participation in others. In addition to a number of negative physical effects, there is also evidence to suggest that sport specialization can be an emotional burden on youth (Smucny, Parikh, & Pandya, 2015). This study found that those students who participated in both VS and OSS scored lower on depression and anxiety symptom scales. However, the current study did not explore if the VS and OSS activities were the same. Research has found that early specialization in one sport can lead to burnout, social isolation, overdependence, arrested behavioral development, and socially maladaptive behaviors (Malina, 2009, 2010). Conversely, Dahab, Potter, Provance, Albright, and Howell (2019) found no differences in quality of life or depression scores between those high school athletes who were classified, by the authors, as low, medium, or highly specialized into one sport. However, in this study, the authors advise that the results should be interpreted with caution due to selection bias and an imbalanced sample (more low specialization than high). As such, future research should aim to collect sport-specific data, such as what sport(s) is/are played at which level (VS or OSS). Gathering such information could help explore the relationship of both specialization and context on mental health.

Previous research has found mixed results when determining the potential influence of MVPA on the relationship between sport and mental health in nonclinical populations (Bell, Audrey, Gunnell, Cooper, & Campbell, 2019; Doré et al., 2016, 2020; Siefken, Junge, & Laemmle, 2019). The current study found MVPA as a significant covariate; as such, results suggest that both VS and

OSS are forms of physical activity associated with improved mental health status regardless of MVPA. This study therefore supports research that has theorized that the context of physical activity is what is particularly beneficial, not necessarily the intensity of the activity itself (Brunet et al., 2014; Doré et al., 2016; Evans et al., 2017; Lubans et al., 2016). The impact of context on the relationship between physical activity and mental health may be based on the ability of that context to satisfy basic psychological needs (autonomy, competence, and relatedness; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Standage, Gillison, Ntoumanis, & Treasure, 2012). According to the Positive Youth Development model (Fraser-Thomas, Côté, & Deakin, 2005), greater benefits of mental health are seen when physical activity promotes positive psychological and social environments through supportive social relationships. It is therefore possible that sport participation, both within and outside of school, fulfill the three psychological needs and provide social support and acceptance, thereby positively influencing symptoms of depression and anxiety in youth. Future prospective research should explore these mechanisms in the relationships found.

The significant effect of sex on the relationship between sport and mental health in the current study supports earlier evidence (Guddal et al., 2019; Jewett et al., 2014). In males, depression and anxiety scores were significantly different between VS and non-VS participants. However, when comparing female VS participants to nonparticipants, varsity athletes had significantly lower depression scores, but no significant differences were found in anxiety scores. It is possible that the insignificant difference between VS and non-VS females is due to the high levels of anxiety found in females within the general (Kessler et al., 2012) and athletic populations (Dolenc, 2015; Pluhar et al., 2019; Yang et al., 2007). As anxiety levels are higher in females to begin with, it may be that participation in VS does not significantly impact anxiety symptoms. In addition, in males, the analysis revealed a significant difference in the variance of intercept and slope. The interpretation of the ICC revealed that 2% and 3% of variance for depression and anxiety scores was explained at the school level. This could indicate a potential contextual influence on mental health, in that pressures unique to individual schools could influence general levels of male varsity athlete anxiety and depression and/or could influence the effects of VS participation on anxiety.

Using a large and diverse sample of Canadian high school students, this study suggests that sport participation should be promoted for the prevention and management of adolescent mental illness. With such a sample, we can be more confident in generalizing our novel and valuable results to the Canadian adolescent population. Potential additive effects suggest students should be supported in participating in multiple sporting opportunities to increase the benefits of sport participation on internalizing symptoms. These conclusions should be interpreted with the following limitations in mind. First, cross-sectional data cannot infer causation. It is plausible that youth with fewer symptoms of depression and anxiety are more likely to participate in sport. Future research using prospective data should be used to address this limitation and establish the direction of the relationship between sport participation, depression, and anxiety symptoms. Second, the measures used in the current study do not differentiate between team and individual sport participation, or whether OSS was competitive or recreational in nature. The impact of both sport type and competition level on the relationship between sport

participation and mental health has been debated (Breistøl et al., 2017; Doré et al., 2016; McMahon et al., 2017). Third, although excluding sleep and screen as covariates were justified (Field, 2018), this should be considered a limitation. These variables have been shown to impact adolescent mental health (Shanahan et al., 2014; Twenge & Campbell, 2018), therefore, it is possible that the inclusion of these factors may have influenced results. In addition, the analysis did not control for frequency (hours per week) of participation in neither VS nor OSS. Similarly, the effect of additional extracurricular activities (e.g., art, academic, cultural clubs or volunteering) on depression and anxiety symptoms were not considered in this analysis. Both frequency (Eime et al., 2013; Panza et al., 2020) and involvement in other types of activities (Oberle et al., 2020) have been shown to impact adolescent mental health. As such, the current study may have missed a potential effect of these variables on the mental health of students.

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