

Physical Activity, School Climate, and the Emotional Health of Adolescents: Findings from 2010 Canadian Health Behaviour in School-Aged Children (HBSC) Study

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Abstract Positive mental health and well-being for school-aged children have become key areas of research, with studies that show school climate and physical activity as being potentially modifiable correlates of these outcomes. As such, the purpose of this study was to examine the role school climate and physical activity play in the well-being and emotional problems of younger (elementary) and older (secondary) students. Using data obtained from the 2009/2010 administration of the Health Behaviour in School-aged Children (HBSC) survey, this study plotted the combined and independent roles of school climate and physical activity in the perceived emotional well-being and emotional problems of adolescents across Canada ($N = \sim 26,000$ students, Grades 6–10). We ran a series of regressions to assess both the independent and combined influences of physical activity and school climate on (1) emotional well-being and (2) emotional problems. Our findings suggest that (1) there is no significant effect of grade, (2) for emotional well-being, both physical activity and school climate contribute significantly and relatively equally and independently, (3) for emotional problems, physical activity and school climate have independent but differential contributions, (4) physical activity and school

climate are more predictive of emotional well-being than of emotional problems. In conclusion, school climate and physical activity are potentially modifiable factors for school settings and could potentially be targeted to facilitate emotional well-being and reduce emotional problems in young people.

Keywords Physical activity · Emotional well-being · Adolescents · Emotional problems · School climate · HBSC

Introduction

Mental health and well-being are beginning to be recognized as important contributors to a satisfying and healthy life. As such, positive mental health and well-being for school-aged children have become areas requiring significant attention (Freeman & Luu, 2011; Kutcher, Hampton, & Wilson, 2010). Mental health and well-being are directly associated with a number of significant outcomes, including stress reduction, improving the ability to concentrate, reducing the effects of depression, and improving self-esteem (Frumkin, 2001; Maller, 2009). Conversely issues with mental health can lead to problems at home, at school, and in the community (Waddell, McEwen, Shepherd, Offord, & Hua, 2005), in addition to being predictive of an increased likelihood of conduct problems (e.g. being arrested, skipping school; Keyes, 2006) and mental health disorders in adulthood (Kessler et al., 2005); hence maintaining a focus on the mental health and well-being of school-aged children is essential for creating healthy and contributing adults.

Categories for mental health, such as “ill-being” or “emotional problems”, and “well-being” or “emotional health”, have been used interchangeably before to

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differentiate these components of mental health, which is a broad and diverse concept (e.g. Keyes, 2006; Reid, 2014). The absence of emotional problems does not necessarily indicate the presence of emotional health, and vice versa. As measurably exclusive concepts, emotional problems and emotional well-being have been examined separately in Canadian youth populations (Reid, 2014). Data from the last decade of Health Behaviour in School-aged Children (HBSC) survey indicate that there is a difference between younger (i.e. \leq Grade 8, or elementary school-aged students) and older (i.e. \geq Grade 9, or high school-aged students) in terms of their mental health and overall well-being. Older students tend to report more emotional problems and lower emotional well-being than younger students. Furthermore, this division between younger and older students is significant, given the developmental and physical changes taking place at this time (Kemper, 2002; MacCormack, 2014; Shearer & Moore, 2013). Adolescence is not a homogenous group; there are substantial developmental differences between older and younger students in terms of behaviour and emotional responses. To our knowledge, however, present research does not indicate the extent to which there is a differential predictive ability of physical activity and school climate on emotional well-being and emotional problems for younger versus older students. In addition to examining both emotional problems and emotional well-being, we also wanted to know whether younger and older students differ in how they were affected by certain mental health contributors, such as school climate and physical activity; it may be necessary to have different foci when creating interventions for, or teaching to, younger and older students.

School climate (e.g. Denny, Robinson, Milfont, & Grant, 2009; Freeman et al., 2009; Høglund & Leadbeater, 2004) and physical activity (e.g. Janssen & LeBlanc, 2010; Tremblay et al., 2011) are contributors to students' well-being or level of emotional problems. With respect to school climate, Høglund and Leadbeater (2004) examined through a longitudinal study of 432 (49 % girls) first-grade children across 17 schools that greater school disadvantage and poorer school climate were predictive of emotional problems in these school-aged children. In contrast, students who reported a more positive school climate had fewer emotional problems (Bradshaw, Waasdorp, & Leaf, 2012; Denny et al., 2009). Bradshaw et al. (2012) examined how a school-wide positive behavioural intervention program and supports system-affected students' behavioural problems. Their sample consisted of 12,344 elementary school children (47.1 % female), with a variety of demographic characteristics; the trial used a group randomized controlled effectiveness design implemented across 37 elementary schools. Teachers were asked to rate children's behavioural problems. The program had a

significant impact at reducing childhood behavioural problems and increasing social-emotional functioning, indicating the role that school climate and available supports for students may play in decreasing behavioural problems and improving social-emotional outcomes. Furthermore, students who had better relationships within their school and who reported a more positive school climate had the best outcomes for emotional health (see also Freeman et al., 2009). A school climate that is considered welcoming and safe provides a better climate for young people to develop their cognitive skills, confidence, overall well-being, and positive interactions with peers and teachers (Klinger, Mills, & Chapman, 2011). Adolescents thrive when they attend schools where academic work is emphasized, the physical space is maintained, and teachers use regular feedback to support high expectations (Kazdin, 1998). To account for the impact that school climate has on emotional well-being and the existence of emotional problems (DeSocio & Hootman, 2004), school-based indices are commonly included as covariate controls within the model (e.g. Volk, Craig, Boyce, & King, 2006). Instead of using school climate as a control, we sought to understand how well school climate could predict emotional well-being and emotional problems, and contribute to the literature our understanding of the role that school climate can play in children's lives.

In addition to school climate, physical activity may well be a contributor to positive mental health (Janssen & LeBlanc, 2010; Tremblay et al., 2011). It is widely recommended that all young people should participate in moderate-to-vigorous physical activity at least for 60 min per day to achieve health benefit (Canadian Society for Exercise Physiology [CSEP], 2013; Wadsworth et al., 2013). The physical health benefits of regular physical activity, whether from non-vigorous, moderate, or vigorous physical activity, in young people's lives include a gain in fitness levels, the development of healthy and strong bones, as well as the regulation of body weight and chronic-disease risk factors (e.g. high blood pressure, elevated blood cholesterol, and raised blood glucose levels; Janssen & LeBlanc, 2010). In addition to several benefits to a young person's physical health, participation in physical activity behaviours has numerous mental health benefits. In a systematic review of 86 studies that examined the relationships between physical activity, fitness, and health in school-aged children and youth, Janssen and LeBlanc (2010) found a consistent connection between daily physical activity in youth and improved self-efficacy and self-image, and, at the same time, a decrease in depressive symptoms. Conversely, sedentary behaviour is associated with an increased risk of cardio-metabolic disease, all-cause mortality, and a variety of physiological and psychological problems (Tremblay et al., 2011). Thus physical

activity may play a major role in the well-being of young people.

School climate informs the performance of academic achievement, behavioural problems, social-emotional functioning, and concentration problems (e.g. Bradshaw et al., 2012; Klinger, 2000), and physical activity leads to improvements in emotional and physical outcomes (e.g. Janssen & LeBlanc, 2010; Lubans, Plotnikoff, & Lubans, 2012). These studies demonstrate the need for further insight on how school climate and physical activity impact the emotional well-being and emotional problems of Canadian children. As such, the focus of this study was to examine the combined and independent role of both constructs (i.e. school climate and physical activity) as evidenced in the perceived emotional well-being and emotional problems of Canadian children. Such a dual analysis appears to be absent from the literature.

Social determinants, such as grade, gender, and socioeconomic status (SES), play a significant role in influencing youth perceptions relating to school (Adams & Gullotta, 1989; Bradley & Corwyn, 2002). SES has been linked to emotional well-being in children, but can be mediated through factors such as external support systems such as family and school (Bradley & Corwyn, 2002). Trends from the Canadian HBSC report, in addition to showing a difference between the mental health of younger and older students, show a distinct difference in emotional well-being between male and female students (Reid, 2014). Thus even though this study did not focus on the differences between genders or different SES levels, we wanted to account for grade, gender, and SES factors in our study. The following research questions guided this study:

1. To what extent do school climate and physical activity predict the emotional problems and emotional well-being of elementary school-aged (younger) students?
2. To what extent do school climate and physical activity predict emotional problems and emotional well-being of secondary school-aged school (older) students?

With knowledge about the impact of school climate on physical activity and academic achievement (e.g. Ntoumanis & Biddle, 1999; Tremblay, Inman, & Willms, 2000), as well as how physical activity and the school environment independently contribute to the experience of mental health (e.g. Bailey et al., 2009; Bond et al., 2007; Janssen & LeBlanc, 2010; Tyson, Wilson, Crone, Brailsford, & Laws, 2010), this study aims to (1) examine the differences between younger and older grades in the role that physical activity and school climate play in predicting the emotional well-being and emotional problems of students, (2) examine the differential prediction of emotional problems and emotional well-being through physical activity or school climate, and (3) examine whether or not

physical activity and school climate are more predictive of emotional problems or emotional well-being. Furthermore, this study uniquely contributes to the current literature in that it uses a large, nationally representative sample from the largest Canadian data set for this age group.

Method

Participants and Sampling

The data were drawn from the 2009/2010 Canadian HBSC survey, a physical health and mental health survey of adolescent and preadolescent children conducted in affiliation with the World Health Organization. The HBSC survey is conducted internationally; 26,052 children in Grades 6–10 completed the Canadian survey in the 2009/2010 cycle. For the purposes of the present study, the sample is split into two subsamples, younger grades (Grades 8 and below: 50.5 % female) and older grades (Grades 9 and above: 50.8 % female). The survey includes questions relating to health perceptions, behaviours, and outcomes, as well as questions about demographics and psychosocial elements. Institutional consent from school boards and individual schools was solicited; students provided personal consent, and parents provided parental consent. The HBSC is self-weighting and uses cluster sampling design to proportionately represent the distribution of schools by size, location, language, and religion. Previous work using HBSC has been published using unweighted analyses (e.g. Elgar, Roberts, Parry-Langdon, & Boyce, 2005; Smith-Khuri et al., 2004). The HBSC survey is conducted every 4 years in classrooms in countries across the world (Volk et al., 2006). The vast majority of nations are able to survey the recommended minimum sample size for each age group (1500 students per age group; Tabak et al., 2012). The use of the HBSC survey for sampling has been established in the literature and validated as a measurement (e.g. Currie, 1998). See Currie et al. (2001) for more information on the method and application of the HBSC survey.

Instruments

Three of the indices we used were established in the literature (Freeman et al., 2011; Freeman & Luu, 2011; Klinger et al., 2011) and include all of the variables present in the original indices. The Emotional Well-Being Index, the Emotional Problems Index, and the School Climate Index were each used in the Canadian National HBSC Report in addition to individual provincial HBSC reports in 2010 and were the confirmed scales for that data period (Freeman et al., 2011). The fourth index, Physical Activity,

was created for the purpose of this study. As such, it also includes all relevant variables. To increase the cohesion of the individual variables within each index, the variables were inverted so that they were positively aligned within the scale. For the indices, higher scores indicated a more positive response (for example, less feelings of anxiety or best possible life). Variables and indices were constructed from the questions available in the HBSC survey.

Emotional Well-Being Index

The Emotional Well-Being Index (Freeman & Luu, 2011) was constructed from five variables ($\alpha = .73$). The variables were answered on a Likert-type scale with a range of 1–5. The variables included questions about the last week (“Have you felt fit and well?”; “Have you felt full of energy?”; “Have you had fun with your friends?”) and the present time period (“I have a happy home life”; “I have confidence in myself”).

Emotional Problems Index

The Emotional Problems Index (Freeman & Luu, 2011) was constructed from nine variables ($\alpha = .84$). The variables were answered on a Likert-type scale with a range of 1–5. The variables included questions about the last week (“Have you felt sad?”), the last 6 months (“I have felt low”; “I have felt nervous”; “I have had difficulties in getting to sleep”), and the present time period (“I have trouble making decisions”; “I often wish I were someone else”; “I often feel helpless”; “I often feel left out of things”; “I often feel lonely”).

School Climate Index

The School Climate Index (Klinger et al., 2011) was constructed from eight variables ($\alpha = .84$). The variables were answered on a five-point Likert-type scale anchored with bipolar adjectives (e.g. always, never). The variables included questions about the present time period, sectioned into questions regarding the teacher (“My teachers are interested in me as a student”; “Most of my teachers are friendly”; “Our teachers treat us fairly”), the school itself (“The rules of this school are fair”; “Our school is a nice place to be”), and the individual within the school setting (“I feel I belong at this school”; “I am encouraged to express my own views in my classes”; “How do you feel about school at present?”).

Physical Activity Index

We created the Physical Activity Index by running a principal component analysis on all physical activity-

related items from the HBSC survey, selecting items with a factor loading $>.5$. We then ran a reliability analysis and removed items until the internal reliability was maximized. As items were initially scored on different scales, all items were standardized to a consistent five-point scale by calculating raw scores as percentages of the initial maximum original scale value, then recalculating from that percentage to a score out of five. Thus the resulting scale score out of five reflects a statistical rather than an exact participation rate. The higher number (i.e. “5”) represents a higher overall level of physical activity participation, and the lower number, (i.e. “1”) represents a lower overall level of physical activity participation. The resulting Physical Activity Index contained four items with an α value of .82. Two items asked about frequency of moderate-to-vigorous physical activity outside of school hours (“Outside of school hours, how many hours a week do you usually exercise in your free time so much that you get out of breath or sweat?”; “Outside of school hours, how often do you usually exercise in your free time so much that you get out of breath or sweat?”). The other two items asked about frequency of at least 60 min of physical activity in a week-long period (“In the past 7 days, how many days were spent doing 60 min of physical activity”; “In a typical week, how many days do you spend doing 60 min of physical activity”).

Gender, Grade, and SES

Gender was coded as females = 2 and males = 1. Grade was coded from Grades 6–10. Considering the range of grade divisions used by school boards and the developmental differences between younger and older youth, we designated two subgroups of grades. The end of Grade 8 is a meaningful threshold for group divisions because of the pubertal development of older adolescents. Differences between the psychology and behaviour of younger and older adolescents have been observed in areas such as bullying behaviour (MacCormack, 2014), physical activity (Kemper, 2002), and mental health (Shearer & Moore, 2013). The group called “older grades” represents Grades 9 and 10. The group “younger grades” represents Grades 6, 7, and 8.

Socio-economic Status

SES was measured based on the response to the question, “How well off do you think your family is?” with response adjectives ranging from, “1 = Very well off” to “5 = Not well off at all”. Even though a single self-reported question may seem insufficient to measure a complex construct, more complex indices may also be problematic. Questions that require children to disclose their family’s income,

education, and employment level may be left unanswered or answered poorly (Currie et al., 1997). Although the Family Affluence Scales (FAS followed by revised FAS II) have been used previously with the HBSC data, comparisons with census data have found that internal reliability of FAS II is even weaker in small towns and rural areas than in urban areas (Klinger, Luhanga, Sebok, & Freeman, 2013) and the Cronbach's α scores of FAS II are typically very low (e.g. $\alpha = .31$; Boudreau & Poulin, 2009). To compensate for the weaknesses of affluence scales, some researchers prefer to use a single item as a proxy for SES. Volk et al. (2006) used the child's perception item to control for SES in their examination of the influence of mental health and parental perceptions on school achievement. The choice by Volk and colleagues to use the single item for SES is a good model for this study because

both studies use Canadian data and are only measuring SES to control for its impact.

Analysis

The data were initially screened for outliers, and outliers were removed from the analyses (Volk et al., 2006). The outliers were randomly distributed across the data set, and their exclusion did not alter the results of the analyses.

For each analysis stage, we entered variables in blocks. For the first stage of analysis, we sought to find the predictive effect of each of our independent variables (School Climate and Physical Activity) on the first dependent variable (Emotional Well-Being), while controlling for gender, grade, and SES. The first block entered all the status variables (gender, grade, and SES). The Physical Activity Index and the School Climate Index were entered second. This analysis was conducted separately for younger-grade students and older-grade students. For the second stage of the analysis, we replaced the Emotional Well-Being Index with the Emotional Problems Index to find the variance accounted for by each Physical Activity and School Climate for both younger-grade and older-grade students, while controlling for gender, grade, and SES.

Results

The means and standard deviation scores are found in Table 1. All data represent the screened data with outliers removed.

Correlations between the variables are reported in Table 2 for younger-grade students and Table 3 for older-grade students. Correlations between all variables were significant, other than between grade and SES for younger students (Table 2). For older-grade students (Table 3), grade was only significantly correlated with the Emotional Well-being Index. Note that due to the large sample size, some small-magnitude correlations are significant.

Table 1 Means and standard deviation of indices and variables

Variables	M	SD
Grade		
Younger grades ($n = 15,636$)	7.00	.82
Older grades ($n = 10,442$)	9.50	.53
SES		
Younger grades ($n = 14,438$)	2.32	1.04
Older grades ($n = 10,020$)	2.38	.95
School climate index		
Younger grades ($n = 14,385$)	2.22	.78
Older grades ($n = 9892$)	2.43	.75
Physical activity index		
Younger grades ($n = 13,045$)	3.56	.94
Older grades ($n = 8572$)	3.46	1.00
Emotional problems index		
Younger grades ($n = 15,380$)	2.44	.82
Older grades ($n = 10,308$)	2.56	.79
Emotional well-being index		
Younger grades ($n = 14,936$)	3.90	.71
Older grades ($n = 9947$)	3.62	.72

Table 2 Correlations between variables—younger grades

Variables	1	2	3	4	5	6	7
1. Gender	X	.00	.21*	.09**	-.12**	.16**	-.11**
2. Grade		X	.02	-.19**	-.03**	.03**	-.15**
3. SES			X	.16**	-.11**	.21**	-.26**
4. School climate index				X	.07**	-.26**	.38**
5. Physical activity index					X	-.20**	.35**
6. Emotional problems index						X	-.51**
7. Emotional well-being index							X

* $p < .05$

** $p < .001$

Table 3 Correlations between variables—older grades

Variables	1	2	3	4	5	6	7
1. Gender	X	-.03**	.04**	.03**	-.15**	.20**	-.19**
2. Grade		X	.01	-.007	-.02	.00	-.03**
3. SES			X	-.16**	-.10**	.23**	-.31**
4. School climate index				X	.11**	-.27**	.38**
5. Physical activity index					X	-.20**	.34**
6. Emotional problems index						X	-.56**
7. Emotional well-being index							X

* $p < .05$

** $p < .001$

Table 4 Regression analysis for variables predicting emotional well-being, younger grades ($n = 11,375$)

Variables	<i>b</i>	SE <i>b</i>	β	R^2 total	R^2 change
Step 1					–
Gender	-.14	.01	-.10	.10**	
Grade	-.12	.01	-.14		
SES	-.17	.01	-.26		
Step 2					.20**
Gender	-.13	.01	-.10	.30**	
Grade	-.06	.01	-.08		
SES	-.13	.01	-.17		
Physical activity index	.22	.01	.30		
School climate index	.04	.00	.33		

* $p < .05$

** $p < .001$. All β s $p < .001$

Tables 4 and 5 show the results of the regression analyses¹ (including β values) predicting Emotional Well-Being for both younger grades and older grades. Collectively, Gender, Grade, SES, School Climate, and Physical Activity significantly predicted Emotional Well-Being for younger grades [Table 4: $F(1, 11,369) = 1605.78, p < .001$] and for older grades [Table 5: $F(1, 7828) = 1054.04, p < .001$] accounting for slightly less than one-third of the variance in Emotional Well-Being ($R^2 = .30$ for younger grades, and $R^2 = .31$ for older grades). After controlling for grade, gender, and SES, school climate ($\beta = .33, p < .001, sr^2$ unique = .10 for younger grades; $\beta = .32, p < .001, sr^2$ unique = .10 for older grades) and Physical Activity ($\beta = .30, sr^2$ unique = .09 younger grades; $\beta = .27, sr^2$ unique = .07 older grades, $p < .001$ for both younger and older grades) each contributed significantly and independently. Therefore, the additional variance accounted for by School Climate was 10 % for younger grades and 10 % for older grades. The additional variance accounted for by

¹ Analyses were also run using a provincial weighting with no differences in ultimate conclusions. Thus the unweighted results are presented here.

Table 5 Regression analysis for variables predicting emotional well-being, older grades ($n = 7834$)

Variables	<i>B</i>	SE <i>b</i>	β	R^2 total	R^2 change
Step 1					–
Gender	-.21	.02	-.15	.12**	
Grade	-.05	.02	-.03		
SES	-.23	.01	-.30		
Step 2					.19**
Gender	-.17	.01	-.12	.31**	
Grade	-.04	.01	-.03		
SES	-.17	.01	-.23		
Physical activity index	.19	.01	.27		
School climate index	.04	.00	.32		

* $p < .05$

** $p < .001$. All β s $p < .001$

Physical Activity was 9 % for younger grades and 7 % for older grades. Contributions of School Climate and Physical Activity to predicting Emotional Well-Being were largely non-overlapping.

Tables 6 and 7 show the results of the regression analyses (including β values) predicting Emotional Problems for both younger grades and older grades. Collectively, Gender, Grade, SES, Physical Activity, and School Climate significantly predicted Emotional Problems in younger grades [Table 6: $F(1, 11,514) = 514.22, p < .001$] and older grades [Table 7: $F(1, 8014) = 334.216, p < .001$], accounting for about 15 % of the variance in Emotional Problems for younger students ($R^2 = .14$; adjusted $R^2 = .14$) and older students ($R^2 = .16$; adjusted $R^2 = .16$). School Climate ($\beta = -.24, p < .001, sr^2$ unique = .05 for younger grades; $\beta = -.23, p < .001, sr^2$ unique = .05 for older grades) was the greater independent contributor, although both School Climate and Physical Activity ($\beta = -.15, p < .001, sr^2$ unique = .02, Physical Activity, younger students; $\beta = -.13, p < .001, sr^2$ unique = .02, Physical Activity older students) independently significantly contributed. Therefore, the independent

Table 6 Regression analysis for variables predicting emotional problems, younger grades ($n = 11,520$)

Variables	<i>b</i>	SE <i>b</i>	β	R^2 total	R^2 change
Step 1					
Gender	.25	.02	.15	.07**	–
Grade	.03	.01	.03*		
SES	.16	.01	.21		
Step 2					
Gender	.25	.01	.16	.14**	.07**
Grade	–.02	.01	–.02*		
SES	.12	.01	.15		
Physical activity index	–.13	.01	–.15		
School climate index	–.03	.01	–.24		

* $p < .05$ ** $p < .001$. All β s $p < .001$, unless otherwise indicated**Table 7** Regression analysis for variables predicting emotional problems, older grades ($n = 8020$)

Variables	<i>B</i>	SE <i>b</i>	β	R^2 total	R^2 change
Step 1					
Gender	.31	.02	.20	.09**	–
Grade	.01	.02	.01		
SES	.18	.01	.22		
Step 2					
Gender	.29	.02	.19	.16**	.07**
Grade	.01	.02	.00		
SES	.14	.01	.17		
Physical activity index	–.10	.01	–.13		
School climate index	–.03	.00	–.23		

* $p < .05$ ** $p < .001$. All β s $p < .001$, except grade β s which were not found to be significant

contribution of variance accounted for by School Climate over and above demographic variables was 5 % for younger and older grades. The independent contribution of variance accounted for by Physical Activity over and above demographic variables was 2 % for both younger and older grades.

Discussion

Using the Canadian HBSC data for 2009/2010, we examined the extent to which school climate and physical activity were able to predict the emotional well-being and emotional problems of students. With the understanding that grade, gender, and SES play a significant role in the well-being and emotional problems of children (Adams & Gullotta, 1989; Bradley & Corwyn, 2002; Freeman & Luu, 2011), we accounted for these three factors in our analysis.

We hypothesized that school climate and physical activity would each positively predict the well-being and negatively predict the emotional problems of both younger-grade and older-grade students.

Overall, (1) there were no major differences between younger and older grades in terms of school climate and physical activity predicting emotional problems and emotional well-being, (2) for emotional well-being, both physical activity and school climate predicted significantly, equally, and independently, (3) for emotional problems, physical activity and school climate had independent but differential predictability, and (4) physical activity and school climate were more predictive of emotional well-being than of emotional problems.

Emotional Well-Being

Grade, gender, SES, physical activity, and school climate, combined, explained approximately 30 % of the variance for emotional well-being for both younger and older school students. The covariates together (SES, grade, and gender) accounted for approximately the same amount of variance (approximately 10 %) that physical activity and school climate each accounted for independently (approximately 10 % each, with slightly less for physical activity).

Additionally, there were no differences found between the variance explained for emotional well-being by physical activity and school climate for younger and older grades, despite the differences in emotional well-being and emotional problems for these groups (Reid, 2014). This lack of difference may indicate that school climate and physical activity both play an equally important role to younger and older students alike, despite the differential levels of emotional well-being.

Physical activity and school climate have the benefit of being potentially modifiable when compared to demographic variables, and therefore possible targets for

intervention. Physical activity is an area that is modifiable on an individual basis; modifying physical activity in the daily life of a child either at school or at home could have potential implications for the overall mental health of the child. In addition, modifying school climate as a social variable would create a space where many students could be reached (Suldo, McMahan, Chappel, & Loker, 2012).

Although the present study does not examine specific mechanisms of change in regard to physical activity, other studies have found that physical activity is a predictor of well-being via the mechanisms of increased self-esteem, the removal of negative guilt often associated with not doing physical activity, and enhanced mood (Biddle & Mutrie, 2008). In a similar vein, physical activity is associated with a decrease in depressive symptoms, as well as increased self-efficacy and more positive self-image (Janssen & LeBlanc, 2010). Physical activity is an important contributor to mental health and offers affective benefits for school-aged children (e.g. Bailey et al., 2009; Janssen & LeBlanc, 2010).

Our findings regarding the association between emotional well-being and school climate complement previous findings that students who feel a sense of connectedness with their school are less likely to struggle with emotional well-being difficulties (e.g. Wold, Samdal, Nutbeam, & Kannas, 1998). Adolescents are more likely to report high levels of emotional well-being when they enjoy their school, consider the teachers and system to be fair, have opportunities to express their views, and perceive their teachers to be friendly and engaged (Klinger, 2011). School climate and physical activity appear to be equally important at both the younger and older school level, lending credence to the idea of including both of these factors when examining students' well-being at both levels.

Emotional Problems

Grade, gender, SES, physical activity, and school climate combined explained approximately 15 % of the variance for emotional problems at both the younger- and older-grade levels. There were no differences between the contribution of physical activity and school climate to emotional problems for younger or older grades.

Although both physical activity and school climate were significant, school climate was a stronger predictor of emotional problems when compared to physical activity. While school climate and physical activity together predicted less variance in emotional problems than in emotional well-being, physical activity and school climate should be taken into consideration, in combination with other factors, when dealing with emotional problems for students in both the younger and older grades. Previous research has suggested that students' positive perceptions

of school climate are associated with fewer emotional problems (e.g. Haynes, Emmons, & Ben-Avie, 1997; Kuperminc, Leadbeater, & Blatt, 2001). Additionally, there has been some research to suggest that a positive school climate has a major effect for students at greater risk of academic, emotional, and behavioural difficulties (e.g. Haynes et al., 1997). When their school experience is engaging and positive, adolescents are less likely to participate with like-minded peers in risky behaviour (Bond et al., 2007; Klinger, 2011). The importance of physical activity on emotional problems is supported in a longitudinal study by Wiles et al. (2008), where children aged 11–14 getting at least 1 h of physical activity per day had fewer emotional problems at a 1-year follow-up.

Differential Prediction of Emotional Well-Being and Emotional Problems

Similar to previous research (e.g. Lubans et al., 2012), this study showed that physical activity has a viable link to the emotional well-being of school-aged students. In addition, our findings support the idea that emotional problems and emotional well-being are separate entities (Keyes, 2006). Therefore, alleviating emotional problems is not the same as promoting emotional thriving. The implications of this finding advocate for the use of school-based interventions that focus on asset-promotion in addition to deficit-reduction (Morgan & Ziglio, 2007). Although it is important to recognize problems (i.e. deficit-reduction approach), the asset-promotion approach allows for the opportunity to maximize key modifiable assets, such as the promotion of physical activity and school climate for emotional well-being, necessary for population health.

The nature of the differential prediction of emotional well-being and emotional problems by physical activity and school climate is not made clear by the present study. A possible explanation of the differential prediction may be that the improvement in emotional well-being and the reduction in emotional problems require some degree of student engagement for students to benefit from the asset-promoting characteristics of physical activity and school climate. Students with greater emotional problems may not have as much capacity to benefit from experiencing a positive school climate or participating in physical activities; thus, these variables are less predictive of emotional problems (Janssen & LeBlanc, 2010). Another possible explanation is that emotional well-being may be more linked to daily experiences, such as physical activity or a positive school climate (Suldo et al., 2012), while emotional problems are a more all-encompassing phenomenon and therefore less influenced by singular environmental characteristics. Tackling complex health issues, such as reducing emotional problems, requires a

multidimensional strategy that includes a range of programs and intervention strategies (Government of Ontario, 2006). According to multitier pyramids that describe the impact of different programs and interventions ranging from broad-based socio-economic factors to focused individualized counselling (e.g. five-tier health impact pyramid, Frieden, 2010), reducing emotional problems may require contextual changes (e.g. school climate and increase physical activity) as well as individual interventions (e.g. counselling and therapy).

Limitations and Future Directions

The results of this study are strengthened by its large and nationally representative sample of the adolescent population in Canada. As with similar large-scale data sets, the data were self-reported instead of objectively measured by students and thus potentially subject to biases inherent to self-report procedures (e.g. positive presentation bias). This bias might have been reduced by the data procedures that ensured anonymity of responses. Future research could look to use more objective measures. For example, physical activity in this study was a self-reported measure; future studies could consider the use of pedometers or accelerometers for the direct assessment of students' physical activity levels. In addition to the measures being self-reported items, the items and scales were limited to the content of the 2010 HBSC survey: However, these items and scales have been used extensively in previous research (e.g. Freeman et al., 2011) and allow for standard comparisons across countries. Creating the Physical Activity Scale was a unique contribution to the analysis of HBSC data sets. Additionally, future researchers might consider analyses that address the potentially nested nature of the data (e.g. hierarchical linear modelling to look at classrooms within schools, within provinces).

Although this study used a coherent measure of school climate, a more in-depth and multifaceted exploration may lend greater insight into the specific mechanisms of influence on emotional problems and emotional well-being. In a similar vein, this quantitative large-scale measurement allows for establishing relationships between variables, but the intricacies of those relationships remain unexplored. Following up the results of this study with a qualitative research design that examined the nuances of the relationship between school climate, physical activity, and both emotional problems and emotional well-being may provide greater insight into what specific contribution each of these factors is making. Such a study is now underway.

As well, for this study, we explored how physical activity and school climate predicted emotional well-being and emotional problems; future studies could examine the

reverse directionality (i.e. how emotional well-being and emotional problems might predict physical activity levels and perceptions of school climate). In addition, future research could continue to focus on the asset-promotion model of school health and search for the interplay of modifiable characteristics, such as physical activity and school climate that could contribute to the positive well-being of youth. Additionally, while gender differences were controlled for, future studies could examine the differences between males and females in using physical activity and school climate to predict emotional well-being and emotional problems.

Using the HBSC data provides a large-scale picture of student health. Using the physical activity and school climate portions of the data set provided an opportunity to see major influences on emotional well-being in Canadian students' lives. Understanding that the emotional well-being of students can be influenced by both school climate and physical activity emphasizes the importance for teachers, principals, administrators, and students maintaining a concerted effort on improving the climate of schools, in addition to providing opportunity for students to be physically active on a regular basis, especially given that these are modifiable factors.

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