

# A MULTILEVEL ANALYSIS OF THE EFFECT OF SCHOOL EXPERIENCES ON INJURY AND LEISURE ACTIVITIES AMONG CANADIAN CHILDREN

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**ABSTRACT.** Using Canadian data from the 1998 Cross-National Survey on Health Behaviors in School-Aged Children, the present study examined the effects of school experiences on injury and leisure activities among Canadian students. Health outcomes were classified into two categories: injury (with and without medical treatment) and leisure activities (time spent on television and computer games, frequency of exercise, and hours of exercise). Multilevel analysis of cross-sectional data (from Grades 6 to 10) indicated that injury among students increased slightly over time and students increasingly lived an inactive life as they grew older. Student injury was not closely associated with either individual characteristics or school experiences. Gender emerged as the strongest student-level predictor of leisure activities. Characteristics of effective schools in which students spent less time on display screens included (a) positive peer influence, (b) fair school rules, and (c) positive sense of belonging to school. School experiences highlighted positive sense of belonging to school as the strongest school-level predictor of physical activities.

## UNE ANALYSE À NIVEAUX MULTIPLES DES EFFETS DES EXPÉRIENCES SCOLAIRES DES ENFANTS CANADIENS SUR LES BLESSURES ET LES ACTIVITÉS DE LOISIR

**RÉSUMÉ.** À l'aide de données canadiennes tirées de l'enquête transnationale de 1998 sur les comportements liés à la santé des jeunes d'âge scolaire, la présente étude a examiné les effets des expériences scolaires sur les blessures et les activités de loisir chez les élèves canadiens. Les conséquences pour la santé ont été classées dans deux catégories : les blessures (avec et sans traitement médical) et les activités de loisir (le temps consacré à la télévision et aux jeux informatiques, la fréquence de l'exercice et les heures d'exercice). L'analyse à niveaux multiples des données transversales (de la 6<sup>e</sup> à la 10<sup>e</sup> année) a révélé que les blessures chez les élèves ont légèrement augmenté au fil du temps et que les élèves menaient une vie de moins en moins active à mesure qu'ils vieillissaient. Les blessures n'étaient pas étroitement liées aux caractéristiques individuelles ou aux expériences scolaires. Le sexe des élèves s'est révélé le principal indicateur prévisionnel des activités de loisir. Les caractéristiques des écoles actives dans lesquelles les élèves passaient moins de temps devant des écrans comprenaient notamment (a) une influence positive des pairs, (b) un règlement d'école équitable et (c) un sentiment

positif d'appartenance à l'école. Les expériences scolaires ont fait ressortir ce sentiment positif d'appartenance comme le principal indicateur prévisionnel des activités physiques à l'école.

**H**ealth outcomes are in large part the product of lifestyle choices, and these choices begin to be made before adulthood (Lammers, 1996). Researchers have witnessed an increase in risk factors related to lifestyle choices among children (e.g., Taubert, Moller, & Washington, 1996). Some of the most obvious examples are the increase in time spent watching display screens and the decrease in participation in physical activities. Ganley and Sherman (2000) considered regular physical activities as important to facilitate weight control, strengthen bones, and reduce risks in mental and cardiovascular disorders. In fact, they claimed that an active childhood helps promote lifetime fitness.

Injuries do occur in physical activities. According to Di Scala, Gallagher, and Schneps (1997), recreational areas are the most likely place where injuries occur; and most injuries are unintentional and tend to occur among children 10 to 14 years of age as a result of collision, tripping, and falling in sport and recreation (see also Junkins, Jr., et al., 1999). Most experts agree that with simple instructions children can enjoy their physical activities while reducing the risk of injury (e.g., Ganley & Sherman, 2000).

With input from a group of North America's most authoritative injury prevention experts, the National Fire Protection Association in the United States initiated the first comprehensive injury prevention program designed for use in classrooms, "Risk Watch," that teaches children how to detect risks and approach risks in a way that avoids, reduces, or eliminates injury. In Canada, Sunnybrook Hospital sponsored a very similar injury prevention program, "Smart Risk." These programs aim to develop awareness and knowledge of injury prevention in sport and recreation so that children can participate and engage in physical activities both actively and safely.

Although injury and leisure activities seemingly have nothing to do with schools, schools are in a unique position to promote health. Most well-known is perhaps the fact that schools can use health education curricula and health promotion programs to develop health literacy – the knowledge, values, attitudes, and beliefs necessary for health supportive decision making. Most adverse health outcomes can be effectively prevented through the "development of knowledge, positive attitudes, and healthy behaviors" (Lammers, 1996, p. 278), which health education curricula seek to achieve with knowledge of proper nutrition, drug awareness, and appreciation of exercise. An unfortunate reality is that health education has been reduced in high school in several Canadian provinces. A number of researchers see

existing health education curricula and health promotion programs as not as effective as one might expect (see Lammers, 1996). Furthermore, studies suggest that potential benefits of these programs are often minimized by factors outside these programs, one of which is the lack of physical activities in leisure time (e.g., Ignico & Mahon, 1994, Lammers, 1996).

In addition to school health education curricula, a supportive school environment in itself can help develop health-enhancing behaviors. Students tend to experience more satisfaction with their schools when they feel safe, are fairly treated, and are supported by their teachers (Samdal, Nutbeam, Wold, & Kannas, 1998). In contrast, students who are dissatisfied with their schools because of low student autonomy and unreasonable teacher expectations are more likely to engage in smoking and drinking (Samdal, Wold, Klepp, & Kannas, 1998). In general, students tend to be more likely to engage in health-compromising behaviors when they experience alienation in school (Jessor, 1991; Nutbeam & Aaro, 1991; Nutbeam, Aaro, & Catford, 1989; Nutbeam, Smith, Moore, & Bauman, 1993). In this sense, a non-supportive school environment can constitute a health risk to students.

Students' behaviors are usually influenced by schooling processes which refer to the many variables associated with schooling that affect educational outcomes either directly or indirectly. Schooling processes can often be classified into two sets of variables. One set describes the context of a school, such as school size, school location, teacher experience, and characteristics of student intakes. The other set of variables, often referred to as "evaluative variables," are associated with the climate of the school. These evaluative variables portray the inner workings of school life, for example, how students and staff are organized for instruction, the formal and informal rules that govern school operation, the nature of interactions between students and staff, and the attitudes, values, and expectations of students, parents, and teachers.

A number of research studies have shown that several evaluative variables are strongly related to student educational outcomes. For example, three of the most important evaluative variables, which can be directly controlled through the actions of teachers, parents, and principals, are the disciplinary climate of the school, the academic expectations of peers and teachers (often referred to as academic press), and the extent of parental involvement in children's education. In the area of school health, Henderson and Rowe (1998) advocated a healthy school environment that supports students' learning and contributes to their health. They listed essential elements of such a healthy school environment as (a) minimizing distractions; (b) minimizing physical, psychological, and social hazards; (c) creating a climate in which students and school staff do their best work; (d) expecting that all students can succeed; and (e) implementing supportive policies. In essence,

these elements are well in line with the theoretical emphasis on schooling processes.

Simons-Morton, Crump, Haynie, and Saylor (1999) have made the criticism that so little scientific attention has been given to the complex interactions between students and school environment that there is little working knowledge for policymakers regarding how school experiences affect students' health outcomes and behaviors. The availability of the data from the Cross-National Survey on Health Behaviors in School-Aged Children (HBSC) has made it possible for researchers to fill in this gap in the research literature.

The present study attempted to analyze leisure activities of Canadian children, with a focus on the impact of school experiences on participation in leisure activities. As a related issue, injury was also examined because most injuries do happen in leisure activities such as sport and recreation. The significance of the present study can be appreciated from various perspectives. Using a nationally representative sample, the present study provides nationally representative evidence on injury and leisure activities that parents, educators, health professionals, program staff, and policymakers can use to create awareness and develop measures that target certain groups of students to minimize injury and promote positive leisure pursuits. It also provides nationally representative base-line data against which program evaluators can assess future preventions and interventions on injury and leisure activities for effectiveness.

As presented earlier, school environment is related to risk behaviors. The present study helps identify schooling processes that govern this relationship. Schooling processes in the present study touch the reformative notions of democratic involvement of students (with such measures as sense of belonging to school and feeling about school roles) and active engagement in learning (with such measures as academic press and parental involvement). Refined efforts along this line of research can focus on these and other reformative notions such as accountability and inclusionary practices. Knowledge that can be gained from such research (including the present one) is critical to our understanding of the role and mechanism of schools in promoting positive health outcomes and behaviors.

As a foreshadow of findings in the present study, there is empirical evidence that lifestyle choices are determined by much more than individuals. Friends, parents, and educators all have critical influences on children's lifestyle. Access to activities is related to the "interactions" or "relationships" formed throughout childhood. In other words, learning, according to Vygotsky and many others, is socially constructed. This is why it is essential to examine health outcomes and behaviors in the social environment in which children spend most of their days – school. It is the intention of the present study to

recognize that lifestyle choices, just like academic mastery, are products of social interactions and relationships and that analysis of these social interactions and relationships in school holds the key to understanding children's lifestyle choices.

## METHOD

### *Data*

Canadian data from the 1998 Cross-National Survey on Health Behaviors in School-Aged Children (HBSC) were used in the present study to examine the effects of school experiences on injury and leisure activities among Canadian students. Targeting students in Grades 6 to 10, the HBSC randomly and systematically selected school classes in Canada (i.e., sampling unit is school class). All children born between January 1 and December 31 in 1982 to 1986 in the sampled classes participated in the HBSC. Canadian samples included 2,112 students in the sixth grade, 2,056 students in the seventh grade, 2,225 students in the eighth grade, 2,362 students in the ninth grade, and 2,517 students in the tenth grade.

### *Variables*

Five health outcomes and behaviors were used as outcome variables, classified into two categories: injury (injury with medical treatment and injury without medical treatment) and leisure activities (time spent on television and computer games, frequency of exercise, and hours of exercise). These outcome measures were constructed into dummy (0, 1) variables to facilitate the use of probability to describe the health events of interest (as is conventional in medical research) and to deal with the use of irregular scales in the HBSC (i.e., intervals between choice options are not equal). Appendix 1 presents coding information on these outcome variables.

Independent variables included a number of student-level and school-level variables as predictors of injury and leisure activities. Student-level variables included gender, age, mother's socioeconomic status (SES), father's SES, number of parents, and academic status. Gender was renamed as female (female = 1 and male = 0). Two measures of SES were created on the basis of parental occupation (mother SES and father SES). Number of parents ranged from not living with any parents to living with both parents. Academic status was a measure of a student's perception of his or her academic ability in comparison to others.

Because all information was obtained from students in the HBSC, the student-level information was aggregated to the school level to construct 12 school-level variables in two categories. School context variables included school mean mother's SES and school mean father's SES. School climate

variables included positive circle of friends, negative circle of friends, peer environment, academic press, fair school rules, student skipping class, school safety, child-parent relationship, parental involvement, and sense of belonging to school. To improve students' health outcomes and behaviors through schooling, these school climate variables are important targets of investigation, because they can be controlled directly by politicians, administrators, educators, and parents.

In the HBSC, *positive circle of friends* measured the extent to which a student's friends value schooling, academic work, and a good relationship with parents, whereas *negative circle of friends* measured the extent to which a student's friends use substances (drugs, alcohol, and tobacco) and carry weapons. *Peer environment* measured the nature of the social environment in which students interact with one another (enjoying being together, being kind and helpful, and having mutual respect). *Academic press* measured the academic expectations that school staff hold for their students and the academic attitudes that school staff have toward their students. *Fair school rules* measured student perceptions of school rules as being fair. *Student skipping class* measured the frequency that students skip classes. *School safety* measured student perceptions of school as being a safe place. *Child-parent relationship* measured how comfortably students interact with their parents and how positively students feel about their parents. *Parental involvement* measured how actively parents get involved with their children's education. *Sense of belonging to school* measured the extent to which students value their memberships with their schools.

### *Statistical procedures*

The sampling procedure in the HBSC resulted in data hierarchy with students nested within schools. Data analysis must take this data hierarchy into account. For this reason, multilevel modeling techniques were adopted for data analysis in the present study (Bryk & Raudenbush, 1992). Multilevel modeling techniques allow one to separate individual differences in an outcome measure from school effects on the outcome measure so that school effects are estimated as the effects over and above individual differences. Because health outcome measures were dichotomous, multilevel logistic models were employed in data analysis (see Bryk & Raudenbush, 1992). A series of multilevel models were developed to examine the relationship of injury and leisure activities to student-level and school-level variables. These models had two levels. The first-level model was the student model, and the second-level model was the school model. Data analysis was performed in two stages.

In the first stage, student-level models (one for each school) were developed (without any predictors at the school level) to examine the effects of

student characteristics on their health outcomes and behaviors. Students within each school provided a school average measure on a particular health outcome, and these school average measures (one from each school) became the outcome variable at the school level. In the second stage, a school-level model was developed in which school context and climate variables were introduced to model those school average measures (one from each school) on the particular health outcome. Such a multilevel model therefore estimated not only effects of student-level variables but also effects of school-level variables over and above those of student-level variables. The same procedure was carried out for each of the grade levels to detect patterns of changes across grade levels.

Note that student-level variables were either centered around their means or standardized to have a mean of zero and a standard deviation of one so that the grand mean estimated in the multilevel model became a meaningful measure of a particular health outcome for what is often referred to as the “typical (Canadian) student” with nationally average characteristics (in terms of gender, age, mother’s SES, father’s SES, number of parents, and academic status) (see Bryk & Raudenbush, 1992). As a national average measure on that particular health outcome, this estimate is informative and important.

## RESULTS

Descriptive statistics for outcome measures on injury and leisure activities are presented in Appendix 2. Injury measures included being injured at least once with medical treatment (mirroring serious injury) and being injured at least once without medical treatment (mirroring minor injury). Both the proportion of students injured with medical treatment and the proportion of students injured without medical treatment were similar across grades. Leisure activities measures included watching TV at least 2 hours daily and playing computer games at least 4 hours weekly, exercising every day, and exercising at least 7 hours weekly. The proportion of students watching TV and playing computer games decreased slightly across grades, and so did the proportion of students exercising daily. The proportion of students exercising at least 7 hours weekly remained similar across grades.

### *Probabilities of injury and leisure activities*

Descriptive statistics based on raw data provided only preliminary ideas about injury and leisure activities among students. Table 1 presents estimated probabilities for the typical student on injury and leisure activities, with adjustment for sampling and measurement errors. The typical student was about 33% likely in Grade 6, about 41% likely in Grade 7, about 42% likely in Grade 8, about 45% likely in Grade 9, and about 41% likely in Grade 10

to have an injury at least once that needed medical treatment. The typical student was about 37% likely in Grade 6, about 42% likely in Grade 7, about 41% likely in Grade 8, about 42% likely in Grade 9, and about 38% likely in Grade 10 to have an injury at least once that did not need medical treatment.

**TABLE 1.** Probability of injury and leisure activities for the typical Canadian student with nationally average characteristics, by grade levels

|                                                            | Grade 6 | Grade 7 | Grade 8 | Grade 9 | Grade 10 |
|------------------------------------------------------------|---------|---------|---------|---------|----------|
| Being injured at least once requiring medical treatment    | 0.33    | 0.41    | 0.42    | 0.45    | 0.41     |
| Being injured at least once requiring no medical treatment | 0.37    | 0.42    | 0.41    | 0.42    | 0.38     |
| Watching television and playing computer games             | 0.18    | 0.22    | 0.16    | 0.15    | 0.09     |
| Exercising everyday                                        | 0.24    | 0.26    | 0.19    | 0.16    | 0.12     |
| Exercising at least 7 hours weekly                         | 0.17    | 0.22    | 0.21    | 0.18    | 0.17     |

**NOTE.** Estimates for watching television and playing computer games measure the probability that the typical Canadian student watches television at least 2 hours daily and plays computer games at least 4 hours weekly.

The typical student was about 18% likely in Grade 6, about 22% likely in Grade 7, about 16% likely in Grade 8, about 15% likely in Grade 9, and about 9% likely in Grade 10 to watch TV (at least 2 hours daily) and play computer games (at least 4 hours weekly). The typical student was about 24% likely in Grade 6, about 26% likely in Grade 7, about 19% likely in Grade 8, about 16% likely in Grade 9, and about 12% likely in Grade 10 to exercise every day. Finally, the typical student was about 17% likely in Grade 6, about 22% likely in Grade 7, about 21% likely in Grade 8, about 18% likely in Grade 9, and about 17% likely in Grade 10 to exercise at least 7 hours weekly.

#### *Effects of student-level and school-level variables on injury*

Table 2 shows multilevel modeling results on being injured at least once with medical treatment. Male students were about 1.52 times as likely (1 / 0.66) in Grade 6 and about 1.25 times as likely (1 / 0.80) in Grade 10 to have serious injury as female students. Students with high mother's SES were about 1.14 times as likely in Grade 8 and about 1.21 times as likely in Grade 10 to have serious injury as students with low mother's SES. Students who considered themselves as having lower (or worse) academic status were



about 1.33 times as likely (1 / 0.75) in Grade 7, about 1.28 times as likely (1 / 0.78) in Grade 9, and about 1.14 times as likely (1 / 0.88) in Grade 10 to have serious injury as students who considered themselves as having higher (or better) academic status.

At the school level, students in schools with the presence of a negative circle of friends were about 1.31 times as likely in Grade 10 to have serious injury as students in schools with the absence of a negative circle of friends. Students in schools with unfair school rules were about 1.85 times as likely (1 / 0.54) in Grade 8 to have serious injury as students in schools with fair school rules. In Grade 10, however, students in schools with fair school rules

**TABLE 2.** HLM results estimating the effects of student-level and school-level variables on injury requiring medical treatment, by grade levels

|                              | Grade 6 |      | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|------------------------------|---------|------|---------|------|---------|------|---------|------|----------|------|
|                              | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp      | SE   |
| <b>STUDENT-LEVEL EFFECTS</b> |         |      |         |      |         |      |         |      |          |      |
| Female (vs. male)            | 0.66    | 0.16 |         |      |         |      |         |      | 0.80     | 0.10 |
| Mother's SES                 |         |      |         |      | 1.14    | 0.06 | 1.21    | 0.07 |          |      |
| Academic status              |         |      | 0.75    | 0.10 |         |      | 0.78    | 0.08 | 0.88     | 0.06 |
| <b>SCHOOL-LEVEL EFFECTS</b>  |         |      |         |      |         |      |         |      |          |      |
| Negative circle of friends   |         |      |         |      |         |      |         |      | 1.31     | 0.11 |
| Fair school rules            |         |      |         |      | 0.54    | 0.16 | 1.68    | 0.21 |          |      |
| School mean mother's SES     |         |      |         |      |         |      |         |      | 1.22     | 0.07 |

**NOTE.** Estimates come from simplified models with statistically significant variables only (0.05 as the level of significance). Exp denotes the regression result in terms of *e* raised to the power of the effect of a predictor variable, which is the expected change in probability that an event occurs associated with one unit increase in the predictor variable.

were about 1.68 times as likely to have serious injury as students in schools with unfair school rules. Students in schools with higher school mean mother's SES were about 1.22 times as likely in Grade 10 to have serious injury as students in schools with lower school mean mother's SES.

It appears that the most important variables at the student level were gender (Grades 6 and 10) and academic status (Grades 7, 9, and 10). The effect of gender was larger in Grade 6 than in Grade 10. Academic status showed effects in 3 out of 5 grade levels, and the effect of academic status decreased across grades. The most important variables at the school level were school rules (Grades 8 and 9) and negative circle of friends (Grade 10). No school-

level variables showed effects in more than 2 grade levels, indicating a lack of consistency in effect among variables at the school level.

Table 3 presents multilevel modeling results on being injured at least once without medical treatment. There was only one statistically significant variable at the student level. Students who considered themselves as having lower (or worse) academic status were about 1.41 times as likely (1 / 0.71) in Grade 7, about 1.32 times as likely (1 / 0.76) in Grade 9, and about 1.39 times as likely (1 / 0.74) in Grade 10 to have minor injury as students who considered themselves as having higher (or better) academic status.

At the school level, students in schools with fair school rules were about 1.45 times as likely to have minor injury in Grade 9 as students in schools with unfair school rules. Students in schools where skipping class was more

**TABLE 3.** HLM results estimating the effects of student-level and school-level variables on injury requiring no medical treatment, by grade levels

|                        | Grade 6 |    | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|------------------------|---------|----|---------|------|---------|------|---------|------|----------|------|
|                        | Exp     | SE | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp      | SE   |
| STUDENT-LEVEL EFFECTS  |         |    |         |      |         |      |         |      |          |      |
| Academic status        |         |    | 0.71    | 0.08 |         |      | 0.76    | 0.08 | 0.74     | 0.07 |
| SCHOOL-LEVEL EFFECTS   |         |    |         |      |         |      |         |      |          |      |
| Fair school rules      |         |    |         |      |         |      | 1.45    | 0.16 |          |      |
| Student skipping class |         |    |         |      | 0.61    | 0.20 |         |      |          |      |

**NOTE.** Estimates come from simplified models with statistically significant variables only (0.05 as the level of significance). Exp denotes the regression result in terms of  $\beta$  raised to the power of the effect of a predictor variable, which is the expected change in probability that an event occurs associated with one unit increase in the predictor variable. There are no statistically significant variables at the student and school levels in Grade 6.

often among students were about 1.64 times as likely (1 / 0.61) to have minor injury in Grade 8 as students in schools where skipping class was less often among students.

It seems that the most important variable at the student level was academic status. Academic status showed effects in 3 out of 5 grade levels (Grades 7, 9, and 10), and the effect remained similar across grades. The most important variables at the school level were student skipping class (Grade 8) and school rules (Grade 9). No school-level variables showed effects in more than 1 grade level.

*Effects of student-level and school-level variables on leisure activities*

Table 4 shows multilevel modeling results on watching TV at least 2 hours daily and playing computer games at least 4 hours weekly. Male students were about 4.00 times as likely (1 / 0.25) in Grade 6, about 4.00 times as likely (1 / 0.25) in Grade 7, about 5.88 times as likely (1 / 0.21) in Grade 8, about 6.67 times as likely (1 / 0.17) in Grade 9, and about 10.00 times as likely (1 / 0.10) in Grade 10 as female students to watch TV and play computer games. Younger students were more likely to watch TV and play computer games than older students (in the same grade level). Consider two students with their age one month apart. The younger student was about 1.03 times as likely (1 / 0.97) in Grade 10 to watch TV and play computer games as the older student.

**TABLE 4.** HLM results estimating the effects of student-level and school-level variables on watching television and playing computer games, by grade levels

|                              | Grade 6 |      | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|------------------------------|---------|------|---------|------|---------|------|---------|------|----------|------|
|                              | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp      | SE   |
| <b>STUDENT-LEVEL EFFECTS</b> |         |      |         |      |         |      |         |      |          |      |
| Female (vs. male)            | 0.25    | 0.23 | 0.25    | 0.21 | 0.17    | 0.25 | 0.15    | 0.24 | 0.10     | 0.19 |
| Age                          |         |      |         |      |         |      |         |      | 0.97     | 0.01 |
| Father's SES                 | 0.75    | 0.10 |         |      |         |      |         |      | 0.85     | 0.07 |
| Academic status              |         |      |         |      |         |      | 0.79    | 0.11 |          |      |
| <b>SCHOOL-LEVEL EFFECTS</b>  |         |      |         |      |         |      |         |      |          |      |
| Positive circle of friends   |         |      |         |      |         |      | 0.42    | 0.33 |          |      |
| Peer environment             |         |      |         |      |         |      | 0.37    | 0.44 |          |      |
| Fair school rules            |         |      |         |      | 0.52    | 0.23 |         |      |          |      |
| Sense of belonging to school |         |      |         |      |         |      |         |      | 0.49     | 0.23 |

**NOTE.** Estimates come from simplified models with statistically significant variables only (0.05 as the level of significance). Exp denotes the regression result in terms of *e* raised to the power of the effect of a predictor variable, which is the expected change in probability that an event occurs associated with one unit increase in the predictor variable.

Students with low father's SES were about 1.33 times as likely (1 / 0.75) in Grade 6 and about 1.18 times as likely (1 / 0.85) in Grade 10 to watch TV and play computer games as students with high father's SES. Students who considered themselves as having lower (or worse) academic status were about 1.27 times as likely in Grade 9 to watch TV and play computer games as students who considered themselves as having higher (or better) academic status.

At the school level, students in schools with the absence of a positive circle of friends were about 2.38 times as likely (1 / 0.42) in Grade 9 to watch TV and play computer games as students in schools with the presence of a positive circle of friends. Also in Grade 9, students in schools with negative peer environment were about 2.70 times as likely (1 / 0.37) to watch TV and play computer games as students in schools with positive peer environment. Students in schools with fair school rules were about 1.92 times as likely (1 / 0.52) to watch TV and play computer games in Grade 8 as students in schools with unfair school rules. Finally, students in schools with negative sense of belonging to school were about 2.04 times as likely (1 / 0.49) to watch TV and play computer games in Grade 10 as students in schools with positive sense of belonging to school.

The most important variables at the student level were gender (Grades 6 to 10) and father's SES (Grades 6 and 10). Gender showed effects in all grade levels, and the effect of gender increased substantially across grades. The effect of father's SES was similar in both grades. The most important variables at the school level were negative circle of friend (Grade 9), peer environment (Grade 9), and sense of belonging to school (Grade 10). No school-level variables showed effects in more than 1 grade level.

Table 5 presents multilevel modeling results on exercising everyday. Male students were about 1.96 times as likely (1 / 0.51) in Grade 6, about 1.59 times as likely (1 / 0.63) in Grade 7, about 1.92 times as likely (1 / 0.52) in Grade 8, about 2.86 times as likely (1 / 0.35) in Grade 9, and about 2.08 times as likely (1 / 0.48) in Grade 10 as female students to exercise everyday.

**TABLE 5.** HLM results estimating the effects of student-level and school-level variables on exercising everyday, by grade levels

|                              | Grade 6 |      | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|------------------------------|---------|------|---------|------|---------|------|---------|------|----------|------|
|                              | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp      | SE   |
| <b>STUDENT-LEVEL EFFECTS</b> |         |      |         |      |         |      |         |      |          |      |
| Female (vs. male)            | 0.51    | 0.17 | 0.63    | 0.16 | 0.52    | 0.21 | 0.35    | 0.20 | 0.48     | 0.07 |
| <b>SCHOOL-LEVEL EFFECTS</b>  |         |      |         |      |         |      |         |      |          |      |
| Negative circle of friends   |         |      |         |      | 1.60    | 0.21 |         |      |          |      |
| Sense of belonging to school |         |      |         |      |         |      | 2.14    | 0.31 |          |      |

**NOTE.** Estimates come from simplified models with statistically significant variables only (0.05 as the level of significance). Exp denotes the regression result in terms of  $e$  raised to the power of the effect of a predictor variable, which is the expected change in probability that an event occurs associated with one unit increase in the predictor variable.

At school-level, students in schools with the presence of a negative circle of friends were about 1.60 times as likely to exercise everyday in Grade 8 as students in schools with the absence of a negative circle of friends. Students in schools with positive sense of belonging to school were about 2.14 times as likely to exercise everyday in Grade 9 as students in schools with negative sense of belonging to school.

The most important variable at the student level was gender (Grades 6 to 10). Gender showed effects in all grade levels. The effect was substantially larger in the later grades than in the earlier grades. The most important variables at the school level were sense of belonging to school (Grade 9) and negative circle of friends (Grade 8). No school-level variables showed effects in more than 1 grade level.

Table 6 shows multilevel modeling results on exercising at least 7 hours weekly. Male students were about 1.82 times as likely (1 / 0.55) in Grade 6, about 2.13 times as likely (1 / 0.47) in Grade 7, about 2.38 times as likely (1 / 0.42) in Grade 8, about 3.03 times as likely (1 / 0.33) in Grade 9, and about 2.02 times as likely (1 / 0.45) in Grade 10 to exercise at least 7 hours weekly as female students. Students with high mother's SES were about 1.20 times as likely in Grade 9 and about 1.19 times as likely in Grade 10 to exercise at least 7 hours weekly as students with low mother's SES. Students who considered themselves as having higher (or better) academic status were about 1.31 times as likely in Grade 6 and about 1.32 times as likely in Grade 10 to exercise at least 7 hours weekly as students who considered themselves as having lower (or worse) academic status.

**TABLE 6.** HLM results estimating the effects of student-level and school-level variables on exercising at least 7 hours weekly, by grade levels

|                              | Grade 6 |      | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|------------------------------|---------|------|---------|------|---------|------|---------|------|----------|------|
|                              | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp     | SE   | Exp      | SE   |
| <b>STUDENT-LEVEL EFFECTS</b> |         |      |         |      |         |      |         |      |          |      |
| Female (vs. male)            | 0.55    | 0.21 | 0.47    | 0.17 | 0.42    | 0.17 | 0.33    | 0.16 | 0.45     | 0.12 |
| Mother's SES                 |         |      |         |      |         |      | 1.20    | 0.09 | 1.19     | 0.07 |
| Academic status              | 1.31    | 0.13 |         |      |         |      |         |      | 1.32     | 0.08 |
| <b>SCHOOL-LEVEL EFFECTS</b>  |         |      |         |      |         |      |         |      |          |      |
| Fair school rules            |         |      |         |      | 0.67    | 0.21 |         |      |          |      |
| School mean mother's SES     |         |      |         |      |         |      |         |      | 1.25     | 0.09 |

**NOTE.** Estimates come from simplified models with statistically significant variables only (0.05 as the level of significance). Exp denotes the regression result in terms of *e* raised to the power of the effect of a predictor variable, which is the expected change in probability that an event occurs associated with one unit increase in the predictor variable.

At the school level, students in schools with unfair school rules were about 1.49 times as likely ( $1 / 0.67$ ) to exercise at least 7 hours weekly in Grade 8 as students in schools with fair school rules. Students in schools with higher school mean mother's SES were about 1.25 times as likely to exercise at least 7 hours weekly in Grade 10 as students in schools with lower school mean mother's SES.

The most important variables at the student level were gender (Grades 6 to 10) and academic status (Grades 6 and 10). Gender showed effects in all grade levels. The effect of gender became substantial in Grade 8 and peaked in Grade 9. The effect of academic status remained almost the same across grades. The most important variables at the school level were school rules (Grade 8) and school mean mother's SES (Grade 10). No school-level variables showed effects in more than 1 grade level.

## DISCUSSION

The present study aimed to examine the effects of students' school experiences on their injury and leisure activities. Studies of school effects on academic outcomes typically show small and inconsistent effects at the school level. This does not mean that schools have small and inconsistent effects on student academic outcomes. Most variation in academic outcomes is "absorbed" by variables at the student level. This is why school effects are interpreted as effects over and above student effects (one of the advantages of multilevel data analysis). School-level variables that can significantly explain the "residual" or "leftover" variation in academic outcomes are truly powerful predictors of student academic outcomes. The same logic holds true with health outcomes. As a matter of fact, school effects on health outcomes as shown in the present study are greater than school effects on academic outcomes as typically shown in the literature. Therefore, significant school-level variables identified in the present study are truly powerful predictors of student health outcomes and behaviors (injury and leisure activities in the present case).

### *Injury among Canadian children*

Injury (both serious and minor) showed a slight growth from Grade 6 to Grade 9 (with a peak in Grade 9), but injury (both serious and minor) declined slightly at the beginning of senior high school (Grade 10). More than one in three Canadian students suffered from injury (in terms of both serious and minor injury) during a period of 12 months. Such statistics highlight the need for safety education and injury prevention among Canadian children. This is where programs such as "Risk Watch" and "Smart Risk" can really make a difference if parents and educators can bring these programs into homes and classrooms for safety education.

Overall, student injury (either serious or minor) was not closely associated with their individual characteristics and their school experiences. At the student level, compared with female students, male students were more vulnerable to serious injury at the end of elementary school (Grade 6). This finding is well in line with Junkins et al. (1999) who described students at high risk of injury as male ones in Grade 4 to Grade 6. At the school level, disciplinary climate emerged in Grades 8 and 9 as the strongest predictor of student injury. Findings like this that link injury with school experiences are rare in the research literature. However, students in schools with both good and poor disciplinary climate could be injured. Thus, safety education and injury prevention are necessary regardless of students' individual and school background.

The HBSC data did not allow identification of the cause of injury. It is important for school staff to find out causes of students' injuries. The point is to make sure that injuries occurred in schools with poor disciplinary climate are not due to serious causes, such as bullying, fighting, and rough playing. For injuries occurring in schools with good disciplinary climate, school staff need to identify whether injuries occur inside school or outside school. If injuries occur inside school, students are likely practicing unsafe activities (for example, games involving chasing and pushing). Adult supervision in the hallway and on the playground can substantially reduce incidents of injuries in school. If injuries occur outside school, parents need to be informed that students have been injured outside school. Parental attention and supervision can then be emphasized to prevent further incidents of injuries outside school.

### *Leisure activities among Canadian children*

Participation in leisure activities appears to indicate a critical grade level, the beginning of junior high school (Grade 7) in which all three measures of leisure activities peaked. This situation indicates that Canadian students tend to engage in leisure activities more intensively in Grade 7 than in other grades. It represents a good opportunity for school staff to help students establish healthy lifestyles. Participation in leisure activities declined slightly but consistently thereafter. This is certainly good news regarding watching display screens. For example, in Grade 10, just about 1 in 10 students watched display screens excessively. However, statistics are worrisome regarding exercising. For example, in Grade 10, fewer than 2 in 10 students exercised regularly (everyday or at least 7 hours each week). It appears that Canadian students are living an inactive life.

At the student level, gender emerged as the single strongest predictor of leisure activities (across all three measures). Male students spent substantially more time watching display screens than female students, with the gender gap increasing significantly from Grade 6 to Grade 10. Compared with

female students, male students are more vulnerable to display screens (for example, about 10 times as likely as female students to watch display screens in Grade 10). School staff need to target male students for watching display screens as soon as they get into junior high schools. On the other hand, female students spent substantially less time in physical activities than male students, with the gender gap peaking in Grades 9 and 10. Compared with male students, female students are more vulnerable to an inactive lifestyle. School staff need to target female students for physical activities as soon as they get into junior high schools.

Effects of school experiences on students' leisure activities did not appear until Grade 8, and schools made a difference in students' leisure activities in subsequent grades. Schools can adequately respond to the public concern about students' watching display screens excessively, because they appear to be able to help alter this unhealthy lifestyle. Characteristics of effective schools in which students spent less time on display screens can be described as (a) positive peer influence (including positive circle of friends and peer environment), (b) fair school rules, and (c) positive sense of belonging to school. Fair school rules were important in Grade 8, peer influence emerged as the strongest predictor of watching display screens in Grade 9, and sense of belonging to school was important in Grade 10. Therefore, school staff may intervene in upper junior high school grades to change students' behaviors of watching display screens, and may specifically target Grade 9 as the critical grade level for behavior change through creating positive peer influence (e.g., using appropriate role models).

School staff may need to pay close attention to leisure activities within peer groups. Administrators and teachers can obtain a general picture of students' leisure activities through, for example, simple questionnaires and informal chats with students and parents. This information helps school staff develop extracurricular activities that reduce students' watching display screens, such as academic clubs, technology clubs, arts clubs, and sport activities. It is very important that schools develop adequate extracurricular programs and encourage students to participate in them.

When students see fairness in school rules and have a positive sense of belonging to school, they spend more time on school activities rather than going home or to the mall to watch display screens. School staff should make every effort to make students feel at home in school. To achieve fairness of school rules, students can be involved in making those rules. To some extent, the reformative notion of democratic involvement of students does appear relevant in addressing health outcomes and behaviors. To achieve a positive sense of belonging to school, students need to feel cared for and valued in their school. Students usually feel proud and valued when they help perform lunch duties, help collect homework assignments, help



organize field trips, help supervise younger students in lower grade levels, and contribute special talents to school events. Fair school rules and positive sense of belonging to school can ensure students' willingness and desire to take part in extracurricular activities that usually take students away from display screens to develop their special talents.

When it comes to physical activities, school experiences highlight positive sense of belonging to school as the single strongest predictor in Grade 9. School staff may target upper junior high school grades for change in students' exercising behaviors through creating positive sense of belonging to school. Schools usually offer excellent sport facilities for students to use. However, unless students have positive sense of belonging to school, they are unlikely to take advantage of those sport facilities.

The positive fact that female students spent a lot less time watching display screens than male students (across all grade levels) is compromised seriously by the negative fact that female students also spent a lot less time in physical activities (in terms of both frequency and duration of physical activities) than male students (across all grade levels). Physical education teachers need to realize this situation and organize more physical activities suitable for and interesting to female students. Most physical education teachers are adequately knowledgeable about age-appropriate and gender-appropriate physical activities, and they should make an effort to make these physical activities available to female students and attract them to participate. In particular, female physical education teachers can set up good examples for female students and lead them to participation in appropriate physical activities.

Finally, there needs to be a recognition of alternative physical activities. In addition to the traditional team-oriented sport activities, school staff may need to find out what other activities appeal to students (in particular female students). Those activities may be dancing, skating, hiking, martial arts, or track and field. School staff can then design appropriate programs to attract students to participate in physical activities.

#### *Research contribution and suggestion*

School-level variables in the current study measured and emphasized multi-dimensional climatic characteristics of schools that often reinforce student cognitive and affective processes associated with health. Many climatic (reinforcing) variables at the school level (e.g., fairness of school rules and sense of belonging to school) were found to be important to student health outcomes and behaviors in injury and leisure activities. In addition, results of the current study support the public concern about lifestyle choices and risk factors of young adolescents. For example, findings concerning leisure activities (excessive watching of display screens and lack of adequate exer-

cise) have provided additional evidence that the public concern about lifestyle choices and risk factors of young adolescents is real and urgent. Policymakers, administrators, and educators need to take immediate actions to stop negative trends in student health outcomes and behaviors in injury and leisure activities.

Results of the current study have also extended the research literature on adolescent health. The study has provided a large amount of new working knowledge for policymaking purposes. For example, critical transition periods (grade levels) for health intervention on health behaviors (e.g., behaviors associated with leisure activities) have been identified. Most findings from the current study have not been observed in the research literature (e.g., the critical impact of sense of belonging to school). These new findings will serve not only to generate new working knowledge but also to indicate new research directions, thus opening many new doors to further investigations into adolescent health outcomes and behaviors.

Injury and leisure activities are treated as outcomes in the current study. In doing so, it focuses on individual differences in and school effects on injury and leisure activities. This type of research is useful to identify prevention and intervention targets and strategies for school health education or physical education. The current study is an invitation for research to consider injury and leisure activities as predictors of, say, learning or health outcomes. Research of this nature focuses on the impact of injury and leisure activities on learning or health outcomes of interest. This type of research is useful to identify elements of injury and leisure activities that promote or hinder the well-being of children in learning or health. In doing so, it reveals desirable goals for school health education or physical education to achieve. Both types of studies are necessary to gain a full understanding of the role of injury and leisure activities in the life of today's children.

#### *Summary of policy implications*

It is well recognized that promoting positive health outcomes and behaviors among children needs to be a joint effort of parents, educators, and policymakers. Results of the current study offer support for this recognition in terms of injury prevention and healthy lifestyle promotion. Parents need to educate their children and monitor their children's activities outside school to prevent injury. School staff need to monitor student activities inside school to prevent injury. School staff should target male students to reduce the time spent on watching display screens and female students to increase the amount of physical activities. Administrators and teachers need to develop extracurricular programs to reduce students' watching display screens, and they need to make age-appropriate and gender-appropriate physical activities available to female students and attract them to participate.

The nature of peer groups (circles of friends) is significantly related to the time spent on watching display screens and the amount of physical activities. It is important that school staff influence peer groups and create a positive peer environment (with measures such as awareness programs, reward programs, role models, and close adult supervision). The level of student sense of belonging to school is significantly related to the time spent on watching display screens and the amount of physical activities. It is important that school staff improve student sense of belonging to school (with measures such as performing lunch duties, collecting homework assignments, arranging field trips, supervising younger students in lower grade levels, and contributing special talents to school events). The level of school disciplinary climate (in particular, disciplinary rules and student absenteeism) is significantly related to the time spent on watching display screens and the amount of physical activities. It is important that school staff work towards a supportive school disciplinary environment with clear and fair rules.

Policymakers may want to consider restoring school health education curriculum to develop adequate health literacy among students—the knowledge, values, attitudes, and beliefs necessary for health supportive decision making. Programs that provide adequate training for school staff on health promotion and intervention can help a school's effort in preventing injury and promoting healthy lifestyles. Policymakers may also want to consider creating (at least mobile) school nurses' positions to provide guidance and assistance for school health promotion and intervention.

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## APPENDIX I

### DESCRIPTION OF HEALTH OUTCOMES MEASURES

#### *Injury with medical treatment*

During the past 12 month, were you hurt or injured and had to be treated by a doctor or a nurse (0 = None, 1 = 1 time, 2 = 2 times, 3 = 3 times, 4 = 4 or more times)? A dummy variable, named "injured at least once with medical treatment," is created, coded 0 if students register "None", 1 if students register "1 time" or "2 times" or "3 times" or "4 or more times."

#### *Injury without medical treatment*

During the past 12 months, how many times were you injured so that you missed one full day of school or other usual activities, but were not treated by a nurse or a doctor (0 = None, 1 = 1 time, 2 = 2 times, 3 = 3 times, 4 = 4 or more times)? A dummy variable, named "injured at least once without medical treatment," is created, coded 0 if students register "None," 1 if students register "1 time" or "2 times" or "3 times" or "4 or more times."

#### *Time spent on display screens*

(a) How many hours a day do you usually watch television (0 = None, 1 = Less than a half hour a day, 2 = Between a half and one hour a day, 3 = 2 to 3 hours a day, 4 = 4 hours a day, 5 = more than 4 hours a day)? (b) How many hours a week do you usually play computer games (including arcade games, Nintendo, Sega) (0 = None, 1 = Less than 1 hour a week, 2 = 1 to 3 hours a week, 3 = 4 to 6 hours a week, 4 = 7 to 9 hours a week, 5 = 10 or more hours a week)? A dummy variable, named "watching television at least 2 hours daily and playing computer games at least 4 hours weekly," is created, coded 0 if students do not register both "2-3 hours a day" or "4 hours a day" or "More than 4 hours a day" for television and "4-6 hours a week"

or “7-9 hours a week” or “10 or more hours a week” for computer games, 1 if students register both “2-3 hours a day” or “4 hours a day” or “More than 4 hours a day” for television and “4-6 hours a week” or “7-9 hours a week” or “10 or more hours a week” for computer games.

**Frequency of Exercise**

Outside school hours in your free time, how often do you exercise so that you get out of breath or sweat (0 = None, 1 = Less than once a month, 2 = Once a month, 3 = Once a week, 4 = 2 to 3 times a week, 5 = 4 to 6 times a week, 6 = Every day)? A dummy variable, named “exercising everyday” is created, coded 0 if students register “Never” or “Less than one a month” or “Once a month” or “Once a week” or “2 to 3 times a week” or “4 to 6 times a week”, 1 if students register “Every day”.

**Hours of Exercise**

Outside school hours in your free time, how many hours a week do you usually exercise so that you get out of breath or sweat (0 = None, 1 = About a half hour a week, 2 = About 1 hour a week, 3 = About 2 to 3 hours a week, 4 = About 4 to 6 hours a week, 5 = 7 hours or more a week)? A dummy variable, named “exercising at least 7 hours weekly” is created, coded 0 if students register “None” or “About a half hour a week” or “About 1 hour a week” or “About 2 to 3 hours a week” or “About 4 to 6 hours a week”, 1 if students register “7 hours or more a week”.

**APPENDIX II**

**DESCRIPTIVE STATISTICS ON INJURY AND LEASURE ACTIVITIES, BY GRADE LEVELS**

|                                                                                                              | Grade 6 |      | Grade 7 |      | Grade 8 |      | Grade 9 |      | Grade 10 |      |
|--------------------------------------------------------------------------------------------------------------|---------|------|---------|------|---------|------|---------|------|----------|------|
|                                                                                                              | M       | SD   | M       | SD   | M       | SD   | M       | SD   | M        | SD   |
| <b>INJURY</b>                                                                                                |         |      |         |      |         |      |         |      |          |      |
| Proportion of students injured at least once with medical treatment                                          |         |      |         |      |         |      |         |      |          |      |
|                                                                                                              | 0.34    | 0.47 | 0.40    | 0.49 | 0.41    | 0.49 | 0.44    | 0.50 | 0.40     | 0.49 |
| Proportion of students injured at least once without medical treatment                                       |         |      |         |      |         |      |         |      |          |      |
|                                                                                                              | 0.37    | 0.48 | 0.39    | 0.49 | 0.39    | 0.49 | 0.41    | 0.49 | 0.38     | 0.49 |
| <b>LEISURE ACTIVITIES</b>                                                                                    |         |      |         |      |         |      |         |      |          |      |
| Proportion of students watching TV at least 2 hours daily and playing computer games at least 4 hours weekly |         |      |         |      |         |      |         |      |          |      |
|                                                                                                              | 0.20    | 0.40 | 0.24    | 0.43 | 0.19    | 0.40 | 0.19    | 0.40 | 0.14     | 0.35 |
| Proportion of students exercising everyday                                                                   |         |      |         |      |         |      |         |      |          |      |
|                                                                                                              | 0.25    | 0.43 | 0.26    | 0.44 | 0.20    | 0.40 | 0.17    | 0.37 | 0.13     | 0.34 |
| Proportion of students exercising at least 7 hours weekly                                                    |         |      |         |      |         |      |         |      |          |      |
|                                                                                                              | 0.18    | 0.38 | 0.21    | 0.41 | 0.21    | 0.41 | 0.20    | 0.39 | 0.18     | 0.39 |

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