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Effect of a Ban on Extracurricular Sports Activities by Secondary School Teachers on Physical Activity Levels of Adolescents: A Multilevel Analysis

Roman Pabayo, MSc
Jennifer O'Loughlin, PhD
Lise Gauvin, PhD
Gilles Paradis, MD, MSc
Katherine Gray-Donald, PhD

To study the effect of a teachers' ban on supervising sports-related extracurricular physical activities (ECAs), levels of physical activity among 979 grade 7 students (mean age = 12.7 [0.5] years at baseline) were compared during and after the ban in seven schools that fully implemented the ban, and three schools that did not implement the ban fully. On average, schools offered 18.0 (*SD* = 5.1) ECAs during a no-ban school year. Students attending full implementation schools were significantly more likely than students in nonimplementation schools to be active after the ban ended (odds ratio for being active = 1.89 [95% confidence interval: 1.39, 2.58]). They also increased the number of physical activities in which they participated (coefficient = 4.04; *SE* = 1.01). Ending a teachers' ban on sports-related ECAs was associated with increased involvement in physical activity among secondary school students.

Keywords: *adolescent; physical activity; school*

Physical activity promotes optimal growth and development in children and adolescents. It prevents short-term health problems, and over the lifespan, it may prevent long-term chronic diseases such as diabetes, cancers, and cardiovascular disease (Story & Neumark-Sztainer, 1999). Recent secular declines in levels of physical activity among

Roman Pabayo, Toronto Public Health Planning and Policy, Toronto, Ontario, Canada. Jennifer O'Loughlin, Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, Montreal, Canada. Lise Gauvin, Faculté de Médecine, Groupe de Recherche Interdisciplinaire en Santé and Médecine Sociale et Préventive, Université de Montréal, Canada. Gilles Paradis, Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, and Direction de Santé Publique de Montréal-Centre, Montreal, Canada. Katherine Gray-Donald, School of Dietetics and Human Nutrition, Macdonald Campus, McGill University, Montreal, Canada.

Address correspondence to Dr. Jennifer O'Loughlin, Department of Epidemiology, Biostatistics, and Occupational Health, 1020 Pine Avenue West, McGill University, Montreal, Quebec H3A1A2; phone: (514) 398-3231; e-mail: jennifer.oloughlin@mcgill.ca.

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children and adolescents (Centers for Disease Control and Prevention [CDC], 1995, 1998; Health Canada, 1999; U.S. Department of Health and Human Services, 1996) are of considerable concern because inactivity early in life may track from childhood to adolescence and adulthood (Kelder, Perry, Klepp, & Lytle, 1994; Kuh & Cooper, 1992; Malina, 1996; Pate, Baranowski, Dowda, & Trost, 1996; Suter & Hawes, 1993; Telama, Leskinen, & Yang, 1996; Telama, Xiaolin, Laakso, & Viikari, 1997). In addition, patterns of physical inactivity can be linked to the increasing prevalence of overweight and obesity among children and adolescents (Berkey et al., 2000; Eisenmann, Bartee, & Wang, 2002; Garaulet et al., 2000; Gordon-Larsen, Adair, & Popkin, 2002; Health Canada, 1999).

Although numerous cross-sectional and longitudinal studies have identified a variety of sociodemographic and psychosocial factors related to physical activity in youth (Gordon-Larsen, McMurray, & Popkin, 2000; Kohl & Hobbs, 1998; Sallis, Prochaska, Taylor, Hill, & Geraci, 1999), there is growing interest in better understanding how the physical environment relates to activity levels (Sallis, Kraft, & Linton, 2002). In particular, it is recognized that schools can provide many opportunities to promote physical activity beyond the physical education class, through extracurricular activities including intra- and extramural sports teams and special sports events. Although ecologic models suggesting that environmental factors can affect behavior are gaining recognition, there is in fact very little empirical support for the role of environmental factors in influencing regular involvement in physical activity in youth (Sallis et al., 2002). Much will be learned through randomized trials involving manipulation of environmental factors. However, new information can also be gathered through investigations of naturally occurring events. In this study, we examined the effect of a naturally occurring event that decreased opportunities for physical activity in high school students, namely a ban by teachers on supervising sports-related extracurricular activities (ECAs) for students. In September 1999, as a pressure tactic in the context of collective bargaining negotiations, secondary school teachers in Montreal refused to supervise ECAs from September 1999 to January 2000. The ban was implemented differentially across schools providing a unique opportunity to study how activity-promoting environmental factors affect levels of physical activity among adolescents.

METHOD

As part of the ongoing McGill University Study on the Natural History of Nicotine Dependence in Teens (the NDIT Study), longitudinal data on physical activity are collected every 3 to 4 months in a sample of 1,293 grade 7 students initially aged 12 to 13 years (56.2% of those eligible to participate), in a convenience sample of 10 secondary schools in Montreal. Baseline data were collected through self-report questionnaires completed at school between October 1999 and January 2000. Trained technicians measured height, weight, and triceps skinfold thickness according to a standardized protocol (Evers & Hooper, 1995). Follow-up questionnaire data were collected every 3 to 4 months thereafter. Signed consent was obtained from both students and a parent/guardian, and ethical approval was obtained from the McGill University Faculty of Medicine Institutional Review Board. A detailed description of the study methods has been published (O'Loughlin et al., 2002).

Study Variables

Sociodemographic data included sex, age, language spoken at home, family composition, and parental education. Schools were classified as being low/average, or high income, based on the mean household income of students attending each school (Marceau, Cowley, & Bernier, 2001).

Frequency of involvement in physical activity was determined using a 7-day recall adapted from the Weekly Activity Checklist (Sallis et al., 1993) to reflect common physical activities engaged in by adolescents in Montreal. For each of the preceding 7 days, students checked which of 25 physical activities they had participated in on that day. A frequency score was computed for each student by summing the total number of activities checked across all 7 days. The original instrument correlated with an objective activity measure (Caltrac accelerometer) at $r = .34$, $p < .01$, and 3-day test-retest reliability was 0.74 (Sallis et al., 1993). Our version of the instrument was used in a previous study that indicated higher frequency of physical activity was related to significantly higher mean intakes of energy (Johnson-Down, O'Loughlin, Koski, & Gray-Donald, 1997). We used two measures of involvement in physical activity as outcome variables, including the number of activities that students engaged in during the previous week and whether or not research participants were physically active. Specifically, for each measurement period, children were categorized as being active (i.e., participating in at least 7 activities per week) or inactive (participating in less than 7 activities per week) (U.S. Department of Health and Human Services, 1996).

Body mass index (BMI) was computed with the following formula: weight (kg)/height $(m)^2$. Participants were categorized as overweight (yes, no) according to BMI percentiles for males and females aged 12 years (Cole, Bellizzi, Flegal, & Dietz, 2000). To avoid classifying muscular children or those with a large bone structure as overweight according to BMI criteria, participants must also have had a triceps skinfold thickness over the 85th sex-specific percentile of the sample to be categorized as overweight (Johnson-Down et al., 1997).

To obtain data on the number of sports-related ECAs offered in each school, school principals or vice-principals completed a self-report questionnaire that provided data on intramural and extramural sports teams available in the school, as well as on the number and type of special events related to physical activity held each year in the school (i.e., Terry Fox Run; Jump Rope for Heart). A series of questions identified physical activity programs and events available during a usual school year during which there was no ECA ban. Schools were categorized as providing many (≥ 18) or few (< 18) sports-related ECAs and special events during a no-ban school year. A second series of questions collected data on these same indicators for the period during which the ECA ban was in effect. Schools were categorized as "high implementation schools" if there were a substantially lower number of sports-related ECAs and special sports events during the ban (i.e., lost more than 60% of ECAs). "Low implementation schools" included those with little or no difference in the number of ECAs and special sports events during the ban compared to a no-ban school year.

Data Analysis

Data for this analysis were drawn from baseline data collected during the fall of 1999 when the ban was in effect, and from questionnaire data collected 1 year later during fall 2000; 94.2% of baseline participants completed the 1-year follow-up questionnaire. Because repeated measures of activity were nested within persons who in turn were nested within schools, and because the ban was implemented at the school level, we applied multilevel modeling analyses for both the continuous outcome (i.e., number of physical activities engaged in) and the dichotomous (Bernouilli) activity status outcome. Multilevel models are a generalization of the general linear model used in traditional regression analysis, which are gaining widespread acceptance and use in the public health and physical activity literatures. These analytic methods have two features that render them particularly well-suited to this data set: (a) multilevel models allow for the analysis of hierarchically structured data sets (e.g., repeated measures nested within individuals nested within schools); (b) multilevel models allow for the relaxation of the assumption of fixed coefficients (i.e., values on the outcome variable being homogeneous at baseline) (Diez-Roux, 2000). Several authors (Diez-Roux, 2000; Raudenbush & Bryk, 2002) have shown that ignoring the hierarchical structure of a data set can lead to inferential errors and that estimating random effect coefficients can more adequately model data structures typically obtained in field research.

To clarify the effects attributable to ending a ban on physical activity involvement, we adopted a step-up approach (Raudenbush & Bryk, 2002). We first estimated a null model that decomposed the variance into the percentages associated with each of the changes across measurement periods (i.e., repeated measures), between person variations (i.e., individual difference variables), and between school differences (i.e., school-level characteristics and events). For the activity status outcome, we computed 95% plausible value ranges because level-1 variance is not estimated in such models. More complex models were then developed by sequentially adding the following sets of variables to the null models: (a) a variable to distinguish measures occurring at baseline from those occurring at year 1; (b) sex (0 = male, 1 = female) and overweight status (0 = not overweight, 1 = overweight); (c) a variable distinguishing low implementation schools from high implementation schools; and (d) a variable distinguishing schools with low (reference category), average, and high incomes. For models 2, 3, and 4, the influence of variables was examined both at baseline and for change. This iterative process permitted adjustments for new sets of variables while adjusting for variables in previous model(s). The final model tested the effects of the ban on physical activity, while adjusting for time, sex, and overweight status of research participants and school-level income. To avoid overparametrization of the model, we ran analyses with only one random effect on the intercept. We did not explicitly test for any additional modifier effects because the sample size at the school level was limited ($n = 10$).

RESULTS

Students with missing data on physical activity or anthropometric measures ($n = 291$) and those with implausible physical activity scores (greater than 70 physical activities in the past week; $n = 23$) were excluded; complete data were available for 979 students. The mean age of research participants at baseline was 12.7 ($SD = 0.5$) years; 47.1% were male; 30.6% spoke French at home, 50.7% spoke English, 11.8% spoke both, and 7.0%

Table 1. Comparison of the Characteristics of Research Participants in High and Low Implementation Schools and Sports-Related Extracurricular Activities (ECAs) in a No-Ban School Year, Montreal, Canada, 1999-2000

	Participants in High Implementation Schools (n = 639)	Participants in Low Implementation Schools (n = 340)	p Value
Age, y, mean (*SD*)	12.7 (0.4)	12.8 (0.6)	< .01
Male, %	48.5	44.4	.22
Baseline physical activity, mean (*SD*)	18.9 (12.9)	15.0 (9.8)	< .01
University educated, %			
Father	62.2	32.1	< .01
Mother	54.0	36.7	< .01
Overweight, %	12.8	15.9	.19
	High Implementation Schools (n = 7)	**Low Implementation Schools (n = 3)**	**p Value**
Total sports-related ECAs, mean (*SD*)	20.0 (4.3)	13.3 (4.0)	.08
Intramural sports activities, mean (*SD*)[a]	7.7 (3.0)	8.0 (1.7)	.86
Extramural sports activities, mean (*SD*)[b]	9.3 (3.0)	2.0 (1.7)	< .01
Sports-related special events, mean (*SD*)[c]	3.0 (1.0)	3.3 (0.6)	.53

a. Includes basketball, soccer, football, rugby, swimming, softball, volleyball, hockey, badminton, weight room, cosom/floor hockey, gymnastics, track and field, field hockey, cross-country skiing, downhill skiing, and lacrosse.
b. Includes basketball, soccer, flag/touch/contact football, football, rugby, swimming, badminton, softball, volleyball, tennis, hockey, cosom/floor hockey, curling, gymnastics, indoor track and field, outdoor track and field, field hockey, cross-country skiing, downhill skiing, wrestling, and lacrosse.
c. Includes track and field days, outings to promote sports, sports tournaments, fundraising sports activities, sports week/month, school dances, and ski trips.

indicated another language spoken at home. Two thirds of research participants (65.3%) attended an English language school; 17.5%, 56.2%, and 26.4% of students attended a low, medium, or high income school, respectively.

Schools offered 18.0 (*SD* = 5.1) sports-related ECAs on average during a no-ban school year (range = 11.0-24.0). Seven of the 10 study schools were classified as having high implementation of the ECA ban, and the 3 remaining schools were categorized as having low implementation of the ECA ban. High implementation schools offered more extramural sports activities during a no-ban year ($p < .01$; see Table 1).

Because the variable measuring number of physical activities during the past week was positively skewed, we used a square root transformation to normalize these data. Results from analyses using untransformed and transformed data were analogous. For ease of comprehension, we report results using untransformed data.

Multilevel analyses of data pertaining to number of physical activities engaged in during the previous week showed that ending the ban resulted in increased involvement in physical activity. That is, the null model allowing for decomposition of variance showed that 56.2%, 37.4%, and 6.2% of the variance in number of physical activities in the past week was attributable to within-person, between-person, and between school variation,

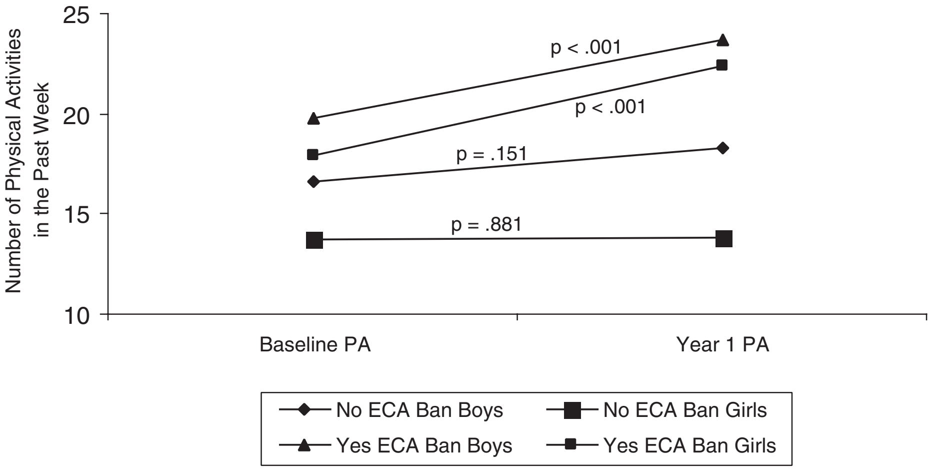

Figure 1. Change in average number of physical activities per week from baseline to follow-up, stratified by sex and implementation of the ban on ECAs.
NOTE: ECA = extracurricular activity; PA = physical activity.

respectively. The average number of activities engaged in over the previous week across the two measurement periods was estimated at 19.1. Addition of the variable accounting for measurement period (model 1) explained 4.6% of the within-person variance. Furthermore, the number of activities in the previous week was estimated to be 17.6 at baseline and 20.6 at the second measurement period. In this preliminary model, no predictor variables to distinguish between schools with high and low implementation of the ban were used. Addition of sex and obesity status (model 2) accounted for 2.1% of the between-person variance and showed that girls participated in 2.3 fewer activities than boys; this gender gap remained stable across measurement periods. Obesity status was not associated with number of activities reported in the previous week.

Addition of the variable differentiating high and low implementation schools (model 3) showed that adolescents in high implementation schools were more active at baseline; they participated in 3.8 more activities per week than adolescents in low implementation schools (see Figure 1). The effect of attending a high versus a low implementation school accounted for 59.8% of the between-school (school-level) variance at baseline. These analyses also showed that adolescents in high implementation schools increased the number of activities ($\gamma_{101} = 3.4$, $p < .0001$) after the ban ended even though they were more active at baseline, whereas adolescents in low implementation schools did not change their level of involvement in physical activity across time. To ensure that this effect was not confounded by other school characteristics, we ran a final model (model 4) that included two variables differentiating schools attended mainly by students in families with low (reference category), average, and high incomes. Whereas the baseline difference between adolescents attending high and low implementation schools was confounded by school-level income, the effect of ending a ban was not influenced by the addition of income. Adolescents in schools serving families with high incomes participated in 3.9 more activities per week on average than adolescents attending schools serving low and average income families (p = .056). However, the coefficient operationalizing the effect of ending the ban remained statistically significant ($\gamma_{101} = 4.04$, $p <$ .001), suggesting that the effect of ending the ban on increasing average number of activi-

Table 2. Results of Multilevel Modeling Analyses Testing for the Effects of Ending the Ban on Number of Physical Activities

Variance Component Between Participant	Parameter	Variance Estimate (μ)	Standard Deviation	df	Chi-Square	p Value
Baseline	μ_{00}	1.06	1.03	6	19.47	.004
	μ_0	66.68	8.17	967	2367.90	.0001
	E	91.79	9.58	—	—	—

Within-Participant Fixed Effect	Parameter	Coefficient	SE	t-ratio	p Value
Baseline	γ_{000}	17.41	1.47	11.81	.0001
High implementation	γ_{001}	1.70	1.23	1.38	.22
Average income school	γ_{002}	–1.47	1.40	–1.05	.34
High income school	γ_{003}	3.93	1.67	2.36	.06
Sex	γ_{010}	–2.41	0.81	–2.98	.003
Overweight/obese	γ_{020}	–0.30	1.17	–0.25	.80
Follow-up	γ_{100}	–0.76	1.31	–0.58	.56
High implementation	γ_{101}	4.04	1.01	3.99	.0001
Average income school	γ_{102}	1.84	1.19	1.55	.12
High income school	γ_{103}	–0.17	1.41	–0.12	.91
Sex	γ_{110}	–0.03	0.87	–0.04	.97
Overweight/obese	γ_{120}	1.14	1.25	0.91	.36

Final model

Level-1 model: $\text{Number of PAs} = \pi_0 + \pi_1 \text{ Time} + \varepsilon$

Level-2 model:

$$\pi_0 = \beta_{00} + \beta_{01} \text{ Sex} + \beta_{02} \text{ Overweight/obese} + \mu_0$$
$$\pi_1 = \beta_{10} + \beta_{11} \text{ Sex} + \beta_{12} \text{ Overweight/obese}$$

Level-3 model:

$$\beta_{00} = \gamma_{000} + \gamma_{001} \text{ High Implementation} + \gamma_{002} \text{ Average Income School} + \gamma_{003} + \mu_{00}$$
$$\beta_{01} = \gamma_{010}$$
$$\beta_{02} = \gamma_{020}$$
$$\beta_{10} = \gamma_{101} + \gamma_{101} \text{ High Implementation} + \gamma_{102} \text{ Average Income School} + \gamma_{103}$$
$$\beta_{01} = \gamma_{110}$$
$$\beta_{02} = \gamma_{120}$$

ties per week was not confounded by school-level income. The results of the final model (model 4) are presented in Table 2.

Analyses performed using the dichotomous activity status variable yielded similar results. The 95% plausible value range established from the null model showed that the percentage of active children across schools varied between 85.1% and 88.7%. Addition of the time variable (model 1) not accounting for level of implementation of the ban showed that the likelihood of being active increased from baseline to the second measurement period. Sex and obesity status (model 2) were not associated with the likelihood of being active. However, addition of the variable accounting for ending the ban (model 3) showed that adolescents in high implementation schools were significantly more likely to be active once the ban ended, in comparison to adolescents attending low implementation schools. To ensure that these effects were not confounded by average income of schools, we entered the two variables operationalizing school-level income into the equation

Table 3. Results of Multilevel Modeling Analyses Testing for the Effects of Ending the Ban on the Likelihood of Being Active

Variance Component Between Participant	Parameter	Variance Estimate (μ)	Standard Deviation	df	Chi-Square	*p* Value
Intercept	μ_{00}	0.0002	0.01	6	5.06	> .500
	μ_0	0.63	0.79	967	920.19	> .500

Within-Participant Fixed Effect	Parameter	Coefficient	*SE*	t-ratio	*p* Value
Baseline	γ_{000}	1.86	0.29	6.48	.0001
High implementation	γ_{001}	0.05	0.21	0.23	.83
Average income school	γ_{002}	–0.35	0.26	–1.33	.23
High income school	γ_{003}	0.04	0.32	0.11	.92
Sex	γ_{010}	–0.07	0.18	–0.38	.71
Overweight/obese	γ_{020}	0.32	0.29	1.125	.26
Follow-up	γ_{100}	–0.20	0.40	–0.49	.62
High implementation	γ_{101}	0.64	0.31	2.06	.04
Average income school	γ_{102}	0.47	0.37	1.28	.20
High income school	γ_{103}	0.18	0.47	0.38	.71
Sex	γ_{110}	–0.04	0.27	–0.15	.88
Overweight/obese	γ_{120}	–0.30	0.41	–0.74	.46

Final model

Level-1 model: Probability of being active = P

$$\text{Log}\,[P / (1 - P)] = \pi_0 + \pi_1 \text{ Time}$$

Level-2 model:

$$\pi_0 = \beta_{00} + \beta_{01} \text{ Sex} + \beta_{02} \text{ Overweight/obese} + \mu_0$$
$$\pi_1 = \beta_{10} + \beta_{11} \text{ Sex} + \beta_{12} \text{ Overweight/obese}$$

Level-3 model:

$$\beta_{00} = \gamma_{000} + \gamma_{001} \text{ High Implementation} + \gamma_{002} \text{ Average Income School} + \gamma_{003} + \mu_{00}$$
$$\beta_{01} = \gamma_{010}$$
$$\beta_{02} = \gamma_{020}$$
$$\beta_{10} = \gamma_{101} + \gamma_{101} \text{ High Implementation} + \gamma_{102} \text{ Average Income School} + \gamma_{103}$$
$$\beta_{01} = \gamma_{110}$$
$$\beta_{02} = \gamma_{120}$$

NOTE: ECA = extracurricular activity; PA = physical activity.

(model 4). Whereas the previous analysis showed that research participants attending schools serving high-income families tended to engage in greater numbers of activities, this analysis showed no such income gap. Nevertheless, ending the ban resulted in an increase in the likelihood of being active. Results for this final model appear in Table 3.

DISCUSSION

The purpose of this analysis was to examine how a reduction in the number of opportunities for physical activity at school affected levels of physical activity among adolescents. This study took advantage of a natural experiment in which a labor dispute resulted in a teachers' ban on supervising sports-related ECAs. After the ban ended, adolescents attending schools that implemented the ban increased the number of activities in which they were involved and were more likely to be physically active than adolescents attending schools that did not implement the ban. These findings are particularly noteworthy because levels of physical activity generally decline during adolescence, especially among girls (Armstrong, Welsman, & Kirby, 2000; Barnett, O'Loughlin, & Paradis, 2002; Bradley, McMurray, Harrell, & Deng, 2000; Caspersen, Pereira, & Curran, 2000; CDC, 1995, 1998; Gordon-Larsen et al., 2002; Gordon-Larsen, McMurray, & Popkin, 1999; Health Canada, 1999; Hoefer, McKenzie, Sallis, Marshall, & Conway, 2001; Kimm et al., 2000; O'Loughlin, Paradis, Kishchuk, Barnett, & Renaud, 1999; U.S. Department of Health and Human Services, 1996). Also, to date there are few interventions known to effectively maintain or increase physical activity during this period of maturation. Our results corroborate those of a recent clinical trial, in which Dale, Charles, and Dale (2000) observed that schoolchildren did not compensate for lost opportunities to be physically active at school by becoming more active outside school.

More generally, these findings provide support for ecologic models suggesting that environmental factors such as availability of and access to sports facilities and resources affect behavior (Sallis, Bauman, & Pratt, 1998). Indeed, there is evidence that students in schools with more sports equipment and with higher levels of teacher supervision are more active than students attending schools with fewer resources (Sallis et al., 2001). Furthermore, the literature evaluating interventions to increase physical activity suggests that environmental interventions might be more effective than health education curricula in promoting increased involvement in physical activity (Kahn et al., 2002; Stone, McKenzie, Welk, & Booth, 1998).

Because adolescents spend many of their waking hours at school, schools represent an important milieu in which to address their physical activity needs (Kahn et al., 2002; McGinnis & DeGraw, 1991; Sallis et al., 1998; Sallis et al., 2001; Stone et al., 1998). Based on our findings, we anticipate that when more opportunities to be physically active are made available at school, many adolescents will respond positively by participating in these activities, with the result that they become more physically active. School-based organized sports can be an important aspect of the school environment from several perspectives. In addition to allowing easy and regular access to sports activities, they offer occasions for social interchange with peers in safe and supervised environments, and they allow for positive role modeling by team coaches and parent volunteers. An active sports program likely increases school cohesiveness, as well as the sense of belonging to a community among students, their families, and school personnel.

Inactivity in adolescents has been linked to excess weight gain (O'Loughlin, Gray-Donald, Paradis, & Meshefedijan, 2000), and over the past few decades, the prevalence of overweight and obesity has increased dramatically in North American youth (Health Canada, 1999; Tremblay & Wilms, 2000). A reduction in access to school sports could interrupt the maintenance of regular physical activity levels in adolescents, making them even more vulnerable to adopting a physically inactive lifestyle with the resultant effect on health. Even short-term decreases in access to school-based sports activities could result in weight gain (O'Loughlin et al., 2000). Policy makers, school personnel, parents, and adolescents should be made aware of the potential effect of changes to the school physical activity program on student health, and these considerations must be taken into account in planning the school physical activity program.

Limitations

The extent to which the results can be generalized may be limited because the study schools made up a convenience sample. The physical activity data were based on self-reports by adolescents, which are subject to misclassification. However, as indicated earlier, our 7-day recall is reliable (Sallis et al., 1993) and there is evidence for criterion-related validity against the Caltrac accelerometer (Sallis et al., 1993) as well as convergent construct validity against energy intake (Johnson-Down et al., 1997). A third limitation relates to the nonexperimental study design, which might not have allowed adequate control of possible confounding. Specifically, none of the three French schools in this study were categorized as high implementation schools because the ECA ban was implemented differently in French and English school boards. Therefore, there was almost complete overlap between exposure to the ban and language, and it was not possible to control for language in multivariate modeling. It could be that the observed increases in physical activity were related to language and not to ending the ban. However, although there is ample reason to hypothesize that a ban on ECAs might result in lower levels of involvement in physical activity, there is little reason to suspect that language relates to an increase in physical activity. Furthermore, both outcomes investigated (number of physical activities engaged in during the previous week and activity) were measured between the ages of 12 and 13 years. Studies have consistently indicated that physical activity declines during this period, without indication that there is a difference in physical activity behavior associated with language (Armstrong et al., 2000; Barnett et al., 2002; Bradley et al., 2000; Caspersen et al., 2000; CDC, 1995, 1998; Gordon-Larsen et al., 2002; Gordon-Larsen et al., 1999; Health Canada, 1999; Hoefer et al., 2001; Kimm et al., 2000; O'Loughlin et al., 1999; U.S. Department of Health and Human Services, 1996), and no previous study has indicated that language is related to physical activity.

Finally, baseline levels of physical activity were not equivalent across high and low implementation schools. Whereas interim model testing suggested that students attending high implementation schools were more active at baseline, subsequent model testing showed that family income might be an appropriate explanatory factor. Adolescents attending schools serving high-income families reported involvement in more physical activities compared to schools serving low- and average-income families. In our sample, there appears to be overlap between income and implementation of the ban. Although this natural experiment did not allow for distinguishing baseline effects associated with the ban from those associated with income, the effects of the ban were not confounded by school-level income. Given these intriguing findings, we recommend that further studies examine the association between opportunities for involvement in physical activity at the school level and other factors that differentiate and characterize schools. It may then be possible to better disentangle which variables affect increases in involvement in physical activity among adolescents.

CONCLUSION

This study suggests that the school environment can influence the maintenance of healthy physical activity behavior among adolescents. More specifically, students attending schools where opportunities for physical activity were reduced were more likely to increase their physical activity levels once these activities were reinstated. The effect appeared to be greater in girls than in boys. This study highlights the importance of environmental factors on physical activity behavior among adolescents.

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