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School sport policy and school-based physical activity environments and their association with observed physical activity in middle school children

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ABSTRACT

Empirical research on the effects of school sport policies on children's physical activity is limited. This study examined sport policies (intramural vs. varsity), physical settings within schools, and supervision in relation to physical activity using the System for Observing Play and Leisure in Youth (SOPLAY). Data were collected on physical activity levels of children in four middle schools. Regression analyses assessed the main effects of sport policy, type of physical activity setting, and supervision as well as interactions. Regression models were stratified by gender. Children in intramural schools were more likely to use indoor spaces and be boys. Regression models indicated that varsity sport programs were associated with lower physical activity levels among boys but not girls. Significant associations between type of physical activity settings and physical activity levels were observed only for boys. Adult supervision was not associated with children's physical activity levels. Finally, descriptive results showed athletic facilities were under-utilized in all schools.

1. Introduction

Childhood obesity and overweight in the U.S. (Hedley et al., 2004; Ogden et al., 2008, 2010), Australia (Gill et al., 2009), and other European countries (Janssen et al., 2005; Padez et al., 2004) remain a significant public health concern. Although regular physical activity provides numerous physiological and mental health benefits for children and adolescents (Strong et al., 2005), recent objectively measured data suggest that they are not getting recommended levels of physical activity (Troiano et al., 2008). Individual behaviors, community structure, lifestyle, and the built environment are primary contributing factors to this shortfall (Gorman et al., 2007; Trasande et al., 2010). Furthermore, research specifically examining the physical environment and factors that facilitate or inhibit healthy behavior has increased over the past decade (Chomitz et al., 2011; Sallis et al., 2006).

Children in most countries spend a substantial amount of time in schools, settings that provide safe and convenient programs and facilities that promote physical activity (Birnbaum et al., 2005; Johnston et al., 2007). Beyond physical education, schools offer organized extracurricular activities, such as school sports, activity clubs, and other structured and non-structured leisure activities making schools a viable medium for promoting physical activity among youth (McKenzie and Kahan, 2008; Wechsler et al., 2000). A focus on school environments and policies that shape them aligns with ecologic models used in active living studies and health promotion (Sallis et al., 2006). In particular, schools and athletic facilities within them are behavior settings where physical activity behaviors occur. Examination of the accessibility and characteristics of school environments is useful therefore in understanding their contribution to children's physical activity. The model offered by Sallis et al. (2006) also highlights how the policy environment shapes physical activity behaviors through various mechanisms including the built environment, programs, and economic incentives.

Few studies have examined school sport policies and school athletic environments and their relation to children's physical activity despite their potential to support physical activity among children. This is unfortunate since sport participation declines significantly among both boys and girls during their middle school years (Casey et al., 2009; Hedstrom and Gould, 2004).

A study conducted among English and Welsh children showed that by age 16, most adolescents had adopted a pattern of leisure activities and sport participation that formed the foundation for

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their adult leisure lifestyle (Green et al., 2005). Therefore, policies that limit participation in school sports based on ability can significantly exclude middle school aged children from opportunities for physical activity at a time when many stop participating. Although competitive varsity sports are associated with several mental health benefits (Pate et al., 2000) and elevated levels of physical activity (Sirard et al., 2006), questions remain as to whether this sport delivery model best meets the needs of most middle school students (NASPE, 2008).

Regular and frequent physical activity at a level of at least moderate intensity (3.0–5.9 times the intensity of rest) (CDC, 2011) with bouts of vigorous intensity (6.0 or more times the intensity of rest) clearly play an important role in maintaining children's health (Bergeron, 2007). Unfortunately, school physical education classes and time for unstructured free play have been reduced (Kahn et al., 2002; Lee et al., 2007) and opportunities for unstructured free play have become increasingly scarce. Consequently, parents have increasingly looked to organized school and community sports to engage their children in physical activity (Bergeron, 2007). Meanwhile, questions have emerged about whether the structure of organized youth sport provides a significant source of physical activity (Leek et al., 2010). Inefficient practice management and an emphasis on practice drills, game strategies, and specialized sport skills that are indicative of many varsity sport environments often result in participants standing around waiting for their turn to practice (Bergeron, 2007).

Major US health organizations endorse youth sport programs for children's health. In 2001, the American Academy of Pediatrics released a position statement promoting sports as an effective way for children to attain both physical activity and social benefits (Washington et al., 2001). In 2005, the Institute of Medicine, concerned with declining physical activity patterns in youth, recommended that intramural sports be more widely introduced within schools in order to meet the needs of students with a wide range of abilities, including those who lack the time, skills or confidence to participate in varsity sports (Koplan et al., 2005).

Intramural school sports differ from varsity school sports in four main ways. First, every student has the opportunity to participate regardless of ability as opposed to varsity sports, which are limited to students who make a team. Furthermore, all intramural sports are offered to both boys and girls meaning they can participate together as opposed to varsity sports, which are gender segregated. Second, intramural programs are self-contained within the school. Thus, there are no competitions scheduled against other schools. The rationale is that this cuts down on travel expenses and time and allows administrators to use resources more efficiently to benefit a greater number of students. Third, the range of intramural sports tends to be greater than varsity sports due to the philosophy of encouraging children to try new sports, having a mandate to meet the needs of all participants regardless of ability, and providing opportunities for students to experience physical activity that contributes to an active lifestyle. Thus although traditional school sports such as soccer and basketball are available, other non-traditional sports (e.g., floor hockey, golf, dance, and flag football) are also offered. Finally, intramural sports usually have more youth involvement where students can be involved in the planning and organization of these programs.

The Institute of Medicine also recommended that intramural sport programs become a staple of both school and after school programs. Although they strongly recommended the implementation of intramural sports, the committee also noted that more research, specifically larger scale studies, be conducted to identify how they contribute both singly and in conjunction with other interventions to meet physical activity objectives.

Research suggests that a school sport policy promoting intramural sports (relative to varsity sports) might introduce more children to a wider variety of sports and perhaps foster increased physical activity during youth and over the lifespan (Perkins et al., 2004). School sport policies may be of particular importance for girls as they are influenced substantially by the school social climate (Birnbaum et al., 2005), which in turn is influenced by school policies. Several studies in the U.S. and Europe showed that girls were less likely than boys to be physically active (Riddoch et al., 2004; Sallis et al., 2000; Troiano et al., 2008; Trost et al., 2002a,b), but none directly addressed the effects of school sport policies on the physical activity of adolescent girls and boys. The current study addressed three aims. Specifically it sought to (a) examine whether school policy (intramural vs. varsity sports) was associated with children's moderate and vigorous physical activity; (b) examine whether the physical environment (type of physical activity settings) and social environment (presence of adult supervision and presence and number of other children) were associated with children's moderate and vigorous physical activity; and (c) examine whether the school policy, and physical and social environmental were associated with different levels of physical activity levels based on gender.

2. Method

2.1. Settings

Four middle schools with similar demographic populations based on race/ethnicity, income, and geographic location were settings for the study (Table 1). Two schools had a school athletics policy that was exclusively devoted to competitive varsity sports and the other two had a modified policy devoted exclusively to providing intramural sports with no varsity (competitive) option. The two varsity schools had a larger enrollment ($N=968$ and 1006 students) than the two intramural schools ($N=582$ and 543 students). All procedures were approved by the Institutional Review Board at the researchers' university and the county school board Evaluation and Research Department.

Table 1
Racial/ethnic, socioeconomic status (SES), and sport policy characteristics of study schools.

School	Race/ethnic composition	SES[a] (%)	Sport policy type
EMMS	56% Black 31% White 9% Hispanic 4% Other $N=968$	43	Varsity
DMS	30% Black 57% White 9% Hispanic 4% Other $n=1006$	33	Varsity
MSMS	52% Black 45% White 0% Hispanic 3% Other $n=582$	33	Intramural
CMMS	36% Black 58% White 6% Other $n=543$	31	Intramural

[a] Percent of student population receiving free or reduced price school lunch.

The schools with intramural programs were new schools that had opened within the past seven years. Administrators at these schools decided from the onset to allocate their sport budgets exclusively to intramural programs in lieu of varsity sports. They believed that the philosophy behind intramural sports provided more children with opportunities to participate in sport. All the intramural activities took place at the school Monday–Thursday from 2:30 pm to 4:30 pm for 3 seasons (Fall, Winter, and Spring). Each season lasted between 8–10 weeks. Between three to five intramural sports were offered each season with the selection based on surveys of student preferences for activity offerings. The most popular activities were basketball, flag football, and soccer. Lacrosse, cup stacking, floor hockey, golf, tennis, table tennis, frisbee golf, and badminton were also offered.

The two other schools adopted a varsity sport program symptomatic of the majority of middle schools across the country. These varsity sport programs offered students the opportunity to try out for and play on ten teams—five for girls (volleyball, soccer, basketball, softball, and track and field) and five for boys (football, soccer, basketball, baseball, and track and field).

2.2. Observational procedures

Trained observers used the System for Observing Play and Leisure in Youth (SOPLAY, (McKenzie, 2002)) to record use, setting characteristics, and student physical activity levels in the predetermined physical activity areas that were designated for sports in each of the four schools between 2:30 and 4:30 pm. SOPLAY provides a count of individuals within each designated activity zone and classification of observed activity using momentary time sampling.

SOPLAY was developed specifically to assess both the number of youth in an activity area and their physical activity levels (McKenzie et al., 2000). All potential areas for physical activity at school were identified and measured prior to data collection. Agreement among assessors was established on the location, size, and boundaries of each target area (activity settings), and maps detailing them were made and used consistently throughout the study. During a scan the physical activity of each individual in a target area was coded as Sedentary (i.e., lying down, sitting, or standing), Walking, or Very Active. These activity codes have been validated by heart rate monitoring (McKenzie et al., 1991; Rowe et al., 2004). Separate scans were made for girls and boys. In addition to physical activity coding, type of activity target area (i.e., the type of sport or athletic environment), and level of adult supervision (none, limited, or full supervision) were also recorded. No supervision was recorded when no adult was present. Limited supervision was recorded when an adult (e.g., teacher or coach) was present but was not highly engaged or involved in the activity; and full supervision was recorded when an adult was in direct control of students, was participating fully, or was highly involved in the activity.

Simultaneous coding was conducted for the time of the observation and for contextual characteristics such as area accessibility, usability, and whether or not supervision, organized activities, and equipment were provided. Areas in the study included athletic courts (e.g., basketball, volleyball, tennis), sport fields and facilities (football, soccer, baseball, softball, track, long jump and high jump), open space, and other areas (e.g., dance studios). Each school had between 6–9 activity areas.

To cover multiple sports seasons, observations were conducted between April, 2009 and September to December 2009. Because no school sports took place between June and August, data were not collected during that time period. Observations were limited to Monday–Thursday, because no intramural sports and only a limited number of varsity sports occurred on Friday. A total of 1510 scans were completed. 868 scans were conducted independently and 642 were conducted in pairs for reliability assessment. After reliability checks were completed, duplicate scans were removed resulting in a final total of 1188 observations (661 VS scans; 527 IM scans). Details of the SOPLAY observation schedule are summarized in Tables 2 and 3.

Table 2
Number of SOPLAY observations days per school by day of the week and month.[a]

	April	September	October	November	December
Monday	3	1	3	3	0
Tuesday	4	2	3	3	2
Wednesday	5	1	2	1	0
Thursday	5	2	3	2	3
Total	**17**	**6**	**11**	**9**	**5**

[a] For example· schools were visited 3 Mondays in April, 1 Monday in September, 3 times in October, etc. Observations were not conducted on Fridays.

Table 3
Number of SOPLAY observations days per school by day of the week.[a]

School	Monday	Tuesday	Wednesday	Thursday
EMMS	8	6	6	7
DMMS	2	5	4	3
MSMS	2	4	2	6
CCMMS	0	6	0	6
Total	**12**	**21**	**12**	**22**

[a] For example, EMMS had 8 visits on Mondays, 6 visits on Tuesdays, 6 visits on Wednesdays, etc. Observations were not conducted on Fridays.

Inter-observer reliability results were reported for physical activity levels and supervision using Cohen's Kappa. Standards for Cohen's Kappa recommend 0.40–0.59 as moderate inter-rater reliability, 0.60–0.79 as substantial, and 0.80 outstanding inter-observer reliability (Landis and Koch, 1977). Microsoft Excel 2007 was used to calculate Cohen's Kappa following the steps documented previously (Bocarro et al., 2009). Inter-rater reliability for SOPLAY codes was acceptable (kappa range=0.54–0.97). Percent agreement between observers ranged from 89.36% to 98.9%.

2.3. Data analysis

The main aim of this study was to examine whether school policy (intramural vs. varsity) was predictive of students' likelihood to engage in after-school moderate and vigorous PA in specific activity areas. Secondary aims were to examine (1) the main effects of supervision (none, limited, and full), social context (number of active boys and girls in a specific area), and type of physical activity setting and (2) the interaction effects of school policy by supervision, supervision by type of physical activity setting, and school policy by type of physical activity setting on the students' likelihood of engaging in moderate and vigorous PA. Effects were estimated using generalized linear mixed models (GLMMs) with binomial variance and ordinal logit link functions (i.e., ordinal logistic regression) accounting for two levels of dependency in the data. Specifically, individual-student physical activity behavior was observed in 25 different activity areas on several occasions. Hence, the dataset had a hierarchical structure whereby individual student data were nested within observation days ($n=153$ in total; on average 6.1 days per individual activity

area) within activity areas ($n=25$) within schools ($n=4$). Given the small number of schools and the fact that policy was a school-level variable, only dependency at the day and activity area level could be taken into account by the regression models. To examine the validity of the standard errors of the regression coefficients, residual school-level clustering effects were assessed by estimating intraclass correlations coefficients (ICCs) of the model residuals. All models were adjusted for time of the year (spring vs. fall) and day of the week (Monday to Thursday) during which observations were performed since these differed by school. Models were also adjusted for activity area size. Separate models were estimated for boys and girls, and for main and interaction effects. The proportional odds assumption was tested using Brant's test on a single-level model before estimating GLMMs accounting for dependency in the data. Regression analyses were conducted using Stata 10.0. Descriptive statistics were calculated in SPSS 18.

3. Results

Overall, 6735 children (52% boys and 48% girls) were observed in the study setting. Most children in intramural schools were observed in gyms (68.6%), followed by multi-purpose fields (12.2%), tracks (8.4%), and baseball fields (6.4%). Children in varsity schools, however, were observed in multi-purpose field areas (31.8%), gyms (28.8%), tracks (15.5%), and baseball fields (8.4%). The locations for activity are summarized in Tables 4 and 5. Across all schools physical activity areas were vacant during 68% of observed visits, with areas in IM schools vacant more often than those in VS schools (78% vs. 59%). Table 6 provides a breakdown of children's physical activity levels by school sport policy. Overall when observed, 52.4% of students were sedentary, 29.8% were walking, and 17.8% were engaged in vigorous activity. Table 7 summarizes the level of supervision by school type. Full supervision was more apparent in varsity schools (88.2%) than in intramural schools (59.6%) although limited supervision was greater among intramural schools (33.3% IM vs. 8.1% VS).

Table 8 displays the results for the regression models examining the relationship between physical activity levels, school policy type, size of physical activity zone, and gender and supervision levels. All ordinal logistic mixed models yielded virtually zero school-level residual ICCs, supporting the validity of the estimates of the regression coefficients and relative standard errors. Brent's tests of proportionality of odds ratios were not statistically significant and, thus, supported the validity of the regression models.

The analysis revealed several patterns. Main-effect ordinal logistic mixed models revealed that the odds of engaging in higher levels of physical activity was lower among boys from schools with a varsity program than boys attending intramural schools (OR: 0.41, 95% CI: 0.30, 0.58) (see Table 8). Among girls, the effect of school policy was not statistically significant. No significant main effects of supervision on the likelihood of engaging in higher levels of physical activity were observed. Students' physical activity level was positively associated with the number of same-gender active children. Activity setting was an important correlate of the likelihood of engaging in higher levels of physical activity in boys but not in girls. Boys tended to be most active in an inside studio, track, soccer/football field, open area, and basketball court. Girls tended to be less active in a gym than on a baseball field (see Table 8).

No significant supervision by policy interaction effects on the odds of engaging in MVPA were observed in girls. In boys, full vs. no supervision was associated with significantly higher odds of being active in intramural schools (OR: 1.42; 95% CI: 0.83, 2.41) than varsity schools (OR: 0.69; 95% CI: 0.41, 1.17). Although these supervision effects were not statistically different from zero, they were statistically different from each other ($p<.01$). The effects of supervision on the likelihood of engaging in MVPA somewhat depended on the activity setting. Thus, among boys, supervision vs. no supervision was associated with lower odds of being active in baseball but higher

Table 4
School policy type by zone description.

Zone description	Varsity	Intramural	TOTAL
Baseball	431 (8.4%)	104 (6.4%)	535 (7.9%)
Basketball (outside)	111 (2.2%)	36 (2.2%)	147 (2.2%)
Inside studio	31 (0.6%)	9 (0.6%)	40 (0.6%)
Track	793 (15.5%)	137 (8.4%)	930 (13.8%)
Multi-purpose field	1624 (31.8%)	198 (12.2%)	1822 (27.1%)
Football/soccer	381 (7.5%)	23 (1.4%)	404 (6.0%)
Gym	1471 (28.8%)	1117 (68.6%)	2588 (38.4%)
Open area	249 (4.9%)	5 (0.3%)	254 (3.8%)
Tennis	15 (0.3%)	0 (0.0%)	15 (0.2%)
Total	5106 (75.8%)	1629 (24.2%)	6735 (100%)

Table 5
School physical activity areas by gender.

Zone description	Boys	Girls	Total
Baseball	246 (7.0%)	289 (8.9%)	535 (7.9%)
Basketball (outside)	64 (1.8%)	83 (2.6%)	147 (2.2%)
Inside studio	6 (0.2%)	34 (1.0%)	40 (0.6%)
Track	253 (7.2%)	677 (20.9%)	930 (13.8%)
Multi-purpose Field	1287 (36.8%)	535 (16.5%)	1822 (27.0%)
Football/soccer	311 (8.9%)	93 (2.9%)	404 (6.0%)
Gym	1315 (37.2%)	1273 (39.4%)	2588 (38.4%)
Open area	7 (0.2%)	248 (7.7%)	254 (3.8%)
Tennis	13 (0.4%)	2 (0.1%)	15 (0.2%)
Total	3501 (52.0%)	3234 (48.0%)	6735 (100%)

Table 6
Physical activity levels by school sport policy.

Policy	Activity Level		
	Sedentary	Walking	Very active
Intramural	46.5% ($n=758$)	32.6% ($n=531$)	20.9% ($n=340$)
Varsity	54.2% ($n=2770$)	28.9% ($n=1474$)	16.9% ($n=862$)
Total	3528 (52.4%)	2005 (29.8%)	1202 (17.8%)

Table 7
School type by supervision.

Supervision level	Varsity	Intramural	Total
No supervision	139 (3.8%)	115 (7.1%)	308 (4.6%)
Limited supervision	411 (8.1%)	543 (33.3%)	954 (14.2%)
Full supervision	4502 (88.2%)	971 (59.6)	5473 (81.3%)
Total	5106 (75.8%)	1629 (24.2%)	6735 (100.0%)

Table 8
Associations of school policy, supervision, activity setting and social context with students' physical activity levels.

	Boys ($n=3501$)		Girls ($n=3234$)	
	OR	95% CI	OR	95% CI
Main effects				
Individual-level variables				
Supervision (ref. category: no supervision)				
Limited	0.69	0.44, 1.06	0.78	0.28, 2.18
Full	0.91	0.58, 1.42	0.77	0.26, 2.33
Area-level variables				
Policy (ref. category: intramural)				
Varsity	0.41[c]	0.30, 0.58	0.90	0.41, 1.99
Social context				
Number of active boys	1.01[a]	1.00, 1.01	1.00	0.99, 1.00
Number of active girls	0.99	0.97, 1.00	1.01[c]	1.01, 1.02
Activity setting (ref. category: baseball)				
Basketball	2.11[a]	1.09, 4.10	0.66	0.36, 1.24
Inside studio	6.34[c]	3.27, 12.27	0.61	0.12, 3.11
Track	3.41[c]	1.88, 6.18	0.96	0.55, 1.68
Multi-purpose	1.57	0.96, 2.55	0.83	0.48, 1.44
Soccer/Football	2.47[c]	1.43, 4.24	0.34	0.10, 1.15
Open area	2.48[a]	1.03, 5.97	0.57	0.28, 1.15
Tennis	0.77	0.29, 2.06	0.72	0.21, 2.40
Gym	1.31	0.74, 2.30	0.47[a]	0.25, 0.90
Interaction effects				
Supervision by policy				
Limited vs. no supervision in intramural policy	0.86	0.53, 1.40	1.41	0.52, 3.85
Full vs. no supervision in intramural policy	1.42	0.83, 2.41	1.56	0.30, 4.91
Limited vs. no supervision in varsity policy	0.70	0.38, 1.27	0.54	0.14, 2.13
Full vs. no supervision in varsity policy	0.69	0.41, 1.17	0.57	0.17, 1.95
Supervision by activity setting				
Limited vs. no supervision—baseball	0.60[a]	0.38, 0.95	0.84	0.26, 2.75
Full vs. no supervision—baseball	0.80	0.50, 1.28	0.85	0.23, 3.13
Limited vs. no supervision—basketball	1.35	0.62, 2.93	n/a	
Full vs. no supervision—basketball	1.74[a]	1.10, 3.01	0.42	0.16, 1.10
Limited vs. no supervision—inside studio	n/a		3.48	0.63, 19.14
Full vs. no supervision - inside studio	n/a		n/a	
Limited vs. no supervision—track	1.65	0.61, 4.48	0.42	0.11, 1.58
Full vs. no supervision—track	0.71	0.27, 1.06	0.47	0.10, 2.14
Limited vs. no supervision—multi-purpose	0.51	0.16, 1.59	0.28	0.00, 25.15
Full vs. no supervision—multi-purpose	0.57	0.19, 1.72	0.31	0.00, 19.24
Limited vs. no supervision—soccer/football	0.97	0.61, 1.57	5.01	0.66, 38.11
Full vs. no supervision—soccer/football	0.71	0.48, 1.06	3.82[a]	1.07, 6.09
Limited vs. no supervision—open area	n/a		0.23	0.05, 1.06
Full vs. no supervision—open area	0.79	0.26, 2.43	0.32[b]	0.13, 0.76
Limited vs. no supervision—tennis	n/a		n/a	
Full vs. no supervision—tennis	3.80	0.73, 19.87	n/a	
Limited vs. no supervision—gym	0.51	0.24, 1.09	1.94	0.91, 4.16
Full vs. no supervision—gym	0.91	0.45, 1.86	1.53	0.67, 3.48
Policy by activity setting				
Varsity vs. intramural—baseball	0.42[c]	0.30, 0.58	2.58	0.65, 10.23
Varsity vs. intramural—basketball	0.38[a]	0.16, 0.89	0.84	0.37, 1.89
Varsity vs. intramural—inside studio	n/a		0.16[a]	0.03, 0.92
Varsity vs. intramural—track	0.19[b]	0.05, 0.76	4.15	0.13, 12.10
Varsity vs. intramural—multi-purpose	0.23[c]	0.15, 0.35	0.31	0.08, 1.18
Varsity vs. intramural—soccer/football	n/a		n/a	
Varsity vs. intramural—open area	0.36	0.11, 1.17	0.35	0.10, 1.19
Varsity vs. intramural—tennis	n/a		n/a	
Varsity vs. intramural—gym	0.57[a]	0.35, 0.93	0.76	0.27, 2.09

Note: Models show proportional odds ratios of engaging in moderate-to-vigorous vs. sedentary activity and vigorous vs. sedentary-to moderate activity and relative 95% confidence intervals. All models adjusted for time of the year (spring vs. fall) and day of the week of observation, and size of activity area. n/a=not applicable as number of observations in cell too small ($n<2$).

[a] $p<0.05$.
[b] $p<0.01$.
[c] $p<0.001$.

odds of being active in basketball. Among girls, supervision was related to higher odds of engaging in MVPA in soccer but lower odds in open areas (see Table 8).

The effect of school policy on MVPA also depended on the activity setting. Among girls, being in a varsity school was predictive of lower odds of engaging in MVPA within an open

space setting. Boys in schools with a varsity program were less likely to engage in MVPA than their intramural counterparts in baseball, basketball, track and field, multi-purpose area and gym settings (see Table 8).

4. Discussion

Although limited to four schools in one geographic region, this study represents one of the first to objectively measure the association of school sport policies with adolescent's physical activity levels. The results contribute to the existing literature in three main ways. First, the study showed that school sport policies may impact opportunities for MVPA activity levels among children. Over half (53%) the children were sedentary when observed suggesting that school sport programs may not be engaging children in high amounts of physical activity. The evidence of the school sport policy effect on boys' and girls' was mixed. The varsity school sport policy was related to lower activity among boys only. One reason for this may be a lack of attractive sport programming options for girls. Focus groups conducted with a sample of girls from two of these schools revealed that they perceived they had fewer sport options than boys, and that programs, when co-educational, tended to be dominated by boys (Witmer et al., 2011). The school social climate that supports middle school girls being physically active has been seen as a critical variable in influencing their levels of physical activity (Birnbaum et al., 2005). Other studies have shown that enjoyment and the social environment of physical activity interventions were rated highly by girls and that programs should account for those variables (Barr-Anderson et al., 2007). Gender differences between the two school sport policies may also be due to the co-educational orientation of intramural sports that allowed boys and girls to play together. This may have unintended consequences that might inhibit girls from participating. A study of alternative sport programs designed to increase teenage girls' participation, for example, found that the absence of adult control and supervision resulted in activities being dominated by boys, which provided an unwelcome and unattractive environment for girls (Skille and Waddington, 2006).

Second, analyses of activity settings and their interaction with the type of sport policy yielded some significant and important findings. Boys were significantly more active in 5 of the 8 activity settings examined. Activity settings are modifiable features of school environments. However, a disconcerting finding was that activity settings (main effects) were not positively associated with girls' activity levels. Prior studies have shown that girls' play style differs from boys. These studies have shown that boys prefer standardized games (e.g., football, soccer fields), occupying more space than girls. They also tend to be more competitive with better players dominating (Harten et al., 2008). Conversely, girls tend to be more inclusive and have less need for larger spaces. On the other hand, 5 of 8 activity settings were positively associated with boy's physical activity. Current school environments therefore may not be benefitting boys and girls equally. If so, this would suggest a need for both programming and policy change. From a feminist theory perspective, perhaps these spaces are "gendered" and were designed for boys who are accruing more benefit (Wearing, 1998). This perspective suggests that male hegemony might be reflected in the design and use of school-based physical activity settings. More critical examinations of the meaning of place in relation to gender differences in physical activity patterns are required to address this issue.

Finally, supervision within each of these programs did not appear to have a significant impact on children's physical activity levels. Within some sports, supervision did seem to either suppress or increase children's physical activity levels but overall supervision was not a significant predictive factor. This does seem contradictory to some recent studies that suggest adult supervision may be suppressing physical activity within highly competitive sport (Bergeron, 2007; Leek et al., 2010). However, prior studies have found that children are less likely to participate in physical activity with the absence of adult supervision (Sallis et al., 2001). It appears that more environmental supports with appropriate adult supervised activities that attracted students would also encourage greater levels of physical activity.

Finally, the findings show that sport facilities at these schools were under-utilized, with 68% of designated sport areas vacant during the after-school (2.30–4.30 pm) observational period. Given that physical activity has been positively associated with accessible and convenient facilities especially for children and adolescents (Hume et al., 2005; Sallis et al., 2001; Sallis et al., 2003) this finding is concerning. School facilities around the world have been identified as an important environment to facilitate physical activity among children (Durant et al., 2009; Everett Jones et al., 2003; Sallis et al., 2003; Trudeau and Shephard, 2005) but are only valuable when they are being used. Other reports and studies have also identified the limited use of school facilities. For example, a 2009 parental survey conducted by the North Carolina State Center for Health reported that their children never or rarely used playing fields at a school in their community during after school hours or weekends (NC State Center for Health Statistics, 2009). Furthermore, a SOPLAY study examining use of 20 school playgrounds found that although activity levels were high when children were present, overall utilization was low (Colabianchi et al., 2009).

Several limitations to this study should be acknowledged. First, the data were collected in only four schools in one city. This limits variability in school physical activity settings and ability to generalize to other locations. Four schools also prevent a more rigorous assessment of clustering of students within schools. Thus, it was not possible to properly specify the effect of a sport policy (a higher ordered predictor) on individual level behavior. Therefore, any apparent sport policy effect could be due to factors within individual schools. A second limitation noted elsewhere (Floyd et al., 2008; McKenzie et al., 2006) is that SOPLAY consists of momentary time sampling involving children being observed at a single point in time and not continuously over the course of a session. Third, measurement of physical activity was limited to the 2.30–4.30 pm after school period and did not account for total daily physical activity. Future studies should consider measuring total daily physical activity to provide a more comprehensive picture of the contribution of school environments on children's physical activity levels. Finally, information relating to the context was not collected (e.g., the size of games, whether it was a scrimmage or time spent practicing skills). Future studies may wish to adapt the SOPLAY methods to account for more specific context relating to the sport setting. Nonetheless, SOPLAY is a valid and reliable tool for measuring physical activity among children particularly in large, open environments (McKenzie, 2002). Finally, no data were collected during the January to March time period; thus winter activities in the schools were not accounted for. Future studies should seek to randomize policy to a larger number of schools in prospective studies to derive more conclusive findings on the effects of sport policies on children's physical activity in schools.

Strengths of the study include use of objective and validated measures of physical activity among children, an opportunity to examine the impact of a policy change using cross-sectional data, and insight into how different types of sports (varsity vs. intramural) are associated with middle school students' physical activity. More research of this kind is needed to encourage school

officials and policy makers to adopt sport policies that allow for greater participation by wider segments of children leading to increased opportunities for physical activity.

The results of this study can inform policy changes related to opportunities for physical activity among middle school students and the greater community. For example, joint programming or joint use of school facilities with community partners such as public parks and recreation departments could result in greater and more efficient utilization of facilities. Local governments and school districts serve the same people; consequently, partnerships between school districts, local government agencies, and community-based organizations sharing public schools facilities during non-school hours can create more opportunities for physical activity (Filardo et al., 2010).

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