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Research Article

Gender Disparity in Structured Physical Activity and Overall Activity Level in Adolescence: Evaluation of Youth Risk Behavior Surveillance Data

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Background. Adolescent girls are less likely to meet physical activity recommendations than boys. This study examined the relative contribution of structured physical activity opportunities including physical education (PE) class and sports teams to overall activity levels for girls and boys. *Methods*. Data from 591 9th–12th grade students who completed the 2009 Philadelphia Youth Risk Behavior Survey were examined. Logistic regression was used to estimate the relationship between PE and sports teams and physical activity levels. Models were stratified by gender to estimate gender differences. *Results*. Girls were less likely to be active than boys: 27.9% of girls were sedentary as compared to 10.6% of boys. PE class was not related to activity levels among boys, while highly active girls were seven times more likely to participate in daily PE than were sedentary girls. Playing on one or more sports teams was associated with low-moderate and high activity in girls; among boys, sports team participation was only associated with high activity. *Conclusions*. The structured physical activity opportunities of PE and sports teams may contribute more to overall activity levels in girls than boys. A more rigorous assessment of this hypothesis is warranted to inform efforts to promote activity levels in girls.

1. Introduction

Gender differences in physical activity levels among youth are well documented [1–5]. Less than half the proportion of girls as compared to boys achieve the recommended 60 minutes or more of activity per day in the previous week (11% versus 25%, resp.) [5]. The likelihood of developing chronic diseases such as obesity, type 2 diabetes, and high blood pressure significantly increased in sedentary as compared to active youth [6], and given the gender disparity in physical activity levels, this can translate to a relatively increased risk among girls. Given that sedentary behaviors among youth continue into adulthood [7, 8], these negative health effects have the potential to become life-long afflictions, particularly among women. Understanding the factors that contribute to this gender disparity in physical activity, particularly among youth, could inform programming efforts.

Previous studies have examined the correlates and determinants of physical activity in adolescents [1, 9] and reported that, in addition to being male, other variables associated with increased levels of activity include being white, of younger age, having lower levels of depression, eating healthy foods, watching less television, and engaging in lower levels of tobacco and alcohol use [9–12]. Organizational influences such as involvement in physical education classes and sports teams are also important [9]. For example, school-based PE represented 11% of daily moderate-to-vigorous physical activity for boys while significantly less total MVPA was

accumulated on days without school-based PE [13, 14]. However, what is less well understood is the extent to which these variables contribute to the gender disparity in physical activity specifically, whether participation in structured physical activity, such PE classes, is a stronger correlate of overall activity levels in girls than boys. Particularly as budget considerations leave some schools reconsidering the frequency of PE offerings, understanding the contribution of PE to overall physical activity may inform both practice and ongoing policy discussions.

Since girls are less likely to be active during unstructured time, such as recess, than boys [15], it could be argued that physical education in school may be a stronger correlate of activity levels for girls than boys and that reducing school time devoted to physical education [16] will only serve to widen the already pervasive gender gap in activity levels. To test this hypothesis, the current study sought to examine the relative contribution of organizational variables, specifically participation in physical education class and sports teams, to overall levels of physical activity for girls and boys, independent of the individual level variables demonstrated to relate to adolescent physical activity.

2. Methods and Materials

2.1. Study Design and Participants. This study uses cross-sectional data from the Philadelphia Youth Risk Behavior Survey (YRBS) collected in the spring of 2009. In accordance with CDC sampling methodology all students in selected classrooms within designated schools were asked to voluntarily complete the self-report inventory [17]. Participants in this study represent 47 separate high school buildings from across the City of Philadelphia. All adolescents completing the Philadelphia YRBS who provided data for each of the variables included in this study were eligible for this secondary analysis, creating a sample size of 591 students for this study. Passive parental consent was obtained and surveys were completed anonymously [17]. This study was approved by the Institutional Review Board of Temple University and by the School District of Philadelphia.

2.2. Study Measures. Paper and pencil surveys were used to assess the study variables. Earlier versions of the YRBS have been assessed for, and have demonstrated, appropriate validity and reliability [17, 18]. Low scoring items on previous versions have been removed or modified resulting in only the strongest items being carried forward to the 2009 survey [17].

Demographics. Self-reported grade, race/ethnicity, height and weight were evaluated. Body mass index was calculated as body mass/height^2 (kg/m^2).

Psychological Variables. Past year depressive symptoms, suicidal ideation and suicide attempts [19, 20], were evaluated using three items that required a yes/no response.

Weight Perceptions and Concerns were evaluated [21, 22] using six items requiring a dichotomous (yes/no) response. Questions included. Do you consider yourself to be slightly/very overweight? In the last 30 days have you used strategies to lose weight, including (1) exercising, (2) eating less, (3) fasting for a 24-hour period, (4) taking pills, and (5) vomiting or use laxatives.

Drug Use. Current use (in the last 30-days) of tobacco, alcohol, marijuana, cocaine, heroin, methamphetamine, or ecstasy was evaluated using a single item for each substance with a binary response (0 times versus 1 or more times).

Fruit and Vegetable Intake. Dietary habits were considered with a series of questions asking. How many times in the past seven days did you eat... (1) fruit (2) green salad (3) potatoes and (4) other vegetable? Student responses to each question were collapsed into zero times versus one or more times. Previous work has established a positive association between eating a healthy diet and participation in physical activity [9, 23].

Screen Time. Screen time was assessed with two items: on an average school day, how many hours do you... (1) watch TV, and (2) play video or computer games or use a computer for something that is not school work? Responses were dichotomized as three or more hours/day or less than three hours per day.

Organizational Variables. The number of days per week that the student participated in physical education and the number of sports teams in which the student was a member were each evaluated.

Outcome Variable. The primary physical activity outcome was assessed with the question, "During the past seven days, on how many days were you physically active for a total of at least 60 minutes per day?" Responses were coded into one of three categories [24, 25] whereby students reporting zero days of activity were considered sedentary, those reporting activity on one to four days were considered low-moderately active, and those reporting activity on five to seven days were considered highly active. This self-report physical activity item has demonstrated moderate reliability in previous research [26].

2.3. Statistical Analysis. Demographic characteristics of the sample were generated. The association between the independent variables and physical activity level was estimated using chi-square (χ^2) tests of association for nominal or ordinal data or analysis of variance (ANOVA) for interval data. Independent variables that were significantly associated with physical activity were entered into a forward stepwise logistic regression model (.3 for entry). Separate logistic regression models that compared low-moderate levels of activity with sedentary behavior and high levels of activity with sedentary behavior were estimated. To evaluate gender-specific associations, the regression models were rerun with stratification for gender. All statistical analyses were conducted using SPSS version 19 (SPSS for Windows, Chicago, IL).

3. Results

3.1. Participant Characteristics. The study sample was comprised of the 591 9th–12th grade students with complete data for all included study questions. Over half the sample was

Table 1: Bivariate association of individual and organizational level variables with self-reported physical activity in the last week for 9th–12th grade girls and boys.

	Sedentary	Low-moderate activity	High activity
	N = 126 (0 days)	N = 270 (1–4 Days)	N = 195 (5–7 Days)
Individual level variables			
***Sex			
Female	N = 102 (81%)	N = 168 (62%)	N = 95 (49%)
Male	N = 24 (19%)	N = 102 (38%)	N = 100 (51%)
Overweight status (BMI ≥ 25)			
Yes	N = 28 (22%)	N = 57 (21%)	N = 28 (14%)
No	N = 24 (78%)	N = 213 (79%)	N = 167 (86%)
Grade			
9th grade	N = 18 (14%)	N = 53 (19%)	N = 41 (21%)
10th grade	N = 34 (27%)	N = 91 (34%)	N = 60 (31%)
11th grade	N = 54 (43%)	N = 103 (38%)	N = 67 (34%)
12th grade	N = 20 (16%)	N = 23 (9%)	N = 27 (14%)
Race			
Caucasian	N = 19 (15%)	N = 44 (16%)	N = 33 (17%)
African American	N = 69 (55%)	N = 134 (50%)	N = 94 (48%)
Hispanic	N = 19 (15%)	N = 49 (18%)	N = 36 (19%)
Other	N = 19 (15%)	N = 43 (16%)	N = 32 (16%)
*Depression symptoms (sad 2 weeks in the last 12 months)			
Yes	N = 39 (31%)	N = 103 (38%)	N = 57 (29%)
No	N = 87 (69%)	N = 167 (62%)	N = 138 (71%)
Suicidal ideation (considered suicide in the last 12 months)			
Yes	N = 19 (15%)	N = 38 (14%)	N = 20 (10%)
No	N = 107 (85%)	N = 232 (86%)	N = 175 (90%)
Attempted suicide (1+ times in the last 12 months)			
Yes	N = 11 (9%)	N = 17 (6%)	N = 12 (6%)
No	N = 115 (91%)	N = 253 (94%)	N = 183 (94%)
Tobacco use in the last 30 days			
Yes	N = 11 (9%)	N = 29 (11%)	N = 20 (10%)
No	N = 115 (91%)	N = 241 (89%)	N = 175 (90%)
*Alcohol use in the last 30 days			
Yes	N = 40 (32%)	N = 94 (35%)	N = 54 (28%)
No	N = 86 (68%)	N = 176 (65%)	N = 141 (72%)
Marijuana use in the last 30 days			
Yes	N = 16 (13%)	N = 43 (16%)	N = 31 (16%)
No	N = 110 (87%)	N = 227 (84%)	N = 164 (84%)
**Weight perception			
Self-reports being slightly/very overweight	N = 43 (34%)	N = 94 (35%)	N = 39 (20%)
Does not self-report being slightly/very overweight	N = 83 (66%)	N = 176 (65%)	N = 156 (80%)
Weight concern			
**Exercise to lose weight in the last 30 days			
Yes	N = 48 (38%)	N = 161 (60%)	N = 123 (63%)
No	N = 78 (62%)	N = 109 (40%)	N = 72 (37%)
*Eat less to lose weight			
Yes	N = 38 (30%)	N = 107 (40%)	N = 72 (37%)
No	N = 88 (70%)	N = 163 (60%)	N = 123 (63%)

Table 1: Continued.

	Sedentary	Low-moderate activity	High activity
	N = 126 (0 days)	N = 270 (1–4 Days)	N = 195 (5–7 Days)
*Fast to lose weight			
Yes	N = 8 (6%)	N = 30 (11%)	N = 12 (6%)
No	N = 118 (94%)	N = 240 (89%)	N = 183 (94%)
Take pills to lose weight			
Yes	N = 5 (4%)	N = 7 (3%)	N = 6 (3%)
No	N = 121 (96%)	N = 263 (97%)	N = 189 (97%)
Vomit to lose weight			
Yes	N = 4 (3%)	N = 13 (5%)	N = 7 (4%)
No	N = 122 (97%)	N = 257 (95%)	N = 188 (96%)
Dietary behaviors			
**Ate fruit in the last 7 days			
Yes	N = 97 (77%)	N = 230 (85%)	N = 169 (87%)
No	N = 29 (23%)	N = 40 (15%)	N = 26 (13%)
Ate green salad in the last 7 days			
Yes	N = 62 (49%)	N = 139 (52%)	N = 112 (57%)
No	N = 64 (51%)	N = 131 (49%)	N = 83 (43%)
***Ate potatoes in the last 7 days			
Yes	N = 56 (44%)	N = 157 (58%)	N = 119 (61%)
No	N = 70 (56%)	N = 113 (42%)	N = 76 (39%)
*Ate carrots in the last 7 days			
Yes	N = 28 (22%)	N = 89 (33%)	N = 62 (32%)
No	N = 98 (78%)	N = 181 (67%)	N = 133 (68%)
*Ate other veggies in the last 7 days			
Yes	N = 95 (76%)	N = 227 (84%)	N = 159 (82%)
No	N = 31 (25%)	N = 43 (16%)	N = 36 (18%)
**Watched television for ≥ 3 hours/day			
Yes	N = 77 (61%)	N = 130 (48%)	N = 92 (47%)
No	N = 49 (39%)	N = 140 (52%)	N = 103 (53%)
Organizational variable			
***Played in ≥ 1 sport team in the last 12 months			
Yes	N = 29 (23%)	N = 100 (37%)	N = 117 (60%)
No	N = 97 (77%)	N = 170 (63%)	N = 78 (40%)
***Did PE ≥ 1 in average week			
Yes	N = 39 (31%)	N = 83 (31%)	N = 96 (49%)
No	N = 87 (69%)	N = 187 (69%)	N = 99 (51%)
***Did PE every day in the lastweek			
Yes	N = 15 (12%)	N = 39 (14%)	N = 58 (30%)
No	N = 111 (88%)	N = 231 (86%)	N = 137 (70%)

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

female (N = 365, 61.8%). Nineteen percent (N = 112) of the students were in 9th grade, 31% (N = 185) in 10th grade, 38% (N = 224) in 11th grade, and 12% (N = 70) in 12th grade. Half the sample reported being African American (50%; N = 297), 18% indicated being Hispanic (N = 104), and 16% classified themselves as Caucasian (N = 96). Nineteen percent of the students (N = 113) were overweight, and one-third (33%; N = 195) self-reported achieving 60 minutes of moderate to vigorous physical activity on five or more days of the week. Descriptive characteristics for the study variables are provided in Table 1.

3.2. Bivariate Analysis. The association between the independent variables evaluated and levels of physical activity is provided in Table 1. Of relevance to this investigation, a greater proportion of females than males reported being

Table 2: Logistic regression to show relative association between independent variables and sedentary versus low-moderate and sedentary versus high levels of activity.

Variable	Low-moderate activity (N = 270)			High activity (N = 321)		
	S.E.	Exp(β)	P	S.E.	Exp(β)	P
Exercise to lose weight in the last 30 days	.27	2.69	<.01	0.33	2.88	<.01
Eat less to lose weight in the last 30 days	0.30	1.62	.10	0.36	1.27	.51
Trying to lose weight	0.32	0.59	.10	0.38	0.65	.26
Ate potatoes in the last 7 days	0.23	1.58	.05	0.28	1.80	.03
Watched 3+ hours of TV per day	0.24	0.72	.17	0.28	0.51	.02
Participated in PE Class 1+ day/week	0.31	0.72	0.29	0.35	0.88	0.72
Played on ≥1 sport team in the last year	0.27	1.75	0.04	0.29	3.20	<0.01
Participated in PE class every day	0.43	1.20	0.67	0.46	3.45	<0.01
Grade	0.14	0.73	0.02	0.15	0.92	0.58
Overweight	0.30	0.94	0.83	0.37	1.59	0.21
Sex (1: female; 2: male)	0.28	2.81	<0.01	0.31	3.20	<0.01
	R^2 = 0.13; P < .01			R^2 = 0.27; P < .01		

Unless otherwise stated, No: 0 and Yes: 1.

sedentary, while a greater proportion of males than females reported being highly active (Figure 1). The number of sports teams was found to be highly associated with overall physical activity levels (χ^2 (2) = 47.4; P < .01), specifically, among students who reported being on one or more sports teams in the last year, 92% were active (41% low-moderate activity; 48% highly active) whereas of students who did not belong to a team, 72% were active (49% low-moderate activity, 23% highly active). Similarly, attending physical education class at least once a week (χ^2 (2) = 19.05; P < .01) and daily (χ^2 (2) = 22.4; P < .01) was also highly associated with overall activity levels. Among students who reported attending physical education class at least once a week, 82% were active (38% low-moderate activity; 44% highly active) whereas of those students who did not attend physical education class on a weekly basis, 76% were active (50% low-moderate activity, 27% highly active). A similar trend was found for attending physical education class on a daily basis.

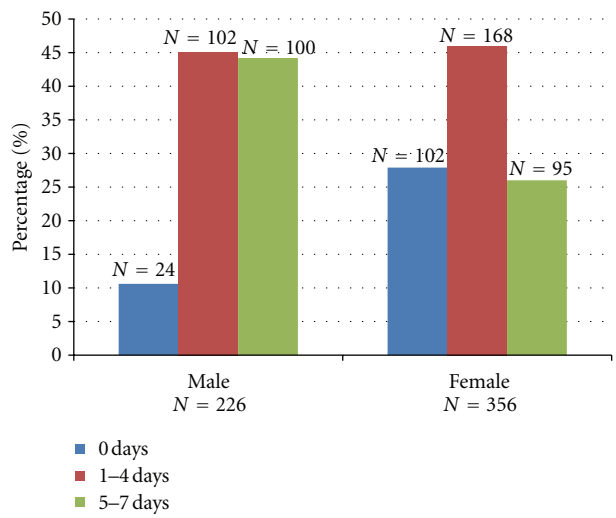

Figure 1: Gender differences in physical activity levels. χ^2 = 33.7; P < .01.

3.3. Regression Models. The overall logistic regression models of low-moderate and high activity are provided in Table 2. A review of the gender-specific model data (provided in Table 3) is provided here.

Correlates of Low-Moderate and High Levels of Activity in Girls. Consistent with the overall model of low-moderate activity, low-moderately active girls were more likely to report exercising to lose weight (Exp(β) = 3.36, P < .01), eating potatoes in the last 7 days (Exp(β) = 1.74, P = .05), playing on at least one sports team in the last year (Exp(β) = 2.14, P = .02), and being in a lower grade in school (Exp(β) =.65, P = .01) as compared to sedentary girls. Specific to this "girls-only" model are data showing that these low-moderately active girls, as compared to sedentary girls, are more likely to report eating less to lose weight (Exp(β) = 2.81, P < .01) but less likely to report trying to lose weight (Exp(β) = 2.88, P < .01) and participating in PE class at least one day each week (Exp(β) =.44, P = .03). Compared to sedentary girls, highly active girls are more likely to report exercising to lose weight (Exp(β) = 2.46, P = .03), playing on at least one sport team in the last year (Exp(β) = 3.24, P < .01), and participating in PE class every day (Exp(β) = 7.06, P < .01). Highly active girls are also about two-thirds less likely to report watching television for at least three hours per day (Exp(β) = 0.34, P < .01) than sedentary girls.

Correlates of Low-Moderate and High Levels of Activity in Boys. The logistic regression model of low-moderate activity for the boys in the sample was not significant, and none of the independent variables included in the model emerged

Table 3: Logistic regression to show relative association between the independent variables and sedentary versus moderate and sedentary versus high levels of activity in girls and boys.

	Low-moderate activity			High activity		
Variable	S.E.	Exp(β)	P	S.E.	Exp(β)	P
(a) Girls						
Exercise to lose weight in the last 30 days	0.327	3.36	0.000	0.404	2.464	0.026
Eat less to lose weight in the last 30 days	0.366	2.81	0.005	0.460	2.050	0.119
Trying to lose weight	0.399	0.36	0.010	0.483	0.642	0.359
Ate potatoes in the last 7 days	0.280	1.74	0.047	0.347	1.918	0.061
Watched 3+ hours of TV per day	0.298	0.67	0.174	0.365	0.342	0.003
Participated in PE class 1+ day/week	0.378	0.44	0.030	0.452	0.603	0.263
Played on ≥1 sport team in the last year	0.322	2.14	0.018	0.369	3.243	0.001
Participated in PE class every day	0.542	1.73	0.312	0.593	7.064	0.001
Grade	0.170	0.65	0.012	0.191	.842	0.368
Overweight	0.345	1.000	1.000	0.479	2.463	0.060
	$R^2 = 0.18$; $P < 0.01$			$R^2 = 0.27$; $P < 0.01$		
(b) Boys						
Exercise to lose weight in the last 30 days	0.600	1.87	0.296	0.614	4.200	.019
Eat less to lose weight in last 30 days	0.606	0.33	0.070	0.617	0.585	0.385
Trying to lose weight	0.669	1.72	0.418	0.692	0.617	0.486
Ate potatoes in the last 7 days	0.481	1.41	0.473	0.519	1.738	0.287
Watched 3+ hours of TV per day	0.480	0.91	0.838	0.520	1.157	0.779
Participated in PE class 1+ day/week	0.701	1.75	0.425	0.761	2.597	0.210
Played on ≥ 1 sport team in the last year	0.509	1.15	0.783	0.512	2.785	0.046
Participated in PE class every day	0.831	0.51	0.418	0.868	0.848	0.849
Grade	0.254	1.06	0.809	0.260	0.975	0.923
Overweight	0.725	0.68	0.597	0.723	0.877	0.856
	$R^2 = 0.05$; $P = .66$ (ns)			$R^2 = 0.13$; $P = .06$		

as being relatively significant correlates. In the logistic regression model of high activity, the results showed that highly active boys were more likely to report exercising to lose weight (Exp(β) = 4.20, $P = .02$) and playing on at least one sports team in the last year (Exp(β) = 2.79, $P = .05$) than their sedentary counterparts.

4. Discussion and Conclusion

The primary purpose of this study was to examine whether the structured physical activity opportunities of sports team participation and school-based PE contributed differently to the physical activity level of girls versus boys, independent of individual level variables. Consistent with previous work [3, 27–29], these results demonstrate that males were significantly more likely to be active than females, and this association was even more pronounced in the high activity (versus sedentary) group (see Table 2). Of relevance to our understanding of the correlates of gender differences in adolescent activity, results suggested that playing on sports teams and participation in PE class contributed differently to overall levels of activity for boys and girls.

Playing on at least one sport team in the last year was significantly associated with being active (versus sedentary): respondents who were highly active were over three times more likely, and those who engaged in low-moderate activity were almost twice as likely, to report being on at least one sport team than sedentary individuals. In terms of gender differences, highly active girls were over three times as likely to report playing on at least one sport team in the last year as compared to sedentary girls, while low-moderately active girls were more than twice as likely to play on at least one sport team than sedentary girls ($P = .001$ and .02, resp.). Among boys, participation in one or more sport teams was related to high, but not to low-moderate, levels of physical activity.

Several lines of evidence can help with the interpretation of these data. First, adolescent boys have been shown to achieve greater physical activity participation during unstructured periods of the day, including recess and after school, than do girls [15]. Thus, boys may achieve low-moderate levels of physical activity without benefit of sports team participation whereas girls may benefit from the impetus of an organized sports team to achieve increased physical activity participation. Second, sports teams also represent a form of social support for physical activity. Given that social support is positively associated with physical activity in adolescent girls [30, 31], promoting team participation and the sense of "belonging" inherent with that may be a strategy for promoting activity in adolescent girls.

Participation in daily physical education class was significantly associated with high levels of activity; however, this effect was not found for participating in PE on at least one day per week. When this relationship was examined in the gender-specific models, physical education participation was not related to overall levels of physical activity for boys, while highly active girls were seven times more likely ($P = .001$) to report participating in PE class every day than sedentary girls. Conversely, low-moderately active girls were half as likely to report participating in PE on one or more days of the week.

That daily PE confers increased likelihood of high activity is not surprising; what is surprising is that in the gender-stratified models, this relationship is only evident for highly active girls. One hypothesis from these data is that the active boys are accumulating activity time outside of PE class. Related to this premise are data showing that, first, boys are more likely to engage in leisure-time physical activity than girls [15] and, second, only half of PE class time actually includes moderate-vigorous activity [32, 33]. On this basis, it is plausible that the active boys in this sample accumulated their active time outside the classroom and that among girls only those who were sufficiently motivated fully engaged in higher levels of activity. This line of interpretation is quite hypothetical, but does highlight the hypothesis that PE may contribute differently to overall activity levels for girls versus boys, and this certainly warrants further investigation.

Results from this exploratory study should be interpreted with consideration of several limiting factors. First, these data are cross-sectional in nature and as such the significant relationships reported are associations and should be considered hypothesis generating. Second, all data are self-report and particularly in the case of physical activity levels are subject to recall bias. Third, while the intent was to elucidate gender differences in the role of the organizational level variables of sports team participation and physical education classes on physical activity levels, independent of individual level influences on physical activity, this was not completely accomplished. There are several individual level variables known to relate to adolescent physical activity levels that were not included in this study (e.g., parental support for physical activity [34].

The implications of these hypothesis-generating data can be summarized in three points. First, these data support the hypothesis that correlates of adolescent physical activity need to be examined in a gender-stratified way so that gender-specific programs can be refined. Second, organized physical activity events and outlets may play a larger role in promoting physical activity levels in girls than boys. Third, physical education class may contribute differently to the overall activity level of girls relative to boys and thus decreases in the frequency of school-based PE may serve to differentially impact female students. Data from this study provide some initial support for these hypotheses. Future trials are needed to fully evaluate this premise, perhaps in the context of a longitudinal trial that also includes younger children.

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