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## Enrollment in Physical Education Is Associated With Overall Physical Activity in Adolescent Girls

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Russell R. Pate, Dianne S. Ward, Jennifer R. O'Neill, and Marsha Dowda

*Little is known about population-level contributions of school physical education to overall physical activity (PA) in youth. Because PA levels are lower in girls than boys, it is particularly important that the effects of PE programs in adolescent girls be understood. Thus, the purpose of this study was to determine the association of enrollment in physical education and overall physical activity participation in adolescent girls. A measurement protocol was administered to cross-sectional samples of 8th-, 9th-, and 12th-grade girls participating in a school-based PA intervention study (1998–2003). PA was assessed with the 3-Day Physical Activity Recall. Three-way analyses of variance were performed to compare groups formed on the basis of physical education enrollment. For each grade group of girls, those who were enrolled in physical education reported more moderate-to-vigorous PA and more vigorous PA than nonenrolled girls. When activity in physical education classes was deleted, 8th- and 9th-grade physical education enrollees were not more active than nonenrollees; however, 12th-grade physical education enrollees remained more active than nonenrollees. Girls who were enrolled in physical education were more physically active than nonenrolled girls in all three grade levels. These findings suggest that expanded enrollment in physical education may increase American adolescent girls' PA level.*

*Key words:* moderate activity, schools, vigorous activity

**P**hysical activity plays a critical role in the healthy development of children and youth (American Heart Association, 2001), and schools have traditionally provided American youth with opportunities for physical activity. Physical education has been an institution in American schools since early in the 20th century (Wuest & Bucher, 1999; American Medical Association, 1902), and the Centers for Disease Control and Prevention (CDC) has recommended comprehensive, daily physical education for students in kindergarten through 12th grade (CDC, 1997). Virtually all schools currently offer physical education classes (Burgeson, Wechsler, Brener, Young, & Spain, 2001).

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*Russell R. Pate, Jennifer R. O'Neill, and Marsha Dowda are with the Department of Exercise Science at the University of South Carolina. Dianne S. Ward is with the Department of Nutrition at the University of North Carolina.*

While school-based physical education is ostensibly well positioned to help provide high school students with the physical activity they need, the overall influence of physical education classes is not clear. At the population level, little is known about the relationship between participation in physical education classes and children's and adolescents' physical activity levels. Although medical, public health, and education professionals recommend that schools increase physical education requirements (Strong et al., 2005; National Association for Sport and Physical Education, 2004; American Academy of Pediatrics, 2000; CDC, 1997), enrollment in high school physical education programs has declined in recent decades (CDC, 2004). Physical education enrollment may be a particularly important source of physical activity for girls who tend to be less active than boys (CDC, 2006) and whose age-related decline in physical activity is steep (Kimm et al., 2002). This decline in girls' physical activity appears to be related to a significant increase in body mass index (BMI) across adolescence (Kimm et al., 2005). Although girls and boys are subject to the same requirements for physical education enrollment, girls are less likely than boys to elect it when it is not re-

quired (CDC, 2004) and more likely to report less positive attitudes toward physical education (Koca & Demirkan, 2004).

Because rates of overweight are increasing rapidly among U.S. youth (Ogden et al., 2006) and overall physical activity levels appear to be declining, it is essential that school-based programs provide students with as much physical activity as possible. However, surprisingly little is known about the population-level contributions of school physical education to overall youth physical activity. Specifically, it is not known if overall physical activity levels are higher in students who take physical education compared to those who don't. Because physical activity levels are lower in girls than boys, it is particularly important that the influence of physical education be understood in adolescent girls. Accordingly, the purpose of this investigation was to determine the association between physical education enrollment and overall physical activity participation. This study was undertaken in three ethnically diverse cross-sectional samples of middle and high school girls.

## Method

### *Study Design and Participants*

The present study reports cross-sectional analyses of data collected as part of the measurement protocol in a large-scale school-based physical activity intervention study, the Lifestyle Education for Activity Program (Pate et al., 2005). Participants were female students in 31 middle schools and 24 high schools in South Carolina. We collected data in samples of 8th-, 9th-, and 12th-grade students and invited all girls in these schools to participate. School assemblies were held at each time point to explain the study and describe incentives for participation. Overall, 2,563 8th-grade girls (1998 and 1999), 2,104 9th-grade girls (1999 and 2000), and 1,594 12th-grade girls (2002 and 2003) participated in the measurement protocol. Each girl and her primary guardian provided written informed consent. After deletions for missing data and races other than African American or White, 2,154 8th-grade, 1,888 9th-grade, and 1,402 12th-grade girls were included in the analyses. Girls from both the control and intervention groups participated. The University of South Carolina Institutional Review Board approved the study.

### *Measures*

Participating girls reported their physical activity using the 3-Day Physical Activity Recall (3DPAR). The 3DPAR is a self-report instrument that has been validated against accelerometry in White and African American adolescent girls and used in previous physical activity studies in adoles-

cent girls (Pate, Ross, Dowda, Trost, & Sirard, 2003; Pate et al., 2005; Motl, Dishman, Dowda, & Pate, 2004). Trained data collectors administered the 3DPAR to small groups of girls, always on a Wednesday during the spring semester of each study year. Participants recalled their activities on Tuesday, Monday, and Sunday and completed a grid for each day. The grid was divided into 30-min blocks, beginning at 7 a.m. and ending at 12 midnight. Girls reported their predominant activity in each block, using a list of 55 common activities grouped into categories (sleep/bathing, eating, work, after-school/spare-time/hobbies, transportation, and physical activities/sports) to facilitate identifying and reporting the predominant activity. Physical education class was included as an activity. Girls also indicated if they performed the activity at a light, moderate, hard or very hard intensity, based on text and graphic figures that described the intensities of common activities. The instrument described light activities as requiring little or no movement with slow breathing, moderate activities as requiring some movement and normal breathing, hard activities as requiring moderate movement and increased breathing, and very hard activities as requiring quick movement and hard breathing. We assigned metabolic equivalent (MET) values to activities using a standard compendium (Ainsworth et al., 2000).

Data were reduced to 3-day averages for the 30-min blocks for which the reported activity was rated at an intensity of 3 METs or more (moderate-to-vigorous physical activity; MVPA) and 6 METs or more (vigorous physical activity; VPA). We also classified each girl as meeting a PA standard if she reported a daily average of one or more 30-min blocks of VPA. Girls completed questionnaires that solicited demographic information, including age and race. They also reported if they were currently taking physical education.

### *Statistical Analyses*

We performed a set of three-way analyses of variances (ANOVAs) to compare physical education enrollment of girls in each grade sample. The analyses controlled for race and the effects of the intervention. The school nested within-group was treated as a random variable in all analyses. The dependent variables were daily averages for MVPA and VPA blocks as well as participation in a daily average of one or more VPA blocks (yes, no). A few girls (8th = 3, 9th = 4, and 12th = 14) at each time point were deleted from the analyses, because they reported unrealistically high rates of vigorous physical activity (more than a daily average of ten 30-min blocks). A second series of analyses was performed after deleting activity reported for physical education classes and recalculating each dependent variable. All statistical analyses were conducted using SAS for Windows version 9.1. (SAS Institute, Inc., 2004).

## Results

Complete data were available for 2,151 girls in 8th grade, 1,884 in 9th grade, and 1,388 in 12th grade. The characteristics of the three cross-sectional samples of girls are presented in Table 1. The percentage of girls who were African American ranged from 49% to 57% across the three grade levels. South Carolina law requires middle school students to take physical education every year and high school students to complete one Carnegie unit of physical education, which most complete during their freshman year. Most of the girls in this study were enrolled in physical education during grades 8 and 9. However, approximately half were currently enrolled at the time of data collection (spring semester). Only about 10% of 12th-grade girls reported being enrolled in physical education.

**Table 1.** Characteristics of study participants

Characteristic	8th grade <i>n</i> = 2,151		9th grade <i>n</i> = 1,884		12th grade <i>n</i> = 1,388	
Age (years)						
<i>M</i> , <i>SD</i>	13.6	0.6	14.6	0.6	17.7	0.6
AA (%)	51.7		49.3		56.6	
In PE (%)	55.0		57.7		9.4	

*Note.* *M* = mean; *SD* = standard deviation; AA = African American; PE = enrolled in physical education.

The main effects for physical education are shown in Table 2. For all three cross-sections, all activity variables were significantly different ( $p < .05$ ) between those enrolled in physical education and those who were not. For each cross-section, girls enrolled in physical education reported more MVPA and VPA, and a higher percentage reported a daily average of one or more blocks of VPA. Girls enrolled in physical education reported 12–32% more MVPA blocks and 33–60% more VPA compared to those not enrolled in physical education. Results of the ANOVAs performed after deleting the activity reported for physical education are shown in Table 3. There were no significant differences for any PA variables between the 8th- and 9th-grade girls enrolled in physical education and those who were not ( $p > .05$ ). Among 12th-grade girls, those enrolled in physical education reported higher VPA levels and a greater percentage of one or more VPA blocks per day ( $p \leq .05$ ) than those not enrolled in physical education.

## Discussion

The key finding of this investigation was that girls enrolled in physical education were more physically active at all three grade levels than those not enrolled. In grades 8 and 9, the association of physical education enrollment with overall physical activity was apparently due primarily to the activity girls engaged in during physical education classes. When activity in physical

**Table 2.** Physical activity in 8th, 9th, and 12th grade girls categorized by physical education enrollment<sup>a</sup>

Physical activity	Yes		Physical education No		<i>F</i>	<i>p</i>
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>		
8th grade						
MVPA	3.7	0.1	3.3	0.1	11.92	< .001
VPA	1.2	0.1	1.0	0.1	3.76	.05
≥ 1 Block VPA (% yes)	44.8	2.1	40.1	2.2	4.61	.04
9th grade						
MVPA	4.1	0.1	3.1	0.1	71.97	< .001
VPA	1.2	0.1	0.8	0.1	33.32	< .001
≥ 1 Block VPA (% yes)	47.8	2.2	32.9	2.4	34.91	< .001
12th grade						
MVPA	5.8	0.3	4.5	0.1	13.03	< .001
VPA	1.5	0.1	0.9	0.0	16.98	< .001
≥ 1 Block VPA (% yes)	54.2	4.2	33.5	1.5	23.01	< .001

*Note.* *M* = mean; *SE* = standard error; *F* = test statistic; MVPA = moderate-to-vigorous physical activity, average number of blocks per day at an intensity of ≥ 3 metabolic equivalents (METs); VPA = vigorous physical activity, average number of blocks per day at an intensity of ≥ 6 METs.

<sup>a</sup>The degrees of freedom for all analyses are 1.

education classes was deleted for 8th- and 9th-grade girls, physical education enrollees were not more active than nonenrollees. Among 12th-grade girls, physical education enrollees were considerably more active than nonenrollees. In this group, deletion of physical education class activity reduced but did not eliminate the significant difference in VPA between enrolled and nonenrolled girls. This is not surprising, because physical education enrollment is almost always elective for 12th-grade girls in South Carolina. Our findings suggest that 12th-grade girls who elect physical education are more physically active outside class than those who do not elect physical education, although their enrollment contributes to the magnitude of the difference in their activity levels, compared to those not enrolled. These findings are important, because the significant increase in BMI observed in girls across adolescence appears to be linked to decreases in physical activity during the same period (Kimm et al., 2005). The additional activity provided by participation in physical education classes may blunt the activity-related increase in BMI.

While many previous studies have examined physical activity levels of children and youth during physical education classes (McKenzie, Marshall, Sallis, & Conway, 2000; McKenzie et al., 1995; Simons-Morton, Parcel, Baranowski, Forthofer, & O'Hara, 1991), few have observed the association of physical education enrollment on students' overall activity levels. Our observations with regard to this association are consistent with the findings of two previous studies. In the Bogalusa Heart

Study cohort, Myers et al. found that boys and girls ages 9–15 years enrolled in physical education reported more PA than nonenrollees (Myers, Strikmiller, Webber, & Berenson, 1996). Similarly, in a nationally representative sample of U.S. students in grades 7–12 (National Longitudinal Study of Adolescent Health) Gordon-Larsen and colleagues found that physical education enrollees, who constituted 21.3% of the total sample, were significantly more likely than nonenrollees to be in the highest MVPA category (Gordon-Larsen, McMurray, & Popkin, 2000). The present study and the two previously published studies were all undertaken in relatively large samples of youth, and collectively they provide consistent and strong evidence that students enrolled in physical education tend to engage in more overall physical activity than nonenrollees (Myers et al., 1996; Gordon-Larsen et al., 2000).

The finding that enrollment in physical education is associated with greater overall physical activity has important implications for public policy. An expert panel convened by the CDC made an evidence-based recommendation that school-aged youth participate in at least 60 min of MVPA each day (Strong et al., 2005). Authorities in public health, education, and medicine have long called for students to be provided with physical education on a daily basis (National Association for Sport and Physical Education, 2004; American Academy of Pediatrics, 2000; CDC 1997). Despite these recommendations, physical education enrollment declined between 1991 and 1995 and was unchanged between

**Table 3.** Physical activity, excluding that performed in physical education classes, in 8th, 9th, and 12th grade girls categorized by physical education enrollment<sup>a</sup>

Physical activity	Yes		Physical education		<i>F</i>	<i>p</i>
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>		
8th grade						
MVPA	3.3	0.1	3.3	0.1	0.02	.89
VPA	1.0	0.1	1.0	0.1	0.59	.44
≥ 1 Block VPA (% yes)	36.9	0.0	39.9	0.0	1.81	.19
9th grade						
MVPA	3.3	0.1	3.1	0.1	2.95	.09
VPA	1.0	0.1	0.9	0.1	2.98	.08
≥ 1 Block VPA (% yes)	38.0	2.1	34.0	2.3	2.93	.10
12th grade						
MVPA	5.1	0.3	4.5	0.1	3.35	.07
VPA	1.2	0.1	0.9	0.0	3.79	.05
≥ 1 Block VPA (% yes)	43.8	4.2	33.4	1.4	5.92	.02

*Note.* *M* = mean; *SE* = standard error; *F* = test statistic; MVPA = moderate-to-vigorous physical activity, average number of blocks per day at an intensity of ≥ 3 metabolic equivalents (METs); VPA = vigorous physical activity, average number of blocks per day at an intensity of ≥ 6 METs.

<sup>a</sup>The degrees of freedom for all analyses are 1.

1995 and 2003 (CDC, 2004). Recent rapid increases in the prevalence of overweight children and youth (Ogden et al., 2006) suggest a pressing need to implement policies that will result in large numbers of young people participating in significantly more physical activity. The results of the present study, in combination with the findings of Myers et al. (1996) and Gordon-Larsen et al. (2000), indicate that systematically increasing student enrollment in physical education is likely to significantly increase physical activity among American youth.

This study had a number of strengths, including the large number of girls in the sample, the approximately equal numbers of African American and White girls, and the high schools in rural, suburban, and urban areas. The study collected data at three time points, using the same collection instruments each time, over an age range during which physical activity in girls typically declines dramatically. Limitations of the study include the smaller number of girls measured in grade 12, due in part to the high dropout rate in South Carolina high schools. Selection bias could not be ruled out; thus, girls who participate in physical education may have been more likely to agree to participate in the intervention study. The measure of physical activity was self-reported, and an objective measure may have added more precision to the physical activity data. However, the 3DPAR has been validated against accelerometry in adolescent girls (Pate et al., 2003) and has demonstrated factorial validity and invariance in the same population (Motl et al., 2004).

In summary, 8th-, 9th-, and 12th-grade girls currently enrolled in physical education were more active than those who were not enrolled. The 8th- and 9th-grade girls were enrolled in required physical education, and the observed difference in PA between enrolled and nonenrolled groups was explained by activity in the physical education classes. Only 9.4% of 12th-grade girls were enrolled in physical education, because in South Carolina, as in most states, it is elective at that grade level. Enrolled girls were more physically active than those who did not elect physical education, but the intergroup difference was not explained primarily by physical activity in the physical education classes. These findings suggest that expanded enrollment in physical education may increase the physical activity level of American adolescent girls.

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## Authors' Notes

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E-mail: rpate@gwm.sc.edu