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Girls' Activity Levels and Lesson Contexts in Middle School PE: TAAG Baseline

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Abstract

Purpose—To assess girls' physical activity (PA) in middle school physical education (PE) as it relates to field site, lesson context and location, teacher gender, and class composition.

Methods—We observed girls' PA levels, lesson contexts, and activity promotion by teachers in 431 lessons in 36 schools from six field sites participating in the Trial of Activity for Adolescent Girls. Interobserver reliabilities exceeded 90% for all three categories. Data were analyzed using mixed-model ANOVA with controls for clustering effects by field site and school.

Results—Mean lesson length was 37.3 (± 9.4) min. Time (13.9 ± 7.0 min) and proportion of lessons ($37.9 \pm 18.5\%$) spent in moderate to vigorous PA (MVPA), and time (4.8 ± 4.2 min) and proportion of lessons ($13.1 \pm 11.7\%$) in vigorous PA (VPA) differed by field site ($P < 0.004$). Lesson time for instructional contexts differed by field site, with overall proportions as follows: game play (27.3%), management (26.1%), fitness activities (19.7%), skill drills (12.1%), knowledge (10.6%), and free play (4.4%). Coed classes were 7.9 min longer than girls-only classes ($P = 0.03$). Although 27 s shorter, outdoor lessons were more intense (MVPA% = 45.7 vs 33.7% of lesson, $P < 0.001$) and provided 4.0 more MVPA minutes ($P < 0.001$). MVPA, VPA, and lesson contexts did not differ by teacher gender. There was little direct promotion of PA by teachers during lessons.

Conclusions—Substantial variation in the conduct of PE exists. Proportion of lesson time girls spent accruing MVPA (i.e., 37.9%) fell short of the *Healthy People 2010* objective of 50%. Numerous possibilities exist for improving girls' PA in PE.

Keywords

CHILDREN; EXERCISE; FEMALES; INTERVENTION; PHYSICAL; SPORTS

Adolescent girls are less active than their male peers, and their decline in physical activity over time is greater (20,25). School physical education (PE) is an important source for promoting physical activity (21,26) and has recently been identified by national government agencies as a major component of efforts to combat serious public health problems such as obesity and

type II diabetes (4,15,27). PE is one of only five interventions strongly recommended for increasing physical activity by the national Task Force on Community Preventive Services (5). PE is mandated in 94% of the U.S. states (14), and unlike most other activity programs, it is available to most adolescents regardless of socioeconomic status.

Because PE provides students with opportunities to be physically active and because it may teach them knowledge and behavioral and movement skills that enhance active life-styles, public health officials are interested in how it is conducted (3,26,27). For example, the *Healthy People 2010* (27) objectives include offering PE on a daily basis (Objective 22–9) and having students active at least 50% of PE time (Objective 22–10).

Extensive descriptive studies of physical activity levels in third grade PE have been conducted, including those in 96 CATCH (Child and Adolescent Trial for Cardiovascular Health) schools in four states (7) and in over 600 schools in the National Institute of Child Health and Human Development (NICHD) study conducted in 10 states (16). Physical activity levels among third graders were dependent upon geographical region, teacher specialty (PE specialists vs classroom teachers), and lesson location (indoors vs outdoors).

Compared with investigations of activity levels in elementary school PE, few studies have been conducted in middle schools (24). There are approximately 14,000 public middle and junior high schools in the United States, and most school districts (84.6%) require physical education at that level (2). Yet, there is little research on the physical activity of middle school girls in PE, particularly as it relates to geographic location, lesson context (i.e., instructional mode) and location, teacher gender, and class gender composition (i.e., coed vs girls-only). Previous studies showed that moderate-to-vigorous physical activity (MVPA) in PE in middle schools was higher than in elementary schools, but the data were from regional samples (8,23). There is also relatively little information on instructor behavior as it relates to promoting students to engage in physical activity either during PE or beyond class time. Additional research also is needed to determine how well middle school PE is meeting national objectives for physical activity.

The present study assesses girls' physical activity (PA) in middle school physical education (PE) as it relates to field site, lesson context and location, teacher gender, and class composition. Baseline data from girls participating in the Trial of Activity for Adolescent Girls (TAAG) from 36 middle schools in the six field sites across the United States are included.

The study uses a validated observation instrument, the System for Observing Fitness Instruction Time (SOFT), to assess physical activity levels, PE lesson contexts, and instructor behavior (10). It examines girls' physical activity levels in middle school PE, the instructional contexts in which PE is delivered, lesson location (i.e., indoors vs outdoors), and class gender composition. In addition, the study examines the extent to which teachers promote physical activity and fitness during PE lessons and examines differences in physical activity provided among field sites and by teacher gender.

METHODS

Schools

Baseline data were collected in PE classes in 36 public middle schools participating in the Trial of Activity for Adolescent Girls (TAAG), a group-randomized controlled study that is testing the effectiveness of an intervention to reduce the decline in physical activity among middle school girls. The TAAG field sites represent diverse geographical areas and populations. Participating institutions are San Diego State University (California), Tulane University (Louisiana), University of Arizona, University of Maryland, University of Minnesota, and

University of South Carolina. The National Heart, Lung, and Blood Institute (NHLBI) sponsored and participated in the study, which was coordinated by the Collaborative Studies Coordinating Center of the University of North Carolina at Chapel Hill.

The schools were diverse in size, facilities, and population characteristics and had an average enrollment of 1027 (SD = 285) students, 47% (SD = 28) of whom were nonwhite and 34% (SD = 25) of whom received free or low-cost meals. Schools signed an agreement to participate, which included offering required physical education during each year of middle school for at least one semester. All research procedures were approved by the institutional review boards of each university and, when applicable, each participating school district.

Data Collection

Observation schedule

The conduct of PE was measured by directly observing PE lessons at each school during 3 d spread over a 5-month period from January to May, 2003. Only PE lessons that contained girls were observed, and the data were obtained at TAAG baseline before schools were randomly assigned to treatment conditions. To account for seasonality and diversity in curricular offerings, observation days in the 36 schools were completed in three cycles, with each school being observed once in each cycle. Cancellations for inclement weather or school emergencies were rescheduled, and lessons scheduled for a classroom were not observed. To assist in selecting representative lessons, trained TAAG measurement coordinators at each site obtained schedules for all PE teachers and, when available, information on the types of instructional units they were to conduct. Coordinators designed a schedule to sample lessons representative of a school in terms of grade level, course content, days of the week, and PE teachers. Four lessons were to be observed during each school visit, and the specific lessons selected were not made known to teachers until just prior to the scheduled class. Occasionally, due to school schedule changes, four lessons could not be viewed in 1 d, and remaining observations were rescheduled as soon as possible.

Observation system

SORT (10) was used to obtain simultaneous recordings of student activity levels, the lesson context in which they occurred (i.e., how lesson content was delivered, including time spent on fitness, skill drills, game play, free play, knowledge, and management), and teacher interactions relative to promoting physical activity and fitness. Details on the categories and procedures for using the system have been published elsewhere (10,12), and a procedures manual specific to TAAG was prepared to ensure common use across field sites. Briefly, on a rotational basis, the physical activity levels of four randomly selected girls, the lesson context, and teacher interactions were coded every 20 s throughout the entire lesson. The activity codes (lying, sitting, standing, walking, and vigorous) have been calibrated using heart rate monitoring (10,19) and validated using accelerometry (22). Observations for a PE lesson began when 51% of students in the class had reached the instructional area, and ended when 51% had departed. The number of students actively participating in class was recorded; those absent or not participating physically were not included in the count. Teacher gender, class gender composition, and lesson location were also recorded.

Observer training and certification

Twenty-four observers, with at least two from each field site, met at a single location for training and certification. Initial training included the memorization of codes, classroom lectures, videotape assessment, and field practice in schools. After training, observers became certified by reaching an interobserver agreement criterion of 85% on all variables on three preceded “gold-standard” videotaped lessons.

Observation procedures and data management

Observers, paced by preceded audio tapes, entered data onto Scantron forms. At the completion of each lesson, forms were checked for missing data and forwarded to the coordinating center for scanning and analysis.

Reliability assessment

Field-based interobserver reliabilities were conducted on 56 lessons during 39 different assessment days at 27 different schools, which is approximately 12% of observations. During reliability checks, two observers independently coded the same girls during the same lesson while being paced by a single tape recorder equipped with a y-adaptor and two earphone jacks. A percent interobserver agreement (IOA) was calculated for each variable using the following formula: $[\# \text{ agreements}/(\# \text{ agreements} + \# \text{ disagreements})] \times 100$ (6). Across the 5-month period, IOAs were 90, 93, and 98% for student activity levels, lesson context, and teacher interactions, respectively. Intraclass correlations for estimates of energy expenditure rate (EER; $\text{kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), total energy expenditure (TEE; $\text{kcal}\cdot\text{kg}^{-1}$), and proportion of lesson engaged in moderate-to-vigorous physical activity (MVPA) were 0.97, 0.99, and 0.98, respectively.

Data Analysis

Dependent variables

The dependent variables examined (see Tables 1 and 2) reflect four general categories: class factors, student activity levels, lesson context, and teacher interactions. Class factors included lesson length and class size (number of students). Student activity levels included proportions of time spent at various activity levels and three activity summary measures: (a) the proportion of lesson time engaged in MVPA, (b) mean estimated EER, and (c) mean estimated TEE. Time spent in MVPA, a quantity addressed in *Healthy People 2010* (27) and in *Physical Activity and Health: A Report of the Surgeon General* (26), was derived by summing lesson time spent walking and being vigorous. Similar to previous studies (8), EER was estimated using the following equation: $(\text{proportion of observations spent lying down} \times 0.029 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) + (\text{proportion of observations sitting} \times 0.047 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) + (\text{proportion of observations standing} \times 0.051 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) + (\text{proportion of observations walking} \times 0.096 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}) + (\text{proportion of observations spent being vigorous} \times 0.144 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1})$. The energy expenditure constants for activity level were derived from heart rate monitoring (10). TEE, an estimate of the total energy expended per lesson, was calculated by multiplying EER by the lesson length. Lesson context variables (i.e., how PE was delivered) included proportions of time spent in the six lesson contexts of management, knowledge, fitness, skill practice, game play, and free play. Teacher promotion of physical activity included proportions of intervals spent in three teacher interaction categories: promoting in-class physical activity or fitness, promoting out-of-class physical activity or fitness, and no physical activity or fitness promotion.

Statistical analysis

Class lessons for which SOFIT data were obtained were regarded as the primary units of analysis and assumed to be a representative sample of all PE lessons within a school. Mixed model analysis of variance (using SAS PROC MIXED procedure; SAS Institute, Cary, NC) was used for comparisons of dependent variables among the six sites, and between groups defined by teacher gender, lesson location, and class gender composition. All group variables were treated as fixed effects. Random effects were included for site, and school nested within site to account for the lack of statistical independence of lesson-level outcomes within schools and schools within sites (except for the series of models testing for site differences, in which

site was treated as a fixed effect; Table 1). Summary statistics are presented as unadjusted means and standard deviations. However, all significance tests represent the adjusted independent relationship each fixed effect has with the dependent variable. Effect sizes were calculated using the formula offered by Rosenthal and Rosnow (18), $r = \text{square root } \{F/[F + (ddf/ndf)]\}$, where F = the F statistic from the mixed-model ANCOVA and ndf and ddf indicate numerator and denominator degrees of freedom, respectively.

RESULTS

A total of 431 lessons were observed, with a range of 70–74 per field site. Mean observed lesson length (i.e., the time students spent in the instructional setting) was 37.3 min (SD = 9.4), and classes had an average of 30 (SD = 12.1) students participating in them. Sixty percent of the lessons were taught by females, 65% were held indoors, and 83% were conducted in a coeducational format.

Physical Activity

Table 1 presents unadjusted means and standard deviations and mean ranges by field site for lesson length, estimated lesson energy expenditure, and number of minutes spent at various student activity levels and in different lesson contexts. There were significant differences among field sites for all student activity variables. Girls accrued an average of 13.9 MVPA and 4.8 VPA minutes per lesson.

Table 2, which adjusts for lesson length, provides an indication of the intensity of lessons by presenting data for energy expenditure rate and proportion (%) of lesson for physical activity variables. Similar to accrued minutes of physical activity, there were significant differences among field sites relative to proportion of lesson time spent in the different student activity variables. Overall, girls spent a substantial proportion of time being sedentary and engaged in VPA and MVPA an average of 13.1 and 37.9% of lesson time, respectively. The mean energy expenditure rate was $0.073 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, and an average of $2.7 \text{ kcal}\cdot\text{kg}^{-1}$ was expended per lesson.

Lesson Contexts

Tables 1 and 2 show -substantial variability within the contexts in how PE was delivered (see large standard deviations). There were significant differences among field sites for both the number of minutes and proportion of lesson for three lesson contexts: management, knowledge, and fitness activities. The most prominent contexts were game play (27.3% of lesson), management (26.1%), and fitness (19.7%). On average, little time was spent in skill drills (12.1%) and in free play situations (4.4%).

Physical Activity during Specific Lesson Contexts

Table 3 shows there were significant differences in both the amounts of time allocated to different lesson contexts and in activity levels that accrued within contexts. For example, contexts differed in the mean energy expenditure rates they provided ($P < 0.001$), with girls expending the most energy during fitness activities ($0.094 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$), which were followed closely by skill drills and game play. Figure 1 summarizes data for proportion of time spent in MVPA during the contexts and shows that girls were engaged in MVPA 59% of the time during fitness contexts, compared with 48 and 46% of the time during skill drill and game play situations, respectively.

Lesson Location

Outdoor lessons were 47 s shorter than indoor lessons ($P < 0.001$) but provided more activity minutes (MVPA = 16.5 vs 12.5 min; $P < 0.001$) and were of greater intensity (MVPA% = 45.7 vs 33.7% of lesson). Girls spent a relatively large amount of time sitting in indoor classes (37.5%) and standing during outdoor classes (33.8%).

Time allocations for how PE was delivered (i.e., lesson contexts) varied with the location of classes. Figure 2 shows that outdoor classes provided proportionally more time for fitness and management, whereas indoor lessons allocated more time for knowledge. Levels of teacher promotion of in-class and out-of-class physical activity were not significantly different in the two locations.

Class Gender Composition

Coeducational lessons were 7.9 min longer than girls-only lessons ($P = 0.027$) and provided 3.1 min more of MVPA and a greater energy expenditure ($P = 0.042$). When lesson length was controlled, the proportion of time girls spent in vigorous activity and MVPA did not differ by class gender composition. Although there was a tendency for coeducational classes to provide proportionally more game play (28.7 vs 21.1% of lesson) and less skill drills (11.4 vs 16.5% of lesson) and management time (25.6 vs 29.7%) than girls-only classes, there were no significant differences in how lesson contexts were allocated. Mean class size in girls-only (28, SD = 13.6) and coeducational classes (30, SD = 11.8) were similar.

Additional Variables

Teacher interactions to promote physical activity and fitness—Table 2 shows teacher interactions to promote physical activity and physical fitness highly variable across field sites. Only 2.3 and 0.7% of observed intervals contained in-class and out-of-class physical activity promotion, respectively. Teacher activity promotion rates did not differ by class gender composition, lesson location, or teacher gender.

Teacher gender, grade level, and class size—Lessons taught by male teachers were similar in length to those taught by females (39.0 vs 36.1 min; $P = 0.337$). There were also no significant differences by teacher gender for any physical activity and lesson context variable or teacher promotion of in- and out-of-class physical activity and fitness. Also, energy expenditure and MVPA minutes did not differ significantly by grade level or the number of students in class.

DISCUSSION

This study is one of the few to use direct observation techniques to examine the physical activity of adolescent girls during middle school physical education. Its primary purpose was to generate information on girls' engagement in physical activity during PE and to assess lesson context (i.e., how PE content is delivered) and instructors' promotion of physical activity. There was tremendous variability in the lessons taught in the 36 schools, and the study provides a contextually rich data source (e.g., class gender composition, lesson location, instructor gender) on the conduct of PE in middle schools in six diverse geographic locations.

Allocation of lesson time

Observed (i.e., actual) lesson time was 37.3 min. Scheduled time (i.e., bell time) was substantially longer, but opportunities for physical activity during PE are reduced substantially because of managerial and policy events such as students changing clothes and teachers needing to supervise locker and equipment rooms. Spaces for indoor activities are typically

closer to locker rooms, so it is understandable why indoor lessons were nearly 1 min longer than outdoor lessons. Additional room to move outdoors and different PE content (e.g., soccer vs gymnastics) are likely contributors to girls being more active in outdoor lessons. Increasing managerial efficiency, providing more equipment, and selecting content that is more active might help improve activity levels in both settings.

Activity levels during PE

There were large differences among lessons, schools, and field sites, with girls accruing an average total 13.9 min of MVPA per lesson (37.9% of lesson). These figures are greater than those observed in the CATCH baseline study of third graders (10.6 min of MVPA; 36.2% of lesson) (7) but less than those for girls in a large middle school study conducted in San Diego (16.3 min of MVPA; 48%) (8). The mean MVPA percent in the present study is substantially less (i.e., 37.9 vs 50%) than *Healthy People Year 2010 Objective 22–10* (26), although one site exceeded that criterion.

Girls spent little time in activities at a level vigorous enough (i.e., 4.8 min of VPA; 13.1% of lesson) to enhance cardiorespiratory fitness. Low levels such as this become even a greater concern with the data indicating that girls at one site received only 1.7 vigorous minutes and 9.0 min of MVPA per lesson (4.4 and 19.6% of lesson time, respectively).

Lesson contexts and physical activity

There were vast differences in the amount of time allocated to different lesson contexts. Activity levels also varied substantially by lesson context, with girls being most physically active during fitness activities (i.e., 59% of the time), skill drills (48.6%), and game play (46.2%). These data suggest that one way to increase adolescent's physical activity levels during PE is to modify the time allocated to different contexts. The MSPAN (Middle School Physical Activity and Nutrition) intervention improved overall MVPA in lessons by 18%, but this resulted primarily from teachers selecting better activities rather than allocating lesson time for contexts differently (11). In the current study, a substantial amount of lesson time was spent on management (26%), and this might be reduced through efficient roll taking and student grouping strategies. Additionally, the knowledge context was coded for about 4 min per lesson, and during this time girls rarely engaged in MVPA (i.e., less than 6% of this time). Teachers might consider delivering knowledge content while students are simultaneously engaged physically or by modifying the structure of classes so that important knowledge concepts are delivered in a classroom environment where there are likely to be fewer distractions.

Overall amounts of physical activity

Additional concerns emerge when our direct observation data are considered along with information on frequency and duration of PE from a previous study (13) in these 36 schools. That study showed that there was a wide range of PE requirements in these schools, with differences existing in the length of lessons, number of lessons per week, and number of weeks per year (13). Overall, students were scheduled for 106 h of PE per year, with scheduled time ranging from 37.5 h for sixth graders in Arizona to 155.5 h for all grades in California. Even without discounting for missed PE classes (e.g., because of school cancellations, inclement weather, and examinations), girls in these schools would only receive about 29 h·yr⁻¹ of MVPA (i.e., 106 h of scheduled PE × 0.72 (proportion scheduled time a lesson was conducted) × 0.379 (proportion of lesson time girls spent in MVPA) and 10 h of VPA (i.e., 106 h of scheduled PE × 0.72 (proportion scheduled time a lesson was conducted) × 0.131 (proportion of lesson time spent in vigorous activity)).

Figure 3 compares the number of MVPA and VPA minutes accrued in PE per week with the *Healthy People 2010* recommendations for physical activity in all settings (i.e., 30 min·d⁻¹).

On average, girls accumulated about 17 min of VPA per week, which is less than one third of the vigorous physical activity recommended weekly (27). They also accrued about 48 min of MVPA weekly, which is a small amount compared with the 60 min·d⁻¹ recommended for adolescents (1). Improving the conduct of PE could help meet these objectives, but students must also be provided with substantial opportunities for physical activity outside of class time. These could involve programs offered during nonclass time on campus (e.g., early morning, lunch period, and after-school recreational, interscholastic, and club programs) and time in community and home settings. School environments should be restructured to specifically encourage students to engage in physical activity, including informing them about community programs.

Teacher gender

We analyzed data by teacher gender to assess for potential differences resulting from gender value orientations (17). Similar to the CATCH (7) and MSPAN studies (8), no differences in physical activity variables or lesson contexts by teacher gender were found. These results suggest that modifiable factors (e.g., lesson contexts and content), not teacher gender, should be considered when designing PE programs to promote physical activity.

Class size and gender composition

Class size, which was found to be associated with physical activity in a previous middle school study (8), was not related to activity variables in this investigation. Coeducational lessons were about 8 min longer than girls-only lessons. The significant differences in physical activity levels in coed and girls-only lessons were associated with lesson length rather than the proportion of lessons. Some of the extra length may have been associated with differences in classes assigned to block and traditional scheduling. A previous study found a tendency for girls to be more active in coeducational than girls-only lessons (9). Girls-only classes allocated more time for skill drills and less time for game play than coed classes, and these factors reduced the effect of class gender composition on student accrual of MVPA. Further investigations of potential mediators such as class size, class gender composition, lesson length, and lesson context on student physical activity in PE are needed.

Teacher verbal promotion of physical activity and fitness

We found low rates of verbal promotion for both in-class and out-of class engagement in physical activity and fitness. These behaviors are potentially modifiable, and they are important. In-class physical activity promotion by teachers might lead to students accruing increased activity intensity and more activity time during lessons. Out-of-class physical activity promotion might lead to students engaging in active play, sports, and classes beyond the required PE lessons.

Study limitations

Limitations of the study include observations being restricted to lessons taught from January to May. There may be seasonal differences in physical activity because of PE content and lesson location. For example, climate (and latitude) vary substantially from site to site, with Minnesota having substantial seasonal variability and San Diego very little. Additionally, the three southeastern sites have relatively more precipitation and humidity, and Arizona is characterized by a dry climate. The structure of PE varied accordingly, with San Diego and Arizona holding more PE classes outside. A variety of other unexamined factors may also account for site differences. Study schools were volunteer subsets of far larger pools, and implications of generalizability to entire regions represented by the sites are therefore limited. A limitation to studying instructor behavior is that teachers were not required to wear wireless microphones because of potential reactivity. Although observers positioned themselves in

earshot of teachers, hearing them was occasionally difficult (e.g., during private conversations and when basketballs were bouncing). Also, the energy expenditure estimations were calculated from results of heart rate monitoring from previous studies, and not with the girls currently being observed.

Concluding comments

Although these 36 schools provided limited amounts of physical activity during classes, school PE remains a critical place for promoting health-related physical activity. It is the only setting in which some girls can accrue vigorous physical activity and learn important generalizable physical skills. The present study identifies specific areas where improvement in the conduct of PE may be possible, including modifying curricular content, allocating additional lesson time to more activity promoting contexts (e.g., fitness), improving managerial efficiency, and increasing teacher promotion of physical activity. These ideas will be investigated during the TAAG 2-yr intervention.

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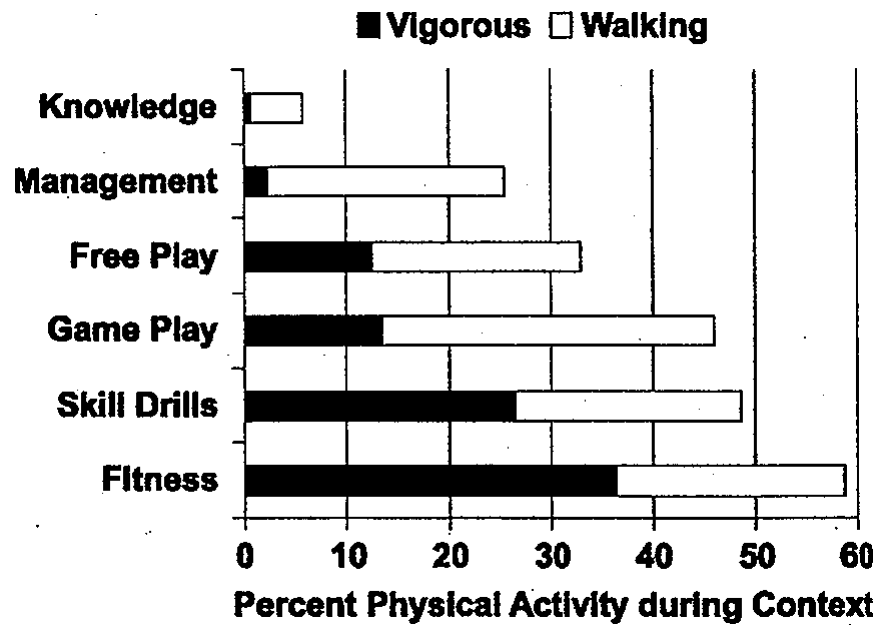


FIGURE 1.
Proportion of lesson time spent in vigorous activity and walking during six contexts.

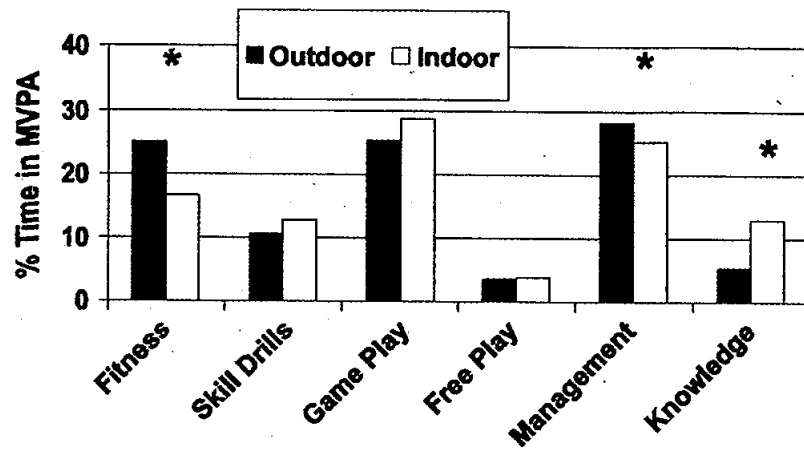


FIGURE 2. Proportion of lesson time spent in six contexts during outdoor and indoor PE classes. PE, physical education. *Significant difference ($P < 0.05$) between outdoor and indoor classes.

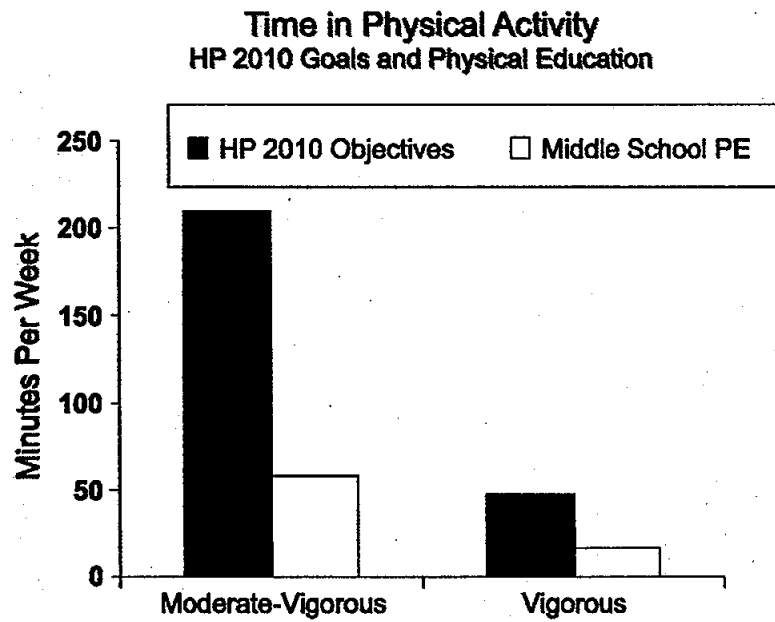


FIGURE 3. Minutes per week girls spent in physical activity in PE classes compared with the HP 2010 objectives for all settings. HP 2010, *Healthy People 2010*; PE, physical education.

TABLE 1
Lesson length, energy expenditure, and minutes per lesson for girls' activity and lesson contexts.

	All Lessons (N = 431) Mean (SD)		Field Site (N = 70-74) Range		Test of Equality across Field Sites		
					F	P	r
Lesson length (min)	37.3 (9.4)		34.0-40.0		0.46	0.804	0.27
Lesson TEE (kcal·kg ⁻¹)	2.7 (0.8)		2.4-3.0		1.30	0.292	0.42
Student activity (min)							
Lying down	0.2 (0.7)		0.0-0.6		3.16	0.021	0.59
Sitting	11.9 (9.6)		6.6-17.3		6.23	<0.001	0.71
Standing	11.3 (6.5)		7.6-15.0		2.98	0.026	0.58
Walking	9.1 (5.5)		5.7-13.2		7.87	0.000	0.75
Vigorous	4.8 (4.2)		1.7-6.4		4.50	0.004	0.65
MVPA	13.9 (7.0)		9.0-18.8		6.01	0.001	0.71
Lesson context (min)							
Management	9.6 (5.2)		7.7-13.3		3.54	0.012	0.61
Knowledge	3.9 (5.4)		0.5-6.0		5.95	0.001	0.71
Fitness activity	7.1 (8.7)		2.6-10.2		2.88	0.031	0.57
Skill drills	4.3 (7.4)		2.8-5.6		0.91	0.485	0.36
Game play	10.9 (12.5)		8.3-15.3		0.78	0.575	0.34
Free play	1.4 (5.7)		0.0-4.0		0.76	0.585	0.34

TAAG field site comparisons: *ndf* = 5; *ddf* = 30. TEE, total energy expenditure estimation; MVPA, moderate to vigorous physical activity (walking + vigorous).

TABLE 2
Energy expenditure rate and proportion of observed intervals for girls' activity, lesson context, and teacher physical activity promotion.

	All Lessons		Field Site		Test of Equality across Field Sites		
	Mean (SD)		Range		F	P	r
Lesson EER (kcal·kg ⁻¹ ·min ⁻¹)	0.073 (0.013)		0.062–0.082		8.36	< 0.001	0.76
Student activity (%)							
Lying down	0.6 (1.8)		0.1–1.5		2.70	0.040	0.56
Sitting	31.6 (22.6)		17.1–44.7		11.71	< 0.001	0.81
Standing	29.9 (15.0)		22.7–37.7		4.73	0.003	0.66
Walking	24.8 (15.1)		15.0–37.2		16.27	< 0.001	0.85
Vigorous	13.1 (11.7)		4.4–18.4		4.91	0.002	0.67
MVPA (walk + vigorous)	37.9 (18.5)		24.0–53.2		11.95	< 0.001	0.82
Lesson context (%)							
Management	26.1 (12.9)		19.4–35.1		6.24	< 0.001	0.71
Knowledge	10.6 (14.0)		1.4–14.6		5.77	0.001	0.70
Fitness activity	19.7 (24.7)		8.8–27.5		2.45	0.057	0.54
Skill drills	12.1 (21.1)		7.2–18.8		1.25	0.309	0.42
Game play	27.3 (29.0)		21.3–38.2		0.88	0.509	0.36
Free play	4.4 (16.9)		0.0–11.8		0.74	0.601	0.33
Teacher interaction (%)							
In-class	2.3 (4.4)		0.1–4.6		5.26	0.001	0.68
Out-of-class	0.7 (8.0)		0.0–3.9		2.03	0.103	0.50
None	97.1 (9.2)		94.1–99.9		2.96	0.027	0.57

TAAG field site comparisons: *ndf* = 5; *ddf* = 30. EER, energy expenditure rate estimation; MVPA, moderate to vigorous physical activity (walking + vigorous).

TABLE 3
 Comparison of six lesson contexts by mean length (SD) and girls' physical activity levels during them.

	Fitness		Game Play		Knowledge		Management		Free Play		Skills		F	r
	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)			
Context length (min)*	7.1 (8.7)		10.9 (12.5)		3.9 (5.4)		9.6 (5.2)		1.5 (5.7)		4.3 (7.4)		92.63	0.39
Context (kcal·kg ⁻¹ ·min ⁻¹)*	0.094 (0.023)		0.078 (0.015)		0.051 (0.008)		0.061 (0.011)		0.071 (0.023)		0.083 (0.021)		305.5	0.72
Activity level (% of context)														
Lying down*	1.5 (4.7)		0.1 (0.5)		0.7 (4.3)		0.4 (2.4)		0.0 (0.0)		0.2 (1.3)		7.68	0.16
Sitting*	17.2 (23.7)		12.4 (20.8)		65.9 (38.6)		51.3 (27.9)		29.4 (31.1)		12.6 (24.4)		200.40	0.64
Standing*	22.5 (19.9)		41.4 (21.7)		27.7 (34.6)		22.8 (19.4)		37.6 (25.4)		38.6 (23.2)		29.96	0.31
Walking*	22.3 (24.0)		32.6 (18.0)		5.0 (12.7)		23.2 (18.8)		20.6 (17.1)		26.4 (19.7)		77.36	0.46
Vigorous*	36.4 (26.1)		13.6 (15.0)		0.6 (3.9)		2.3 (5.6)		12.4 (23.9)		22.2 (23.7)		232.40	0.67

Test of equality across lessons: $ndf = 5$; $ddf = 1417$.

* Significant difference on values among lesson contexts ($P < 0.001$). MVPA, moderate to vigorous physical activity (walking + vigorous).