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PHYSICAL ACTIVITY

Physical Education and Recess Contributions to Sixth Graders' Physical Activity

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Abstract

Background: *The purpose of this study was twofold: (a) to examine the percentage of the daily threshold (12,000 steps) that physical education (PE) class and recess contribute to 6th grade students' overall daily physical activity (PA) and (b) to examine the relationships between gender, PA outside of school, BMI, and steps during both recess and PE.* ***Method:*** *One hundred thirty-eight 6th grade students aged 11–13 years participated. Students completed the Physical Activity Questionnaire for Older Children (PAQ-C) and wore a pedometer to measure steps taken for 6 consecutive PE classes and recess sessions.* ***Results:*** *The overall contribution of recess and PE to the daily step goal ranged from 7.1% to 9.6% of the target step count of 12,000. All PA variables were positively correlated with one another (all $p < 0.05$) and children who took more steps during recess and PE tended to have lower BMI percentiles (both $p < 0.05$). However, when all variables were entered into the multiple linear regression model simultaneously, only*

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steps taken during PE was predictive of BMI percentile (total model $r^2 = 0.145$, $p = 0.001$). ***Conclusion:*** *Further research is needed to explore PA in schools along with potential interventions to increase PA.*

According to the Centers for Disease Control and Prevention (CDC, 2014c), over one third of children in the United States are overweight or obese. Activity levels are decreasing for reasons such as lack of safe areas to play, lack of community recreational programs, and increased amount of screen time with media outlets as well as for economic reasons (lack of program funding and familial budgetary choices; CDC, 2014c; Gordon-Larsen, McMurray, & Popkin, 2000; Knowles, Niven, & Fawkner, 2011). Middle school–aged children should receive at least 60 min of physical activity (PA) every day as well as accumulate 12,000 steps/day (Colly, Janssen, & Tremblay, 2012; National Association for Sport and Physical Education & American Health Association, 2012; President's Council on Physical Fitness and Sports, 2001; Vincent & Pangrazi, 2002). During adolescence, it has also been shown that females' PA is significantly less than males' PA (Flohr, Todd, & Tudor-Locke, 2006; Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006; Vincent & Pangrazi, 2002). Children who are not attaining this amount of PA have a higher chance of premature death from heart disease; a higher chance of developing type 2 diabetes, high blood pressure, and certain cancers; and an increased risk of anxiety and depression (CDC, 2014b). A good setting to address and increase PA levels may be schools because of the amount of time students spend there each day.

Physical education (PE) is an important subject within the school setting when considering the amount of PA students achieve because they spend upwards of 6 to 7 hr in school per day (Flohr et al., 2006; Tudor-Locke et al., 2006; Vincent & Pangrazi, 2002). It has been shown that middle school students can achieve as much as 17% (2,046 steps) of their daily steps during PE days when PA is based on 12,000 steps/day (Flohr & Todd, 2003; Flohr et al., 2006). Similarly, Tudor-Locke et al. (2006) found students took an average of 1,417 steps during a 30-min PE period, which accounted for ~18% of their daily PA. In comparisons of boys and girls in PE, no significant difference has been shown (Flohr et al., 2006; Tudor-Locke et al., 2006)

Additionally, within the school setting, recess can also play a significant role in contributing to students' overall daily PA. Tudor-Locke et al. (2006) found that lunchtime (time eating lunch and unstructured recess) provided the biggest portion of PA obtained during the school day. When a 15-min, unstructured recess time was factored in, in addition to the aforementioned lunchtime, students received roughly 30% of their daily PA when based on an average daily count step of 12,000 steps/day. Further supporting this finding, Beighle, Morgan, Le Masurier, and Pangrazi (2006) found that elementary school students receive 9% of their daily steps during an unstructured recess, with an average step count of 1,090 during a 15-min recess. In comparisons of girls' and boys' PA during recess, it has been shown that boys participate in significantly more PA (Beighle et al., 2006; Brusseau et al., 2011; Tudor-Locke et al., 2006).

Many researchers have examined PA throughout the segmented day, but few have examined the amount of steps students take in schools that do not offer daily PE, but do offer a structured, daily recess. Additionally, few researchers have compared the amount of PA in PE and structured recess (Smith & Biddle, 2008). The purpose of this study was twofold. The first purpose was to examine the percentage of the daily threshold (12,000 steps) that PE class and structured recess contribute to sixth grade students' overall daily PA. Additionally, our goal was to examine the relationship between gender, PA outside of school (PAQ-C), BMI, and steps during both recess and PE.

Method

Participants

Sixth grade students from one elementary school in a large, rural community in the Midwest were invited to participate in the study. Students and primary caregivers were informed of the procedures of the study. The primary caregivers provided informed consent, and the students provided assent to participate in the study. Prior to data collection, the university institutional review board and school administrators approved this study. One hundred thirty-eight students (72 males, 66 females) aged 11–13 years (M = 11.7, SD = 0.6) participated. The race of participants included White non-Hispanic (97.1%), multiracial (2.2%), and African American (0.7%).

Setting

Participants attended PE twice a week and were taught by a certified PE teacher. The average class had 24 students. PE lessons were 30 min in length and included pickleball activities (e.g., skills, drills, lead-up games, and tournament play). The PE lessons were taught in the school gymnasium, which was the size of a regulation basketball court and held four pickleball courts.

Recess occurred before lunch and lasted approximately 20 min. The planning and execution of the structured recess was a main focus for the assistant principal. Therefore, each recess had planned activities that the assistant principal set up with some input by the PE teacher. Each activity was supervised for appropriate behavior (e.g., playing fairly, using appropriate language, using the equipment appropriately). The playground was a blacktop surface, approximately 115 ft × 170 ft. It was split into three areas for the following activities: four square courts, six basketball hoops, and a space for jump ropes. The participants had access to equipment for all activities. The participants were not allowed to move freely throughout the playground, but rather they were required to pick an activity at the beginning of recess and continue with it until recess was over. Also, the participants had the option to walk around the school on the sidewalk with a recess supervisor.

Instrumentation

Demographic information. Demographic information (race, gender, and age) was gathered by accessing the principal investigator's student database from a secure school computer.

BMI. In this study, a BMI value was calculated by dividing a participant's body mass by height squared (kg/m^2). According to the CDC (2014a), BMI is a reliable indicator of body fatness, but is not a direct measure of body fat. It has been shown to correlate with direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (CDC, 2014a; Mei et al., 2002). It is easy to perform as well as inexpensive. For children and adolescents, BMI is referred to as BMI-for-age because age and sex are taken into consideration. In this study, participants' BMI measurements occurred within the school day, but outside of PE. The school health clerk performed the measurements. The principal investigator recorded the

measurements into the BMI for schools tool, as offered by the CDC (2014a).

Physical Activity Questionnaire for Older Children (PAQ-C). The PAQ-C was used and is a self-administered, 7-day recall instrument (Kowalski, Crocker, & Donen, 2004). Participants completed the investigator-led PA self-report questionnaire during the school day, but outside of their PE class. Once the surveys were completed, scores were compiled into an Excel worksheet.

Pedometers. The New Lifestyles SW-701 Digi-Walker was used to assess the number of steps that participants took during PE classes and recess sessions. According to the New Lifestyles (n.d.) website, it works best for those who are not considered obese and for those traveling at a speed greater than 2.5 mph. The SW-701 was shown to have the smallest mean error (−0.1) when compared with nine other pedometers (Schneider, Crouter, Lukajic, & Bassett, 2003).

Procedures

Data collection occurred over 6 weeks. During the first week, participants were instructed how to attach, wear, and use the pedometer appropriately. The participants practiced picking up, attaching, wearing, and returning their pedometers in PE class and in recess prior to data collection.

In Weeks 2 to 6, step counts in six consecutive PE classes, occurring two times a week, and in six outdoor structured recesses were recorded. The principal investigator observed the class to ensure that tampering was not taking place. If tampering was observed, the participant was identified and those data were thrown out. Immediately following the conclusion of the PE class and recess, participants were instructed to remove their pedometers and return them to the appropriate place. An investigator recorded the steps from each pedometer on a data sheet and reset the pedometer to 0 for the next class or recess session. Throughout the 6-week collection period, participants were measured for height and weight by the school health clerk and completed the PAQ-C during school hours.

Data Analysis

Statistical analysis was completed using IBM SPSS 21 (IBM Corp., 2012). Descriptive statistics were computed for all variables and are presented as $M \pm SD$. Independent t tests were used to examine gen-

der differences, and a Pearson chi-square test for independence was used to compare the percentage of overweight and obesity in boys and girls. Partial correlations were computed to examine how well the variables were related to one another independently while controlling for gender and age. Finally, a multiple linear regression was used to examine the shared contribution of gender, PA outside of school (PAQ-C), BMI, and steps during both recess and PE to BMI percentile. Four models were used: Model 1, age and sex; Model 2, age, sex, and PAQ-C; Model 3, age, sex, PAC-Q, and recess steps; and Model 4, age, sex, PAC-Q, recess, and PE steps.

Results

Inclusion criteria for this study were attending four out of six PE classes and four out of six recesses. Every student met those criteria. Descriptive statistics for variables are presented in Table 1. The independent samples *t* test indicated boys were significantly different than girls in terms of scoring higher on the PAQ-C (3.05 ± 0.60 vs. 2.80 ± 0.57, $p < 0.05$), taking more steps during recess (1,150 ± 375 vs. 890 ± 327, $p < 0.05$), the percentage contribution of recess to the 12,000 step threshold (9.6 ± 3.1 vs. 7.4 ± 2.7, $p < 0.05$), taking more steps during PE (1,116 ± 301 vs. 847 ± 219, $p < 0.05$), the percentage contribution of PE to the 12,000 step threshold (9.3 ± 2.5 vs. 7.1 ± 1.8, $p < 0.05$), and total contribution to the 12,000 step threshold in both PE and recess (18.9 ± 4.7 vs. 14.5 ± 3.4, $p < 0.05$).

Table 1
Descriptive Statistics by Gender

Statistic	Boys (*n* = 72)	Girls (*n* = 66)	Combined (*N* = 138)
Age (years)	11.7 (0.6)	11.7 (0.6)	11.7 (0.6)
BMI (kg/m2)	21.5 (4.8)	21.6 (5.5)	21.5 (5.1)
BMI Percentile	70.1 (26.4)	66.2 (27.8)	68.2 (27.0)
% Overweight/Obese	36.1%	31.8%	34.1%
PAQ-C	3.05 (0.60)	2.80 (0.57)*	2.93 (0.59)
Steps During PE	1,116 (301)	847 (219)*	987 (296)
Contribution of PE to 12K Target (%)	9.3 (2.5)	7.1 (1.8)*	8.2 (2.5)

Table 1 (cont.)

Statistic	Boys ($n = 72$)	Girls ($n = 66$)	Combined ($N = 138$)
Steps During Recess	1,150 (375)	890 (327)*	1,025 (375)
Contribution of Recess to 12K Target (%)	9.6 (3.1)	7.4 (2.7)*	8.5 (3.1)
Total Contribution to 12K Target (%)	18.9 (4.7)	14.5 (3.4)*	16.8 (4.7)

*Statistically significant difference between boys and girls ($p < 0.05$).

The partial correlations were adjusted for age and gender. Results indicated statistically significant associations between the following variables (see Table 2): BMI percentile and PE steps (–0.318, $p < 0.05$), recess steps (–0.191, $p < 0.05$), and PE/recess contribution (–0.305, $p < 0.05$); PAQ-C and PE steps (0.214, $p < 0.05$), recess steps (0.318, $p < 0.05$), and PE/recess contribution (0.339, $p < 0.05$); PE steps and recess steps (0.286, $p < 0.05$) and PE/recess contribution (0.735, $p < 0.05$); and recess steps and PE/recess contribution (0.860, $p < 0.05$). No significant association was found between BMI percentile and PAQ-C.

Table 2
Partial Correlations for BMI Percentile and Physical Activity

Variable	BMI percentile	PAQ-C	PE steps	Recess steps	PE/recess contribution
BMI Percentile	–	–0.120	–0.318*	–0.191*	–0.305*
PAQ-C	–	–	0.214*	0.318*	0.339*
PE Steps	–	–	–	0.286*	0.735*
Recess Steps	–	–	–	–	0.860*
PE/Recess Contribution	–	–	–	–	0.860*

*Statistically significant correlations ($p < 0.05$).

Four models of multiple linear regressions were conducted for predicting BMI percentile from PA (see Table 3). Each model was found to be a significant predictor for BMI percentile: Model 1 (age + sex), $p = 0.028$, $r^2 = 0.051$; Model 2 (age + sex + PAQ-C), $p = 0.028$, $r^2 = 0.065$; Model 3 (age + sex + PAQ-C + recess steps), $p = 0.013$, $r^2 = 0.090$; and Model 4 (age + sex + PAQ-C + recess steps + PE steps), $p < 0.001$, $r^2 = 0.159$. The predictor β-coefficient for PE steps within Model 4 was also found to be significant, −0.028, $p < 0.001$, respectively.

Table 3
Multiple Linear Regression Predicting BMI Percentile From Physical Activity

Model	Model *p*	Predictor β coefficient *p*	Model r^2	r^2 change from previous
1: Age + Sex	0.028*	–	0.051	–
2: Age + Sex + PAQ-C	0.028*	–	0.065	0.014
PAQ-C		−5.442 (0.164)		
3: Age + Sex + PAQ-C + Recess Steps	0.013*	–	0.090	0.025
PAQ-C		−2.992 (0.463)		
Recess Steps		−0.013 (0.060)		
4: Age + Sex + PAQ-C + Recess Steps + PE Steps	< 0.001*	–	0.159	0.069
PAQ-C		−1.227 (0.757)		
Recess Steps		−0.008 (0.259)		
PE Steps		−0.028 (0.001)*		

*Statistically significant predictor.

Discussion

The most important findings from this study were the roles PE and structured recess play in contributing to sixth grade students' overall PA. Additionally, boys were found to be significantly more

physically active than girls, and participants with higher BMI percentiles were found to be less active than their counterparts with lower BMI percentiles during both PE and recess. As mentioned above, PE was found to account for 8.2 ± 2.5% of the overall daily PA or 987 ± 296 steps, whereas structured recess was found to account for 8.5 ± 3.1% or 1,025 ± 375 steps. The combined overall contribution of both PE and recess (50 min combined) was found to be 16.8 ± 4.7%. When broken down into steps per minute, participants took 40.8 steps/min overall. These findings are well below participants in fourth to sixth grades who took 50.9–59.5 steps/min during their PE and recess times (Brusseau et al., 2011; Tudor-Locke et al., 2006). However, it is important to note that previous studies did not include structured recesses and also included periods that allowed for free play, lunchtime (time spent eating lunch and free time following the conclusion of eating) for 40 min, and an additional recess for 15 min. This factor alone allowed for more opportunity for the participants to be physically active, which could account for the higher step rates overall. Also, it is thought that the focus of the PE classes during this study played a notable role in the amount of steps participants took during PE when compared with previous studies. This will be further explained in the following paragraphs.

The sixth grade participants in this study took an average of 987 ± 296 steps during a 30-min PE class, accounting for roughly 8% of their overall daily PA. When broken down into steps per minute, participants took 32.9 steps/min during PE. These findings are well below the research findings for PE, of the same grade: 43.4–47.3 steps/min (Alderman, Benham-Deal, Beighle, Erwin, & Olson, 2012; Tudor-Locke et al., 2006). Their counterparts' steps in a 30-min PE accounted for 11%–12% of the overall daily PA (Alderman et al., 2012; Tudor-Locke et al., 2006). A possible explanation for the difference in results could be the focus of the lessons. Research has shown that adolescents' perception in skill ability and actual skill ability play a role in PA (Hill & Hannon, 2008; Reed, Metzker, & Phillips, 2004). Specifically, Hill and Hannon (2008) reported that lower skilled students "perceive their inability to perform the basic skills will limit their success in competitive situations" (p. 186). In this study, pickleball skills and tournament play were the main foci of the lessons. Because none of the students had played pickleball

or had experience with a racket sport in PE, a lower amount of PA during PE may be explained by perceptions of skill level and actual skill level. However, it is important to note that this is an assumption based on previous research, as skill level and/or skill perceptions of pickleball were not measured in this study, and limited skill improvement could be expected in only six 30-min PE lessons.

Current pedometer-determined PA literature in PE has shown mixed results in regard to gender differences in PE (Alderman et al., 2012; Brusseau et al., 2011; Flohr & Todd, 2003; Tudor-Locke et al., 2006). In this study, an examination of gender showed boys took more steps than did girls in PE. A possible explanation for this is that as adolescents age, they become less physically active, girls more so than boys (Pate, Dowda, O'Neill, & Ward, 2007). It is important to note the biological difference between the boys and girls in this study. It has been reported that girls mature roughly two years before boys (12 years vs. 14 years; Malina, Bouchard, & Bar-Or, 2004; Tanner, 1989). Sherar, Esliger, Baxter-Jones, and Tremblay (2007) reported boys aged 10–13 were engaged in significantly more moderate to vigorous physical activity overall than were girls. Additionally, it has also been shown that boys prefer playing competitive sports more than girls do (Courtier, Chepko, & Coughlin, 2007; Hill & Hannon, 2008). Therefore, the way in which girls in this study perceived pickleball may have played a role in the amount of PA they accumulated in PE.

A 20-min structured recess accounted for roughly 9% of sixth graders' overall daily PA. Participants took an average of 1,025 ± 375 steps (51.25 steps/min). Participants were found to receive more pedometer-determined PA during a structured recess than were participants in previous research findings (Grades 1 to 4) who were reported to take 870 ± 250 steps during a 15-min (58 steps/min) structured recess, accounting for 7% of their overall daily PA (Stellino-Babkes, Sinclair, Partridge, & King, 2010). Differences in findings between this study and prior research may be explained by the way the recess was structured. In this study, participants had four activities from which to choose each day, whereas the participants in the work of Stellino-Babkes et al. (2010) participated in one activity each week. Perhaps having a choice in activities in which to participate daily explains why participants in this study had a higher level of

pedometer-determined PA. According to self-determination theory (Deci & Ryan, 1985), a basic need of all people is to engage in activities of one's choosing and be the origin of one's behavior. Research in motivation has shown that choice can play a role in what drives a person to be physically active. When given a choice, it has been shown that motivation to participate in physical activities can increase in students in Grades 5 and 6 (Cox & Williams, 2008). Further studies conducted with only one activity offered versus many activities offered during a structured recess may help determine if PA is more affected by the structure of the recess or the number of activities offered during the structured recess.

Current research in pedometer- and accelerometer-determined PA during a structured recess has shown that boys are more physically active than girls (Huberty et al., 2001; Ridgers, Stratton, Fairclough, & Twisk, 2007; Stellino-Babkes et al., 2010). This study supports the existing literature in terms of the effect of gender and PA levels in structured recess. Our examination of structured recess steps showed that boys (1,150 ± 375) accumulated significantly more steps than did girls (890 ± 327) during a 20-min structured recess. This accounted for roughly 10% and 7% of overall daily PA as well as 64 steps/min and 49.4 steps/min for boys and girls, respectively. The overall contribution to daily PA and the step rates were found to be similar for boys (909 ± 257 steps and 58 steps/min) and marginally larger for girls (825 ± 2,360 steps and 55 steps/min) in a study to examine structured recess steps of boys and girls (825 ± 2,360) in first to fifth grades (Stellino-Babkes et al., 2010). Further examination should include activities geared toward increasing overall PA that girls receive during recess.

Significant gender differences were also found in the PAQ-C. Boys on average scored 3.05 ± 0.60, whereas girls scored 2.80 ± 0.57. Albeit a small difference between scores, the results add to current research that boys are more physically active overall than girls. Tudor-Locke et al. (2006) also reported a significant difference in gender for middle school participants (13,000 ± 4,398 steps vs. 10,455 ± 3,648 steps) in PA outside of school on weekends for boys and girls, respectively. These findings continue to suggest that the importance of PA needs to be continually emphasized to girls, and perhaps examples of PA need to be offered that girls may be more interested to participate in outside of school.

Participants with higher BMI percentiles were found to be less active than their counterparts with lower BMI percentiles during both PE and recess. These findings are in line with those from a study conducted by Gao, Oh, and Sheng (2011), who found a significant difference in PA levels during PE between middle school students labeled *overweight* and *healthy weight*. They reported that students with a BMI percentile greater than 85% spent significantly less time in moderate to vigorous physical activity (61.1%) and significantly more time being sedentary (13.5%) during PE than did those with a healthy BMI (68.2% and 7.6%, respectively; Gao, Oh, & Sheng, 2011). Likewise in structured recess, Stellino-Babkes et al. (2010) reported higher PA levels in participants with a healthy BMI percentile as compared with those with a BMI percentile greater than 85% (912 ± 250 steps vs. 810 ± 258 steps) in 15 min. The findings in our study continue to highlight the importance of PE and structured recess in the amount of PA that students receive during the school day, even more so for those with higher BMI percentiles.

The data in this study show a low percentage of steps contributing to overall daily PA; thus, it is important to note how schools can contribute more to increasing PA. A comprehensive school physical activity program (CSPAP) incorporates PA "programming before, during, and after the school day" (American Alliance of Health, Physical Education, Recreation, and Dance [AAHPERD], 2013, p. 2). It makes sense that PE and recess, structured or unstructured, allow for PA to occur during the day, but there are many other opportunities for PA to occur at school. For example, a focused PA break can be taken throughout the day in the classroom. These breaks could be as easy as getting the students up and doing simple calisthenics. PA opportunities should also be offered prior to school starting as well as after school. These activities can include "intramural sports (volleyball or basketball), self-directed activities (walking or jogging clubs), classes (dance, yoga, or martial arts) and activity clubs (jump rope, hiking, and fitness)" (AAHPERD, 2013, p. 5). It is important to give attention to the interests of the student body so as to offer activities, competitive and noncompetitive, in which they would be willing to participate. The timing of when such activities are offered should also be considered so as to offer PA opportunities that all students are able to take advantage of (AAHPERD, 2013).

It is also important to note limitations to the study. There was not enough space in the gym for all participants to be engaged in PA during the game play portion of the lessons. The average class size was 24, and the setup of game play only allowed for four courts of doubles to play at one time, thus accounting for three fourths of the class to be active at one time. The other one fourth not participating in game play was responsible for refereeing the games and reporting the scores at the end of the 5-min games. Modified rules to the game also limited movement, and the participants were restricted to staying on their side of the court (they were not allowed to cross over the dividing line on their side of the court). The rules were made to ensure participants were getting equal opportunity to play, thus not allowing one person to play the whole court. PA may have been different had the participants been playing an invasion type of game, allowing for more movement throughout the game.

A second limitation was the way in which the recesses were structured. Participants were not allowed to move freely from one activity to another; if participants became bored, they simply stopped what they were doing. Supervisors in the current structured recesses were not trained to nor told to encourage engagement in PA during recess, but rather they were there to ensure proper behavior (no inappropriate use of words, fighting, etc.) was occurring.

Additionally, the timing of the study and age level of the participants studied was a limitation. This study occurred at the end of the school year with the oldest age group at the school; therefore, the participants were possibly bored of the activities offered during recess and would rather have spent their time hanging out with their friends than engaging in meaningful PA during the time allotted for recess.

Conclusions

This study is important because it is the first in which the contributions of both PE and structured recess to adolescents' total daily PA are examined. Understanding PA contributions during PE and structured recess, as well as throughout the school day, is important in designing and structuring opportunities for adolescents to engage in PA, as they accounted for 16.8% of the participants' total daily PA. These findings are even more important when considering the BMI percentiles of adolescents, as PA was found to decrease significantly

with all PA variables except in self-reported PA. Therefore, special emphasis for creating opportunities to be engaged in PA during both PE and structured recess should concentrate on those who have BMI percentiles greater than the 85th percentile, as well as on girls, who were also shown to have significantly lower levels of PA during the same time periods.

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