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RESEARCH ARTICLE

The Impact of Playworks on Boys' and Girls' Physical Activity During Recess

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ABSTRACT

BACKGROUND: School-based programs, such as Playworks, that guide students in organized activities during recess and make improvements to the recess play yard may lead to significant increases in physical activity—especially for girls. This study builds on past research by investigating the impact of Playworks separately for girls and boys.

METHODS: Twenty-nine schools were randomly assigned to receive Playworks for 1 school year or serve as a control group. Postintervention physical activity data were collected via accelerometers and recess observations. Impacts were estimated separately for girls and boys using regression models.

RESULTS: Girls in Playworks schools had significantly higher accelerometer intensity counts and spent more time in vigorous physical activity than girls in control schools. No significant differences based on accelerometer data were found for boys. A significant impact was also found on the types of activities in which girls engaged during recess; girls in the treatment group were less likely than those in the control group to be sedentary and more likely to engage in jumping, tag, and playground games.

CONCLUSIONS: The current findings suggest that Playworks had a significant impact on some measures of girls' physical activity, but no significant impact on measures of boys' physical activity.

Keywords: physical activity; recess; elementary school; Playworks; girls; boys.

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Children's participation in moderate-to-vigorous physical activity (MVPA) during recess has been linked to a substantial number of health and academic benefits.[1,2] Past research, however, has consistently documented persistent differences in children's physical activity by sex, with boys exhibiting higher levels of MVPA than girls, both overall and specifically during school recess periods.[3-8] These differences could be explained by boys' and girls' participation in specific activities. For example, past research suggests that boys are more likely to spend their recess time actively playing team sports such as soccer and football, whereas girls are more likely to spend time socializing and playing turn-taking games such as jump rope, resulting in girls spending much of their recess time standing in line.[6,9] These same studies have suggested that the few girls who *do* participate in team sports during recess tend to stand in the center of the field and watch rather than actively participate.[6,9]

Programs that introduce students to new games and activities and make improvements to the recess play yard may lead to increases in physical activity and utilization of the recess space, especially for girls.[10-12] One such program, Playworks, places full-time coaches in low-income schools to provide opportunities for organized play during recess and class time while also fostering social skills related to cooperation and conflict resolution. The Playworks coach in each school attempts to engage students in physical activity by providing them with equipment, such as balls and cones, and by introducing organized games within distinct areas or zones designated on the recess play yard.

Strategies similar to those used in Playworks have been shown to increase the intensity of students'

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physical activity at recess. For example, providing adult supervision during recess, encouraging children to be more active, and training staff to implement organized physical activities during recess have been shown to be effective strategies for increasing students' MVPA during recess.[9,13,14] Providing recreational equipment and adding colored markings to the recess yard have also been shown to increase students' physical activity.[9,15,16] In addition, a quasi-experimental study of Playworks showed that with each additional year of exposure, students reported significantly higher levels of physical activity.[17]

Past research suggests that physical activity interventions may be more effective at increasing the physical activity of girls than boys.[18,19] In a systematic review of school-based physical activity interventions, Brown and Summerbell[12] found that the programs were most successful at increasing physical activity among younger children and girls. Similarly, a recent evaluation of a school-based intervention aimed at increasing students' physical activity and reducing sedentary behaviors found that boys had higher overall physical activity at all time points than girls, regardless of study condition, but that the increase in physical activity from baseline to post intervention was significantly higher among girls in the treatment group compared to girls in the control group; a similar significant effect was not found for boys.[20] Moreover, Sallis et al[21] found that a school-based program designed to increase physical activity and fitness levels among 4th and 5th grade students showed a stronger intervention effect for girls than boys, explained in part by girls' lower levels of fitness at baseline.

The current article examines the impact of Playworks on the physical activity of boys and girls during recess. We build on findings from a study that evaluated the impact of Playworks on student and school outcomes using a random assignment design, in which schools were recruited and randomly assigned to implement Playworks or be part of a control group. That study found marginally significant differences between treatment and control group students in the mean percentage of time spent in vigorous physical activity and the intensity of physical activity during recess.[22] Research, however, has not yet examined the possible differential effect of Playworks on girls' and boys' physical activity at recess. The aim of this article is to investigate the effects of Playworks on girls' and boys' physical activity separately using data collected via accelerometers and structured recess observations.

METHODS

Participants

Twenty-nine schools from 6 cities across the United States were randomly assigned to treatment (17 schools) and control groups (12 schools) during the 2010-2011 (cohort 1) or 2011-2012 (cohort 2) school year. The schools had not previously implemented Playworks but were interested in doing so. During the 1-year study period for each cohort, schools in the treatment group implemented Playworks and control schools did not implement the program. Random assignment of schools helped to ensure that there were no systematic differences between the schools in the treatment and control groups and that the differences in outcomes between the 2 groups could be attributed solely to the effect of Playworks. To improve the statistical precision of impact estimates, random assignment was conducted within matched blocks of schools that were similar in terms of observable characteristics, including school size, highest grade offered, student race/ethnicity, and the percentage of students eligible for free or reduced-price lunch. Both treatment and control schools predominantly served African-American and Hispanic students, and the majority of students at each school qualified for free or reduced-price lunch.

A total of 1573 students (823 girls and 750 boys) from 98 4th and 5th grade classrooms in 27 study schools wore accelerometers for at least 10 minutes during their recess periods and were included in our analyses; all 1573 students wore accelerometers for 1 day and 367 of these students wore accelerometers for 2 days (one classroom from each school was randomly selected to participate in a second day of accelerometer data collection). Excluded from analyses were students who did not obtain written parental consent (about 30%), as well as a handful of students (less than 5%) who either refused to participate, were absent during data collection, had an accelerometer malfunction, or for whom we did not have data regarding their sex (male or female). The overall response rate for the accelerometer data collection was 66%, and was the same across treatment schools and control schools. Students from one study school did not participate in the accelerometer data collection because the school did not have any separate 4th or 5th grade classrooms (these students were combined with lower and higher grade level classrooms in the school). This school and the school it was matched with during random assignment were dropped from the accelerometer analysis, leaving 27 schools.

Six structured recess observations were also conducted at each of the 29 study schools. During each observation period, up to 8 zones of the recess space were observed to capture information on student physical activity levels and types of activities. All students present in observed zones were included in our scans.

Instruments

Accelerometers. Accelerometers are monitoring devices worn on the body that allow researchers to

objectively measure the intensity of physical activity. ActiGraph (Pensacola, FL) GT3X accelerometers were used in the current study to measure both the intensity of students' physical activity and number of steps taken during recess. After data collection, we used the ActiLife 5 software package[23] to construct outcomes that represent the mean number of accelerometer intensity counts recorded per minute during recess and the mean number of steps taken per minute during recess. Intensity cut points were also used to measure the percentage of time students spent in moderate or vigorous activity during recess. In particular, students' accelerometer wear time was divided into 5-second epochs, and each epoch was identified as time spent in moderate or vigorous activity if the intensity counts recorded during that epoch were greater than or equal to 75 or 289, respectively. Although 1-minute, 30-second, and 15-second epochs are typically used to measure time spent in MVPA, the shorter 5-second epoch lengths used here are recommended by Edwardson and Gorely[24] for use with child samples; recent research suggests that the shorter 5-second epoch lengths used here are more appropriate for measuring physical activity in children as their activity can be more spontaneous, lasting only a matter of seconds, and is not always picked up using longer epochs.[25-27]

Structured recess observations. The System for Observing Play and Leisure Activity in Youth (SOPLAY) [28] was used to collect information on student physical activity levels and types of activities in which students were engaged. Individual students in each observed zone were coded as engaging in sedentary, moderate, or vigorous activity, based on momentary time sampling. Observers also recorded the main activity in which the majority of students (50% or more) were engaged within each zone; these activities were then coded into 7 distinct categories, such as ''sitting, talking, or other sedentary activity'' or ''jumping, running, tag, or chase games.''

Prior to data collection, observers were provided with a 3-day training that included watching a SOPLAY training video produced by the creator of SOPLAY, live coding of children on a playground, and a formal assessment. To assess interrater reliability in the field, 2 certified observers independently conducted at least 33% of all recess observations at each site simultaneously. Reliability was then assessed between the 2 observers by aggregating counts of physical activity intensity levels (sedentary, moderate, and vigorous) across boys and girls and across all intervals within an observation. The Pearson correlation coefficient between observers was 0.98, 0.98, and 0.97 for sedentary, moderate, and vigorous activity counts, respectively.

Procedure

Data were collected during either the spring of the 2010-2011 (cohort 1) or 2011-2012 (cohort 2) school year, over a 1-week period in each school.

Accelerometers. A sample of students at each school was asked to wear ActiGraph GT3X accelerometers during 1 or 2 school days. Within most schools, a random sample of 4 classrooms was selected, balanced across 4th and 5th grades, and all students in those classrooms were asked to participate in the accelerometer data collection. In schools with 4 or fewer 4th and 5th grade classrooms, students from all 4th and 5th grade classrooms were asked to participate in the accelerometer data collection. From the classrooms selected in each school, one classroom was randomly selected and students in that classroom wore the accelerometers for an additional school day. We computed a weighted average of the accelerometer data for students who wore accelerometers for 2 days.

Before participating in accelerometer data collection, students were required to return a signed parental consent form and sign a student assent form. During the data collection period, the research team arrived at participating classrooms at the beginning of the school day. Team members described the function of the accelerometer and then attached an accelerometer to each consented student's hip using an elastic belt. Students were instructed to seek out someone from the research team if their monitor came loose during the day. The monitors were taken off at the end of the school day by a research team member, and physical activity data were uploaded to a computer. Each school provided information about the start and end time for recess periods for each grade, and accelerometer data measured during these scheduled recess periods were used for analysis. While the data collection team was on site in treatment and control schools, they confirmed, and when necessary corrected, the original recess schedules provided by schools, based on when recess actually occurred during the week of data collection, providing us with an accurate record of the recess schedule for each school. We used the corrected version of the recess schedules when determining the start and end time for recess periods for the accelerometer analysis.

Structured recess observations. Six recess observations were conducted at each school over the course of 4 or 5 days. Prior to data collection, the research team selected 6 recess periods to observe (based on recess schedules provided by each school), balanced across grade level(s) and time of day (morning, lunch, and afternoon recess). Each school's recess yard was also divided into zones prior to data collection, based on the types of activities that took place within each area of the play yard and the density of students typically in the area, in order to ensure observers would be able to code student activities without too much difficulty.

Observers then systematically scanned up to 8 zones during each of the 6 recess observations. Within each zone, observers first coded girls' physical activity and then repeated the scan for boys. After both scans were completed, the observer repeated the process in the next closest zone. If time allowed, scans were completed for all zones and then observers returned to the first zone and continued observing until the recess period had ended.

Data Analysis

The impact of Playworks was estimated by comparing the average outcomes in treatment and control schools using regression models that were customized to the unit of analysis (student or recess observation scan). Analyses were conducted separately for girls and boys and accounted for clustering of students within classrooms and schools.

For outcomes based on student-level data from the accelerometers, we estimated the following model:

$$Y_{ijs} = \alpha_s + \gamma T_s + \mu_s + \varepsilon_{ijs},$$

where Y_{ijs} is the outcome for student i in classroom j in school s, α_s is a vector of indicator variables denoting the random assignment block in which the school was located, T_s indicates whether the school in which the student was enrolled was assigned to the treatment group, μ_s is a school-specific random error term, ε_{ijs} is a student-level random error term, and γ is the impact parameter to be estimated. Our analysis model is consistent with the blocked randomized design that was implemented. School random effects were used in the models to reflect that schools were the unit of random assignment and fixed effects were used to reflect that randomization was conducted within a pair, trio, or quartet of schools in the same city. We used generalize estimating equations (GEE) to account for clustering of students within schools. GEE automatically accounts for any correlations among students below the level of clustering (which, in this case, was schools) and so the standard errors also reflect nesting of students within classrooms. We took a weighted average of the outcomes for students with 2 days of accelerometer wear prior to model fitting. We did not include any student demographic covariates when estimating impacts on the accelerometer-based outcomes because there were no significant differences between treatment and control groups on these variables.

For outcomes based on the recess observations, we estimated the following model:

$$Y_{js} = \alpha_s + \gamma T_s + \mu_s + \varepsilon_{js},$$

where Y_{js} is the outcome for recess observation j in school s, α_s is a vector of indicator variables denoting the random assignment block in which the school was located, T_s indicates whether the school was assigned to the treatment group, μ_s is a school-specific random error term, ε_{js} is a recess observation-level random error term, and γ is the parameter to be estimated.

Models for continuous outcome variables were estimated using least-squares estimation, and models of binary outcome variables were estimated using logistic regression estimation. Standard errors for the estimated impacts on student-level outcomes accounted for clustering at the school level using generalized estimating equations.[29] All p-values were calculated based on the estimated impacts and corresponding standard errors.

Sampling weights were used when estimating student-level impacts to account for both the selection probabilities of students into the accelerometer sample and non-response so that students included in the impact analysis represented all eligible students in the participating schools. Sampling weights for the recess observations were constructed so that equal weight was given to each school. This approach ensures that schools with smaller play areas or shorter recess periods, where not as many scans were taken, get the same weight as those with larger play areas or longer recess periods.

RESULTS

Accelerometers

Playworks had a significant impact on the mean number of accelerometer intensity counts recorded per minute during recess for girls, with girls in treatment schools registering, on average, 315 more accelerometer intensity counts per minute during recess than their counterparts in control schools; this amounted to about a 34% increase in intensity counts per minute. Although girls in treatment schools also took, on average, about 5 more steps per minute during recess than did girls in control schools, this difference was not statistically significant (Table 1). No significant differences in mean number of accelerometer intensity counts or steps taken were found for boys.

Playworks also had a significant impact on the percentage of time girls spent in vigorous activity during recess. The average percentage of time girls spent in vigorous activity during recess was about 4 percentage points higher in treatment schools compared to control schools (Table 1). No significant differences were observed for the time girls spent in MVPA or among boys on either variable (MVPA or vigorous activity alone).

Structured Recess Observations

No significant differences were found in the mean percentage of girls or boys observed engaging in MVPA or vigorous activity alone based on the SOPLAY

Table 1. **Impacts on Physical Activity at Recess Based on Accelerometers**

Outcome	Treatment	Control	Difference	p-Value
Sample size				
Girls	489	334	—	—
Boys	415	335	—	—
Mean number of accelerometer intensity counts recorded per minute during recess				
Girls	1241.9	927.3	314.5	.05
Boys	1395.8	1101.3	294.5	.16
Mean number of steps taken per minute during recess				
Girls	27.7	22.6	5.1	.06
Boys	32.1	28.1	4.0	.30
Mean percentage of accelerometer wear time during recess spent in:				
Girls				
Moderately or vigorously intense activity	33.3	27.5	5.8	.10
Vigorously intense activity	12.0	8.3	3.7	.03
Boys				
Moderately or vigorously intense activity	39.9	34.0	5.9	.26
Vigorously intense activity	15.5	10.8	4.8	.11

observations. During the recess observations, we also recorded the main activity in which students were engaged within each zone. We then coded these main activities into 7 distinct categories, such as ''sitting, talking, or other sedentary activity'' or ''jumping, running, tag, or chase games.'' Results showed that both girls and boys in the treatment group were more likely than their control group counterparts to engage in playground games (four-square, tetherball, dodge ball, wall ball, Simon says) and less likely to engage in sedentary activities (Table 1). Girls in treatment schools were also significantly more likely than girls in the control schools to engage in jumping, running, tag, or chase games. Significant impacts were not found for other recess activities, such as standing or walking; climbing, sliding, or swinging on a play structure; or team sports such as soccer and baseball (Table 2). To test whether the distributions of categorical main activity variables collectively differed from one another, we also conducted chi-square tests for both girls and boys. The p-values for these tests were .03 (girls) and .22 (boys), indicating an overall statistically significant impact in observed main activities among girls but not among boys.

DISCUSSION

Consistent with past research suggesting that physical activity interventions may be more successful with girls than boys, the current study found impacts of Playworks on some measures of girls' physical activity but did not find similar results for boys. Girls who received Playworks had significantly higher intensity counts per minute and spent more time in vigorous physical activity during recess than girls in control schools, according to accelerometer data. These findings are particularly noteworthy because accelerometers are the preferred method for obtaining objective measurements of physical activity in free-living settings outside of the laboratory environment.[30,31] We did not find a statistically significant impact on the mean number of steps girls took per minute or on the mean percentage of accelerometer wear time in *combined* moderate and vigorous activity, but the patterns of findings for these 2 outcomes were in the same direction as the statistically significant findings, with girls in treatment schools showing more physical activity relative to control girls.

No significant differences based on accelerometer data, however, were found for boys. One possible explanation for this finding could be that boys are generally more physically active than girls to begin with, leaving more room for improvement among girls. In addition, research suggests that girls generally have fewer active role models and less perceived benefits of physical activity than boys.[5] Playworks may be especially effective with girls because it targets these barriers by providing an encouraging coach who uses an inclusive approach to introduce games and activities that foster social skills and cooperation, which may be especially appealing to girls. The lack of significant impacts on boys' accelerometer data, however, also suggests that there could be room for program improvement with regard to increasing boys' physical activity.

Playworks also had a significant impact on the types of activities in which girls engaged during recess. Observation data showed that girls in treatment schools were more likely than their control group counterparts to engage in playground games and in jumping, running, tag, or chase games and were less likely to be engaged in sedentary activities. Boys in treatment schools were also less likely to engage in sedentary activities and more likely to engage in playground games than were boys in control schools, but, unlike the girl sample, there was no overall

Table 2. **Impacts on Physical Activity and Activities at Recess Based on Observations**

Outcome	Treatment	Control	Difference	p-Value
Number of recess observation scans				
Girls	102	69	—	—
Boys	101	69	—	—
Mean percentage of students who were observed engaging in:				
Girls				
Moderate or vigorous activity	58.7	64.1	−5.3	.09
Vigorous activity	21.4	21.3	0.1	.99
Boys				
Moderate or vigorous activity	67.8	70.9	−3.1	.31
Vigorous activity	25.1	24.1	1.0	.71
Percentage of scans in which the following activity was the main activity observed:*				
Girls†				
Sitting, talking, or other sedentary activity	7.4	21.2	−13.8	.00
Standing or walking	16.2	22.4	−6.2	.36
Jumping, running, tag, or chase games	23.9	14.6	9.4	.01
Climbing, sliding, or swinging on a play structure	10.5	13.6	−3.2	.47
Soccer, football, or hockey	4.1	3.3	0.7	.78
Baseball, kickball, basketball, or volleyball	14.9	10.2	4.7	.40
Playground games (four-square, tetherball, dodge ball, wall ball, Simon says)	18.3	9.4	8.9	.02
Boys†				
Sitting, talking, or other sedentary activity	5.8	11.1	−5.3	.03
Standing or walking	13.7	19.6	−5.9	.34
Jumping, running, tag, or chase games	15.9	11.9	3.9	.36
Climbing, sliding, or swinging on a play structure	9.7	11.7	−2.0	.58
Soccer, football, or hockey	6.2	8.6	−2.4	.53
Baseball, kickball, basketball, or volleyball	26.1	19.0	7.1	.31
Playground games (four-square, tetherball, dodge ball, wall ball, Simon says)	17.8	8.8	9.0	.02

*These percentages sum to less than 100 because a small percentage of main activities did not fit into these categories.
†To test whether the distributions of main activity variables collectively differed from one another, chi-square tests were conducted separately for girls and boys. The p-values for these tests were .03 (girls) and .22 (boys), indicating an overall significant impact in observed main activities among girls but not among boys.

significant difference between boys in the treatment and control groups in terms of their activities, based on a chi-square test.

Although girls at Playworks schools spent more time in vigorous physical activity than girls in control schools according to accelerometer data, similar impacts were not found in the percentages of girls engaged in MVPA or vigorous activity alone based on the SOPLAY observations. There are clear differences between the data sources for these two findings, which could explain the difference in findings. In particular, the accelerometer data are based on student-level activity recorded during the entire recess period, whereas SOPLAY data provide information on group activity patterns by systematically observing students in zones of the recess play yard. In addition, accelerometer data were collected from 4th and 5th grade students only, whereas the recess observations spanned all grades at each school (usually kindergarten through grade 5). Thus, it is possible that Playworks had an impact on the physical activity of 4th and 5th grade girls but did not have an impact on younger girls' physical activity.

It is also possible that the SOPLAY tool simply did not pick up the impact on physical activity that was recorded by the accelerometers because of the nature of the observation scans. For example, girls at schools with Playworks were most likely to be engaged in turn-taking activities, such as jumping rope, four-square, tetherball, and wall ball. Although these activities can involve vigorous physical activity when girls are actively engaged, girls are also likely to stand in line waiting for their turn. It is possible that the SOPLAY scans often took place when girls were waiting in line, and not when they were actively jumping rope or throwing a ball, so their activity during the scan was coded as sedentary, even though their overall activity across the recess period might be categorized as vigorous by the accelerometer data. Nevertheless, the pattern of findings is consistent with the notion that Playworks led to increases in girls' physical activity at recess.

Limitations

Although the results of this study show impacts on some measures of girls' physical activity after 1 year of exposure to Playworks, the study did not collect data from students or schools prior to study implementation. Having baseline measures is not necessary to obtain unbiased impact estimates, given the random assignment design; baseline data, however, would have provided more power to detect impacts.

In addition, a key question in the study of physical activity is how to implement programs that result in sustained changes in physical activity patterns. The current study, however, did not collect data in subsequent years to determine whether impacts were maintained. Follow-up data collection periods beyond year 1 would have allowed us to investigate possible improvements in Playworks implementation across time, as well as track longer-term student outcomes. It is possible that girls' intensity of physical activity might become more similar to the intensity of activity observed in control schools during later school years as the novelty of the Playworks coach, organized games, and equipment wears off. It is also possible, however, that the impact on physical activity could grow larger as Playworks becomes more embedded in the recess culture at schools and implementation of the program improves across time. Indeed, London et al[32] found that implementation of the Playworks program was strongest in schools that had an established recess culture; at schools with the strongest Playworks implementation, and where recess was more organized, students were more engaged, principals and teachers were supportive and knowledgeable about the program, and the schools had policies in place that supported the goals of Playworks. Future studies should measure the long-term impacts of Playworks, both overall and among boys and girls, as Playworks becomes a standard, long-term part of a school's programming.

Conclusions

Children are more likely to become physically active at recess when they have access to adequate space and equipment and when adults make direct attempts to organize recess games and activities.[33] Past research has found that Playworks, which includes an adult coach providing equipment and organizing activities, leads to marginally significant impacts on time spent in vigorous physical activity and the intensity of physical activity during recess.[22] The current study extends these findings by showing that Playworks had a significant impact on some measures of girls' physical activity, but no significant impact on measures of boys' physical activity.

IMPLICATIONS FOR SCHOOL HEALTH

Educators, researchers, and policymakers are continuously trying to identify promising interventions to help encourage physical activity during school, in light of the obesity epidemic in the United States and its associated health impacts.[1,2,4] Consistent with previous studies, boys in the current study were generally more physically active during recess than girls, regardless of whether they received Playworks. The current study suggests, however, that programs such as Playworks may offer a set of strategies that is particularly effective at increasing girls' vigorous physical activity during recess. Moreover, the observation data suggest that providing children with a coach who implements organized physical activities during recess, introduces new equipment, and encourages students to be more active could be especially effective at increasing girls' interest and participation in new games and activities (such as playground games), as opposed to hanging out and talking during recess.

Human Subjects Approval Statement

This study was approved by the Public/Private Ventures Institutional Review Board and the New England Institutional Review Board.

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