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Predictors of Physical Activity During Recess

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Predictors of Physical Activity During Recess

by

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Abstract

Predictors of Physical Activity During Recess

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Recess is a fundamental part of the school-day with the opportunity for children to participate in physical activity (PA). Substantial variability exists in the time and percent children spend in moderate-to-vigorous physical activity (MVPA) during recess, suggesting the need to understand what variables predict recess PA. The purpose of this study was to examine the relationship between individual-level and school-level variables and recess PA with a large and diverse student and school sample. Participants were 1,728 Central Texas fourth graders from 19 schools, part of the Texas Initiative for Children's Activity and Nutrition (I-CAN!). One school-week of children's PA was collected using triaxial accelerometers between 2013 and 2015. Percent time and weekly time in MVPA during recess were calculated, and a mixed model was fit to the data to account for the hierarchical nature of the data. After calculating intra-class correlations (ICCs), schools accounted for a significant amount of the variance in percent time (ICC = 0.30 (95% CI: 0.18, 0.46)) and weekly time in MVPA (ICC =.23 (95% CI: 0.13, 0.37)). Gender ($p<0.0001$), bad weather ($p\leq0.024$), and fitness ($p<0.0001$) were all significant predictors of recess MVPA in both models, with boys being more active than girls, bad weather negatively predicting recess MVPA, and fitness positively predicting recess MVPA. An interaction between fitness and gender was observed ($p = 0.005$) with fitness being more associated with boys' recess MVPA than girls' in the weekly MVPA model, but not in the percent MVPA model. Our study is the first to find that recess MVPA is related to fitness. Although a significant amount of the variance in recess MVPA was attributed to schools, the only school-level variable that significantly predicted recess MVPA was bad weather. This suggests that other school-level variables not in our study, like unfixed equipment and the social environment, might mediate recess PA and warrant further study to better inform recess policy.

Table of Contents

List of Tables

List of Figures

Introduction

In school settings, recess provides a unique opportunity for students to be physically active with the chance for free-play. It is a fundamental part of the school day as 93% of public elementary schools regularly schedule recess (Erwin et al., 2014; Ramstetter et al., 2010). Recess has been associated with attentional, cognitive, social, and emotional benefits (Ramstetter et al., 2010) and can account for as much as 40% of a child's daily recommended physical activity (PA) (Ridgers et al., 2006). This is significant as most children are not sufficiently active (Cooper et al., 2016; Kohl et al., 2012). However, a significant amount of PA is not assured and may depend on the amount of time devoted to recess (Reilly et al., 2016). Typically, students spend between 15-47% of recess in moderate-to-vigorous physical activity (MVPA), which amounts to between 3 and 25 minutes of MVPA per day (Erwin et al., 2014; Ridgers et al., 2006). This is a surprisingly large amount of variability in recess MVPA that has been shown both between studies and even within others (Erwin et al., 2014; Reilly et al., 2016; Ridgers, Salmon, et al., 2012; Ridgers, Stratton, & Fairclough, 2006). This suggests that there is significant moderation of PA during recess.

Previous studies have consistently associated recess PA with gender, unfixed play equipment, and weather (Harrison et al., 2011; Parrish et al., 2013; Ridgers, Salmon, et al., 2012). Boys are more active than girls (Ridgers, Salmon, et al., 2012), a pattern typical of school-based, observational PA research (Sterdt, Liersch, & Walter, 2014). Providing unfixed play equipment increases recess PA (McKenzie et al., 2010; Ridgers, Salmon, et al., 2012), while bad weather negatively impacts recess PA (Kolle et al., 2009; Tucker & Gilliland, 2007). Despite these consistent findings, most variables thought to predict recess PA have conflicting results (see Ridgers et al., 2012 for a comprehensive description). Some variables like body mass index (BMI), permanent area improvements, and recess length have been well-studied, but inconsistently related to recess PA. Other variables, like socioeconomic status (SES), ethnicity, fitness, outdoor space, and recess vs. lunch have been suggested to be important but have not been well-studied (Gonzalez-Suarez & Grimmer-Somers, 2009; Parrish et al., 2009).

In addition to a lack of research, there are a number of limitations with the extant literature. As can be seen in Table 1, sample sizes are typically small as are the number of schools represented in most studies. Because a number of school-level variables have been suggested and students are nested within schools, there must be a sufficient sample of schools to examine these predictors within a hierarchical model. Additionally, although many studies use an objective measure of PA, methodological differences, specifically cut point choice and epoch length, can have significant effects on PA estimates (Nettlefold et al., 2016; Trost et al., 2011). There is, therefore, a dire need for research that provides an objective measure of PA during recess and explores the contribution of school-level and student-level variables to recess PA with a large sample drawn from numerous schools. This study is designed to fill this void.

Methods

PARTICIPANTS

The Texas Initiative for Children's Activity and Nutrition (I-CAN!) was a school-based physical activity intervention designed to introduce physically active academic lessons. Of the 3,028 students recruited, parent informed consent and student assent was obtained from 2,716 4th grade students recruited from 28 schools in four Central Texas school districts. All study protocols were approved by the university's Institutional Review Board. As a part of this study, accelerometry was collected from each student. As these data are time stamped, the time spent in recess could be isolated, which served as the primary data for this study. Recess times were available for 20 of the 28 schools. One of these schools was as excluded as an outlier as its percent in MVPA was greater than 2.8 standard deviations below the mean, leaving a total of 19 schools and 1,728 students.

DEMOGRAPHICS, BMI, AND AEROBIC FITNESS

Participant demographic information (i.e. sex, age, race/ethnicity, and eligibility for free/reduced lunch) was obtained through school records. The final sample included slightly more boys than girls (48% vs. 44%) a diverse racial, ethnic, and economic distribution (22% Hispanic; 7% Black; 7% Asian; 31% eligible for free or reduced lunch of those reported), and good variability in fitness and BMI. Thus, the sample was sufficiently diverse to adequately test these demographic variables as predictors of recess PA. Demographic characteristics can be seen in Table 2.

Eligibility for free/reduced lunch was used as a proxy for lower SES as free/reduced lunch is a commonly used measure for SES. Its validity is contested (Harwell & LeBeau, 2010), but it is highly related to other community SES measures (Nicholson et al., 2014). Body mass, height and aerobic fitness were collected according to FITNESSGRAM® (Welk & Meredith, 2007) standards by school staff. Height was measured rounding down to the nearest 1/4th inch with students standing shoeless, facing forward. Body weight was measured rounding down to the lowest tenth of a pound using a calibrated scale without shoes or excessive clothing. Body mass index (Kg/m^2) was calculated as a part of the FITNESSGRAM® protocol. Aerobic fitness was estimated using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test, a validated and reliable, progressively challenging aerobic test (Morrow, Martin, & Jackson, 2010). FITNESSGRAM® assessments are completed yearly by physical educators in Texas and these data were obtained from schools for all participating students.

Physical Activity

PA data were collected during the school hours, over the course of one school-week (five consecutive days). Schools were randomly assigned to have their students' data collected during the Fall or Spring semester of the academic year. Children's PA was assessed with a triaxial accelerometer ActiGraph® Manufacting Technologies, Inc. model GTX3X+ (Welk, Schaben, & Morrow, 2004). To ensure a complete collection of school-day PA, accelerometers were distributed at the beginning of the school day by research staff and taken off as students left class at the end of each school day. The accelerometers were worn throughout the entire school-day in an elastic belt around the waist, positioned on the right hip (Trost, Mciver, & Pate, 2005). Data were collected in 5-second epochs to best capture children's activity (Nettlefold et al., 2016). Periods of greater than 90 minutes of zero counts were defined as non-wear time according to Choi et al. (2011). PA data were downloaded onto a computer and analyzed with ActiLife v6.13.3 software that applied Evenson cut points (Evenson et al., 2008; Trost et al., 2011). In ActiLife, filters were applied to recess times and the weekly, validated recess PA was downloaded for each student. Outcomes for PA were weekly time in MVPA (min.) and percent time in MVPA (percentage of MVPA during valid wear time). Students with all zeros counts (n=7) or only one day of recess PA (n=16) were excluded. For students with fewer than five days of recess sessions (e.g. absent one day), weekly time in MVPA for the existing days was extrapolated to one week.

School-level variables

Schoolyards were coded according to the mapping strategies component of the validated System for Observing Play and Leisure Activity in Youth (SOPLAY) (McKenzie, 2002). Schoolyard outcomes included permanent area improvements, playground space, and playground space per student. To deal with overlapping improvements, we counted the highest number of permanent improvements that could be used at one time. Schoolyard characteristics for each school were collected in the spring of 2017, after the completion of the I-CAN! study. Past images from Google™ Earth Pro were used to check for changes in schoolyard permanent area improvements. 4 schools had updated permanent area improvements. These schools were coded without the inclusion of these improvements. Estimates of playground spatial space (sq. $ft.^2$) were found using past aerial pictures and the polygon measurement tool in Google™ Earth Pro software. Average area was calculated from three estimations of playground spatial area. The number of children enrolled in the fourth grade was provided from each school. Playground spatial area and student enrollment were used to calculate the playground space per student. The number of bad weather days were determined using time-stamped archived weather data from Weather Underground ("Historical Weather," 2017). Bad weather was considered as temperatures below 40^{o} F, above 100^{o} F, or any amount of precipitation during the recess time. As part of the larger research project, students undertook physically active academic lessons. While the intervention was limited to 10-15 min of PA, it is possible that it had an effect on recess PA. To ensure that this wasn't the case, schools were coded control or experimental and included in the final analysis.

Data Analysis

Correlations and descriptive statistics were calculated for students using SAS Version 9.4 software (SAS Institute, Cary, NC). Continuous variables, e.g. BMI and PACER score, were centered around the mean, and gender was adjusted for interation (-1=female and 1=male). After calculating the intra-class correlation (ICC), linear mixed models for percent time in MVPA and weekly time in MVPA were fit using SAS PROC

MIXED, Version 9.4. For percent time in MVPA, permanent area improvements, bad weather days, gender, PACER score, and an interaction between PACER score and gender were included as fixed effects. Gender, SES, and race (nonwhite vs. white), were included as random effects. For weekly time in MVPA, recess length was regressed on time in MVPA and the residuals were run as the dependent variable in the model to control for recess length. Area improvements, bad weather days, gender, PACER score, and an interaction between PACER score and gender were included as fixed effects. Gender, SES, and race were included as random effects. The models were built according to Bell et al. (2013) taking into account previous literature, initial correlations, model fit, and the significance and direction of the relationship between the variable, percent time in MVPA, weekly time in MVPA, and the final estimate in the model. After the final models were built, the experimental vs. control conditions were included as fixed effects to test if the intervention impacted recess PA.

Results

Descriptive Statistics

Descriptive statistics for categorical and ordinal school-level variables are displayed in Table 3. Each variable had a good distribution across almost all conditions. Descriptive statistics for continuous variables are shown in Table 4. Sample sizes ranged from 1326 to 1705 for individual-level variables. The sample size for all school-level variables was 19. Students spent about 25% of recess in MVPA, accounting for 31 minutes of MVPA per school-week. Schools averaged about 15 permanent area improvements, ranging from 4 to 27.

Correlations and Comparative Statistics

Correlations, before accounting for the nested effect of schools, are presented in Table 5. Three MVPA measures are included in the table, percent, weekly, and the residuals of recess length regressed on weekly MVPA. Recess vs. lunch, gender, permanent area improvements, bad weather days, and PACER score are the only variables that have very significant ($p<.001$) relationships with all three MVPA measures. With the exception of bad weather days (Figure 2), all of these variables have a positive relationship with recess MVPA. Boys were more active than girls (Figure 1), and higher PACER scores were related to more minutes of recess MVPA during the school-week (Figure 3).

Hierarchical Model

The school-level ICCs for percent time in MVPA and weekly time in MVPA were 0.30 (95% CI: 0.18, 0.46) and .23 (95% CI: 0.13, 0.37) respectively. Due to these high ICCs, linear mixed models were fit. 334 students were missing PACER, SES, gender, or ethnicity data and had to be excluded from the mixed model. Most of these missing data were due to missing PACER scores as 2 entire schools did not report PACER scores and 322 students weekly were missing PACER data. Students with missing data achieved more recess MVPA, but were also subject to fewer bad weather days. These missing data are reported in Table 6. 1,371 students and 17 schools were included in the final model.

Hierarchical mixed models were fit for both percent time in MVPA and weekly time in MVPA. The results are summarized in Table 7. Bad weather days, gender, and PACER score were significant predictors of both percent time in MVPA and weekly time in MVPA. Boys were significantly more active than girls ($\beta = 0.064$, $SE = 0.009$, $p < 0.0001$; $\beta = 7.366$, $SE = 1.11$, $p < 0.0001$). PACER scores were positively related to recess MVPA ($\beta = 0.0007$, $SE = 0.00017$, $p < 0.0001$; $\beta = 0.097$, $SE = 0.022$, $p < 0.0001$). Bad weather days were negatively associated with recess MVPA ($\beta = -0.036$, $SE = 0.01$, $p = 0.001$; $\beta = -2.792$, $SE = 1.157$, $p = 0.024$). For weekly time in MVPA gender moderated PACER scores' impact on recess MVPA ($\beta = -0.058$, $SE = 0.02$, $p = 0.005$.) Higher PACER score predicted higher MVPA in boys, but not in girls (Figures 4 and 5). As random effects, ethnicity and gender accounted for a significant amount of the variance in percent time in MVPA with 8.1% ($\beta = -0.00112$, $SE = 0.00068$, $p = 0.049$) and 5.9% ($\beta = -0.00083$, $SE = 0.00046$, $p = 0.036$) respectively. Only gender accounted for a significant amount of the variance in weekly time in MVPA with 7% ($\beta = -14.746$, $SE = 7.706$, $p = 0.028$). Area improvements and recess vs. lunch were not significant predictors of percent time in MVPA or weekly time in MVPA. Whether a school took part in the intervention as an experimental group or as a control was included in the final model and did not impact recess MVPA ($\beta = -0.010$, $SE = 0.035$, $p = 0.779$; $\beta = -2.828$, $SE = 3.596$, $p = 0.447$).

Discussion

The purpose of this study was to examine school-level and individual-level predictors of MVPA in fourth grade children during recess with a large, racially and socioeconomically diverse sample from Central Texas. The results confirm consistent findings in the literature and propose novel findings. Similar to previous research we found that bad weather significantly negatively impacts recess PA and that boys are significantly more active than girls during recess (Ridgers, Salmon, et al., 2012). However, unlike previous research, we found that fitness is significantly positively associated with recess PA, and furthermore, that fitness moderates recess PA by gender with fitness being a better of predictor of recess PA in boys than girls.

Individual-level Variables

Boys were more active than girls, consequently, our data support the most consistent finding in recess PA (Ridgers, Salmon, et al., 2012). To our knowledge, only one study has examined the relationship between fitness and MVPA during recess (Faison-Hodge & Porreta, 2008). Unfortunately, the study was inconclusive and used a specialized and small sample size. Our study is the first to show that fitness is a significant, positive predictor of recess MVPA. Additionally, given the interaction between fitness and sex, our results indicate that fitness is a stronger predictor of boys' recess PA than girls'. Previous research investigating the social context of recess in elementary students found that boys are more likely to participate in ball games, while girls are more likely to engage in sedentary play and conversation (Blatchford, Baines, & Pellegrini, 2003; Pawlowski et al., 2014). It seems likely that more fit boys engage in these ball games or other types of high-intensity play, while less fit boys engage in more sedentary play during recess. For girls, it may be that recess is a more social environment; thus, fitness is not a strong predictor of PA.

School-level Variables

Despite considerable school-level PA variability, our school-level outcomes were not great recess PA predictors. Bad weather was a negative predictor of MVPA. This is not surprising, as temperature and precipitation have consistently been associated with decreases in recess PA (Kolle et al., 2009; Ridgers, Salmon, et al., 2012). Although permanent area improvements were correlated with recess MVPA, once the school-level variance was accounted for in the mixed model, permanent area improvements were no longer related to recess MVPA. These results are similar to previous research, in which permanent area improvements are occasionally associated with increased MVPA, but not consistently (Ridgers, Salmon, et al., 2012). Recess length and recess vs. lunch showed similar characteristics. Both were correlated to percent in MVPA, but were either not included or not significant in the final model. These findings are typical of recess research, with both variables occasionally, but not consistently being related to PA (Ridgers, Salmon, et al., 2012).

There is often large variability in both time and percent in MVPA during recess both between studies and within studies (Reilly et al., 2016). This strongly suggests that there is room for predictors of recess PA. Yet few variables have been consistent predictors of recess MVPA. Gender, bad weather, unfixed equipment, and perceived encouragement are among the few (Ridgers, Salmon, et al., 2012; Sallis, Prochaska, & Taylor, 2000). Our results confirm some of these previous findings and assert new ones. Research has not yet explored the relationship between fitness and recess PA. This study shows that there is a relationship between fitness and both percent time in MVPA and weekly time in MVPA with a large and diverse sample of students and schools. It also asserts that this relationship between fitness and recess PA is stronger in boys. While these findings are important, they struggle to inform us about recess policy. Although we saw substantial variability in recess MVPA at the school-level, most of our school-level measures did not predict recess MVPA. This suggests that other school-level variables account for this variability. Additionally, the relationship between fitness and recess PA suggests that recess is not an effective environment for low-fit children to accumulate PA. As these are the children we want to impact with PA interventions and substantial school-level variability remains, more research is necessary to understand the importance of recess.

Tables

Table 1. School Recess MVPA

First Author, Setting	Percent time in MVPA	Time in MVPA (min/day)	Recess Length (min)	Sample Size	Schools	Method of Measurement	Cut Points
Blaes et al., (2013), France	28.21	5.64	15	427	4	ActiGraph® GT1M	Trost
Cohen et al., (2014), Australia	-	11	20	460	8	ActiGraph® GT3X	Evenson
D'Haese et al., (2013), Belgium	24.39	4	15-20	184	3	ActiGraph® GT3X	Evenson
Engelen et al., (2013), Australia	-	11	60-80	221	12	ActiGraph® GT3X	Evenson
Fairclough et al., (2012), England	-	10	19	223	8	ActiGraph® GT1M	> 2000 counts / minute
Ridgers et al., (2005), England	29.03	24.53	85	228	23	ActiGraph® GT1M	> 163 counts / 5s
Saint-Maurice et al., (2011), U.S.	36.29	-	20-50	100	2	ActiGraph® GT1M	Freedson

Studies were taken from a recess PA systematic review (Reilly et al., 2016)

Table 2. Demographic Characteristics of Students

Variable	Number	Percent or Mean(SD)	Percent Time in MVPA	Weekly Time in MVPA (min)
Age (yr)	1466	9.6 ± 0.5	-	-
Gender (%)				
Male	822	48.2	28.1	35.4
Female	745	43.7	20.9	26
Not reported	138	8.1	26.1	34.8
Ethnicity (%)				
White	851	49.9	25.2	33.6
Hispanic	359	21.1	23.8	25.8
American Indian / Alaska Native	26	1.5	24.4	32.3
Asian	115	6.7	24.4	31.8
Black	119	7	24.7	26.2
Native Hawaiian / Other Pacific Islander	1	0.1	31.8	47.7
Multi	92	5.4	23.8	29.6
Not reported	43	2.5	26	34.9
Reduced or free lunch (%)				
Yes	491	28.8	23.9	28.5
No	1068	62.6	25	31.9
Not reported	146	8.6	26.4	35.3
BMI (Kg/m^2)	1326	18.6 ± 4	-	-
PACER Score (laps)	1383	31.5 ± 19.37	-	-

Table 3. Characteristics of School-level Variables

Variable	Schools	Students	Percent of Students	Percent Time in MVPA	Weekly Time in MVPA (min)
Experimental vs Control					
Experimental	12	1089	64	24	29.3
Control	7	616	36	25.3	32.4
Recess vs. Lunch					
Before	5	534	31	24.6	33
Neither	8	664	39	22	26
After	6	507	30	28.8	36.2
Bad Weather (days)					
0	9	899	53	26.6	33
1	4	401	23	26.7	37.6
2	1	96	6	16.5	16.5
3	5	309	18	19.9	22.5
Recess Length (min)					
15	3	293	17	18.5	13.9
20	6	423	25	25	25
25	2	201	12	31.5	39.5
30	7	693	41	25.2	37.9
35	1	103	6	26	45.5

Table 4. Descriptive Statistics of Continuous Variables

Variable	N	Mean	SD	Minimum	Maximum
Weekly MVPA (min)	1705	31.2	17.8	0.3	86.9
Percent MVPA (%)	1705	24.9	12.2	0.3	69.5
PACER (laps)	1383	31.5	19.4	3	153
BMI (Kg/m^2)	1326	18.6	4	10.5	38.8
Permanent Area Improvements	19	14.9	7.2	4	27
Playground Area (ft^2)	19	89457	51443	23819	204008
Space per Student (ft^2/student)	19	835	487	145	1814

Table 5. Correlation Matrix of Outcome Measures

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Percent in MVPA	1.00															
2. Weekly MVPA	***0.89***	1.00														
3. Weekly MVPA Residuals	***0.89***	***0.79***	1.00													
4. Recess Length	***0.16***	***0.53***	0.00	1.00												
5. Recess vs Lunch	***0.13***	*0.07*	***0.11***	***-0.09***	1.00											
6. Control vs Experimental	0.05	***0.08***	0.04	***0.11***	***-0.37***	1.00										
7. Ethnicity	0.05	***0.17***	0.00	***0.31***	***-0.09***	0.06	1.00									
8. Gender	***0.29***	***0.26***	***0.28***	0.02	0.00	0.06	*0.08*	1.00								
9. SES	-0.04	***-0.08***	-0.03	***-0.14***	0.00	***0.09***	***-0.28***	0.02	1.00							
10. Age	0.01	0.06	-0.02	***0.13***	***-0.14***	0.02	0.02	0.07	0.04	1.00						
11. Area Improvements	***0.13***	***0.21***	*0.07*	***0.25***	-0.03	0.01	*0.08*	-0.03	***-0.41***	0.01	1.00					
12. Area	0.05	-0.02	***0.09***	***-0.20***	***0.24***	***0.43***	***-0.23***	0.01	***0.11***	-0.01	***0.26***	1.00				
13. Area per Student	-0.01	***-0.10***	0.03	***-0.24***	***0.25***	***0.38***	***-0.25***	0.02	***0.13***	-0.01	***0.21***	***0.96***	1.00			
14. Bad Weather Days	***-0.23***	***-0.24***	***-0.22***	***-0.12***	0.02	-0.05	-0.03	0.01	***-0.11***	***0.08***	***0.13***	*-0.06*	***0.11***	1.00		
15. BMI	-0.03	***-0.11***	0.00	***-0.21***	-0.04	0.05	***-0.10***	0.02	***0.23***	0.06	***-0.30***	0.04	0.04	-0.07	1.00	
16. PACER	0.14	***0.30***	***0.11***	***0.38***	***-0.09***	***0.20***	***0.15***	***0.24***	-0.06	***0.13***	0.01	*-0.09*	*-0.09*	0.00	***-0.35***	1.00

$p<0.01$, ***$p<0.001$***

Table 6. Descriptive Characteristics of Data Missing from the Mixed Model

Continuous Variable	Condition	N (with data)	M	SD	Percent Time in MVPA	Weekly Time in MVPA (min)
PACER Score	Missing	12	29.167	14.547	30.1	43.1
	Included	1371	31.532	19.421	24.8	31.5
Area Improvements	Missing	334	12.485	6.6823	29.0	37.9
	Included	1371	15.468	7.162	23.8	29.6

Categorical Variable		Condition	N (with data)	Percent Time in MVPA	Weekly Time in MVPA (min)
Gender	Female	Missing	90	25.2	31.7
		Included	655	20.2	25.2
	Male	Missing	106	36.1	47.1
		Included	716	27	33.6
Free or Reduced Lunch	Yes	Missing	98	29.7	38.2
		Included	393	22.4	26.1
	No	Missing	90	32.7	41.6
		Included	978	24.3	31
Ethnicity	Nonwhite	Missing	116	31.3	39.2
		Included	596	22.7	25.4
	White	Missing	76	31.2	41.4
		Included	775	24.6	32.9
Bad Weather	0	Missing	263	30.9	41.1
		Included	636	24.8	29.6
	1	Missing	24	27.2	36.4
		Included	377	26.6	37.7
	2	Missing	13	19.6	19.6
		Included	83	16	16
	3	Missing	34	19.7	21
		Included	275	19.9	22.6
Recess vs. Lunch	Before	Missing	44	24	31.9
		Included	490	24.7	33.1
	Neither	Missing	72	22.2	29.1
		Included	592	21.9	25.6
	After	Missing	218	32.4	42
		Included	289	26.1	31.9

Table 7. Fixed and Random Effects for Recess Physical Activity Predictors

	Percent in MVPA						Weekly MVPA					
Fixed Effects	**Estimate**	**Standard Error**	***DF***	***P***	***Lower***	***Upper***	**Estimate**	**Standard Error**	***DF***	***P***	***Lower***	***Upper***
Intercept	0.196	0.037	10.5	0.0003	0.114	0.279	-3.671	4.349	14	0.413	-13.001	5.657
Area Improvements	0.003	0.002	9.75	0.177	-0.002	0.008	0.106	0.251	13	0.68	-0.436	0.648
Bad Weather Days	-0.036	0.01	20.7	0.001	-0.057	-0.016	-2.792	1.157	24.6	0.024	-5.177	-0.407
Gender	0.064	0.009	16.2	<0.0001	0.045	0.083	7.366	1.11	17.1	<0.0001	4.917	9.815
PACER	0.0007	0.00017	1345	<0.0001	0.0004	0.001	0.097	0.022	1335	<0.0001	0.055	0.14
PACER*Gender	0.0003	0.0002	682	0.084	0	0.001	0.058	0.02	766	0.005	0.018	0.099
Recess vs. Lunch	0.034	0.02	9.81	0.123	-0.011	0.079	-	-	-	-	-	-
Experimental	0.010	0.035	9.04	0.779	-0.069	0.089	-2.828	3.596	12.2	0.447	-10.650	4.995

Random Effects	**Percent of Variance (%)**	**Estimate**	**Standard Error**	**P**	**Lower**	**Upper**	**Percent of Variance (%)**	**Estimate**	**Standard Error**	**P**	**Lower**	**Upper**
Intercept	23.5	0.00326	0.00161	0.021	0.0015	0.0117	20.5	43.1629	18.9126	0.0112	21.3246	129.1400
Gender	5.9	0.00083	0.00046	0.036	0.000351	0.003695	7	14.7457	7.7056	0.0278	6.5414	58.5403
Ethnicity (Caucasian)	8.1	0.00112	0.00068	0.049	0.000451	0.006019	2	4.2882	4.1571	0.1511	1.1938	140.0900
SES	0.1	0.00013	0.00021	0.271	0.000022	1.3636	5	10.6264	8.0182	0.0925	3.6293	109.0500
Residual	61.6	0.00856	0.00033	<0.0001	0.007939	0.009252	65.4	137.94	5.3838	<0.0001	127.9700	149.1300

Figures

Figure 1. Percent Time in MVPA during Recess by Gender

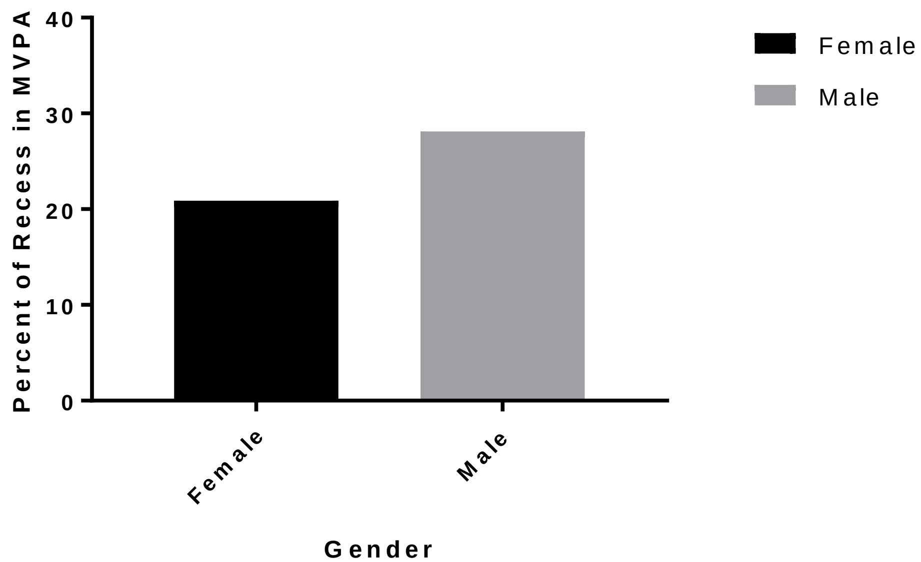


Figure 2. Percent Time in MVPA during Recess by Number of Bad Weather Days

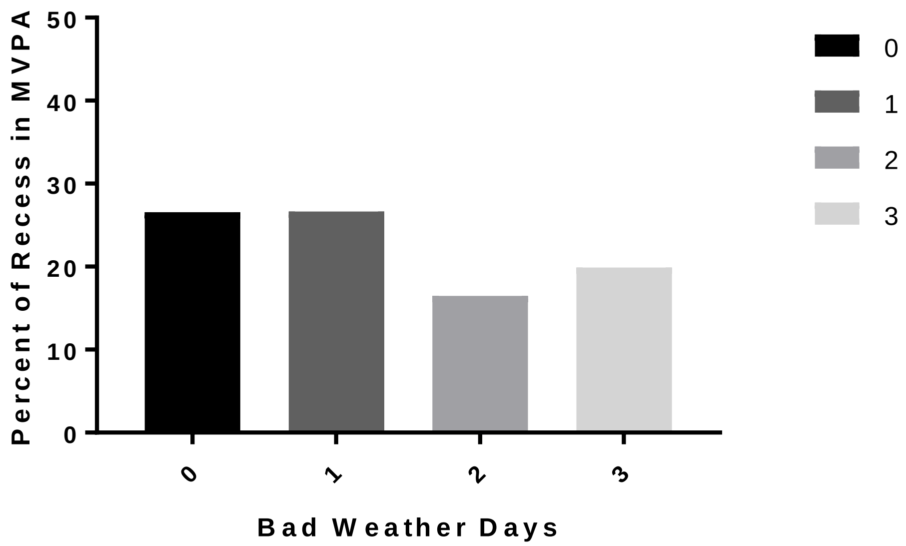


Figure 3. The Relationship Between Fitness and Recess MVPA

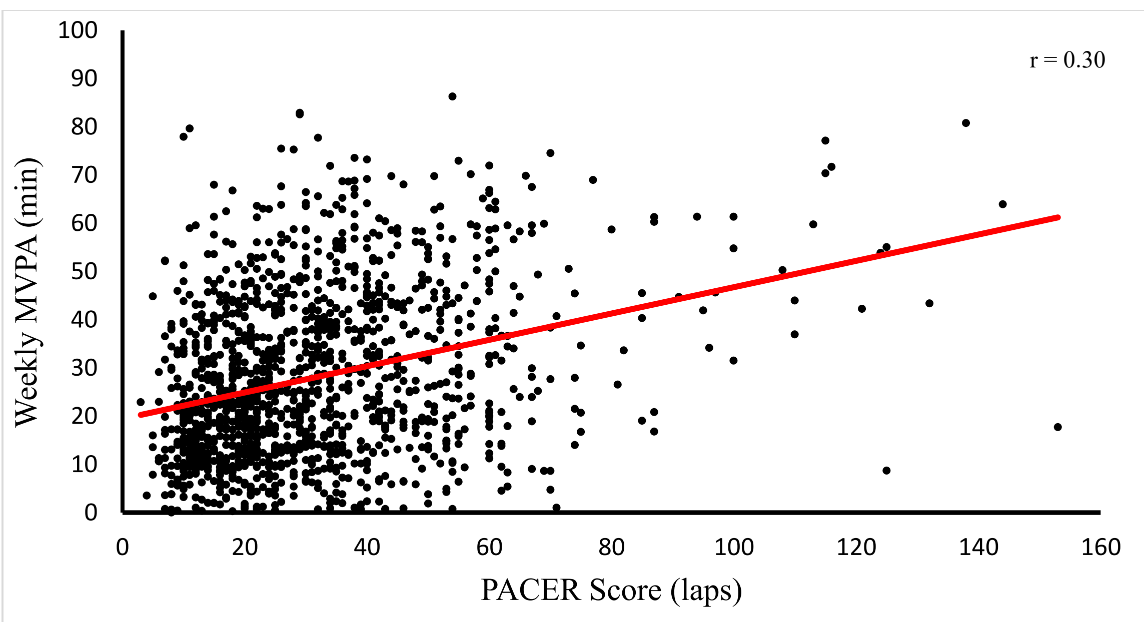


Figure 4. The Relationship Between Fitness and Recess MVPA in Girls

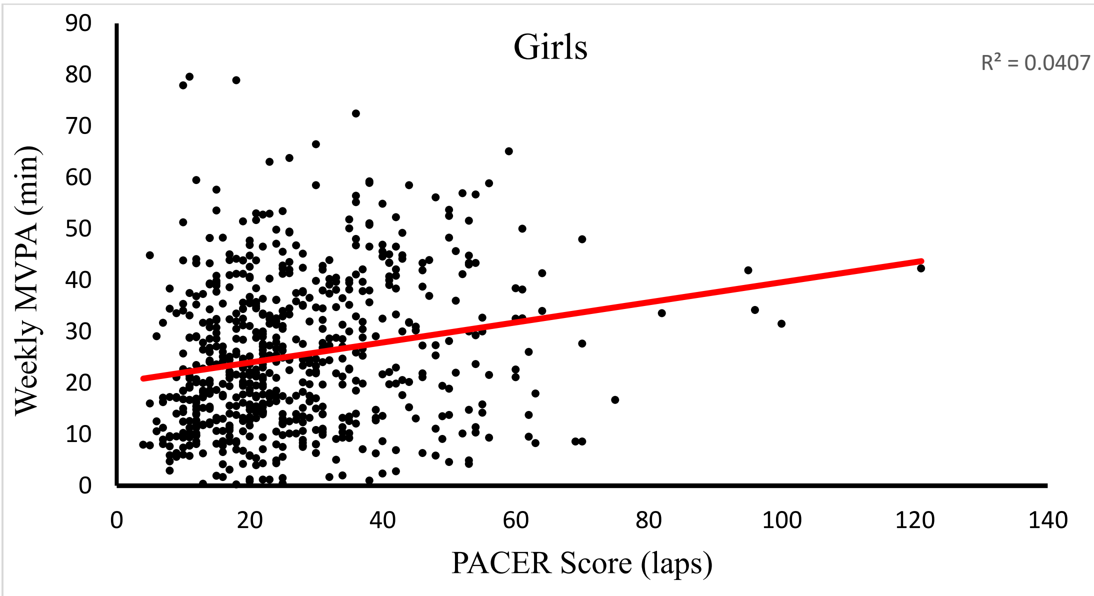
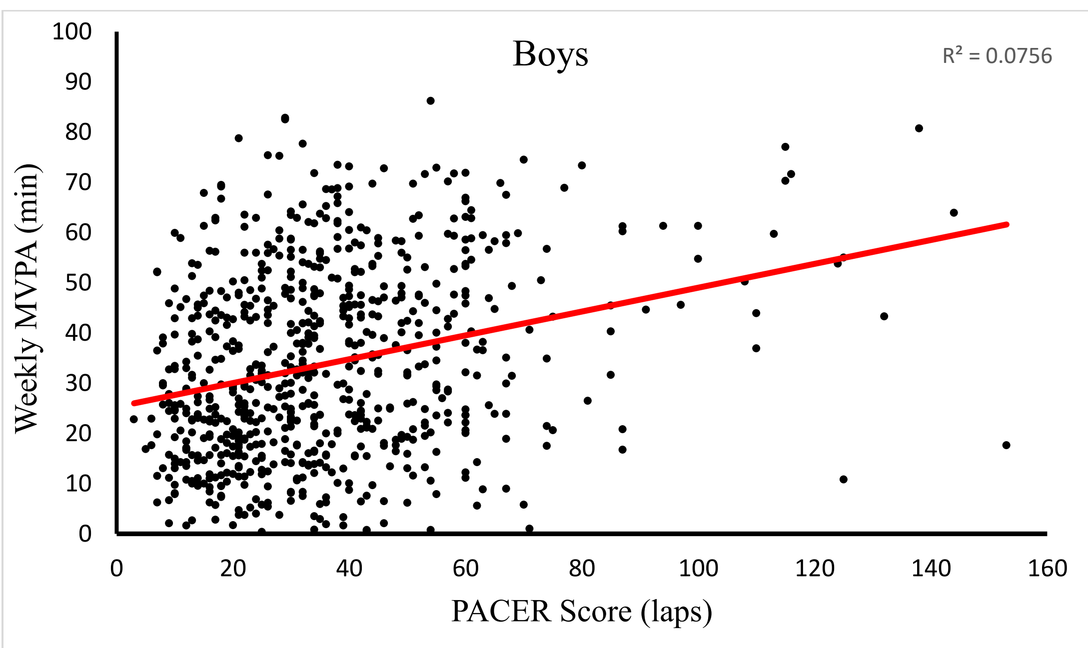


Figure 5. The Relationship Between Fitness and Recess MVPA in Boys



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