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Evaluating the impact of school policies and facility conditions on elementary student physical activity

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Master of Public Health

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Abstract

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By Haley Logan Hershey

Adolescent physical activity (PA) has been associated with long-term physical and mental health benefits. While a multitude of health outcomes associated with PA have been studied, the role of school policies and facilities in providing PA opportunities is unclear. This study investigated how school policies and facilities affected total daily moderate-to-vigorous physical activity (MVPA) for a cohort of 4,448 4th grade students enrolled in 39 schools within the Gwinnett County Public School (GCPS) district in Georgia, USA. School policies were assessed and scored using a modified version of the School Physical Activity Policy Assessment and facilities were assessed using a modified version of the School Observation: Environment Checklist. Student-level demographic information on gender, socioeconomic status, and race/ethnicity were collected from the GCPS district. Predictors of MVPA were modeled using multi-level linear models incorporating student-level demographic factors and school-level policy and facility predictors. Schools with at or above median physical education and recess scores were associated with 2.56 (standard error = 1.09) and 3.75 (standard error = 1.75) more minutes of total daily MVPA compared to schools with below median scores, respectively. At the student-level, females engaged in 4.39 (standard error = 0.37) fewer minutes of total daily MVPA than males. Attending schools with at or above median recess policy scores decreased disparities between white and black students, while attending schools with at or above median physical education policy scores was associated with fewer minutes of MVPA in female versus male students. This study demonstrates that school policies supporting a more PA conducive environment can lead to more total daily MVPA among adolescent students, but these effects are not manifested uniformly across students with different demographic backgrounds.

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Background

The long-term physical and cognitive health benefits of physical activity have been well documented (1). For adolescents, physical activity is associated with reductions in obesity, improves bone density and systolic blood pressure, and can even have positive mental health effects on symptoms of depression (2). Further, physical activity has been shown to improve academic outcomes, like standardized test scores (3) and academic performance in subjects like mathematics and reading (4, 5). Despite many rigorous evaluations of physical activity demonstrating a wide-range of beneficial health effects and improvements in academic performance, less than a quarter of children between the ages of 6 to 17 meet the Centers for Disease Control and Prevention's (CDC) recommendation of 60 minutes of moderate-to-vigorous physical activity (MVPA) each day (6). The alarming lack of adolescent physical activity engagement has shifted focus to schools as practical environments for health promotion (7).

The Role of Schools

Schools reach around 95% of children ages 5 to 17 each day during the academic year and are thus important platforms for promoting good health habits and implementing physical activity interventions (7). Physical activity policies and facility conditions in elementary schools can be critical to the adoption of good health habits among adolescents. The CDC's Whole School, Whole Community, Whole Child (WSCC) model emphasizes this principle by encouraging schools to adopt well-designed physical education programs that provide a platform for students to learn the skills needed to establish physically active lifestyles (8). Additionally, the WSCC model highlights how school buildings and surrounding facilities are crucial in promoting a safe and healthy

learning environment (8). Thus, implementing and evaluating physical activity policies as well as maintaining optimal facility conditions can promote beneficial health behaviors and create efficacious learning environments for elementary students.

Further, improving schools' roles in promoting health may address the MVPA disparities that exist among gender, race/ethnicity, and SES. A recent study found that low socioeconomic status (SES) communities have higher youth obesity rates, lower youth participation in physical activity outside of school, and less community walkability (9). Additionally, educators in low-income elementary schools believe a lack of time dedicated to physical activity and recess as well as a lack of funding for physical education are barriers to students engaging in physical activity (10).

Findings in the *National Health and Nutrition Examination Survey* (NHANES) from 2007 through 2016 reveal that adolescent males engage in more MVPA than females and that this relationship depends on race/ethnicity; Among female adolescents, minority race/ethnicity was associated with lower likelihood of MVPA (11). Additionally, female adolescents from higher income households were more likely to engage in MVPA than female adolescents from lower income households (11). These findings are similar to the CDC's *Youth Risk Behavior Survey* from 2017, in which a larger proportion of males in grades 9-12 were physically active for at least 60 minutes per day on 5 or more days per week compared to females, and white male students were more physically active than Hispanic and black male students (12). This relationship was similar among female students (12). Improving MVPA opportunities in schools through evidence-based PA policy implementation may address these disparities that exist among adolescents and continue into later academic years.

Physical Activity and Physical Education Policies in the United States

While the benefits of physical education are well-documented, many elementary schools do not meet physical education recommendations (13). For a majority of the past two decades there has been an increased focus on standardized test performance and a decreased emphasis on art, music, and physical education programs due to the 2002 implementation of the federal No Child Left Behind Act (13). Further, the 2016 *Shape of the Nation* report indicated that 50 states have set standards for physical education programs but only 39 states require students at the elementary level to participate in physical education in one or more grades from Kindergarten to 5th grade (14). Only 19 states have specified time requirements for the amount of physical education at all grade levels and only five states' meet the recommended 150 minutes of physical education per week (14). Additionally, only 17 states require school districts or schools to provide a minimum amount of time dedicated to physical activity of elementary students and only eight states require school districts or schools to provide daily recess (14).

The dearth of schools meeting national recommendations for physical education and physical activity is further complicated by more than half the states allowing school districts or students to apply for waivers to substitute physical education requirements with other activities, such as interscholastic or community sports, marching band, and cheerleading (14). One study even reported that the recommended amount of MVPA for elementary students was not achieved as physical education classes were often skipped due to scheduling conflicts with other school events, field trips, or teacher absences (15).

While many states have physical education policies, these requirements have not rendered action and improvement to schools' daily structure of physical activity and

education (16). The lack of standardization for U.S. elementary physical education requirements and the gap in administrative accountability may be fueled by a lack of resource evaluation and dissemination as well as a lack of reproduced evidence-based physical education findings (13). Without consensus and clear guidelines for effective physical education practice, many schools may adopt uninformed policies.

Physical Activity and Physical Education Facilities in the United States

Access to adequate physical education facilities, equipment, and spaces that allow physical activity are essential resources schools need to engage students in physical activity. While more than 50% of states receive funding for physical education programs, only one state, South Carolina, assesses the availability and quality of physical education facilities and equipment on an annual basis (14). Evaluating physical education resources and providing well-maintained equipment is critical to promoting physical activity in students. One study reported that school environments that had access to high levels of permanent physical improvements in school facilities and adult supervision had a four-fold increase in physical activity in girls and a five-fold increase in physical activity in boys compared to low levels of supervision and physical improvements (17). Another study reported that students only engage in MVPA for 45% of physical education lesson time but having access to adequate sporting equipment and facilities predicted an increase in MVPA and a decrease in time spent on administrative tasks related to class management (18).

While almost all U.S. schools lack valid physical education facility evaluation, this disproportionately affects low income and high minority youth that may have decreased access to quality facilities for physical activity. This is concerning as the

availability of gymnasiums is associated with more time in physical education per week, and high enrollment, high minority, and urban schools have fewer gymnasiums compared to low enrollment, low minority, suburban and rural schools (19). Therefore, providing physical education space and maintaining quality facilities and equipment has the potential to reduce health disparities in physical education and physical activity in disadvantaged school districts.

Current Evaluation

While prior research has indicated that physical activity policies and facilities may increase the amount of physical activity students engage in while attending school, the public education systems in the U.S. lack policy and facility evaluation necessary for understanding the implications these may have on student health and academic outcomes. The current study seeks to understand the association between physical activity policies and facilities with the amount of MVPA students participate in.

The state of Georgia requires schools to provide 90 hours of health and physical education each academic year, from kindergarten to 5th grade, and requires students to participate in an annual physical education assessment evaluating physical fitness (20). However, Georgia does not have a specified minimum weekly amount of physical activity time required for elementary students and does not require schools to provide recess each day (14). Georgia also does not annually evaluate the provision and condition of facilities and equipment used for physical education class (14). A lack of defined state policies and encouragement of district unification allows the current evaluation to explore how the Gwinnett County Public School district has structured its physical education and physical activity requirements for students and schools.

The main hypothesis being evaluated is that elementary schools with physical activity promoting policies and a large provision of physical activity facilities and equipment will be associated with higher average amounts of MVPA in elementary students and reduced MVPA disparities among students of different demographic backgrounds. It is crucial to investigate the association between policy and facility environments with the amount of MVPA students participate in to provide evidence to school administrators, policy makers, various levels of government, and health educators about the influence these school attributes have on increasing students' MVPA levels and reducing MVPA disparities among different student groups.

Methods

Study Design

This study investigates a cohort of 40 schools from the Gwinnett County Public School (GCPS) district in Georgia, USA following 4th grade students over a two-year intervention period, into 5th grade. Data for this study are taken from an IRB approved cluster randomized control trial, in which 40 schools were randomly selected from the 82 elementary schools in the district and assigned to either an intervention (20 schools) or control (20 schools) arm. Schools randomized to intervention received *Health Empowers You!*, an evidence-based program designed by HealthMPowers, focused on increasing school-based physical activity in the classroom (21). The *Health Empowers You!* Program partners schools with physical activity specialists to provide training and technical assistance to teachers implementing the program (21). The current study does not differentiate between intervention schools that implemented the *Health Empowers You!* Program and control schools in analyses.

Study Population

The analysis focused on data collected during the first intervention year, when 4th grade students were recruited to participate. Student informed consent was required from guardians for participating students. There were 6,525 students in 4th grade in the participating 40 schools, with 76% providing informed consent. The total number of 4th grade students that provided informed consent to participate in the study is 4,970, with an average of 113 4th grade students per school.

Data Collection Instruments

There were four data collection sources included for this analysis: the Gwinnett County Public School (GCPS) district, ActiGraph wGT3X-BT accelerometers, the School Observation: Environment Checklist (OSEC), and the School Physical Activity Policy Assessment (S-PAPA).

Demographic information on each student was gathered from GCPS and was used to record gender, race/ethnicity, and free or reduced pricing lunch (FRPL) status.

Moderate-to-vigorous physical activity (MVPA) measures were collected twice for each student per academic year using ActiGraph wGT3X-BT accelerometers. Class sets wearing accelerometers rotated throughout the year. Students wore the accelerometers during the school day, putting accelerometers on at the beginning of their first scheduled class and removing them at the end of their last scheduled class. Accelerometers were worn around the waist using a belt, to which accelerometers were attached. Students wore accelerometers consecutively throughout the school week (Monday-Friday).

The school environment was assessed using the School Observation: Environment Checklist (OSEC), an instrument that evaluates how physical activity is supported by the school environment and facilities. OSEC evaluates the availability and condition of a school's lobby, hallways, gyms, and outdoor areas. OSEC was completed once during the second semester of the study's first year, by the physical activity specialist, and was also completed at the beginning of the second year to capture any changes in the facility environment.

Physical activity and physical education policies were assessed using a modified version of the School Physical Activity Policy Assessment (S-PAPA) (22), which incorporates responses from different school personnel for different domains. The S-PAPA uses multi-choice questions to inquire about physical activity policies and opportunities within the school (22). The assessment is comprised of three modules focused on physical education, recess, and other school programs that may occur before, during, or after the school day (22). The assessment has 82 items total: 40 PE items, 27 recess items, and 15 other school program items (22). The current study uses a modified version of the S-PAPA, incorporating six physical education focused questions completed by one physical education specialist at each school and six recess focused questions completed by 4th grade teachers at each school. The modified S-PAPA instrument was completed during the first semester of each school year.

Study Measures

Outcome: Moderate-To-Vigorous Physical Activity

The ActiGraph wGT3X-BT accelerometers measure MVPA using Metabolic Equivalents (METs). A MET is defined as a ratio of an individual's working metabolic rate compared with their resting metabolic rate (23). Moderate intensity physical activity ranges from 3-6 METs, while vigorous physical activity is defined as activity above 6 METs (23). Initial MVPA from students' 4th grade fall semester was calculated by averaging students' total minutes of MVPA recorded by the accelerometers, during the first semester of data collection, over the number of days an accelerometer was worn. Only students who had worn the accelerometer for a minimum of 80% of the school day were included in the final analysis dataset to increase reliability of estimates. Students

were excluded if they had less than 80% wear time (n=408). One student was excluded as they attended two participating schools in one semester.

Exposure: Assessment of the School Environment and Facilities

OSEC data was entered for each school by summing across 39 yes-no style questions inquiring about the presence or absence of PA focused attributes. Each question was either coded 1 for "yes" and 0 for "no" or reverse coded for questions in which "no" indicated a favorable PA environment. Summary scores were categorized within three domains: advertising, atmosphere, and accessibility. The advertising domain has a score range of 0-3, accessibility has a score range of 0-14, and atmosphere has a score range of 0-22. Higher scores indicated a more PA conducive environment. All schools had complete data for OSEC.

Exposure: Assessment of Physical Activity and Physical Education Policies

The six questions on the PE component of S-PAPA are listed below.

S-PAPA PE Domain Questions
1. What is the ratio of students/PE teacher for fourth grade?
2. Do you have a para?
3. During physical education, how often are students required to do extra physical activity for disciplinary reasons?
4. How often do classroom teachers/counselors withhold individual students from physical education to fulfill other academic requirements?
5. How often do classroom teachers withhold individual students from physical education for disciplinary reasons?
6. How often is the delivery of physical education compromised because of competing demands for physical education space?

The first question inquiring about the student-to-PE teacher ratio was coded 1 for a lower than median ratio and 0 for a higher or equal to median ratio. The second question asking about the presence of a para was coded 1 for "yes" and 0 for "no." A "para" references a paraprofessional or educator who assists with classroom facilitation. Of the six questions on the PE component, the last four questions ranging from "never" to "very often" were

reverse coded 5 to 1, as responses of "never" indicated a more PE conducive environment. These scores were summed and schools with lower than the median score were given a low S-PAPA PE school score and schools with higher than or equal to the median score were given a high S-PAPA PE school score. This scoring method is based on a previous study that developed a 2-quantile scoring method for a derivative of the S-PAPA to evaluate the effects that schools with a policy rich environment versus schools with a lack of PA promoting policies had on student outcomes (24). The majority of schools (39 out of 40) had complete data for all six questions. One school was excluded from analyses since it had no data for the S-PAPA PE domain, this eliminated 107 students from the analyses.

The six questions on the recess component of S-PAPA are listed below.

S-PAPA Recess Domain Questions
1. How often do you keep individual students from recess to fulfill academic requirements?
2. How often do you keep individual students from recess for disciplinary reasons?
3. Do you regularly provide organized activities during recess?
4. Are recess supervisors asked to encourage students to be physically active during recess?
5. Are recess rules taught to the students?
6. During inclement weather, can students be physically active during recess?

The first two questions ranged from "never" to "very often" were reverse coded 5 to 1. The remaining four yes-no style questions were rated 1 for "yes" and 0 for "no." Individual questions were summed for each teacher and the average of teacher scores for each school was calculated to create each S-PAPA recess school score. Each school had between 2 and 8 teachers with complete data. Schools lower than the median score were given a low S-PAPA recess school score and schools higher than or equal to the median score were given a high S-PAPA recess school score.

Covariates

Gender, race/ethnicity, and student SES were considered as covariates. Gender was categorized as male or female and was coded 0 or 1, respectively. There were six race and ethnicity categories: Asian, Black, Hispanic, White, American Indian/Alaska Native, and Multi-racial, which were coded using indicator variables with White as the reference category. Student socioeconomic status (SES) was determined by FRPL status, in which not reduced, reduced, and free lunch pricing were coded using indicator variables with not reduced as the reference category. Only students with complete data for all demographic information were included. Five additional students were excluded since they did not have complete data for all demographic information.

Statistical Analysis

Statistical analyses were conducted using SAS v9.4. The final analyses included 4,448 students from 39 schools. Initial analyses examined the frequency of gender, race/ethnicity, and FRPL status for the student sample as well as OSEC and S-PAPA frequencies for schools. Final analyses consisted of multi-level linear models that incorporated a random intercept for schools and estimated fixed effects for student and school-level predictors. Student-level effect modification was assessed between student-level demographics as well as cross-level interactions with school-level policy and facility measures.

Multi-level linear models used restricted maximum likelihood estimation and assessed statistical significance for each predictor at the alpha 0.05 level. The intracluster correlation coefficient $\left(ICC = \frac{\sigma^2{}_{School}}{\sigma^2{}_{School} + \sigma^2{}_{Residual\ Error}}\right)$ was used to evaluate how each

model explained between-school variance. Collinearity of predictors were assessed using variance inflation factors (VIF); VIF values over 10 indicated collinearity.

Results

Student Demographics

During the first semester of data collection, the mean total daily MVPA during school was 21.13 minutes, with a standard deviation of 9.30 minutes (Table 1). The student study participants were equally distributed between males and females. The majority of student participants were Hispanic (33.2%), White (25.6%), and Black (24.3%). Over half of students received either free (44.2%) or reduced (8.3%) lunch pricing. The frequency of school-level OSEC and S-PAPA scores are shown for all 39 participating schools (Table 2).

Predictors of Initial 4th Grade Total Daily MVPA

The intracluster correlation coefficient (ICC) for the unconditional model, indicating between-school variation in total daily MVPA, suggests that approximately 13% of the between school variation is due to schools, while 87% is due to students. The ICC supports the use of representing variation in total daily MVPA using multi-level modeling. Statistical significance of school and student-level predictors, as well as cross-level interaction terms, added to the unconditional model were assessed at the alpha 0.05 level. Using a VIF value of 10, there were no indications of collinearity between predictors in each model.

Student-level demographic covariates were then added to the model as predictors of variation in total daily MVPA (Table 3). Gender was statistically significantly associated with student-level variation in total daily MVPA, with female students, on average, engaging in 5.17 (Standard error (SE) 0.25) fewer minutes of total daily MVPA than male students. Additionally, race/ethnicity was statistically significantly associated

with student-level variation in total daily MVPA, with black and multi-racial students engaging in 3.29 (SE 0.38) and 1.72 (SE 0.64) more minutes of total daily MVPA compared to white students, respectively and Asian students engaging in 0.96 (SE 0.44) fewer minutes of total daily MVPA compared to white students. Student-level demographic factors did not explain between school variance, with an ICC increase to 14.72% from 13.30% in the unconditional model.

School-level covariates were added to the model, in addition to student-level predictors. All three OSEC domains: accessibility, atmosphere, and advertisement were not statistically significantly associated with total daily MVPA. The S-PAPA recess domain was statistically significantly associated with total daily MVPA, with students attending schools who had scores at or above the median S-PAPA recess domain score engaging in 3.44 (SE 1.04) more minutes of total daily MVPA than students attending schools who had scores below the median S-PAPA recess domain score. These school and student level predictors explained some of the between school variation in total daily MVPA, with an ICC of 11.89%.

The final model included two cross-level interactions: one between the S-PAPA recess domain and race and another between the S-PAPA PE domain and gender. While at or above median scores on the S-PAPA recess domain were associated with more total daily MVPA, this association was modified by racial identification. Black students attending schools with below median S-PAPA recess domain scores engaged in 3.92 more minutes of total daily MVPA than white students at schools with below median S-PAPA recess domain scores, but black students attending schools with at or above median scores in the S-PAPA recess domain engaged in 2.73 more minutes of total daily

MVPA than white students at schools with at or above median S-PAPA recess domain scores. Additionally, while female students attending schools with below median S-PAPA PE scores engaged in 4.19 fewer minutes of total daily MVPA than males attending schools with below median S-PAPA PE scores, female students attending at or above median S-PAPA PE scores engaged in 5.76 fewer minutes of total daily MVPA than males attending schools with at or above median S-PAPA PE scores.

Discussion

This study found that gender and race/ethnicity significantly influence the amount of total daily MVPA that fourth grade students engage in during the school day. On average, male students engage in more total daily MVPA in school than female students and black and multi-racial students engage in more total daily MVPA than white students, while Asian students engage in fewer minutes of total daily MVPA than white students. School-level PE and recess policy predictors were significantly associated with total daily MVPA, with students at schools that scored at or above the median on the S-PAPA PE or the S-PAPA recess domain engaging in more PA than students attending schools below the median score, respectively. However, the S-PAPA PE and recess domains did not provide the same effect for all students. School-level facility predictors, of atmosphere, advertising, and accessibility were not associated with total daily MVPA, which may be a result of limited variability in these domains due to a one school district sample.

These findings are consistent with other studies, which find that boys engage in more PA than girls, on average (11, 12). In contrast to recent findings that report white adolescents engage in more PA than black adolescents (11, 12) our study found the black students engage in more PA than white students. Additionally, previous studies reported an interaction between race and gender (11, 12), while our study found no statistically significant interaction between race/ethnicity and gender. However, the previous findings on the influence of race and gender on PA are from self-reported measures of PA from different grade ranges of students. This study also found that a conducive recess policy environment reduced the disparity between white and black student total daily MVPA

engagement. This result suggests a supportive recess policy environment has the potential to reduce racial/ethnicity disparities, by providing more opportunities for all students to engage in PA. This finding supports the CDC and SHAPE America's *Strategies for Recess in Schools* (25), such that policies prohibiting holding students from recess for disciplinary or academic reasons can be a way to increase the amount of PA students engage in.

Further, this study found that the PE policy environment influenced the amount of total daily MVPA students engaged in. However, not all students benefitted equally from these policies. Male students engaged in more total daily MVPA in a supportive PE policy environment, while female students did not reap these same benefits, actually engaging in fewer minutes of total daily MVPA. This finding may support more individual level attributes of female students. Female students from the *Lifestyle of our Kids* (LOOK) Project were reported to have less favorable attributes related to physical activity, such as lower cardio-respiratory fitness, eye-hand coordination, percent bodyfat, and perceived competence in PE (26). Further, a recent study on students in 4th - 6th grade found that over time adolescent girls with a low perceived athletic competence enjoyed physical education less over the three-year study period (27). The current findings therefore may not be directly related to the PE policies schools institute but may reflect gender differences in PE enjoyment and perceived athletic competence during adolescence.

Strengths and Weaknesses

This study has at least three strengths. First, the Gwinnett County Public School district has a large and diverse student participant population with demonstrated support

from schools invested in promoting physical activity and education; there was large support from student guardians, with 76% providing informed consent for their student to participate in the study. Secondly, there were different sources of data ascertainment for school facilities and policies and student MVPA, with information about school policies and facilities using reports from physical activity specialists and classroom teachers, while PA was objectively measured using accelerometers. Having reported measures about school policies and facilities as well as accelerometers can provide a comprehensive understanding of the student PA environment as well as reduce the potential for dependent errors between school reports on the PA and PE environment and student MVPA. Finally, this study used school facility and policy assessment instruments that were developed for elementary school settings and are reliable tools for understanding the intricacies of the primary school PE and PA environments.

While this study has several strengths, there are at least three limitations. First, this study had a cross-sectional design that was not able to demonstrate the effects of changing policies or facility provision over several academic years and amount of student PA. However, the State Board of Education for Georgia recently revised physical education standards for students in Kindergarten through 12th grade (28), thus this study may reflect recent policy and facility changes school districts implemented to ensure students have the resources necessary to meet these updated standards. Secondly, this study collected data from one school district, which may reduce variability between schools' policy and facility environments, although this study still reported a range of scores among the 39 schools included in the final analyses. Finally, this study did not investigate PA and PE opportunities outside of the school environment, the type or

quality of PA activities, or guardian and student perspectives on their PA and school PE environment. However, the larger cluster randomized control-trial from which this data is from does investigate PA and PE opportunities outside of schools for a subset of students and inquires about the type of PA on Teacher Physical Activity Reporting Forms.

Conclusion

Overall, gender and race/ethnicity are associated with the amount of MVPA students engage in during school, with adolescent girls engaging in fewer minutes of total daily MVPA compared to boys, black and multi-racial students engaging in more total daily MVPA than white students, and Asian students engaging in less total daily MVPA than white students. In this study, the school recess policy environment was differentially associated with the amount of total daily MVPA black and white students engaged in during school, while the PE policy environment differentially influenced adolescent girls' and boys' total daily MVPA.

Future Directions

Future studies may improve our understanding of how the school PA facility environment and policies influence student PA over the academic life-course by implementing a longitudinal investigation or incorporating schools from multiple districts to assess school and student differences over time. Future studies could also incorporate psychological and social attributes that may affect how the school facility and policy environment influence MVPA among students with different demographic backgrounds. This study demonstrated the importance of school-level policies in influencing student-level MVPA, while revealing the differential MVPA benefits for students of varying demographic backgrounds.

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Tables

Table 1. Frequency of Student-Level Attributes in *Evaluating the Impact of School Policies and Facility Conditions on Elementary Student Physical Activity* (n=4,448 students)

	No. or Mean (Std)	%
Total MVPA	21.13 (9.30)	
Socioeconomic Status		
Not Reduced Lunch	2,114	47.5
Reduced Lunch	370	8.3
Free Lunch	1,964	44.2
Race/Ethnicity		
White	1,140	25.6
Black	1,079	24.3
Hispanic	1,477	33.2
Asian	547	12.3
American Indian/Alaska Native	8	0.2
Multi-Racial	197	4.4
Gender		
Male	2,225	50.0
Female	2,223	50.0

Table 2. Frequency of School Policy and Facility Scores in *Evaluating the Impact of School Policies and Facility Conditions on Elementary Student Physical Activity* (n=39 schools)

	No.	%
OSEC Advertisement (range 0-3)		
0	25	64.1
1	13	33.3
2	1	2.6
OSEC Atmosphere (range 0-22)		
13	2	5.1
14	14	35.9
15	6	15.4
16	9	23.08
17	7	18.0
18	1	2.6
OSEC Accessibility (range 0-14)		
6	1	2.6
7	1	2.6
8	7	18.0
9	10	25.6
10	14	35.9
11	3	7.7
12	2	5.1
13	1	2.6
S-PAPA PE Domain (range 4-22)		
8	1	2.6
11	2	5.1
12	5	12.8
13	10	25.6
14	9	23.1
15	7	18.0
16	3	7.7
17	2	5.1
S-PAPA Recess Domain (range 2-14)		
7-7.99	2	5.1
8-8.99	7	18.0
9-9.99	2	5.1
10-10.99	9	23.1
11-11.99	12	30.8
12-12.99	6	15.4
13-13.99	1	2.6

Table 3. Association Between Student-Level and School-Level Predictors with 4th Grade Total Daily MVPA (n=4,448 students)

	Unconditional	Student-Level Predictors	School and Student-Level Predictors	Cross-Level Interactions
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Fixed Effects				
Intercept	21.07 (0.56)[a]	23.45 (0.86) [a]	22.34 (7.11) [a]	22.04 (7.11) [a]
Student-Level Predictors		**Mean Difference (SE)**	**Mean Difference (SE)**	**Mean Difference (SE)**
Gender				
Female (Ref. Male)		-5.17 (0.25) [a]	-5.17 (0.25) [a]	-4.39 (0.37) [a]
Race/Ethnicity (Ref. White)				
Black		3.29 (0.38) [a]	3.31 (0.38) [a]	3.92 (0.49) [a]
Hispanic		0.14 (0.40)	0.17 (0.40)	0.20 (0.40)
Asian		-0.96 (0.44) [a]	-0.95 (0.44) [a]	-0.97 (0.44) [a]
American Indian/Alaska Native		-0.07 (2.90)	-0.07 (2.90)	0.08 (2.90)
Multi-Racial		1.72 (0.64) [a]	1.74 (0.64) [a]	1.76 (0.64) [a]
FRPL Status (Ref. Not Reduced)				
Reduced		-0.60 (0.48)	-0.62 (0.48)	-0.65 (0.48)
Free		-0.10 (0.32)	-0.13 (0.32)	-0.14 (0.32)
School-Level Predictors				
OSEC Advertising			-1.21 (0.97)	-1.22 (0.97)
OSEC Atmosphere			-0.13 (0.39)	-0.14 (0.39)
OSEC Accessibility			0.08 (0.39)	0.07 (0.39)
S-PAPA PE			1.86 (1.06)	2.56 (1.09) [a]
S-PAPA Recess			3.44 (1.04) [a]	3.75 (1.05) [a]
Cross-Level Interactions				
S-PAPA Recess x Black				-1.19 (0.59) [a]
S-PAPA PE x Gender				-1.37 (0.49) [a]
Variance Components				

School Variance	11.45	11.41	8.92	8.92
Student Variance	74.56	66.06	66.06	65.92
ICC	13.30	14.72	11.89	11.92

Abbreviations: ICC, Intracluster correlation coefficient; Ref, reference group; SE, standard error.

[a], Indicates p-value below 0.05

Appendix

EMORY UNIVERSITY | Institutional Review Board

TO: Julie Gazmararian, PhD
Principal Investigator
*SPH: Epidemiology

DATE: November 28, 2017

RE: **Expedited Approval**
IRB00095600
A Rigorous Evaluation of the Relationship between Physical Activity and Education Outcomes in Georgia's Elementary Schools

Thank you for submitting a new application for this protocol. This research is eligible for expedited review under 45 CFR.46.110 and/or 21 CFR 56.110 because it poses minimal risk and fits the regulatory categories F5 and F7 as set forth in the Federal Register. Research involving minor participants is approved under 45 CFR 46.404. The Emory IRB reviewed it by expedited process on 11/27/2017 and granted approval effective from **11/27/2017** through **11/26/2018**. Thereafter, continuation of human subjects research activities requires the submission of a renewal application, which must be reviewed and approved by the IRB prior to the expiration date noted above.

The following documents are approved for use or otherwise acknowledged:

- Study Protocol, undated
- Survey Instruments Document, undated
- Parental Consent and Assent form, version date 11/20/2017
- Consent form Cover Letter, undated
- Letter of Support from Gwinnett County, dated November 7, 2016
- Gwinnett County IRB Approval Letter (Re: File ID 2017-19), dated August 3, 2016

Any reportable events (e.g., unanticipated problems involving risk to subjects or others, noncompliance, breaches of confidentiality, HIPAA violations, protocol deviations) must be reported to the IRB according to our Policies & Procedures at www.irb.emory.edu, immediately, promptly, or periodically. Be sure to check the reporting guidance and contact us if you have questions. Terms and conditions of sponsors, if any, also apply to reporting.

Before implementing any change to this protocol (including but not limited to sample size, informed consent, study design, you must submit an amendment request and secure IRB approval.

In future correspondence about this matter, please refer to the IRB file ID, name of the Principal Investigator, and study title. Thank you.

Sincerely,

Samuel Roberts
Senior Research Protocol Analyst
This letter has been digitally signed

CC: Celli Justine SPH: Career Services

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