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The effects of a two-year middle school physical education program on physical activity and its determinants

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Abstract

Purpose: This study examines the effects of the middle school SPARK PE curriculum on predisposing, enabling, and reinforcing factors for PA as well as self-reported PA in a predominantly low-income, Latinx student population in Los Angeles, California.

Methods: Data were collected from 3,763 seventh- and eighth-grade students at two time points at the 16 middle schools enrolled in the study. Hierarchical logistic regression models were used to assess intervention effects on PA attitudes, PE enjoyment, FitnessGram passing, daily PA, and muscle-strengthening PA, controlling for demographic variables.

Results: While there was no detectable intervention effect on increasing the number of students exercising 60 minutes per day, there was a negative intervention effect detected for muscle strengthening exercises. A significant positive intervention effect was detected for both PE

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enjoyment and FitnessGram passing. Deeper analysis of these findings revealed that the positive effect on PE enjoyment occurred only among male students.

Conclusion: The SPARK curriculum had mixed effects on students' PA behavior as well as predisposing, enabling, and reinforcing factors for PA. Incorporating student perspectives into the evaluation of intervention efforts to promote PA can facilitate a better understanding of the ways in which these efforts influence PA behaviors and its determinants.

Regular physical activity (PA) is associated with healthy growth and development, prevention of chronic conditions, as well as beneficial effects on mental health and academic performance.[1] Despite the health advantages of regular PA,[2,3] few adolescents meet daily and weekly recommendations. Less than one quarter of youth in the United States ages 12–15 meet Department of Health and Human Services recommendations of at least 60 minutes of moderate to vigorous PA each day.[4] Further, demographic disparities exist in levels of PA engagement among youth. Prior research has found that Latinx, female, and low socioeconomic status (SES) adolescents are less physically active than White, male, and more affluent youth, respectively.[5]

Physical education (PE) classes provide an opportunity for *all* youth to engage in regular PA, especially in low-resourced communities.[6–8] Moreover, because students may have less access to space and equipment outside of the school setting, PE can provide increased access to PA resources.[9–11] Yet, many PE classes do not meet National Association for Sport and Physical Education (NASPE) recommendations of 50% of class time spent in moderate to vigorous PA.[12–14] As a result, the public health, nursing, and medical communities have increasingly identified PE as an important site of intervention to increase moderate to vigorous PA.[9,15–17]

In addition to increasing levels of PA during class, experts also recommend that PE classes provide content that is enjoyable and exposes students to a variety of activities in order to encourage participation in PA outside PE class.[18] Among early adolescents, enjoyment of, positive attitudes towards, and self-efficacy for PA are important correlates of PA behaviors both during and outside PE.[19,20] However, a 2018 study from Dishman and colleagues[21] found that enjoyment and motivation for PA decreases as youth progress through middle school. Together with evidence showing that PA begins to decline in early adolescence,[22,23] these findings suggest that middle school-age is an important period to target for interventions to prevent declines in both PA and PA enjoyment and motivation.

The Community Preventative Task Force recommends enhanced school-based PE, which uses different teaching strategies and lesson plans to increase the amount of time students spend in PA in PE.[24] One widely used enhanced school-based PE intervention program, SPARK PE, aims to maximize PA during PE, improve fitness, and increase enjoyment of PE and PA through new and creative activities in order to develop a lifelong commitment to PA.[25] SPARK PE was originally developed for elementary school and expanded to include a middle school curriculum.[26] Evaluation of SPARK PE for middle schools has been limited and used objective measures of in-class PA levels as their primary outcome measures.[27,28] While one of the primary goals of SPARK PE is to increase moderate to vigorous PA during PE, previous research suggests that evaluation efforts should also incorporate the views,

opinions, and insights of students to better understand the ways in which the interventions may influence motivations and barriers they experience in relation to PA.[29]

The purpose of the current study is to examine the effects of the middle school SPARK curriculum on student perceptions of PE and PA and their self-reported PA behaviors in a predominantly low-income, Latinx student population. We use the Youth Physical Activity Promotion Model[30] as a framework for understanding PA behaviors, which are affected by three categories of PA determinants: (1) *predisposing factors*, or those factors that influence youths' decisions to engage in or avoid PA (e.g., attitudes, self-efficacy, and enjoyment); (2) *enabling factors*, which consist of personal attributes and environmental factors that allow youth to be physically active (e.g., fitness ability, body size, and access to PA spaces and resources); and (3) *reinforcing factors*, or influences in the social environment that encourage PA participation (e.g., perceived benefits, barriers, and social support).

METHODS

Schools and Research Design

Middle schools in one school district in Los Angeles, CA were identified by their level of enrollment in the National School Breakfast and Lunch programs, as well as their willingness to participate in an intervention study. PE teacher participation was voluntary. Fifty-one PE teachers across 16 middle schools were enrolled in the study. Study schools had an average of 79.0% of students participating in school meal programs, and the majority of students were Latinx (79.4%). Schools were randomly assigned to the intervention or control condition. Principals from each school agreed to participate as demonstrated through the signing of memoranda of understanding. The University Institutional Review Board and the school district approved the study. Principles of community-based participatory research were applied in partnering with the school district to design, implement, and evaluate the study.[31]

Intervention

Guided by social learning theory, the SPARK middle school curriculum contains instructional strategies, activities, assessments, ideas for adapting instruction (e.g., plans for inclement weather or space limitations), and suggestions for classroom management. Intervention schools were provided a middle school PE curriculum (SPARK PE), $2,500 in equipment vouchers for use in PE classes, and a $200 stipend for completing all 12 hours of the SPARK training. Participating teachers at intervention schools were offered 12 hours of standards-based professional training that occurred in three parts: six hours in October 2014, three hours in January 2015, and three hours in March 2015. Lead by SPARK certified instructors who were also credentialed PE teachers, the training sessions included both didactic instruction and modeling of SPARK lessons and strategies, including opportunities to engage in PA. Following the training, SPARK instructors provided teachers with two on-site consultation visits to conduct an assessment and provide teachers with feedback and recommendations. Teachers at control schools were given the curriculum, equipment, and training after the conclusion of the study. At baseline, control and intervention schools spent a majority of PE lesson time on fitness/skills, classroom management, and play.[12] Almost

half of primary lesson activities consisted of team sports with a smaller percentage of lesson activities involving lessons, drills and skills; fitness; games; and free play.

Data Collection

Student surveys were administered at two time points during the study, and students at all 16 study schools were offered the opportunity to participate in the survey during their PE classes. Prior to data collection at each time point, the research team distributed study information sheets to students informing parents of the survey and allowing parents to opt out. The research team also informed students prior to data collection that participation in the surveys was voluntary, could be stopped at any time, and had no influence on academic grades. Students provided verbal assent to participate in the surveys. Baseline survey data were collected during seventh-grade PE classes between September and December 2014. Follow-up student surveys were administered during eighth-grade PE classes between April and June 2016. Of the 6,201 seventh-grade students at all 16 schools, 4,773 students completed the survey (77.0%) at baseline. At follow up, there were 6,061 8th grade students with 4,885 completing the survey (80%).

The survey was developed by the research team following a comprehensive review of the literature and existing survey instruments. The team adopted and adapted questions from existing measures, and when necessary, constructed new measures (e.g., to assess diet perception and media consumption). The survey instrument was pretested with 18 students (nine males, nine females; six 6th grade, twelve 7th grade). Minor modifications were made to improve parsimony and clarity and then retested with nine additional students (five males, four females). The survey was designed to take approximately 30 minutes to complete to limit the use of classroom time.

Data on student fitness levels were collected during the same time periods as baseline and follow-up survey data collection using FitnessGram, a widely used fitness assessment and reporting system that includes a battery of fitness tests examining aerobic capacity, strength and endurance, flexibility, abdominal strength, trunk strength, and body composition.[32] Baseline and follow-up FitnessGram data were collected by PE teachers using the established FitnessGram administration protocol.[33] FitnessGram data were collected from 3,863 students at baseline (62.3%) and 3,410 students at follow-up (56.3%). These data were merged with student survey data.

Measures

Outcomes—We were interested in the effects of the SPARK intervention on PA outcomes as well as on predisposing and enabling factors for PA. The primary outcomes of interest were daily PA and muscle-strengthening PA. The secondary outcomes of interest were PE enjoyment, PA attitudes, and fitness level. These five outcomes were selected based on the goals and aims outlined in the SPARK curriculum. Because social support and perceived benefits and barriers are important correlates of PA we included these variables as covariates in the analysis.[34]

PA Outcomes included daily PA levels and weekly muscle-strengthening. Students were asked two items adapted from the Youth Risk Behavior Survey[35] : "During the past 7 days, on how many days were you physically active for 60 minutes or more per day (including all activities in and out of school)?" and "On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?" Responses to the two items were dichotomized to indicate meeting national PA recommendations for middle school-aged youth: exercising 60 minutes or more daily (daily PA) and completing muscle strengthening exercises at least 3 days per week (muscle-strengthening PA).[18]

Predisposing factors included PE enjoyment and PA attitudes. PE enjoyment was measured using one item adopted from the Amherst Health and Activity Survey[36] : "How much do you enjoy physical education (PE) classes at school?". Students reported their PE enjoyment using a 5-point scale from very unenjoyable to very enjoyable (0–4). Responses were dichotomized into high enjoyment for students who responded, "PE is somewhat enjoyable" or "PE is very enjoyable" and low enjoyment for students who responded "PE is neither, un-enjoyable or enjoyable", "PE is somewhat un-enjoyable", or "PE is very unenjoyable". Attitudes toward PA were assessed using four items regarding respondents' feelings toward PA (e.g., "I would rather watch TV than play sports or be active") using a three-point scale (0–2). Responses were summed and dichotomized to greater than 4 to reflect high PA attitudes and at most four to reflect low PA attitudes.[37]

Enabling factors included students' fitness levels and perceived barriers. Fitness levels were operationalized as the students' performance on FitnessGram in five key fitness areas: aerobic capacity, strength and endurance, flexibility, abdominal strength, and trunk strength. FitnessGram tests were marked as passed or not passed using age- and gender-specific criterion-referenced standards.[33] Passing rate was calculated by dividing the number of tests passed by five. Perceived barriers to PA were measured using a 20-item scale adapted from the Amherst Health and Activity Study.[36] Students reported how often each barrier statement (e.g., lack of time, lack of skill, lack of equipment) kept them from being physically active, using a 5-point scale from never to often (0–4). These responses were summed to create a scale score (0–80) and dichotomized into two groups: low perceived barriers (0–27) for students who tended to report never or rarely and high perceived barriers (28–80) for students who tended to report a few times, often, or very often. Perceived barriers were treated as a covariate in all models.

Reinforcing factors included perceived benefits of and social support for PA. Perceived benefits of PA were measured using a 9-item scale adapted from the Amherst Health and Activity Study [36]. Students reported their level of agreement with benefit statements (e.g., I will feel less depressed or bored, I will improve my heart and lung fitness, my body will look better) identified as positive outcomes from regular PA, using a 5-point strongly disagree-strongly agree (0–4) scale. These responses were summed to create a scale score (0–36) and dichotomized to account for the non-normality of the distribution. The two categories were selected to retain sufficient sample size while maintaining interpretability: low perceived benefits (0–26) for students who tended to report strongly disagree, somewhat disagree, or neutral and high perceived benefits (27–36) for students who tended to report somewhat agree and strongly agree. Measures of social support for PA were obtained using

the family and friend participation subscales of the Sallis Support for Exercise Scales.[38] Each subscale included 10-items that asked about family and friend encouragement, involvement, and facilitation for PA in the last three months. Students reported how often each social support item occurred in the last three months, using a 5-point scale from never to very often (0–4). Responses were summed to create two scale scores (0–40), one for family and one for friends, and, similar to another study using these scales,[39] dichotomized into high support (21–40) for students who tended to report "often" or "very often" and low support (0–20) for students who tended to report "never", "rarely", or "a few times".

Personal demographics included gender, ethnicity, language spoken at home, language spoken with friends, and weight status. Gender, ethnicity (Latinx or non-Latinx), main language spoken at home (English, Spanish, English and Spanish, or other), and main language spoken with friends (English, Spanish, English and Spanish, or other) were self-reported by students. Body mass index (BMI) was calculated from students' height and weight collected as part of xcalculated using the 2000 Centers for Disease Control and Prevention (CDC) Growth Charts for ages 2 to <20 years of age.[40] Following CDC guidelines, underweight was defined as a percentile <5, healthy weight as a percentile ≥5 and <85, overweight as a percentile ≥85 and <95, and obese as a percentile >95.[41]

Statistical Methods

Key variables were tabulated by intervention condition at both baseline and follow up. We tested for differences between the intervention and control group in demographic characteristics and physical activity variables at baseline and at follow-up using hierarchical logistic regression for binary variables and ordinal logistic regression for ordinal variables (BMI), with random intercepts for school to account for school-level clustering. We tested for a difference in change over time between groups in the dependent variables of interest (the two PA outcomes, PA attitudes, PA enjoyment and fitness level) using hierarchical logistic models with random intercepts for school. Intervention effects were assessed by testing for a significant time by intervention condition interaction in multivariable models controlling for demographic characteristics. Interaction terms to model a three-way interaction between gender, intervention condition, and time point were tested and retained in the model if the three-way interaction term was significant. Multivariable models for the two PA outcomes were similar but also controlled for PA attitudes, PA enjoyment, and fitness level. This analysis was restricted to observations with no missing data in all variables of interest except the fitness level. As a sensitivity analysis, all regression models were also fit to a restricted dataset which included only students who had complete observations at both timepoints. All analyses were performed using Stata version 14.2.

RESULTS

For the 4,901 complete cases (excluding fitness level), a summary of key variables by time point, overall and by intervention condition, is shown in Table 1. Data for 3,763 children were included in the analysis; of these, 1,147 had only baseline data, 1,478 had only follow-up data, and 1,138 had data at both time points. At baseline 901, (39.4%) of the 2,285 students were from control schools and at follow up, 1,136 (43.4%) of 2,616 students were

from control schools. There were 6,428 complete FitnessGram observations and of these, 4,256 (66.2%) had no missing data on the variables of interest. At baseline, half of the students were girls, two-thirds identified as Latinx, and 42.8% of students were overweight or obese. In total, 78.2% of students reported high attitudes of PA and only 37.0% of students passed all five FitnessGram areas. Referencing the past seven days, 26.0% of students reported meeting daily PA recommendations and 61.8% reported meeting weekly muscle strengthening recommendations. There were no significant differences at baseline between the control and intervention samples except in PA enjoyment, in which 78.9% of control students reported having high levels of, compared to 69.9% in the intervention group. Similarly, the only detectable difference at follow up was in fitness level, which saw higher rates in the intervention sample.

PA Outcomes

The results of multivariable hierarchical logistic regression models predicting the two PA outcomes shown in Table 2. While there was no detectable intervention effect on daily PA, there was a negative intervention effect detected for weekly muscle strengthening. Being a girl, reporting high perceived PA barriers, and being obese were found to be negatively associated with both outcomes, while reporting high levels of fitness, PA attitudes, family support, and friend support were positively associated with the two outcomes. Additionally, identifying as Latinx was negatively associated with daily PA while high-level PE enjoyment was positively associated with muscle strengthening exercises. There also were significant differences in rates of performing muscle strengthening exercises by timepoint. Both outcomes had a significant amount of variation explained by differences at the school level. The sensitivity analysis yielded similar results, with a small number of coefficients losing significance due to a smaller sample size.

PA attitudes

Table 3 presents the results of multivariable hierarchical logistic models predicting predisposing and enabling factors: positive PA attitudes, PE enjoyment, and fitness level. Girls had lower odds of having positive PA attitudes than boys, as did those with high PA barriers compared to those with low PA barriers, controlling for other variables. Students who were overweight or obese had lower odds of having positive PA attitudes compared to those who were considered healthy weight. Identifying as Latinx, as well as reporting high family support, high friend support, and high perceived PA benefits were associated with higher odds of reporting positive PA attitudes. There were no differences in PA attitudes by time point or intervention condition and an intervention effect was not detected.

Fitness level

A significant positive intervention effect was detected for both PE enjoyment and fitness level. In addition, girls and students with high perceived barriers for PA had lower odds of passing all five FitnessGram tests as compared to boys and students with low perceived barriers for PA, respectively. Conversely, a positive association was found between fitness level and students reporting high perceived benefits to PA. Differences in fitness level by weight status were also seen. Students who were underweight, overweight, or obese had

lower odds of passing all five FitnessGram test than those who were healthy weight. No associations between ethnicity or family support and fitness level were detected.

PA Enjoyment

A significant positive intervention effect was also detected for PE enjoyment. With regards to high PE enjoyment, an intervention effect was only detected in male students, as the significant three-way interaction between female, intervention condition, and time point suggests that there is no difference in odds between intervention and control groups at follow up attributable to the treatment, controlling for baseline differences in the two groups. Similar to fitness level, PE enjoyment was found to have a negative association with being a girl, a positive association with reporting high perceived benefits to PA, and a negative association with high perceived barriers to PA. Students with high friend support had higher odds of reporting high PE enjoyment than those with lower friend support. Differences were also seen by time point by fitness level and by intervention condition at baseline for high PE enjoyment. No associations between ethnicity or family support and PE enjoyment were detected. Fitness level and PE enjoyment had a significant amount of variation explained by differences at the school level.

DISCUSSION

Declining rates of PA and deteriorating PA attitudes during adolescence underscore the need for PA interventions targeting this age group.[21–23] Given disparities in access to space and equipment for PA outside of the school setting,[10] the PE classroom can be an ideal site to motivate and encourage youth to be physically active during and outside school and cultivate a lifelong commitment to PA.[6,9] This study examines the effects of one such intervention, the middle school SPARK curriculum, on predisposing, enabling, and reinforcing factors for PA as well as self-reported PA behaviors in a predominantly low-income, Latinx student population in Los Angeles, California.

Participation in the SPARK intervention showed mixed effects on self-reported PA outcomes. Similar to a previous SPARK evaluation among fifth graders,[42] we found no intervention effect on self-reported daily PA. However, we also found that participation in the SPARK intervention was negatively associated with meeting guidelines for muscle-strengthening exercise. These findings are surprising given that the SPARK curriculum aims to encourage PA inside and outside of PE. The SPARK curriculum's focus on increasing moderate to vigorous activity levels and improve fitness[25] without a specific focus on muscle strengthening exercise may help to explain the negative intervention effect on that PA outcome. Moreover, curriculum represents only one of the four essential components of PE.[8] Efforts to improve student PA levels may also need to consider incorporating the other essential components of PE such as policy and environment. Further, it could be that to increase PA outside of PE requires a multi-component approach that includes the family or community.[43]

There was some evidence that participation in the SPARK intervention was associated with improved fitness level. While passing rates decreased from 7th to 8th grade, consistent with research suggesting PA declines with each year of adolescence,[22,23] some of this decrease

was mitigated by participation in the SPARK intervention. FitnessGram is widely used as a fitness assessment tool and can have important implications for PE teachers.[44] An evaluation of SPARK among fifth graders also found improvement in health-related fitness outcomes, specifically among girls.[38] This suggests that SPARK may be a useful program for preparing for FitnessGram assessment or improving fitness, rather than increasing PA more broadly.

Similar to previous findings,[27,28] participation in the SPARK intervention also showed mixed effects on predisposing and enabling PA factors among youth in this study. There was no evidence that the intervention improved PA attitudes. Previous evaluations of the middle school SPARK curriculum did not assess its impact on PA attitudes. Conversely, there was some evidence that students at intervention schools enjoyed PE more after the intervention. This supports recent findings from Fu and colleagues who also found that students reported increased PE enjoyment from participating in the SPARK curriculum,[28] but contradicts the results of the MSPAN evaluation which found no intervention effect on PE enjoyment.[27] However, further examination of this finding showed that the intervention effect was only positive for boys. Gender differences in social norms around PA, body size, and body image may underpin girls' perception of PA,[45] potentially decreasing perceptions of PE enjoyment among the girls in the sample. Efforts to improve PA attitudes and PE enjoyment should focus on making PA accessible for all youth, thereby encouraging positive and ongoing PA habits.

Finally, the results of the current study show that overall PA rates among middle school-aged youth remain concerningly low. Approximately one-quarter of students in the study report meeting daily PA recommendations. This is consistent with previous findings[4] and suggests that little has changed in recent years despite substantial research and intervention efforts.[43] In addition, a little over 50% of students in the current study report meeting weekly muscle-strengthening PA guidelines. These low rates underscore a need for innovative approaches for engaging youth in PA. Beyond curriculum, policy and environment, appropriate instruction, and student assessment represent other essential components of PE.[8] Establishing comprehensive support for all four essential components of PE may help to not only improve students' experience of PE; but also, the overall quality of the PE program.[8] In addition, while PE is an important space for encouraging PA participation, it is necessary to simultaneously institutionalize other ways to promote PA during the school day. To achieve this aim the Centers for Disease Control and Prevention and other national organizations promote the Comprehensive School Physical Activity Program which provides a framework for encouraging physical activity before, during, and after school.[46]

The generalizability of findings of this study are limited by the single geographical location (Los Angeles). With the exception of FitnessGram data, all data were self-reported by students. As such, these data are subject to recall and social acceptability biases. FitnessGram data were collected by PE teachers from each school and may have resulted in bias due to inconsistencies in measurement methods. Strengths of the study included the large sample size and high response rates, in addition to the ability to match student data at two time points (before and after intervention). The study sample consisted of primarily low-income, and predominantly Latinx students, representing an understudied population in literature on PA and its determinants.

The importance of PA for healthy development and obesity prevention, highlight the need for greater efforts directed toward preventing declines as youth age. Our research suggests that the middle school SPARK curriculum had mixed effects on students' self-reported PA behavior as well as predisposing, enabling, and reinforcing factors for PA among a population of low-income, Latinx students. School-based interventions such as the SPARK middle school curriculum may be more successful when combined with ecological and policy approaches to promote PA. Incorporating student perspectives into the evaluation of these efforts can facilitate a better understanding of the ways in which the interventions influence PA behaviors and its determinants.

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Table 1.

Characteristics of the Sample[1] at Baseline and Follow up in Total and by Condition[2]

	Baseline			Follow up		
	Total[3] N=2,285 Percent	**Control N=901 Percent**	**Intervention N=1,384 Percent**	**Total N=2,616 Percent**	**Control N=1,136 Percent**	**Intervention N=1,480 Percent**
Outcomes[4]						
High PA Attitudes	78.2	79.0	77.7	78.7	81.8	76.4
High PE Enjoyment	73.4	78.9	69.9**	79.2	81.0	77.9
Fitness Level[5]	37.0	35.0	38.3	37.0	32.3	39.7*
Daily PA	26.0	25.4	26.4	25.7	24.8	26.4
Muscle-Strengthening PA	61.8	55.9	65.7	55.1	50.1	58.3
Covariates						
Female	52.6	51.2	53.5	49.6	49.8	49.4
Latinx	65.6	71.8	64.8	69.1	76.1	63.7
High Family Support	30.4	32.5	29.0	19.6	20.5	18.9
High Friend Support	16.2	16.1	16.3	35.0	36.1	34.2
High Barriers	27.9	28.0	27.8	27.1	26.3	27.6
High Benefits	69.4	69.5	69.4	72.3	72.6	72.0
BMI Category						
Underweight	3.1	2.9	3.2	2.4	2.5	2.3
Healthy weight	54.1	51.1	56.1	57.8	54.0	60.7
Overweight	19.2	19.9	18.7	19.5	20.1	19.0
Obese	23.6	26.2	22.0	20.4	23.5	18.0

*$p < 0.05$,

**$p < 0.01$,

***$p < 0.001$

[1]Only complete cases were used. Some percentages may not sum to 100 due to rounding.

[2]Tests for differences between intervention and control were performed using Wald tests in hierarchical logistic regression models for binary variables and in hierarchical ordered logistic models for ordinal variables.

[3]There were 3,763 children interviewed, 1,147 only at baseline, 1,478 only at follow-up, and 1,138 at both time points.

[4]PA=Physical Activity, PE=Physical Education, BMI=Body Mass Index

[5]Due to missing data in the FitnessGram Passing Rate variable, the sample size for this analysis is 4,256.

Table 2.

Hierarchical Logistic Regression Models Predicting Physical Activity Outcomes (N=4,901)

Coefficients	60 min/day OR (95% C.I.)	Muscle Strengthening OR (95% C.I.)
Fixed Effects		
Follow-up	0.89 (0.69, 1.13)	0.75 (0.60, 0.93) **
Intervention	1.03 (0.73, 1.45)	1.67 (0.96, 2.90)
Follow-up × Intervention	0.97 (0.71, 1.32)	0.72 (0.54, 0.95) *
High PA Attitudes	1.86 (1.48, 2.33) ***	1.63 (1.37, 1.94) ***
High PA Enjoyment	1.07 (0.88, 1.29)	1.20 (1.02, 1.42) *
Fitness Level	1.19 (1.01, 1.40) *	1.36 (1.17, 1.58) ***
Female	0.61 (0.52, 0.70) ***	0.76 (0.67, 0.87) ***
Latinx	0.81 (0.69, 0.95) *	1.02 (0.87, 1.18)
High Family Support	1.85 (1.56, 2.18) ***	1.75 (1.47, 2.07) ***
High Friend Support	1.47 (1.24, 1.75) ***	1.93 (1.63, 2.29) ***
High Barriers	0.66 (0.54, 0.80) ***	0.75 (0.64, 0.87) ***
High Benefits	1.17 (0.98, 1.39) ***	1.09 (0.94, 1.26)
BMI[1] Category		
Underweight	0.95 (0.61, 1.45)	0.77 (0.52, 1.15)
Healthy weight (ref)		
Overweight	0.91 (0.75, 1.10)	1.04 (0.87, 1.24)
Obese	0.75 (0.61, 0.92) **	0.81 (0.67, 0.96) *
Random Effects		
School Level Error Variance[1]	0.066 ***	0.271 ***

* p < 0.05,

** p < 0.01,

*** p < 0.001

[1] BMI = Body Mass Index

[2] Significance of school level error variance were tested using likelihood ratio tests.

Table 3.

Hierarchical Logistic Regression Models Predicting PA[1] Attitudes, PE Enjoyment, and Fitness Level[2] (N=4,901)

Coefficients	High PA Attitudes OR (95% C.I.)	High PE Enjoyment OR (95% C.I.)	Fitness Level[3] OR (95% C.I.)
Fixed Effects			
Follow-up	1.09 (0.86, 1.39)	0.84 (0.59, 1.20)	0.6 (0.47, 0.77)***
Intervention	0.96 (0.77, 1.20)	0.57 (0.39, 0.85)**	1.35 (0.71, 2.58)
Follow-up × Intervention	0.76 (0.56, 1.04)	2.04 (1.29, 3.24)**	1.82 (1.35, 2.47)***
Female	0.52 (0.44, 0.60)***	0.51 (0.36, 0.72)***	0.74 (0.64, 0.85)***
Latinx	1.24 (1.06, 1.46)**	1.17 (1.00, 1.37)	0.95 (0.81, 1.11)
High Family Support	2.02 (1.62, 2.51)***	1.14 (0.95, 1.36)	1.13 (0.95, 1.34)
High Friend Support	2.00 (1.63, 2.47)***	1.36 (1.14, 1.64)*	0.98 (0.82, 1.16)
High Barriers	0.28 (0.24, 0.33)***	0.40 (0.35, 0.47)***	0.67 (0.57, 0.79)***
High Benefits	2.37 (2.03, 2.76)***	1.74 (1.50, 2.02)***	1.24 (1.06, 1.45)**
BMI Category			
Underweight	0.94 (0.59, 1.49)	0.88 (0.58, 1.34)	0.51 (0.34, 0.75)**
Healthy weight (ref)			
Overweight	0.82 (0.67, 0.99)*	0.97 (0.80, 1.16)	0.32 (0.27, 0.38)***
Obese	0.73 (0.60, 0.88)**	0.96 (0.81, 1.15)	0.08 (0.06, 0.11)***
Female × Follow-up	---	1.45 (0.92, 2.31)	---
Female × Intervention	---	1.07 (0.70, 1.63)	---
Female × Intervention × Follow-up	---	0.54 (0.30, 0.98)*	---
Random Effects			
School Level Error Variance[1]	0.000	0.044***	0.375***

* p < 0.05,

** p < 0.01,

*** p < 0.001

[1] PA=Physical Activity, PE = Physical Education, BMI = Body Mass Index

[2] Significance of school level error variance were tested using likelihood ratio tests.

[3] Due to missing data in the Fitnessgram variable, the sample size for this analysis is 4,256.