Title

Evaluation of an Intervention to Increase Physical Activity in Low-Income, Urban Middle Schools

Journal

Journal of School Health, 89(9)

ISSN

0022-4391

Authors

Gill, Monique
Roth, Sarah E
Chan-Golston, Alec M
et al.

Publication Date

2019-09-01

DOI

10.1111/josh.12808

Peer reviewed

HHS Public Access

Author manuscript

J Sch Health. Author manuscript; available in PMC 2020 September 01.

Published in final edited form as:

J Sch Health. 2019 September ; 89(9): 705–714. doi:10.1111/josh.12808.

Evaluation of an intervention to increase physical activity in low-income, urban middle schools

Monique Gill, MPH [Doctoral Candidate],
Department of Community Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Sarah E. Roth, MA [Doctoral Student],
Department of Community Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Alec M. Chan-Golston, MS [Doctoral Student],
Department of Biostatistics, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Lindsay N. Rice, MSW [Project Manager],
Department of Community Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Catherine M. Crespi, PhD [Associate Professor in Residence],
Department of Biostatistics, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Deborah Koniak-Griffin, EdD, RNC, FAAN [Professor Emerita and Associate Dean],
Diversity, Equity, and Inclusion, UCLA School of Nursing, 700 Tiverton Ave., Los Angeles, CA 90095

Brian L. Cole, DrPH [Assistant Professor-in-Residence],
Department of Environmental Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Michael L. Prelip, MPH, DPA [Professor and Chair]
Department of Community Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095

Abstract

BACKGROUND: Physical education (PE) can provide opportunities to engage in daily moderate-to-vigorous physical activity (MVPA), but MVPA levels in many classes are low. This study examines MVPA during middle school PE lessons before and after receiving the SPARK program.

Monique Gill, MPH (Corresponding Author), Doctoral Candidate, Department of Community Health Sciences, UCLA Fielding School of Public Health, 650 Charles E. Young Dr., Los Angeles, CA 90095, Phone: 310-206-3526, moniquegill@ucla.edu.

Human Subjects Approval Statement

Study approval was obtained through the University Institutional Review Board and the school district (IRB#10-001589-CR-00002)

METHODS: Sixteen schools were enrolled in the study. PE teachers at 8 schools received the intervention. PE lessons at all schools (N = 561) were observed over 2 years. Hierarchical linear regression models examined the effect of the intervention on the amount and consistency of MVPA and sedentary behavior.

RESULTS: An average of 13.7% of observed class time was spent in MVPA (approximately 5 minutes of a 60-minute class), compared to 27.5% of time spent sedentary. There was no evidence that the curriculum resulted in increased MVPA or consistent MVPA, or that it decreased sedentary behavior. Findings also suggested that contextual factors may contribute to PA levels in PE.

CONCLUSIONS: Mixed evaluation findings of the SPARK middle school curriculum demonstrate that an out-of-the-box curriculum does not have the same results in all contexts. Implications for school health are described based upon findings. Further research is needed to identify effective strategies to increase MVPA for adolescents both in and outside of PE.

Keywords

child & adolescent health; physical fitness & sport; professional preparation of school health personnel; school health instruction

Despite well-known health benefits of physical activity (PA),[1,2] children and adolescents identify significant barriers to PA and few youths meet recommended guidelines for daily PA.[3,4] In 2012, less than one-fourth of youth aged 12–15 in the United States (US) reported 60 minutes or more of daily moderate-to-vigorous physical activity (MVPA).[3] Furthermore, disparities in PA outcomes, particularly the frequency and amount of PA, persist by sex, race, socioeconomic status, and body size.[5,6]

In recent decades, physical education (PE) has been increasingly viewed as an important opportunity for public health intervention, in part, to overcome issues of lower access to PA resources (eg, equipment and space).[7–9] Ideally, PE can provide a supportive environment to sustain health and well-being regardless of race, gender, ability, and socioeconomic status, creating opportunities for all students to engage in daily MVPA. However, many PE classes do not achieve the National Association for Sport and Physical Education (NASPE) recommended 50% of class time spent in MVPA,[10–12] and core academic subjects and school activities are often prioritized over PE for resources and space.[13,14]

Many public health efforts have targeted improving PE and PA in elementary schools.[15] A particular focus has been on developing capacity for classroom teachers whose role is often expanded to include PE instruction despite lacking formal certification. One widely used program, SPARK (Sports, Play, and Active Recreation for Kids) PE, was developed in the early 1990s with the goal of maximizing PA during PE to improve elementary students' fitness, skills, and enjoyment. The SPARK PE curriculum was designed to serve as a resource for classroom teachers and was accompanied by training and on-site mentoring. Evaluations of SPARK PE in elementary schools demonstrated positive effects on quality of instruction, PA levels in class, sports skills, and academic achievement.[16–18] Elementary classroom teachers also maintained this high-quality PE instruction 18 months after the

study period,[19] suggesting that the training and resources provided by SPARK could result in sustainable improvements to elementary school PE.

Given that PA levels significantly decrease in adolescence and young adulthood,[5,20] early adolescence is a critical period for preventing these declines in PA and promoting active lifestyles that track into adulthood.[21] High quality middle school PE can be instrumental in fostering a lifelong commitment to being physically active, one of the primary goals of PE.[8] Middle school is generally the first time youth are exposed to instruction from a credentialed PE specialist. Middle school also may be the last time youth receive formal instruction as PE requirements and participation decline in high school.[22–24] Moreover, because the percent of in-school PA contributed by PE classes increases as youth move from elementary to middle school, PE plays a more progressively important role among these students.[22] However, in contrast to studies of elementary schools, few recent efforts have evaluated interventions to increase MVPA in middle school PE with a large sample of boys and girls from racially and economically diverse backgrounds.[25–27]

The success of SPARK PE in elementary schools led to efforts to diffuse the program while maintaining fidelity to the evidence-based intervention.[17] SPARK was licensed to one of its corporate sponsors to assist with dissemination efforts and to facilitate rapid expansion of the program.[28] Between 1989 and 2012, SPARK provided staff development, equipment, and curricula to an estimated 2000 school districts across the US (L. Gonzalez, written communication, September 2017). Building on the success of the elementary school program, SPARK was expanded to include a middle school curriculum.[28] Guided by social learning theory and similar to the elementary version, the SPARK middle school curriculum contains instructional strategies, activities, assessments, ideas for adapting instruction (eg, plans for inclement weather or space limitations), and suggestions for classroom management.

SPARK PE for middle school was initially evaluated as part of the Middle School Physical Activity and Nutrition (M-SPAN) project, an environmental, school policy, and social marketing intervention that aimed to increase MVPA and reduce fat intake.[25] This evaluation of the SPARK middle school did not provide a structured curriculum, but rather assisted PE teachers with modifying existing programs and implementing strategies to increase MVPA. Evaluation results showed a statistically significant increase in MVPA in intervention schools.[25] To the authors' knowledge, an evaluation of the structured SPARK PE for middle school curriculum has not been done prior to our study. This study examines the amount and consistency of MVPA in a sample of middle school PE lessons before and after receiving the SPARK middle school curriculum and training in a large, geographically dispersed and economically diverse school district serving predominantly Latino students. Principles of community-based participatory research were applied in partnering with the school district to design, implement, and evaluate the study.

METHODS

Study Participants

Sixteen middle schools in a large urban school district in Los Angeles, CA were identified by their willingness to participate in an intervention study and their level of enrollment in the National School Breakfast and Lunch programs. Across all study schools, an average of 79.0% of students participated in these programs, and the majority of students at the schools were Latino (79.4%). Average enrollment of the 16 schools was 1334 students. Schools were randomly assigned to the intervention or control condition, and PE teacher participation was voluntary. There were 23 participating teachers at intervention schools and 28 at control schools. Table 1 summarizes study school and teacher characteristics.

Principals and PE teachers from each school agreed to participate as demonstrated through the establishment of memoranda of understanding. A total of 561 class sessions were observed over the course of the study (287 intervention class sessions and 274 control class sessions). Depending on the school schedule, students participated in PE class lasting from 24 to 120 minutes in length 2–5 days per week taught by credentialed PE specialists employed full-time by the school district.

PE Intervention

Aimed at assisting PE teachers to maximize student MVPA, the intervention provided a middle school PE curriculum (SPARK PE), $2500 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 3 parts: 6 hours in October 2014, 3 hours in January 2015, and 3 hours in March 2015. Provision of the curriculum also included access to the SPARK Family website, which offers supplemental materials and resources. Teachers at control schools were given the curriculum, equipment, and training after the conclusion of the study. SPARK PE training sessions included both didactic instruction and modeling of SPARK lessons and strategies, including opportunities to engage in PA. Trainings were conducted by SPARK certified instructors, who were also credentialed PE teachers with over 20 years of experience. In addition to the 12 training hours, SPARK trainers provided 2 on-site consultation visits to conduct an assessment and provide teachers with feedback and recommendations. The research team partnered with the school district to revamp an existing PE task force consisting of members from the county's public health department, non-profit organizations providing PE programming during and after school, school administrators, physical educators, and adapted PE teachers. This task force served in an advisory capacity for study design, implementation, and data interpretation.

Data Collection

System for Observing Fitness Instruction Time (SOFIT).—Student activity levels in PE classes were assessed by trained observers during spring 2014 and the 2014–2015 and 2015–2016 school years using a modified version of the validated SOFIT protocol.[29–31] As in the original SOFIT protocol,[32] 4 students in each class were observed for their PA intensity and lesson context on a rotating basis every 10 seconds over the duration of the

class. In-depth information regarding the modified SOFIT protocol can be found elsewhere.[10] The intensity of students' PA was recorded on a 4-point scale: (1) sedentary, (2) light PA, (3) moderate PA, or (4) vigorous PA. Similar to the original SOFIT protocol, lesson context was coded as (M) classroom management, (K) knowledge/didactic instruction, (F) fitness/calisthenics/skills development, and (P) playing games. Additionally, observers recorded the teacher's activity level and engagement every 2 minutes.

Observers also noted location (indoor, outdoor, or both), time of day, class size (≤ 45 students or > 45 students based on district policy for class size limits[33]), grade type (6th, 7th, 8th, or mixed grades), class sex composition (>50% boys, >50% girls, or equal numbers by sex), and observation length. The primary lesson activity of the class period was recorded and categorized as free play, games (eg, capture the flag), fitness (eg, circuit training), drills and skills (eg, football toss), low movement team sports (eg, softball), or high movement team sports (eg, soccer). Percent of time in transition (ie, not engaged in PE content) was calculated by subtracting the observed lesson length from the scheduled length of the class on the school's bell schedule. These variables were included as covariates in the analyses described here.

Observation schedule.—Observations were scheduled at various times of the day and on different days of the week, and teachers were asked to conduct a typical class (ie, no testing or unusual activities). Observations were scheduled once every 2–3 weeks and conducted 3–4 times per teacher, per semester.

Observer training.—Data collectors included 12 graduate students and the project coordinator, all trained by a co-investigator and experienced SOFIT observer. After table-top training with practice observations using videos of PE classes, observers conducted practice observations in the field and compared observations during debriefings. Observers conducted observations in pairs until ratings converged. There were 2 independent observers for 15 PE class periods. Using these data, the intraclass correlation coefficient was calculated for the primary outcome measure, percent of MVPA, using a one-way ANOVA random effects model. This was found to be 0.936, which is evidence of strong reliability between observers.

School and teacher-level data.—School-level and teacher-level data, including percentages of students who participated in the National School Breakfast and Lunch programs and teachers' years of experience, were obtained through publicly available databases.

Data Analysis

All statistical analyses were performed using Stata version 14.2.[34] Characteristics of the sample of lessons were summarized using descriptive statistics. Intervention and control group lessons were compared using Wald tests in a hierarchical logistic regression model. All hierarchical models nested observations within teachers within schools.

Three outcome measures were used: (1) the percent of time spent in MVPA (ie, level 3 or 4 on the SOFIT observation), (2) the percent of time in consistent MVPA, operationalized as

bouts of MVPA of 30 seconds or longer, and (3) the percent of time spent sedentary (ie, level 1 on the SOFIT observation). Hierarchical linear regression models were used to determine the effect of the intervention on these 3 primary outcome variables, controlling for class size, activity type, observation length, time of day, location of class, percent of time spent in classroom context, percent of time spent in transition, grade type, percent of students enrolled in federal school meal programs, years of teacher experience, gender composition of the class, and gender of the teacher. The 3 outcome variables were logarithm transformed to address right skewness. As the data were longitudinal in nature (observations were collected on teachers over time), various combinations of random intercepts and slopes at the teacher and school levels were considered to model these three outcome variables. The model with consistently the best fit (measured by AIC and BIC) was one that included a continuous measure of time since the beginning of the study (months were used for interpretability) and random intercepts at both the teacher and school levels. The following interactions were tested: activity type and class size, activity type and location, class size and years of experience, class size and gender composition, and sex composition and location. Only statistically significant interactions ($p < .05$) were kept in the model.

The same analysis approach was repeated with 4 additional outcome variables – the percent of time spent in MVPA for a given classroom context: management, knowledge, fitness skills, and play. These outcome variables were also logarithm transformed. To avoid over-testing, only interactions that were statistically significant in the primary models were tested for these secondary outcomes.

To assess differences by sex within observations, the primary outcome variables were recalculated for each observation by the gender of the students observed. The difference in these outcomes by sex was used as dependent variables in models that included the covariates described above with the exception of gender composition. Single-sex classes were excluded from this *post hoc* analysis. No interactions were considered for these models.

RESULTS

Table 2 shows a summary of the lesson data from all time points (ie, pre-, during-, and post-training). On average, only 13.7% of observed class time was spent in MVPA and 8.1% in consistent MVPA, compared to 27.5% of time spent sedentary. Most observations were done post-training, with roughly one-fifth of the observations coming from pre-training and one-fifth during training. Of the 6 activity categories, the most common types were team sports (45.1% of all observations) and fitness (27.3%). The average class length was approximately 60 minutes. Observations lasted on average 39.4 minutes; about 20 minutes (32.6%) was spent in transition on average. Most classes were held outdoors (72.4%) and spent similar amounts of time in management (30.6%), fitness/skills (34.7%), and play (29.6%), with lower amounts of time spent in knowledge (5.1%). The sample of classes was composed of 12.3% sixth grade, 34.6% seventh grade, 31.6% eighth grade, and 21.6% mixed grades. The average percent of students enrolled in the National School Breakfast and Lunch programs (weighted by the number of observations at each school) was 77.2%. The average class had a teacher with 14.2 years of experience and was most likely to have similar numbers of boys

and girls. Approximately one-half of the observed classes were taught by a woman. There were no detectable differences in covariates by intervention status.

Table 3 provides the results of the hierarchical linear regression models predicting the (log-transformed) primary PA outcomes: percent of time spent in MVPA, percent of time in consistent MVPA, and percent of time spent sedentary. Unsurprisingly, similar trends were seen in the 2 measures of MVPA. In both cases, the intervention group had higher percentages pre-teacher training and both groups saw higher percentages of MVPA and consistent MVPA post-training. However, the significant negative group-by-time interaction in both models suggests that the intervention resulted in a decrease of the outcomes. In each time period (pre-, during-, and post-training) there was a significant negative trend in time; a change of one month was associated with a small decrease in the outcomes. As expected, class sessions where the primary activity was fitness saw small significant increases in the MVPA outcomes. Changing 1% of class time from management to fitness/skills was associated with a small multiplicative increase in both MVPA outcomes, but changing 1% of class time from management to play was only associated with a small multiplicative increase in percent of time in MVPA. There were no detectable differences between eighth grade classes and the other grades. There were no differences detected by class size, observation length, location, percent of time spent in knowledge, transition time, percent of students enrolled in meal programs, sex composition, sex of teacher, and teacher years of experience. Additionally, no significant amount of variation was explained by the hierarchical structure.

Sedentary behavior was not affected by the intervention, but on average, outdoor activities had 74% (ie, $e^{-0.3}$) of the percent of sedentary behavior that indoor activities had. Similarly, changing 1% of class time from management to either play or fitness/skills was associated with a small reduction in sedentariness. There were no differences by any of the other covariates. However, there was evidence that the hierarchical structure helped explain some of the variation in the data.

Table 4 examines the (log-transformed) percent of time spent in MVPA within different class contexts: management, knowledge, fitness/skills, and play. Interestingly, there were no covariates associated with percent of MVPA spent in management or knowledge, suggesting no intervention effect. The intervention group had a significantly higher percent of MVPA in fitness/skills pre-training, but there was no detectable intervention effect post-intervention. Larger classes were also associated with a small increase in this outcome. Both the intervention and control groups saw improvements in percent of MVPA in play during the post-intervention period, but this was not attributable to the intervention. A negative time trend was also seen, reducing the outcome by a small amount each month. No significant amount of variation was explained by the hierarchical structure in any of the models.

Table 5 predicts the difference in primary outcomes (ie, percent time spent in MVPA, percent time in consistent in MVPA, and percent time in sedentary) between girls and boys in class. Fitness activities were associated with 2.1% higher MVPA in girls than boys, while changing class time from management to play or fitness/skills resulted in higher MVPA in boys than girls. A similar trend was seen in fitness/skills for consistent MVPA. No differences were detected for any other covariates, including a treatment effect. There were

no associations with the difference between girls and boys in sedentary behavior and there was no evidence of nesting in any of the models.

DISCUSSION

This study evaluated the implementation of the SPARK middle school curriculum by examining the amount and consistency of MVPA and sedentary behavior during PE classes before and after the intervention in low-income, urban schools. There was no evidence that use of the SPARK curriculum resulted in increased MVPA or consistent MVPA, or that it decreased sedentary behavior. Whereas these findings are in contrast to the M-SPAN evaluation, which found a significant increase in MVPA in intervention middle schools,[25] there were important differences in study settings and student populations between the current study and the M-SPAN study. Namely, schools in the current study were larger, had a higher percentage of students participating in federal school meal programs, and had a higher percentage of non-white students (approximately 80% of students in the current study qualified for free and reduced-price meals and 90% of students were non-white).[25] Prior research shows that the quantity and quality of PE offerings differs by racial/ethnic makeup as well as socioeconomic composition of the student body.[23] Thus, the complexities of the school context in the current study may have affected the potential for SPARK to significantly alter student PA in PE. However, other study findings suggest positive associations between SPARK and student perceptions of PE and PA.

Overall, the percent of class time spent in MVPA remained low (mean of 13.7%) and more than one-fourth of the class time was spent sedentary, thereby failing to meet the national recommendation of 50%.[12] Additionally, an average of 32.6% of the scheduled class time was lost to transition from the locker room. Based on our data, in a hypothetical 60-minute class we would expect students to spend a little over 5 minutes in MVPA and about 20 minutes transitioning to and from the locker room. These findings suggest a need for further research to understand the daily experiences inside the PE classroom. PE teachers must balance a number of competing priorities, such as fitness testing, meeting standards, and adapting to resource constraints.[24] These factors may limit the amount of class time teachers can devote to PA enhancing activities. This highlights the need for an ongoing dialogue between researchers, teachers, and school administrators in order to maximize MVPA while not losing sight of the other goals of PE. Alternative approaches to increasing MVPA during the school day through short PA breaks, intramural sports, and before- and after-school activities designed to meet the needs of all students may be promising and should be pursued.[35]

As expected, classes in which the primary activity was a fitness activity had increased levels of MVPA and consistent MVPA. This finding is supported by other studies which used fitness infusion interventions to successfully increase MVPA.[36–38] However, whereas PE is a valuable source of daily PA, it is also meant to impart knowledge and a diverse array of skills to students to foster a lifelong passion for exercise. Focusing solely on fitness activities may inhibit student investment in the broader goals of PE. Additionally, when looking at lesson context, a change in 1% of class time from management to fitness skills was associated with an increase in both MVPA and consistent MVPA and a decrease in sedentary

behavior, while a change in one percent of class time from management to play was associated with an increase in MVPA only. Although SPARK aims to both reduce time spent in management and increase MVPA during management, this study found no significant differences in either outcome. However, reducing time in management remains a promising strategy to increase MVPA and reduce sedentary behavior in PE. Further research is needed to determine which types of additional training or support may assist teachers in this effort.

Finally, many observed classes (47.4%) were over the district's policy limit of 45 students in a secondary PE class.[33] However, results showed that having a large class size does not necessarily inhibit PA. For example, when looking at the percent of MVPA in the fitness/skills context, classes with more than 45 students had higher percentages of MVPA than smaller classes. This finding contradicts previous research naming large class size as a barrier to achieving high PA levels in class.[39] Although class size may not be the most important factor in influencing levels of MVPA, it may be a salient issue regarding safety and flexibility with lesson planning.

Limitations

The generalizability of these findings is limited by the single geographical location. Additionally, the study utilized a direct observation method for measuring PA, which may be subject to observer bias. Moreover, teachers and students may alter behavior or practices when being observed. Whereas data were collected over multiple years, the intervention occurred during a single school year, meaning we are unable to comment on any possible temporal trends. Strengths of the study included the longitudinal design, large sample and comparison group.

Conclusions

The success of the SPARK PE curriculum in improving quality of instruction and increasing PA levels in elementary school PE has been well documented[16–19] and ultimately led to the development and distribution of a similarly designed middle school curriculum which was evaluated in this study. However, the middle school PE context is fundamentally different from that of elementary schools where PE is often taught by classroom teachers who are not credentialed for PE. Given this difference, it is possible that some SPARK strategies and lessons did not translate for credentialed middle school PE teachers who do not approach the SPARK curriculum *tabula rasa*. In addition to their education and training specific to PE, these teachers balance other goals and responsibilities which do not fully align with the goals of the SPARK middle school curriculum. In conversations with the research team, teachers in the study reported enjoying implementing SPARK in their classrooms; however, further research is needed to understand how the SPARK curriculum can more effectively fill the needs of teachers while also promoting MVPA.

Whereas experts recommend 50% of PE class time be spent in MVPA, our results showed an average of only 13.7%. Further, there was no evidence that use of the SPARK curriculum resulted in increased MVPA or consistent MVPA, or that it decreased sedentary behavior. Although these findings contrast with prior evaluation of the middle school SPARK curriculum, differences in school characteristics may have contributed to the differences in

MVPA outcomes. Lessons spent in fitness activities showed higher levels of MVPA; however, they still did not achieve the recommended levels. Moreover, focusing solely on fitness activities may inhibit student investment in the broader goals of PE. More research is needed to identify effective strategies to increase MVPA for adolescents both in and outside the PE classroom.

ACKNOWLEDGEMENTS

This research was funded by the National Institute of Nursing Research (5R01NR012676) and supported by grants from the National Heart, Lung and Blood Institute at the National Institutes of Health (P50 HL105188 and R25 HL108854).

REFERENCES

1. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. Int J Behav Nutr Phys Act 2010;7(1):40–56. [PubMed: 20459784]
2. Biddle SJH, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. Br J Sports Med 2011;45(11):886–895. [PubMed: 21807669]
3. Fakhouri T, Hughes J, Song M, Fulton J, Ogden C. Physical activity in U.S. youth aged 12–15 years, 2012. NCHS Data Brief 2014;(141):1–8.
4. Carlson S, Densmore D, Fulton J, Yore M, Kohl H III. Differences in physical activity prevalence and trends from 3 US surveillance systems: NHIS, NHANES, and BRFSS. J Phys Act Health 2009;6(S1):S18–S27. [PubMed: 19998846]
5. Sallis J, Prochaska J, Taylor W. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc 2000;32(5):963–975. [PubMed: 10795788]
6. Van Der Horst K, Paw MJCA, Twisk JWR, Van Mechelen W. A brief review on correlates of physical activity and sedentariness in youth. Med Sci Sports Exerc 2007;39(8):1241–1250. [PubMed: 17762356]
7. Hills AP, Dengel DR, Lubans DR. Supporting public health priorities: recommendations for physical education and physical activity promotion in schools. Prog Cardiovasc Dis 2015;57(4): 368–374. [PubMed: 25269062]
8. Sallis JF, McKenzie TL, Beets MW, Beighle A, Erwin H, Lee S. Physical education's role in public health: steps forward and backward over 20 years and HOPE for the Future. Res Q Exerc Sport 2012;83(2):125–135. [PubMed: 22808697]
9. Whitt-Glover MC, Taylor WC, Floyd MF, Yore MM, Yancey AK, Matthews CE. Disparities in physical activity and sedentary behaviors among US children and adolescents: prevalence, correlates, and intervention implications. J Public Health Policy 2009;30(1S):S309–S334. [PubMed: 19190581]
10. Gill M, Chan-Golston AM, Rice LN, Cole BL, Koniak-Griffin D, Prelip ML. Consistency of moderate to vigorous physical activity in middle school physical education. Fam Community Health 2016;39(4).
11. Fairclough S, Stratton G. Physical activity levels in middle and high school physical education: a review. Pediatr Exerc Sci 2005;17(3):217–236.
12. National Association for Sport and Physical Education. Moving into the Future: National Standards for Physical Education Reston. Reston, VA: American Alliance for Health, Physical Education, Recreation and Dance; 2004.
13. McKenzie TL, Lounsbery MAF. School physical education: the pill not taken. Am J Lifestyle Med 2009;3(3):219–225.
14. Young DR, Felton GM, Grieser M, et al. Policies and opportunities for physical activity in middle school environments. J Sch Health 2007;77(1):41–47. [PubMed: 17212759]
15. Lonsdale C, Rosenkranz RR, Peralta LR, Bennie A, Fahey P, Lubans DR. A systematic review and meta-analysis of interventions designed to increase moderate-to-vigorous physical activity in school physical education lessons. Am J Prev Med 2013;56(2):152–161.

16. Sallis JF, McKenzie TL, Kolody B, Lewis M, Marshall S, Rosengard P. Effects of health-related physical education on academic achievement: Project SPARK. Res Q Exerc Sport 1999;70(2): 127–134. [PubMed: 10380244]
17. Dowda M, Sallis JF, McKenzie TL, Rosengard P, Kohl HW. Evaluating the sustainability of SPARK physical education: a case study of translating research into practice. Res Q Exerc Sport 2005;76(1):11–19. [PubMed: 15810766]
18. McKenzie TL, Sallis JF, Kolody B, Faucette FN. Long-term effects of a physical education curriculum and staff development program: SPARK. Res Q Exerc Sport 1997;68(4):280–291. [PubMed: 9421840]
19. Sallis JF, McKenzie TL, Alcaraz JE, Kolody B, Faucette N, Hovell MF. The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. Sports, Play and Active Recreation for Kids. Am J Public Health 1997;87(8):1328–1334. [PubMed: 9279269]
20. Pate RR, Freedson PS, Sallis JF, et al. Compliance with physical activity guidelines: prevalence in a population of children and youth. Ann Epidemiol 2002;12(5):303–308. [PubMed: 12062916]
21. Malina RM. Physical activity and fitness: pathways from childhood to adulthood. Am J Hum Biol 2001;13:162–172. [PubMed: 11460860]
22. McKenzie TL. Promoting physical activity in youth: focus on middle schooI environments. Quest 2001;53(3):326–334.
23. Johnston LD, Delva J, O'Malley PM. Sports participation and physical education in American secondary schools. Am J Prev Med 2007;33(4):S195–S208. [PubMed: 17884568]
24. Lee SM, Burgeson CR, Fulton JE, Spain CG. Physical education and physical activity: results from the School Health Policies and Programs Study 2006. J Sch Health 2007;77(8):435–463. [PubMed: 17908102]
25. McKenzie TL, Sallis JF, Prochaska JJ, Conway TL, Marshall SJ, Rosengard P. Evaluation of a two-year middle-school physical education intervention: M-SPAN: Med Sci Sports Exerc 2004;36(8): 1382–1388. [PubMed: 15292747]
26. Webber LS, Catellier DJ, Lytle LA, et al. Promoting physical activity in middle school girls. Am J Prev Med 2008;34(3):173–184. [PubMed: 18312804]
27. Jago R, Mcmurray RG, Drews KL, et al. HEALTHY intervention: fitness, physical activity, and metabolic syndrome results. Med Sci Sports Exerc 2011;43(8):1513–1522. [PubMed: 21233778]
28. McKenzie TL, Sallis JF, Rosengard P. Beyond the stucco tower: design, development, and dissemination of the SPARK physical education programs. Quest 2009;61(1):114–127.
29. Lafleur M, Strongin S, Cole BL, et al. Physical education and student activity: evaluating Implementation of a new policy in Los Angeles public schools. Ann Behav Med 2013;45(S1):122–130.
30. Rowe P, van Der Mars H, Schuldheisz J, Fox S. Measuring students' physical activity levels: validating SOFIT for use with high-school students. J Teach Phys Educ 2004;23(3):235–251.
31. Heath EM, Coleman KJ, Lensegrav TL, Fallon JA. Using momentary time sampling to estimate minutes of physical activity in physical education: validation of scores for the System for Observing Fitness Instruction Time. Res Q Exerc Sport 2006;77(1):142–146. [PubMed: 16646362]
32. McKenzie TL, Sallis JF, Nader PR. System for observing fitness instruction time. J Teach Phys Educ 1991;11:195–205.
33. Los Angeles Unified School District. Policy Bulletin: Physical Education Programs –Grades K-12 (BUL-2528.1) 12 2009.
34. StataCorp. Stata Statistical Software: Release 14 College Station, TX: StataCorp LP; 2015.
35. Babey SH, Wolstein J, Diamant AL. Adolescent physical activity role of school support, role models, and social participation in racial and income disparities. Environ Behav 2016;48(1):172–191.
36. Scantling E, Dugdale H. The effects of two instructional formats on the heart rate intensity and skill development of physical education students. The Physical Educator 1998;55(3):138.
37. Quinn PB, Strand B. A comparison of two instructional formats on heart rate intensity and skill development. The Physical Educator 1995;52(2):62.

38. Ignico A, Corson A, Vidoni C. The effects of an intervention strategy on children's heart rates and skill performance. Early Child Dev Care 2006;176(7):753–761.

39. McKenzie TL, Marshall SJ, Sallis JF, Conway TL. Student activity levels, lesson context, and teacher behavior during middle school physical education. Res Q Exerc Sport 2000;71(3):249–259. [PubMed: 10999262]

40. Morgan PJ, Hansen V. Classroom teachers' perceptions of the impact of barriers to teaching physical education on the quality of physical education programs. Res Q Exerc Sport 2008;79(4):506–516. [PubMed: 19177952]

IMPLICATIONS FOR SCHOOL HEALTH

Given the persistence of disparities in PA and the importance of PA for healthy development and obesity prevention, greater efforts must be directed toward preventing declines as youth age. The responsibility of PA promotion in the school setting is typically left to the PE department; however, as shown here, rates of PA in middle school PE are alarmingly low. The findings of this study highlight the value of using data to inform policy and practice. One-third of PE class time is lost to transition, suggesting an immediate opportunity to develop new strategies to maximize time. For example, schools might implement new strategies to reduce time spent in the locker room, or to include activity during administrative tasks such as taking attendance or making announcements. However, the PE landscape is increasingly complex, as teachers balance demands to raise PA levels with meeting content standards, increased emphasis on standardized testing, and adapting to scheduling changes and space inadequacies.[40] Because of the complex nature of PE, it is necessary to institutionalize other ways to promote PA during school, such as short activity breaks, active transport, and school-led initiatives before, after, and during the school day. For example, schools might consider expanding sports or activities available during lunch time or other breaks, ensuring that activities attract both boys and girls. These efforts must focus on making PA accessible for all youth, thereby encouraging positive and ongoing PA habits. The mixed evaluation findings of the SPARK middle school curriculum demonstrate that an out-of-the-box curriculum does not have the same results in all contexts, particularly considering the challenges inherent to large, urban school districts or underserved schools in low-income communities. Finally, collaborative partnerships between public health researchers and school health practitioners are an essential component for effective PA intervention design. Collaboration provides an opportunity for researchers and practitioners to more deeply consider needs and goals of participants and intervention fit. Efforts should include mobilizing PE teachers in efforts to capitalize on their knowledge, capacity, and expertise in order to develop more effective interventions.

Table 1.

Characteristics of the Sample of Schools and Teachers in Total and by Condition

	Total Percent or Mean (SD)	Intervention Percent or Mean (SD)	Control Percent or Mean (SD)
School Characteristics	**N = 16**	**N = 8**	**N = 8**
Enrollment	1334.1 (600.1)	1368.5 (606.1)	1299.6 (633.7)
Percent in Meal Programs[1]	79.0	78.9	79.2
Percent Latino	79.4	79.8	79.1
Teacher Characteristics	**N = 51**	**N = 23**	**N = 28**
Percent Men	56.9	56.5	57.1
Years of Teaching Experience	13.8 (11.5)	13.8 (11.7)	13.8 (11.4)

Note.

[1]Percent of students enrolled in the National School Breakfast and Lunch programs

Table 2.

Characteristics of the Sample of PE Lessons in Total and by Condition[1]

	Total (N = 561) Percent or Mean (SD)	Control (N = 274) Percent or Mean (SD)	Intervention (N = 287) Percent or Mean (SD)
Characteristics			
Percent Time in MVPA	13.7 (8.6)	13.0 (8.7)	14.3 (8.6)
Percent Consistent MVPA	8.1 (7.7)	7.9 (7.6)	8.3 (7.8)
Percent Time in Sedentary	27.5 (17.2)	29.0 (17.5)	26.0 (16.9)
Time Period			
Pre-training	16.0	14.2	17.8
During-training	22.8	21.5	24.0
Post-training	61.1	64.2	58.2
Large Class (> 45 students)	47.4	54.7	40.4
Activity			
Free Play	6.2	10.2	2.4
Games	9.5	8.0	10.8
Fitness	27.3	21.5	32.8
Drills/Skills	11.9	10.6	13.2
Team Sports (Low)	23.5	25.5	12.6
Team Sports (High)	21.6	24.1	19.2
Class Length (mins)	59.0 (17.3)	60.3 (19.2)	57.8 (15.3)
Observation Length (mins)	39.4 (13.1)	40.7 (14.3)	38.1 (11.7)
Location			
Indoors	24.2	22.6	25.8
Outdoors	72.4	75.9	69.0
Both	3.4	1.5	5.2
Percent Time in Context			
Management	30.6 (14.9)	30.0 (14.9)	31.1 (14.9)
Knowledge	5.1 (7.8)	4.4 (7.4)	5.7 (8.1)
Fitness/Skills	34.7 (25.4)	32.9 (24.8)	36.5 (25.9)
Play	29.6 (27.6)	32.7 (27.0)	26.6 (27.9)
Percent Time in Transition	32.6 (12.6)	31.6 (12.7)	33.4 (12.5)
Grade			
6^{th}	12.3	15.0	9.8
7^{th}	34.6	36.9	32.4
8^{th}	31.6	28.1	34.8
Mixed	21.6	20.1	23.0
Percent Boys			
< 45%	18.9	18.6	19.2
45% – 55%	65.4	68.6	62.4
> 55%	15.7	12.8	18.5
Percent taught by Men	49.4	51.1	47.7

*p < .05

**p < .01

***p < .001

Note.

[1]Statistically significant differences between intervention and control groups by covariates were tested using Wald tests in hierarchical logistic regression models.

Table 3.

Hierarchical Linear Regression Models Predicting Percent of Class Time Spent in Physical Activity Outcomes[1] (N = 549)

	MVPA	Consistent MVPA	Sedentary
Coefficients	**B (95% CI)**	**B (95% CI)**	**B (95% CI)**
Fixed Effects			
Intercept	1.48 (0.90, 2.05)***	0.87 (0.10, 1.64)*	4.08 (3.42, 4.74)***
Intervention	0.49 (0.22, 0.75)***	0.43 (0.07, 0.78)*	−0.11 (−0.39, 0.18)
Time Period			
Pre-training (ref)			
During-training	0.06 (−0.23, 0.35)	0.02 (−0.38, 0.42)	−0.24 (−0.50, 0.03)
Post-training	0.94 (0.52, 1.36)***	0.88 (0.31, 1.46)**	0.19 (−0.20, 0.58)
Intervention x Time Period			
Pre-training (ref)			
During-training	−0.34 (−0.68, −0.01)*	−0.42 (−0.88, 0.04)	−0.06 (−0.37, 0.25)
Post-training	−0.46 (−0.75, −0.16)**	−0.56 (−0.96, −0.15)**	0.05 (−0.22, 0.33)
Months (since first observation)	−0.03 (−0.05, −0.01)**	−0.03 (−0.06, 0.00)*	0.00 (−0.02, 0.02)
Large Class (> 45 students)	0.03 (−0.08, 0.14)	0.07 (−0.08, 0.22)	0.04 (−0.07, 0.15)
Fitness Activity	0.16 (0.03, 0.29)*	0.37 (0.19, 0.55)***	−0.03 (−0.15, 0.09)
Observation Length	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)
Afternoon	0.03 (−0.16, 0.22)	0.14 (−0.12, 0.39)	−0.09 (−0.26, 0.09)
Outdoor	0.11 (0.00, 0.22)	0.10 (−0.05, 0.26)	−0.30 (−0.40, −0.20)***
Percent Knowledge	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.01)	0.00 (0.00, 0.01)
Percent Play	0.01 (0.00, 0.01)***	0.00 (0.00, 0.01)	−0.02 (−0.02, −0.02)***
Percent Fitness/Skills	0.01 (0.01, 0.01)***	0.01 (0.00, 0.01)**	−0.02 (−0.02, −0.01)***
Percent Transition Time	0.00 (−0.01, 0.00)	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.00)
Grade Type			
6	0.12 (−0.07, 0.31)	0.11 (−0.15, 0.37)	0.13 (−0.05, 0.32)
7	−0.05 (−0.19, 0.08)	−0.06 (−0.25, 0.12)	0.10 (−0.03, 0.23)
8 (ref)			
Mixed	−0.09 (−0.25, 0.06)	−0.18 (−0.38, 0.03)	0.06 (−0.09, 0.21)
Percent in meal programs	0.00 (0.00, 0.00)	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)
Teacher Experience (yrs)	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.01)
Sex Composition			
More Girls	−0.12 (−0.26, 0.02)	−0.11 (−0.30, 0.08)	0.01 (−0.12, 0.15)
Equal (ref)			
More Boys	−0.03 (−0.17, 0.12)	−0.05 (−0.25, 0.15)	−0.06 (−0.20, 0.07)
Male Teacher	0.06 (−0.05, 0.17)	0.12 (−0.03, 0.27)	0.06 (−0.10, 0.22)
Random Effects			

Coefficients	MVPA B (95% CI)	Consistent MVPA B (95% CI)	Sedentary B (95% CI)
School Level Error Variance[2]	0.0027	0.0000	0.0129***
Teacher Level Error Variance	0.0000	0.0000	0.0382

* p < .05

** p < .01

*** p < .001

Note.

[1] All 3 outcomes are measured on the log scale

[2] Significance of school and teacher level error variance was tested using likelihood ratio tests.

Table 4.

Hierarchical Linear Regression Models Predicting Percent of Time in MVPA within Different Class Contexts[1]

Coefficients	Management N = 549 B (95% CI)	Knowledge N = 328 B (95% CI)	Fitness/Skills N = 512 B (95% CI)	Play N = 356 B (95% CI)
Fixed Effects				
Intercept	0.70 (0.05, 1.36) *	0.36 (−0.13, 0.85)	2.46 (1.68, 3.25) ***	2.52 (1.45, 3.6) ***
Intervention	0.24 (−0.12, 0.60)	0.08 (−0.18, 0.34)	0.72 (0.30, 1.15) **	0.58 (−0.02, 1.17)
Time Period				
Pre-training (ref)				
During-training	−0.11 (−0.51, 0.29)	−0.02 (−0.30, 0.26)	0.18 (−0.28, 0.64)	0.31 (−0.34, 0.96)
Post-training	0.04 (−0.54, 0.62)	−0.11 (−0.52, 0.31)	0.42 (−0.25, 1.09)	1.25 (0.28, 2.21) *
Intervention x Time Period				
Pre-training (ref)				
During-rraining	−0.40 (−0.86, 0.06)	−0.01 (−0.35, 0.32)	−0.44 (−0.98, 0.10)	−0.46 (−1.20, 0.28)
Post-training	−0.17 (−0.57, 0.23)	0.07 (−0.23, 0.36)	−0.54 (−1.01, −0.06) *	−0.55 (−1.17, 0.07)
Months (since first observation)	−0.01 (−0.04, 0.02)	0.00 (−0.02, 0.02)	0.00 (−0.04, 0.03)	−0.06 (−0.10, −0.01) *
Large Class (> 45 students)	−0.01 (−0.16, 0.14)	0.01 (−0.10, 0.11)	0.28 (0.10, 0.45) **	−0.01 (−0.23, 0.22)
Fitness Activity	−0.15 (−0.31, 0.01)	−0.04 (−0.16, 0.07)	0.00 (−0.18, 0.19)	0.18 (−0.15, 0.51)
Observation Length	0.00 (−0.01, 0.00)	0.00 (0.00, 0.01)	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.01)
Afternoon	−0.16 (−0.41, 0.10)	−0.15 (−0.33, 0.03)	0.03 (−0.28, 0.33)	−0.28 (−0.67, 0.10)
Outdoor	0.10 (−0.06, 0.25)	−0.03 (−0.13, 0.07)	−0.04 (−0.23, 0.14)	0.23 (−0.01, 0.47)
Percent Transition Time	0.00 (−0.01, 0.00)	0.00 (−0.01, 0.00)	0.00 (−0.01, 0.01)	−0.01 (−0.02, 0.00)
Grade Type				
6	0.09 (−0.16, 0.35)	0.00 (−0.18, 0.18)	0.16 (−0.15, 0.47)	−0.04 (−0.43, 0.35)
7	0.07 (−0.11, 0.26)	0.01 (−0.13, 0.15)	0.02 (−0.19, 0.24)	−0.05 (−0.33, 0.22)
8 (ref)				
Mixed	0.05 (−0.15, 0.26)	0.13 (−0.01, 0.28)	−0.06 (−0.31, 0.19)	−0.19 (−0.50, 0.13)
Percent in meal programs	0.00 (0.00, 0.01)	0.00 (−0.01, 0.00)	0.00 (0.00, 0.01)	0.00 (−0.01, 0.01)
Teacher Experience (yrs)	0.00 (−0.01, 0.01)	0.00 (−0.01, 0.00)	0.00 (−0.01, 0.01)	0.00 (−0.02, 0.01)
Sex Composition				
More Girls	−0.11 (−0.30, 0.08)	−0.12 (−0.26, 0.01)	−0.13 (−0.36, 0.09)	−0.06 (−0.36, 0.23)
Equal (ref)				
More Boys	0.09 (−0.11, 0.29)	0.13 (−0.01, 0.28)	−0.02 (−0.26, 0.22)	−0.08 (−0.39, 0.23)
Male Teacher	−0.10 (−0.24, 0.05)	−0.09 (−0.20, 0.02)	0.08 (−0.10, 0.26)	−0.21 (−0.44, 0.02)
Random Effects				
School Level Error Variance[2]	0.0026	0.0000	0.0094	0.0409
Teacher Level Error Variance	0.0000	0.0000	0.0000	0.0000

* $p < .05$

** $p < .01$

*** p < .001

Note.

1 All 4 outcomes are measured on the log scale

2 Statistical significance of school and teacher level error variance was tested using likelihood ratio tests.

Table 5.

Hierarchical Linear Regression Models Predicting Difference in Percent of Class Time Spent in Physical Activity Outcomes for Girls and Boys (N = 502)

Coefficients	MVPA B (95% CI)	Consistent MVPA B (95% CI)	Sedentary B (95% CI)
Fixed Effects			
Intercept	0.58 (−6.49, 7.66)	2.49 (−3.96, 8.95)	−0.31 (−11.96, 11.34)
Intervention	0.88 (−2.27, 4.04)	0.40 (−2.49, 3.28)	−0.65 (−5.82, 4.53)
Time Period			
Pre-training (ref)			
During-training	−0.27 (−3.68, 3.15)	−1.44 (−4.58, 1.69)	−0.76 (−6.28, 4.76)
Post-training	−1.15 (−6.15, 3.85)	−2.78 (−7.37, 1.82)	−1.64 (−9.74, 6.45)
Intervention x Time Period			
Pre-training (ref)			
During-training	−0.16 (−4.15, 3.83)	0.12 (−3.54, 3.79)	0.95 (−5.50, 7.41)
Post-training	−1.22 (−4.75, 2.31)	−0.43 (−3.66, 2.81)	1.00 (−4.74, 6.73)
Months (since first observation)	−0.01 (−0.25, 0.23)	0.11 (−0.11, 0.34)	0.26 (−0.14, 0.65)
Large Class (> 45 students)	−0.47 (−1.78, 0.84)	−0.52 (−1.72, 0.68)	0.90 (−1.25, 3.06)
Fitness Activity	2.14 (0.52, 3.76) **	0.97 (−0.52, 2.45)	−0.50 (−3.12, 2.12)
Observation Length	−0.02 (−0.08, 0.04)	−0.01 (−0.06, 0.05)	−0.04 (−0.14, 0.05)
Afternoon	−1.05 (−3.32, 1.22)	−0.94 (−3.03, 1.14)	1.00 (−2.70, 4.70)
Outdoor	−0.31 (−1.73, 1.11)	−0.58 (−1.88, 0.72)	1.01 (−1.29, 3.31)
Percent Knowledge	0.03 (−0.05, 0.12)	0.01 (−0.07, 0.09)	−0.05 (−0.20, 0.09)
Percent Play	−0.05 (−0.10, −0.01) *	−0.03 (−0.07, 0.01)	0.00 (−0.07, 0.07)
Percent Fitness Skills	−0.05 (−0.10, −0.01) *	−0.04 (−0.09, 0.00) *	0.01 (−0.07, 0.08)
Percent Transition Time	0.00 (−0.06, 0.05)	−0.01 (−0.06, 0.04)	−0.01 (−0.10, 0.08)
Grade Type			
6	0.56 (−1.70, 2.82)	0.54 (−1.53, 2.61)	1.41 (−2.29, 5.11)
7	0.90 (−0.71, 2.52)	0.76 (−0.72, 2.24)	0.87 (−1.78, 3.52)
8 (ref)			
Mixed	1.89 (−0.01, 3.78)	1.90 (0.17, 3.64)	−1.51 (−4.62, 1.61)
Percent in meal programs	0.01 (−0.03, 0.06)	−0.01 (−0.05, 0.03)	0.00 (−0.08, 0.08)
Teacher Experience (yrs)	0.02 (−0.06, 0.09)	0.01 (−0.05, 0.08)	−0.02 (−0.14, 0.10)
Sex Composition			
More Girls	−1.22 (−2.99, 0.55)	−0.55 (−2.18, 1.08)	1.57 (−1.30, 4.45)
Equal (ref)			
More Boys	−0.21 (−2.07, 1.64)	0.12 (−1.59, 1.82)	0.33 (−2.67, 3.33)
Male Teacher	−0.19 (−1.61, 1.23)	−0.12 (−1.39, 1.15)	0.66 (−1.79, 3.11)
Random Effects			
School Level Error Variance [1]	0.0000	0.0000	0.0000
Teacher Level Error Variance	0.9958	0.6223	4.4799

Author Manuscript

Author Manuscript

Author Manuscript

*p < .05

**p < .01

***p < .001

[1]Statistical significance of school and teacher level error variance was tested using likelihood ratio tests.