Published in final edited form as:

J Sch Health. 2012 October ; 82(10): 457–461. doi:10.1111/j.1746-1561.2012.00722.x.

Use of SPARK to promote after-school physical activity

Heidi Herrick¹, Hannah Thompson¹, Jennifer Kinder¹, and Kristine A. Madsen, MD, MPH¹

Kristine A. Madsen: madsenk@peds.ucsf.edu

¹University of California, San Francisco, Dept of Pediatrics

Abstract

Background—The after-school period is an important potential venue for increasing youths' physical activity levels. We sought to assess the effectiveness of the Sports, Play, and Recreation for Youth (SPARK) program to increase physical activity and improve cardiorespiratory fitness and weight status among elementary students after school.

Methods—This quasi-experimental controlled study compared change in moderate-to-vigorous physical activity (MVPA), BMI z-score, and cardiorespiratory fitness (VO₂) over 5 months between students in after-school programs exposed to SPARK vs. controls. Participants were 5th grade students at 3 intervention schools (N=48) and 3 control schools (N=52).

Results—There was no difference between groups in mean change in MVPA, BMI z-score, or cardiorespiratory fitness. After-school time dedicated to physical activity did not increase with the implementation of SPARK. Intervention students' self-assessment of their activity levels relative to their peers significantly increased compared to control students ($p = .011$).

Conclusions—In this 5-month study, the SPARK program did not increase MVPA in the after-school setting. Increasing the amount of time dedicated to physical activity may be as important as the curriculum used to effectively increase physical activity after school.

Increasing physical activity is one of the cornerstones for combating obesity and reducing the risk of weight-related morbidity among America's youth.^{1, 2} Despite the known importance of physical activity, only 18% of adolescents report achieving the recommended 60 minutes of daily physical activity.³ This is particularly concerning as disparities in physical activity³ parallel increasing disparities in pediatric obesity.⁴

Schools are a natural venue in which to increase physical activity among diverse youth and the after-school period poses fewer time constraints than the school day.⁵ Results of intervention studies to increase after-school physical activity have been mixed,⁶ making it difficult to identify best practices for promoting physical activity after school. Strategies that have been proven effective during the school day may be equally effective after school. Sports Play and Active Recreation for Kids (SPARK) is one program that was demonstrated to increase students' moderate to vigorous physical activity (MVPA) during the school day.⁷ The SPARK program consists of 3 primary features: an active curriculum, staff-development, and follow-up support.⁷ However, no studies to date have examined the use of SPARK after school as a tool to help staff increase children's physical activity.

During the 2008–2009 school year, a large urban school district set a new policy of achieving 30 minutes of MVPA in the after-school setting per day. To assist schools in reaching this goal, the district purchased the SPARK program. The school district planned to introduce SPARK to 13 schools over a one-year period, and was willing to stagger implementation in order to evaluate SPARK's impact on physical activity. We took advantage of this opportunity to examine the potential of SPARK to increase MVPA in the after-school setting and improve cardiorespiratory fitness and weight status.

METHODS

This was a quasi-experimental controlled study of the impact of SPARK on health outcomes over five-months (spring 2009).

Participants

All fifth grade students enrolled in the after-school programs at the 6 study schools (N=168) were eligible for the study. A parent or guardian for each student provided written consent and the students gave verbal assent. The Committee on Human Research at the University of California, San Francisco approved this research.

Individual schools within the district applied to receive funding and training to implement SPARK in their after-school program and 13 were chosen for participation based on need and on the after-school staff's ability to support the program. Of these 13 schools, the district selected 3 schools to implement the SPARK curriculum immediately, based on the after-school coordinator's leadership in the arenas of physical activity and nutrition. From the remaining 11 schools, 3 control schools were selected based on similarity to intervention schools in student race/ethnicity and percent of students eligible to receive free and reduced price lunch; 60% of students were eligible for free or reduced lunch across the 6 schools, range 34% to 75%. The 3 control schools delayed implementing the SPARK curriculum until after the study period. All 6 study schools designated a physical activity coordinator who was charged with supporting students in physical activity.

Instruments

Cardiorespiratory fitness (VO_2) was assessed using the validated 20-meter shuttle test.⁸ With children in indoor clothes and shoes off, height was measured to the nearest tenth of a centimeter using the 420 Measure-All Portable Measuring Board (KWS Medical Supplies, LLC, North Bend, WA) and weight was measured to the nearest tenth of a kilogram using the Tanita Model BWB 800 digital scale (Tanita Corporation of America, Arlington Heights, IL). Students completed a survey with questions adapted from the California Healthy Kids Survey,⁹ the NHBLI Growth and Health Study,¹⁰ and the Healthy Eating Active Communities survey,¹¹ that assessed frequency of exercise (days per week), enjoyment of sports (*I enjoy activities such as walking, playing ball, bike riding, dancing or skating*) on a four-point scale, and perception of physical activity level (*Compared to most [boys/girls] your age, would you say you are: less active, about as active, or more active*).

Physical activity was assessed using the uniaxial GT1M accelerometer (Actigraph, LLC, Fort Walton Beach, FL), which students wore for 3 consecutive school days at baseline and follow-up. Any period of 20 consecutive minutes or longer of zero activity counts was considered non-wear time¹² and was converted to missing. School days were divided into before school (6 a.m. to beginning of school day), school day (6 hours - set according to the schedule of each student's school), after school (based on each school's after-school program schedule), and evening (from end of after-school program to 10 p.m.). Activity during each 30-second epoch was categorized as MVPA if total activity counts for the epoch were ≥ 1148 , based on Evenson's cutpoints.¹³ A composite method of accelerometer data reduction was used, wherein accelerometer data for each time-stamped epoch were collapsed across days, yielding the proportion of days for which a given epoch was considered MVPA (e.g. if, for a given epoch, 1 of 3 days was considered MVPA, 33% of the "composite" epoch would be considered MVPA). Total minutes of MVPA in each period of the "composite" day were then calculated. This approach reduces the amount of missing data and is more representative of student activity across days than imputation.¹⁴

Procedures

Study measures were collected in January (baseline) and May (post-SPARK) of 2009. During the study period the physical activity coordinators at all 6 schools attended monthly district-mandated meetings addressing a variety of topics: how to increase MVPA in the after-school setting, tips for nutrition and healthy eating lessons, tools for connecting with outside physical activity providers, and how to use existing physical activity and nutrition resources at their respective schools.

The 3 SPARK schools received the SPARK curriculum, an 8-hour SPARK training in September 2008 with a refresher training in December 2008, and almost 200 pieces of standard SPARK physical activity equipment. Additionally, the SPARK program provided a trainer who visited each of the three intervention school sites once over the course of the study to provide technical assistance to the after-school physical activity coordinator. Additionally, a district-provided physical activity coordinator, who was in charge of the SPARK grant, was available as needed to assist the 3 intervention schools in implementing SPARK and visited each site once per month during the study period.

At the end of the study period, researchers conducted semi-structured interviews with the physical activity coordinator at each school to identify barriers to physical activity in the after-school setting, perceptions and use of the SPARK program (intervention schools only), and the potential influence of the study itself on activity levels.

Data Analysis

Body Mass Index (BMI) was calculated as $\text{weight(kg)/height(m)}^2$. BMI z-scores were calculated using the 2000 CDC Growth reference data.¹⁵ VO_2 max was calculated using Leger's equation.⁸

Linear mixed effect models were used to analyze differences between the intervention and control schools at baseline and in response to the intervention, with the covariance structure appropriately adjusting for variability between clusters (schools) and within a cluster (students within the same school). Models analyzing change scores were adjusted for baseline values. Change in survey question responses were dichotomized to either "improved" or "unimproved" and logistic mixed effect models compared the proportion of students improving between groups, accounting for clustering by school. All analyses were performed using Stata/MP version 11 (StataCorp LP, College Station, TX).

RESULTS

A total of 100 students (48 intervention and 52 control students) enrolled in the study and follow-up data were available for all but 1 intervention and 1 control student, both of whom left the school district. A similar proportion of eligible students enrolled at intervention (71%) and control schools (74%). Student characteristics did not differ by group at baseline (Table 1), nor did mother's education. At baseline, girls were significantly less active than boys during school (MVPA 14.4 vs 22.7 mins, $p < .001$) and after-school (MVPA 14.9 vs. 21.8 mins, $p = .001$). Baseline MVPA did not vary by overweight status (BMI 85th percentile).

Over the five-month study period, there was no difference between groups in change in minutes of MVPA in the after-school period, nor for the groups combined. Change in MVPA did not differ by sex, and girls remained less active at follow-up. Student weight status did not modify the effect of SPARK on MPVA, nor did baseline activity level (based on MVPA quartiles). There were no changes in BMI z-score or cardiorespiratory fitness between groups or overall (Table 2).

SPARK students' perception of their physical activity level significantly increased relative to controls ($p = .011$). Change in self-assessment of the number of days per week of exercise or in enjoyment of exercise did not differ between groups (Table 3).

In follow-up interviews, coordinators at controls schools described dedicating an equal amount of time during the after-school program (an average of 45 minutes per day) to physical activity as those in SPARK schools, and all coordinators felt as though they had met their daily goals of physical activity.

DISCUSSION

This study examined the impact of a district-led initiative to increase physical activity in the after-school setting using SPARK, a tested program. Similar to results from 2 recent interventions to increase physical activity after school,^{16, 17} use of the SPARK program did not result in a measurable increase in MVPA after school. SPARK has been shown to increase MVPA for students *during* the school day over the course of 2 years.⁷ It is possible that the present study, spanning only 5 months, did not allow sufficient time for after-school staff to become familiar with and fully implement the SPARK program. However, the present findings, taken together with results from the recent studies of Robinson et al and Klesges et al,^{16, 17} highlight the challenging nature of increasing physical activity after school.

One barrier to increasing physical activity among elementary school students may be that this age group is still relatively active. While youth in low-income communities have been shown to have lower levels of MVPA than their more affluent peers,¹⁸ the largely low-income students in the present study were active at baseline, achieving an average of 21 minutes of MVPA in the after-school period and nearly 60 minutes of total daily MVPA, the level recommended by the Department of Health and Human Services.¹⁹ After-school physical activity levels were similar to those seen in Trost's 2008 study (20.3 minutes of MVPA) among 3rd to 6th grade students from higher income families (mean free or reduced meal eligibility 43%).

High baseline levels of after-school MVPA in this study may reflect dedicated after-school physical activity coordinators who were functioning at a high level prior to the study. All 6 coordinators expressed high motivation for promoting physical activity among youth. It would be interesting to examine SPARK's impact after school among staff with less training and affinity for physical activity.

The present study confirms prior findings demonstrating lower levels of physical activity among girls than boys²⁰ and highlights the need for interventions targeting girls. While girls' after-school MVPA in the present study (14 minutes) was higher than that for girls in Robinson's study (approximately 10 mins),¹⁶ Robinson used Treuth's cutpoint for MVPA of 3000 activity counts per minute.²¹ Using that cutpoint, girls in the present study would achieve only 8 minutes of MVPA after school (data not shown). The most recent study comparing data reduction approaches with the Actigraph accelerometer found that Treuth's cutpoint yielded an increased false negative rate, and suggested using Evenson's cutpoints for 5–15 year old youth.²² The use of consistent cutpoints in future research will allow for more accurate comparisons across interventions and populations.

The study schools did not expand the amount of time dedicated to physical activity after school. The after-school programs dedicated an average of 45 minutes to physical activity and students spent about half this time engaged in MVPA. There is likely a ceiling effect for MVPA, as even in high-performing schools, only 40% of time is spent in MVPA during

PE.²³ Therefore, with students spending 50% of time in MVPA at baseline, increasing time allotted for physical activity may be necessary to increase MVPA.

Given no change in MVPA, it is not surprising that the present study demonstrated no decrease in BMI z-score or increase in cardiorespiratory fitness. Intervention students' self-perceived physical activity levels relative to their peers did increase, which could reflect increased self-efficacy for physical activity. Given that increasing self-efficacy for physical activity predicts increased physical activity, a longer-term study of the SPARK program would be valuable in order to assess potential long term effects of the program on physical activity.

Many limitations should be considered in interpreting these results. In this quasi-experimental study, accelerometers were only worn for 3 days at each time period and may not, therefore, be representative of activity levels over a full week. Given the clustered nature of students in schools, we may have been under-powered to detect difference in outcomes; however, changes were small overall and it is unlikely we missed important effects. Finally, 2 of the 3 coordinators at control schools received a SPARK training 4 months prior to the start of the study. However, if exposure to the SPARK curriculum influenced coordinators in control schools, we would have expected to see an increase in physical activity among control students, which was not the case.

Conclusion

The school district in the present study showed significant commitment to increasing physical activity, creating a policy to ensure at least 30 minutes of activity in the after-school setting. It is heartening that student health and specifically obesity risk are being addressed in school policies. However, the results of the present study suggest that introducing the SPARK program without simultaneously increasing time dedicated to physical activity is unlikely to increase MVPA in the after-school setting.

IMPLICATIONS FOR SCHOOL HEALTH

The after-school setting offers a prime opportunity to promote physical activity in youth. Schools where current levels of physical activity are low might benefit from adding curricula such as SPARK. However, it is likely that increasing *time allotted* for physical activity in after-school programs will be as important as adopting new curriculum, particularly in schools where staff are already successfully engaging youth in physical activity.

Human Subjects Approval

The University of California San Francisco's Committee on Human Research approved this study.

Acknowledgments

NICHD 1K23HD054470-01A1, and American Heart Association 0865005F. No funders were involved in any aspect of the analyses contained herein or in the preparation of this manuscript.

References

1. Andersen LB, Harro M, Sardinha LB, et al. Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). *Lancet*. 2006; 368(9532):299–304. [PubMed: 16860699]

2. Yang X, Telama R, Viikari J, Raitakari OT. Risk of obesity in relation to physical activity tracking from youth to adulthood. *Med Sci Sports Exerc.* 2006; 38(5):919–925. [PubMed: 16672846]
3. Youth Online: Comprehensive Results. Centers for Disease Control and Prevention, YRBSS. 2009.
4. Madsen KA, Weedn AE, Crawford PB. Disparities in peaks, plateaus, and declines in prevalence of high BMI among adolescents. *Pediatrics.* 2010; 126(3):434–442. [PubMed: 20713482]
5. Barroso CS, McCullum-Gomez C, Hoelscher DM, Kelder SH, Murray NG. Self-reported barriers to quality physical education by physical education specialists in Texas. *J Sch Health.* 2005; 75(8): 313–319. [PubMed: 16179081]
6. Pate RR, O'Neill JR. After-school interventions to increase physical activity among youth. *British journal of sports medicine.* 2009; 43(1):14–18. [PubMed: 19019903]
7. 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. American journal of public health.* 1997; 87(8):1328–1334. [PubMed: 9279269]
8. Liu NY, Plowman SA, Looney MA. The reliability and validity of the 20-meter shuttle test in American students 12 to 15 years old. *Res Q Exerc Sport.* 1992; 63(4):360–365. [PubMed: 1439160]
9. California Healthy Kids Survey. San Francisco, CA: WestEd; 2010. Available at: <http://chks.wested.org/about>.
10. Obesity and cardiovascular disease risk factors in black and white girls: the NHLBI Growth and Health Study. *Am J Public Health.* 1992; 82(12):1613–1620. [PubMed: 1456335]
11. Madsen KA, Gosliner W, Woodward-Lopez G, Crawford PB. Physical activity opportunities associated with fitness and weight status among adolescents in low-income communities. *Arch Pediatr Adolesc Med.* 2009; 163(11):1014–1021. [PubMed: 19884592]
12. Esliger DW, Copeland JL, Barnes JD, Tremblay MS. Standardizing and Optimizing the Use of Accelerometer Data for Free-Living Physical Activity Monitoring. *Journal of physical activity & health.* 2005; 3:366–383.
13. Evenson KR, Catellier DJ, Gill K, Ondrak KS, McMurray RG. Calibration of two objective measures of physical activity for children. *Journal of sports sciences.* 2008; 26(14):1557–1565. [PubMed: 18949660]
14. Alhassan S, Sirard JR, Spencer TR, Varady A, Robinson TN. Estimating physical activity from incomplete accelerometer data in field studies. *Journal of physical activity & health.* 2008; 5(Suppl 1):S112–S125. [PubMed: 18364516]
15. Kuczmarski RJ, Ogden CL, et al. CDC growth charts: United States. *Adv Data.* 2000; (314):1–27. [PubMed: 11183293]
16. Robinson TN, Matheson DM, Kraemer HC, et al. A randomized controlled trial of culturally tailored dance and reducing screen time to prevent weight gain in low-income African American girls: Stanford GEMS. *Arch Pediatr Adolesc Med.* 2010; 164(11):995–1004. [PubMed: 21041592]
17. Klesges RC, Obarzanek E, Kumanyika S, et al. The Memphis Girls' health Enrichment Multi-site Studies (GEMS): an evaluation of the efficacy of a 2-year obesity prevention program in African American girls. *Arch Pediatr Adolesc Med.* 2010; 164(11):1007–1014. [PubMed: 21041593]
18. Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of adolescent physical activity and inactivity patterns. *Pediatrics.* 2000; 105(6):E83. [PubMed: 10835096]
19. Physical Activity Guidelines for Americans. Department of Health and Human Services. ODPHP Publication No. U0036. 2008.
20. Caspersen CJ, Pereira MA, Curran KM. Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Med Sci Sports Exerc.* 2000; 32(9):1601–1609. [PubMed: 10994912]
21. Treuth MS, Schmitz K, Catellier DJ, et al. Defining accelerometer thresholds for activity intensities in adolescent girls. *Med Sci Sports Exerc.* 2004; 36(7):1259–1266. [PubMed: 15235335]
22. Trost SG, Loprinzi PD, Moore R, Pfeiffer KA. Comparison of Accelerometer Cut-points for Predicting Activity Intensity in Youth. *Med Sci Sports Exerc.* Epub ahead of print.

23. Failing Fitness: Physical Activity and Physical Education in Schools. UCLA Center to Eliminate Health Disparities and Samuels & Associates. Los Angeles, CA: Funded by The California Endowment; 2007.

Table 1Baseline characteristics, mean $\pm$ SD or N (%)

	Intervention N=48	Control N=52	p value
Female	25 (52.1)	30 (57.7)	.573
Age (years)	10.3 $\pm$ 0.6	10.4 $\pm$ 0.5	.403
BMI (kg/m ²)	19.9 $\pm$ 3.6	19.4 $\pm$ 4.3	.635
BMI z-score	0.7 $\pm$ 1.0	0.4 $\pm$ 1.1	.295
BMI 85 th percentile for age and sex	18 (37.5)	17 (32.7)	.661
Race:			.370
African American	2 (4.2)	0 (0.0)	
Asian	24 (50.0)	29 (55.8)	
Latino	13 (27.1)	18 (34.6)	
White	2 (4.2)	1 (1.9)	
Other	7 (14.6)	4 (7.7)	
After-School Length (min)	173.3	180.0	.853
Time in MVPA (min)			
After School	22.7 $\pm$ 14.8	20.6 $\pm$ 13.4	.763
School-Day	24.1 $\pm$ 10.5	19.9 $\pm$ 12.2	.392
Weekday (6a – 10pm)	62.9 $\pm$ 28.0	55.7 $\pm$ 26.6	.524
VO2max (ml/kg*min)	41.3 $\pm$ 2.1	42.2 $\pm$ 2.3	.467

Table 2

Change from baseline to follow-up

	Intervention N=47	Control N=51	Adjusted p Values
BMI	0.4 ± 0.6	0.2 ± 0.7	.330
BMI z-score	0.04 ± 0.2	-0.00 ± 0.2	.484
Time in MVPA (mins)			
After School	-1.4 ± 10.8	4.2 ± 17.1	.360
School Day	7.6 ± 11.9	1.4 ± 12.4	.190
Entire Weekday	4.5 ± 22.8	4.8 ± 27.5	.539
VO ₂ (ml/kg*min) ± SD	0.1 ± 2.0	-0.5 ± 2.5	.732

Table 3

Responses to survey questions

	Intervention		Control		p value comparing change
	Baseline	Follow-up	Baseline	Follow-up	
Level of activity compared to peers (N):					.011
More Active	8	19	19	16	
As Active	36	25	28	30	
Less Active	3	3	4	5	
Days of exercise per week (mean $\pm$ SD)	4.5 $\pm$ 1.7	5.2 $\pm$ 1.2	4.5 $\pm$ 1.5	4.6 $\pm$ 1.6	.138
Enjoyment of physical activity (N):					.095
Really Agree	34	37	41	31	
Sort of Agree	11	8	9	19	
Sort of Disagree	1	2	0	0	
Really Disagree	1	0	1	1	