Evaluation of a Two-Year Middle-School Physical Education Intervention: M-SPAN

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ABSTRACT

MCKENZIE, T. L., J. F. SALLIS, J. J. PROCHASKA, T. L. CONWAY, S. J. MARSHALL, and P. ROSENGARD. Evaluation of a Two-Year Middle-School Physical Education Intervention: M-SPAN. *Med. Sci. Sports Exerc.*, Vol. 36, No. 8, pp. 1382–1388, 2004. **Purpose:** School physical education (PE) is highly recommended as a means of promoting physical activity, and randomized studies of health-related PE interventions in middle schools have not been reported. We developed, implemented, and assessed an intervention to increase physical activity during middle-school PE classes. **Methods:** Twenty-four middle schools (approximately 25,000 students, 45% nonwhite) in Southern California participated in a randomized trial. Schools were assigned to intervention ($N = 12$) or control ($N = 12$) conditions, and school was the unit of analysis. A major component of the intervention was a 2-yr PE program, which consisted of curricular materials, staff development, and on-site follow-up. Control schools continued usual programs. Student activity and lesson context were observed in 1849 PE lessons using a validated instrument during baseline and intervention years 1 and 2. **Results:** The intervention significantly ($P = 0.02$) improved student moderate to vigorous physical activity (MVPA) in PE, by approximately 3 min per lesson. Effects were cumulative; by year 2 intervention schools increased MVPA by 18%. Effect sizes were greater for boys ($d = 0.98$; large) than girls ($d = 0.68$; medium). **Conclusions:** A standardized program increased MVPA in middle schools without requiring an increase in frequency or duration of PE lessons. Program components were well received by teachers and have the potential for generalization to other schools. Additional strategies may be needed for girls. **Key Words:** EXERCISE, PHYSICAL ACTIVITY, ADOLESCENTS, CHILDREN

Physical activity is important for children's current and future health, (5,6,10,25,26) and current recommendations call for at least 60 $min \cdot d^{-1}$ of moderate-to-vigorous physical activity (5,15). School-based physical education (PE) is one of only five interventions to be strongly recommended as a means for increasing physical activity by the Task Force on Community Preventive Service (7,11). In addition to being a source for developing knowledge and skills that promote engagement in lifelong physical activity, PE can provide children with a substantial proportion of the physical activity recommended for health purposes (6,20,25,26).

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The provision of quality daily PE to all students has long been promoted by physical education professionals (e.g., National Association for Sport and Physical Education) (4,12,15,16). More recently numerous agencies and organizations external to the profession have recognized the importance of PE and provided support for this policy, including the American Academy of Pediatrics (1), American Heart Association (3), American College of Sports Medicine (2), Centers for Disease Control and Prevention (6), and U.S. Department of Health and Human Services (25,26). Policy recommendations calling for daily PE often go unheeded (4,12). The School Health Policies and Programs Study (SHPPS) reported that only 6–8% of secondary schools provided daily PE or its equivalent to all grades throughout the school year, although daily PE is more common in middle schools (4). Meanwhile, direct observational data show that physical activity levels of children in elementary schools may be as low as 36% of class time, (14,24) far short of the 50% recommended by Healthy People 2010 (25).

Randomized trials of enhanced PE have been conducted in elementary schools (14,18,21,24), but there is a paucity of controlled intervention studies that target the nearly 14,000 middle and junior high schools in the United States. In the

one middle-school study that stands out, PE was one component of a successful multidisciplinary school-based health behavior intervention program (Planet Health) that focused on obesity control (9). The relative contribution of the PE component in that study is unknown, however, because direct measures of changes in physical activity of students during PE lessons were not examined.

The present research team recently reported the results of a study (M-SPAN: Middle School Physical Activity and Nutrition) that used environmental, policy, and social marketing interventions to increase physical activity and reduce fat intake of students on middle-school campuses (22). Overall results indicated that changes in physical activity on campus were significant for boys but not girls, and that the nutrition interventions did not reduce dietary fat intake at school. There was some evidence of a favorable intervention effect on boys' body mass index. The earlier paper reported overall changes in physical activity that occurred on campus in specific locations during the school day, as well as before and after school. The current paper focuses specifically on the conduct of PE lessons, and describes the outcomes and process evaluation of a 2-yr intervention consisting of curricular materials, staff development, and on-site consultations.

METHODS

Schools and Research Design

Public middle schools ($N = 48$, grades 6–8 only) within a 1-h drive of a university campus in Southern California were invited to participate in a study of physical activity and nutrition. As incentive to participate, schools were offered $1000 toward the purchase of equipment. The first 24 schools to sign an agreement, approved by institutional review boards of the university and the six participating school districts, were accepted into the study.

Participating schools were diverse in size, facilities, and population characteristics. They had an average enrollment of 1109 (SD = 356) students, with 45% (SD = 20) being nonwhite and 39% (SD = 22) receiving free or low-cost meals. After baseline measures (Spring 1997), schools were stratified by school district and randomly assigned to receive 2 yr of intervention ($N = 12$) or serve as measurement-only controls ($N = 12$).

PE Intervention

M-SPAN PE intervention staff conducted professional development (i.e., in-service training) sessions for intervention school PE teachers on a voluntary basis. Five 3-h sessions were provided; three during year 1 (1997–98) and two during year 2 (1998–99). The staff development program had four main goals: 1) create teacher awareness of the need for active, health-related PE; 2) assist teachers to design and implement active PE curricula; 3) develop teachers' class management and instructional skills to enhance physical activity and student learning; and 4) provide ongoing support for change. Prior elementary school studies provided structured curricula because a substantial amount of PE was taught by classroom teachers (14,21). In contrast, M-SPAN focused on providing sample materials and assisting middle-school physical educators with revising existing programs and instructional strategies to increase student moderate to vigorous physical activity (MVPA).

Staff development sessions included a balance of didactic instruction and modeling/rehearsal. Teachers set goals (i.e., "action plans") for modifying PE at their schools, and these goals were revisited at subsequent sessions. During the final three in-service sessions, teachers were invited to make short presentations to peers to illustrate physical activity promotion strategies they had successfully implemented.

The M-SPAN PE staff consisted of three part-time, credentialed PE teachers. Each had over 10 yr experience in public schools, and they were trained to do staff development by the investigators. In addition to group sessions, they provided school site consultation visits approximately twice per month in year 1 and once per month during year 2. In this capacity, they provided motivation and technical support, modeled lesson segments, and provided recommendations and feedback to teachers.

Data Collection: Outcome Measures

SOFIT (System for Observing Fitness Instruction Time). Primary outcome data were obtained through direct observation using SOFIT, which provided simultaneous records of student activity levels, the lesson context in which they occurred, and teacher behavior (13). Detailed procedures for using the instrument are published elsewhere (13,14). Lesson context refers to how lesson time is being allocated at the observation moment, and includes time for class management, knowledge, physical fitness, skill drills, game play, and free play. Briefly, the physical activity levels of four randomly selected students, the lesson context, and teacher behavior were coded every 20 s throughout entire lessons. The five physical activity codes (lying, sitting, standing, walking, and vigorous) have been calibrated using heart rate monitoring (13,19) and validated using accelerometers (23). Walking and vigorous intervals were summed to indicate MVPA. The number of students participating actively (aka, "dressed out") in class was recorded.

Observation schedule. The conduct of PE was observed during lessons on 11 randomly scheduled days at each school (total of 264 observation days from February 1997 to June 1999). To account for seasonal variability and curricular diversity, observation days were completed in 11 cycles, with each school being observed during one day in each cycle. Lessons to be observed were stratified by grade, teacher type (classroom vs PE specialist), and teacher gender. PE was typically taught outdoors, and observations were not made during inclement weather.

SOFIT observer training, assessment, and recalibration. Five trained staff members conducted all observations. Their initial training included classroom lectures and discussion, videotape assessment, and field practice. During training, the observers became certified by reaching

an interobserver agreement criterion of 85% on all variables on precoded "gold-standard" videotaped lessons. Observers were reassessed using this criterion before each school semester, and a review session was provided each semester to reduce interobserver disagreement and observer drift.

Reliability assessment. Field-based inter-observer reliabilities were conducted throughout the study. Equipped with a y-adapter and two earphone jacks, two observers independently coded the same students during the same lesson while being paced by a single tape recorder. Percent inter-observer agreement (IOA) was calculated. Seventy-four lessons were coded for reliability on 53 d. Overall IOA were 83%, 95%, and 80% for student activity, lesson context, and teacher behavior, respectively. The intraclass correlation for independent observers was 0.96 for MVPA minutes.

Data Analyses: Outcome Measures

Randomized regression models examined changes over time by condition in minutes and lesson proportion spent in MVPA by boys and girls separately and combined. Follow-up tests examined changes in MVPA minutes and proportion within specific lesson contexts. School was the unit of analysis ($N = 24$), and time points were baseline, intervention year 1, and intervention year 2. Effect sizes (d) were calculated for change scores, interpreted as small (0.20), medium (0.50), and large (0.80) (8).

Data Collection: Process Measures

Obtaining process measures, including acceptability levels by users, is important for assessing the implementation of program components and for understanding intervention effects (14,24). Four measures related to the quality of the intervention and its acceptability were collected.

Student enjoyment of and attendance at PE. Surveys were distributed to students in randomly selected classes at all schools. Students completed questionnaires anonymously and returned them to classroom teachers in sealed envelopes. A total of 1578 students (response rate = 72%) completed questionnaires at baseline and 1434 (response rate = 60%) at year 2. One question asked students to score their agreement with the statement, "I like physical education (PE) class" on a five-point Likert-type rating scale (from 1 = strongly disagree to 5 = strongly agree). Another question asked students to indicate how many days they went to PE class (0–5). In a pilot study ($N = 95$ students), 2-wk test-retest reliability intraclass correlations of these PE liking and attendance items were 0.54 and 0.34, respectively, indicating some variability over time.

Teacher evaluation of staff development sessions. At the end of staff development sessions, all participants were asked to evaluate the quality of the session and the usefulness of its content by completing a 20-item survey anonymously. Approximately 20% of participants in staff development sessions were classroom teachers, but they were responsible for only 6% of the PE lessons at schools (all at sixth grade). A total of 215 evaluations (response rate = 89%) were received (80% from credentialed PE specialists, 19% from classroom teachers, and 1% from others). Teachers had from 0 to 39 yr experience teaching PE (median = 13 yr).

Teacher debriefing questionnaire. At the end of year 2, a questionnaire designed to assess teacher satisfaction with each M-SPAN PE component was mailed to intervention schools. Administrators were asked to distribute the questionnaire to teachers who were conducting PE that year and had been exposed to M-SPAN for at least 8 months. The questionnaire included 18 items with a seven-point Likert-type scale (1 = lowest; 7 = highest). Completed questionnaires (response rate = 70%) were received from 42 teachers (mean = 3.5 teachers per school; 81% were from PE specialists). Respondents had taught PE for an average of 14.6 yr (SD = 9.2; range 1–39 yr).

RESULTS

All 24 schools completed the study within their allocated intervention condition, and data from all schools were used in analyses. No adverse effects were reported (see process measures).

Outcome Measures

A total of 1849 lessons (430 at baseline; 711 in year 1; 708 in year 2) taught by 214 teachers (47% female) were observed (mean = 77 lessons per school). From 7 to 14 different teachers were observed per school, and the mean size of classes was 37.5 (SD = 3.8) students.

Across all observations, actual (i.e., observed) lesson length (i.e., time students spent in the instructional setting) was 69% of scheduled lesson length. Actual lesson length was 34.3 min (SD = 4.6) at baseline, 35.5 min (SD = 4.2) during year 1, and 36.7 min (SD = 4.5) during year 2. Changes in lesson length were not significant (condition × time: $F(2,21) = 1.23$, $P = 0.306$).

Table 1 presents unadjusted means and standard deviations for the number of minutes students in intervention and control schools spent at various activity levels, in different lesson contexts, and accompanied by different teacher behaviors at the three time points. Statistical tests were conducted only for the MVPA results. The intervention resulted in significant overall increases in the time students spent in MVPA [$F(1,46) = 5.43$, $P = 0.02$; d = 0.88], approximately 3 min per lesson. Intervention effects on MVPA were cumulative and were different for boys and girls (Fig. 1). Effect sizes on MVPA were large for boys (d = 0.98) [$F(1,22) = 8.36$, $P = 0.009$] and moderate for girls (d = 0.68) [$F(1,46) = 3.20$, $P = 0.08$]. By year 2, girls in intervention schools were engaging in MVPA at a level similar to the boys in control schools. From baseline to year 2, intervention schools increased MVPA by 18%, compared with 3% for control schools.

The intervention had a moderate effect (d = 0.66) but nonsignificant trend [$F(1,46) = 2.99$, $P = 0.09$] for increas-

TABLE 1. Unadjusted means (SD) for minutes per lesson for student activity levels and lesson context in intervention ($N = 12$) and control ($N = 12$) schools during baseline, year 1, and year 2.

	Lesson Minutes					
	Baseline ($N = 430$)		Year 1 ($N = 711$)		Year 2 ($N = 708$)	
Category	I	C	I	C	I	C
Student activity						
Lying down	0.2 (0.2)	0.6 (0.7)	0.1 (0.1)	.1 (0.1)	0.1 (0.1)	0.1 (0.1)
Sitting	6.5 (1.9)	5.3 (3.2)	5.1 (1.8)	5.8 (2.5)	4.8 (1.8)	5.7 (2.4)
Standing	11.3 (2.9)	12.0 (2.5)	11.5 (2.3)	12.1 (2.3)	13.0 (2.7)	12.4 (2.3)
Walking	11.6 (2.5)	11.5 (1.5)	13.6 (2.1)	12.4 (2.0)	14.3 (2.3)	11.9 (2.3)
Very active	4.9 (1.8)	5.0 (0.7)	5.3 (1.5)	4.6 (1.2)	5.2 (1.0)	5.0 (1.2)
*MVPA	16.6 (3.4)	16.5 (1.4)	19.0 (3.3)	17.0 (2.1)	19.5 (3.1)	16.9 (2.1)
Lesson context						
Management	9.4 (1.2)	9.3 (2.2)	9.7 (1.0)	10.2 (2.0)	11.0 (2.5)	10.9 (2.3)
General knowledge	1.8 (1.4)	1.9 (1.5)	1.9 (1.5)	2.1 (1.0)	1.8 (0.9)	1.7 (1.0)
Fitness know	0.1 (0.1)	0.1 (0.2)	0.1 (0.1)	0.1 (0.2)	0.0 (0.0)	0.2 (0.5)
Fitness activity	10.2 (3.9)	6.6 (2.7)	9.0 (3.8)	7.4 (2.2)	8.0 (3.4)	7.7 (2.9)
Skill drills	1.5 (1.3)	2.1 (1.3)	3.3 (2.3)	2.6 (1.4)	2.9 (3.0)	1.8 (1.0)
Game play	9.3 (5.1)	10.6 (4.9)	9.3 (2.6)	9.9 (3.6)	10.2 (5.2)	8.9 (5.5)
Free play	1.1 (2.5)	3.5 (2.8)	2.4 (1.7)	2.9 (2.6)	3.5 (2.9)	3.9 (6.0)
Lesson factors						
Length (min)	34.5 (4.0)	34.0 (4.9)	35.7 (4.2)	35.0 (4.0)	37.4 (5.1)	35.2 (4.3)
Class size (no. students)	35.9 (3.1)	37.8 (4.2)	35.1 (4.4)	39.2 (4.7)	37.3 (3.9)	39.0 (5.6)
Observed per school	17.9 (1.4)	17.9 (1.0)	29.2 (1.5)	30.0 (1.1)	30.1 (1.5)	28.8 (2.9)

N refers to number of lessons observed. MVPA, moderate-to-vigorous physical activity (walking + very active). Class size is the count of students participating during a lesson.
* indicates a time × condition interaction $P < .05$.

ing the proportion of class time students engaged in MVPA (Fig. 2). During year 2, students in intervention schools were active about 52% of lesson time, compared with 48% for those in control schools. Intervention schools surpassed the Healthy People 2010 objective of engaging students in MVPA 50% of class time; control schools remained close to baseline levels.

Follow-up analyses examined the lesson contexts in which student MVPA was increased. Teachers in intervention schools did not make substantial changes in the amounts of time they allocated to lesson contexts (Table 1), but compared with teachers in control schools, they began to maximize opportunities for MVPA during fitness activities, game play, and free play (Fig. 3). In group by time comparisons, however, the only significant effect for MVPA within lesson contexts was for management time (i.e., time spent in the management of students and equipment) (13).

Process Measures

Student enjoyment of and attendance at PE. Changes in PE enjoyment ratings from baseline to year 2 were examined at the school level using gender specific, repeated measures ANOVA. Time by condition changes were not significant for boys [$F(1,21) = 0.094$, $P = 0.743$] or girls [$F(1,22) = 0.267$, $P = 0.611$], indicating enjoyment of PE did not change as a result of the intervention. Students reported attending PE 4.7 $d \cdot wk^{-1}$ at each measurement period, and there were no significant changes over time for either boys or girls.

Teacher evaluation of group staff development sessions. Teachers were positive about the content and quality of sessions. Mean responses on a five-point Likert-type scale (1 = not at all useful; 5 = very useful) indicated participants found the information they received as very useful. Typical ratings were 4.8 ± 0.5 for overall usefulness, 4.7 ± 0.5 for creating an enjoyable student environment, 4.5 ± 0.5 for the high activity curriculum, and 4.7 ± 0.6 for activity demonstrations. Similarly, teachers perceived the quality of sessions (1 = poor; 5 = excellent) to be high, with an overall rating of 4.9 ± 0.3 and subcomponents ranging from 4.5 ± 0.8 for quality of audio-visual materials to 5.0 ± 0.02 for facilitators' knowledge and ease of understanding.

Teacher debriefing questionnaire. Overall, respondents participated in an average of 3.7 of the 5 group staff development sessions (50% attended all 5; the others attended an average of 2.2 sessions). The teachers were positive about the program and would highly recommend it to

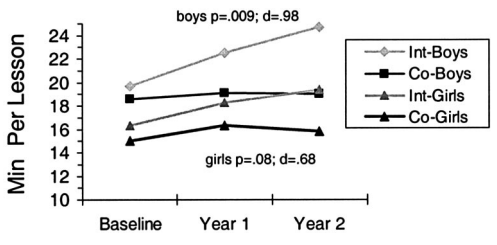

FIGURE 1—Minutes of moderate-to-vigorous physical activity for boys and girls during physical education lessons in 12 intervention and 12 control schools at baseline and intervention years 1 and 2.

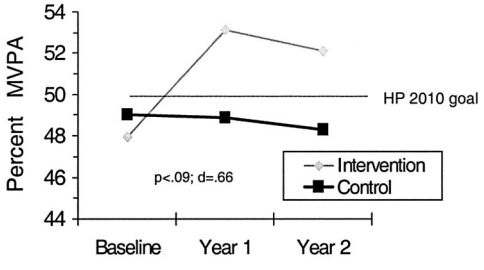

FIGURE 2—Percent of time students engaged in moderate-to-vigorous physical activity during physical education lessons in 12 intervention and 12 control schools at baseline and intervention years 1 and 2.

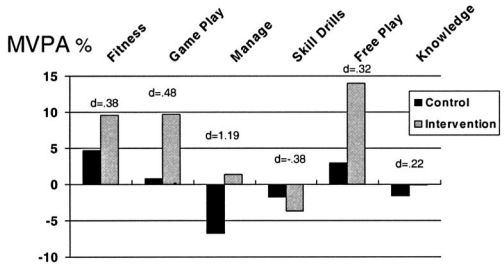

FIGURE 3—Percent change in moderate-to-vigorous physical activity (MVPA) during six specific lesson contexts from baseline to year 2 in 12 intervention and 12 control schools.

others (Table 2). They were particularly satisfied with the quality of materials and the M-SPAN instructors and believed the program improved the status of PE at their school and their own instructional skills. Ratings associated with making changes in programs, including engendering administrative support, were positive but somewhat lower. Teachers rated group staff development sessions substantially higher than on-site individual meetings and gave their lowest ratings to factors that were only indirectly associated with the conduct of PE (e.g., using volunteers and community volunteers).

DISCUSSION

A staff development program increased physical activity in middle-school PE without requiring increases in class frequency or duration. An 18% increase in physical activity during PE classes was attained without hiring new teachers or taking more time away from other curricular areas. We expected increases in physical activity to result from teachers modifying the structure (i.e., context) of lessons, such as by increasing time for fitness activities, but this did not occur. Instead, the mechanism of effect appeared to be the increased proportion of time students were active within selected lesson contexts, specifically fitness activities, game play, free play, and management (Fig. 3). Effects within individual contexts were not statistically significant (except for management); however, their combined effects were significant. Teachers could enhance the efficiency of management time by doing such things as having students warm up while calling roll or distributing equipment.

TABLE 2. Postimplementation ratings of M-SPAN by teachers (based on a 7-point scale).

Characteristics	Mean (SD)
General	
Clarity of M-SPAN materials	6.5 (0.9)
Quality of M-SPAN instructors	6.4 (1.2)
Recommendation of M-SPAN PE to other teachers	6.3 (1.0)
Overall impression of M-SPAN PE	5.9 (1.2)
Beliefs	
M-SPAN improved status of PE at school	5.7 (1.1)
Program beneficial to students	5.6 (1.2)
Personal instruction improved	5.6 (1.2)
Students' level of satisfaction with PE activities	5.4 (1.1)
M-SPAN helped school clarify PE goals	5.4 (1.1)
School administrators supported teachers' changes	5.4 (1.5)
Usefulness	
Group in-service sessions	6.1 (1.0)
Planning materials	5.9 (1.2)
Follow-up sessions	4.9 (1.7)
Out-of-PE resources	4.9 (1.6)
Volunteers	4.6 (1.9)
Incorporating community PA providers	4.4 (1.8)
Personal implementation effort	
Level of personal attempt to make changes	5.4 (1.1)
Ease of making M-SPAN changes	5.2 (1.1)

At baseline, the proportion of class time MVPA was less than the 50% recommended in Healthy People 2010 (25). Training, materials, and consultation were sufficient to surpass this national objective during the first year. Overall, students in intervention schools were in MVPA about 52% of lesson time, whereas those in control schools were in MVPA about 48% of the lesson. Thus, the type of intervention developed for M-SPAN can assist in achieving increased time for the practice of physical skills and game tactics and help meet health objectives. Health effects of physical activity are more related to actual time spent being active than the proportion of a lesson. At year 2, intervention students spent an average of 2.6 more min in MVPA per PE lesson than controls (i.e., 13 $min \cdot wk^{-1}$). Over a 36-wk school year, the intervention would provide an additional 7.8 h of physical activity per student, amounting to about 2494 kcal or 0.71 lb of weight gain prevention for a 41-kg adolescent. Over the 3 yr of middle school, about 2.1 pounds of weight gain prevention could be achieved from the modest increase in daily MVPA in PE. This more efficient use of PE time for physical activity could make a modest contribution to meeting activity guidelines and helping control the epidemic of overweight in youth. Unlike individually oriented behavior change strategies, PE reaches virtually all students. Thus, improved PE can be a strategy that reduces health disparities among youths. The limited change in MVPA is acknowledged, highlighting the need for further development and evaluation of health-related PE for middle schools and for interventions in other settings to create a comprehensive approach to youth physical activity promotion.

Figure 1 indicates intervention effects were cumulative, and 1 yr was not sufficient. Anecdotally, it appeared teachers needed to go through a process of change that required them to understand, accept, and implement new concepts and teaching methods before they became habitual. It also took time for teachers to become comfortable with consultants, implement even small changes in school policies, and become fully engaged in adopting a health-related approach to PE. The adopted changes included both managerial (e.g., incorporating physical activity during the taking of roll) and curricular decisions (e.g., considering that providing physical activity was more important than talking about the history of a sport).

A disappointing finding was that the physical activity increase for girls was not statistically significant ($P = 0.08$). This occurred despite the vast majority of PE classes being coeducational, permitting boys and girls to be exposed to the same teaching methods in the same classes. This result suggests additional intervention strategies may be needed for girls, such as including activities more preferred by girls, single-sex activities, and different motivational and instruc-

tional techniques. Although the intervention effect on girls' physical activity was not significant, the effect size was in the medium range (d = 0.68), indicating girls were obtaining some benefit. Nevertheless, it is essential to ensure that enhanced PE benefits girls and boys similarly. The Trial of Activity for Adolescent Girls (TAAG), recently funded by the National Heart, Lung, and Blood Institute, is evaluating physical activity interventions specifically tailored for middle-school girls.

Another disappointment was that the SOFIT instrument did not assess teacher behavior as well as we would have liked. PE was typically conducted in large, outdoor, noisy settings, and often it was difficult for observers to hear teachers.

Teachers' ratings of the usefulness and quality of the training sessions were high, supporting the approach used in staff development. Rather than providing structured curriculum materials similar to those used in elementary schools where a substantial amount of PE is taught by classroom teachers, (14,21) the goal was to assist middle-school PE specialists make incremental improvements in their current curricula and instructional strategies. Ratings of each intervention component confirmed that teachers valued staff development, sample materials, and on-site consultations. An important limitation, especially of the final debriefing questionnaire, was that nonrespondents could have been less positive about the staff development. Student surveys did not demonstrate intervention effects on enjoyment of PE or attendance at classes. Levels for both variables were high at baseline, leaving little room for improvement.

It is useful to consider how to improve the intervention. One goal was to reduce lesson time spent in management and free play, but this was not accomplished. It appears additional strategies need to be developed to achieve these desired changes in lesson organization. Intervention effects were cumulative (Fig. 1), so continuing the intervention for at least 2 yr is recommended. Additional time is especially needed when attempting to bring about policy changes within a school or district, and adopting health-related goals for PE can be considered a policy change. Follow-up booster sessions are important, particularly because the turnover rate for teachers in some schools approaches 14% per year (17). The study design prevented investigators from providing direct feedback on MVPA to teachers and from using videotapes of their lessons to enhance instruction; these procedures are recommended during dissemination because they allow teachers to quickly assess individual progress toward goals.

The M-SPAN study appears to be the first evaluation of a health-related PE intervention for middle schools. Strengths included 2 yr of systematic intervention, use of direct observation for assessing primary outcomes, collection of process data, and use of the school as unit of randomization, intervention, and analysis. The study was large, encompassing 24 middle schools with diverse ethnic and socio-demographic characteristics and over 25,000 students per year. The size enhances generalizability, though a restriction to Southern California is a limitation that needs to be overcome by evaluating similar interventions in different regions. Unlike some parts of the United States, all schools in the study had PE every school day. Improving PE in schools offering only one to four lessons per week may be even more challenging, because implementing policy changes for additional or longer lessons is beyond the direct control of PE teachers.

Including 24 schools in an intervention study presents logistical and budgetary challenges, but 24 is a small number of analysis units, limiting power to detect statistically significant effects. Nevertheless, overall effects on physical activity, particularly for boys, were significant. Computing effect sizes aided interpretation, particularly because they showed the intervention effect for girls was of medium size, even though not statistically significant. Although any intervention that increases physical activity in entire populations of youth need to be taken seriously, the specific health benefits of three additional minutes per day of physical activity in PE are not clear. It would be useful for subsequent studies to evaluate multiple potential outcomes of enhanced middle school PE. Because other interventions were simultaneously being implemented by M-SPAN to promote physical activity and reduce dietary fat outside of PE, the PE intervention may have taken place in a context more favorable than normal. This is another reason why the study should be replicated.

In summary, this study showed a sustained and realistic intervention can increase students' physical activity in middle-school PE. This was done without permanent investments of hiring new staff or taking additional time from academic coursework. Teachers were able to provide more opportunities for physical activity within certain lesson contexts, without radically changing the structure of lessons. All components of the intervention were well received by teachers, suggesting the potential for dissemination. Further research is needed to evaluate enhancements to the intervention, develop approaches that will be more effective for girls, and replicate the program in other regions. Although the present intervention allowed schools to surpass the Healthy People 2010 (25) objective for amount of physical activity in PE, the absolute increase in daily physical activity was limited, and it is clear that PE alone cannot provide young people all the physical activity they need. Schools, communities, parents, and governments need to place a higher priority on encouraging young people to be physically active daily and to provide programs and environments that make it easy to be active.

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Potential Conflict of Interest: 1. Some MSPAN curricular materials used in the intervention are available (under a different name "SPARK Physical Education Program-Grades 6–8") by The SPARK Programs, an affiliate of SPORTIME, an equipment distributor. Mr. Rosengard is the Executive Director of The SPARK Programs, and Drs. McKenzie and Sallis serve as consultants. 2. The results of the present study do not constitute endorsement of these materials by NIH-NHLBI (funding support), the authors, or ACSM.

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