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Participatory Action Research to Improve Physical Education in San Francisco Public Schools

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Participatory Action Research to Improve Physical Education in San Francisco Public Schools

by

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DISSERTATION

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DEDICATION AND ACKNOWLEDGEMENTS

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A version of Chapter 1 of this dissertation has been published in *Preventing Chronic Disease*.[1] Kristine Madsen, MD, MPH supervised the research that forms the basis of this dissertation chapter and is listed as a coauthor on this publication. The published material is substantially the product of Hannah Thompson's period of study at UCSF and was primarily conducted and written by her. The work she completed for this published manuscript is comparable to a standard dissertation chapter.

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[1] Thompson, H.R., J. Linchey, and K.A. Madsen, *Are physical education policies working? A snapshot from San Francisco, 2011.* Preventing Chronic Disease, 2013. **10**: p. E142.

ABSTRACT

Physical activity is critical for children's health, but activity levels are low. Physical education (PE) provides an ideal opportunity for all students to be physically active and learn the skills to support activity throughout life. Eighty-six percent of states have policies mandating the minimum PE minutes that students should receive. In California, the state with the largest number of public school students, education policy mandates elementary students receive 200 minutes of PE every 10 days. Yet policy compliance both nationally and in California is low, especially at the elementary level. The purpose of this dissertation was to use participatory action research methods, which include deliberate power sharing and collaboration between the researcher and the researched, to objectively assess and improve PE quality and quantity in elementary schools in the San Francisco Unified School District (SFUSD), with a focus on PE policy compliance. After forming a strategic alliance between the SFUSD, the San Francisco Department of Public Health, and UCSF, we conducted a 2-year quasi-experimental study to (1) assess PE policy compliance in 20 elementary schools in the spring of 2011 (Time 1); (2) share results within the school district and publically disseminate data on non-compliance; and (3) examine changes in PE from 2011 to 2013 (Time 2) that may have resulted from the work of the strategic alliance, including publically disclosing data. PE schedules were collected and PE classes were directly observed (Time 1, n= 91; Time 2, n=101) using a validated systematic observational tool. Results from Time 1 were shared throughout the district and received local media coverage. From Time 1 to Time 2, the proportion of schools meeting the PE mandate increased from 20% to 30% ($p<0.03$). PE increased by 11 minutes/week based on teachers' schedules (95% CI: 3.0, 19.6) and by 14 minutes/week (95% CI: 1.9, 26.0) based on observations. Key stakeholders reported increases in priority and funding for PE and attributed

improvements to the public disclosure of local data on the status of PE. Public disclosure could be a method for increasing PE quantity and ensuring greater policy compliance. Testing this approach in other settings is warranted.

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CHAPTER 1

Are Physical Education Policies Working? A Snapshot From an Urban School District

Hannah R. Thompson, Jennifer K. Linchey, and Kristine A. Madsen

ABSTRACT

Objectives: School physical education (PE) has been identified as a critical public health tool to increase youth physical activity. We sought to objectively assess compliance with PE quantity mandates (ie. minute requirements) and quality recommendations (i.e. percent of class time in health-enhancing physical activity or in skill development) in elementary, middle, and high schools in a large urban California school district. In elementary schools, we additionally examined differences in these outcomes by teacher type (credentialed PE teachers versus trained and untrained classroom teachers).

Methods: We collected PE schedules and systematically observed PE lessons (n=154) in 20 elementary, 4 middle, and 4 high schools over 4 months.

Results: Based on schools' master schedules, 83% of elementary schools complied with the mandate of 100 minutes of PE class/week; based on teachers' actual schedules, 20% of schools complied with the mandate; based on observation, 5% were in compliance. All middle and high schools complied with the mandated 200 minutes of PE class/week. On average, classes at all school levels met the recommended 50% of PE lesson time in moderate-to-vigorous physical activity (MVPA). No teacher- or school-level factors significantly predicted PE quantity, but credentialed elementary PE teachers spent more time building students' motor skills.

Conclusions: Our results suggest that current national estimates of PE, which are based on schools' self-report, overestimate PE quantity in elementary schools. While more than half of PE

class time was spent in MVPA, total physical activity from elementary PE was minimal and may do little to contribute to students' overall health.

INTRODUCTION

Despite the many health benefits of physical activity,(1) few youth achieve recommended levels of moderate-to-vigorous physical activity (MVPA).(2) Increasing physical education (PE) in school is an optimal strategy to increase physical activity for all students.(3) In addition to providing structured MVPA, PE supports acquisition of skills, knowledge, and behaviors that may facilitate a lifetime of physical activity.(4)

In California, policy mandates an average of 100 and 200 minutes of PE every week for elementary and middle/high school students, respectively.(5) Yet many schools do not comply with these mandates, particularly elementary schools.(6) Additionally, data on PE frequency are based on administrators' reports, not on objective measures.(6, 7) Thus, the actual degree of compliance with policy is unknown.

The US Department of Health and Human Services recommends that students spend 50% of PE time in MVPA (which is often used as a marker of PE class quality).(9) Credentialed PE teachers (PE specialists) have been shown to deliver greater levels of MVPA than classroom teachers.(8) However, due to budget cuts and low prioritization of PE, many elementary schools rely on classroom teachers to teach PE.(10) In some cases, part-time PE specialists build classroom teachers' capacity to lead PE through training, though many classroom teachers have no formal training in PE. Little evidence exists comparing PE delivered by specialists versus trained and untrained classroom teachers, yet these configurations likely influence the quality and quantity of PE students receive.

To address these gaps, we sought to objectively determine if schools in a diverse urban school district met California's PE quantity mandates and quality recommendations and, at the elementary level, to assess differences in PE quantity, MVPA, and lesson content in PE led by specialists versus trained and untrained classroom teachers.

METHODS

This mixed methods observational study took place between February and May 2011 in an urban district with nearly 56,000 students, 88% of whom are non-white and 60% of whom qualify for free or reduced price meals.(11) The school district's research department and the UCSF Committee on Human Research approved all study procedures.

Sample

There were 72 elementary schools in the district (36 of which had access to a PE specialist), and 13 traditional middle and 11 traditional high schools (all of which had at least 1 full-time PE specialist).

Elementary School Selection: Because assessing differences between specialist and non-specialist schools was a primary study aim, we selected 20 elementary schools for inclusion using stratified random selection based on the presence of a PE specialist (10 with a specialist, 10 without). Sample size calculations (taking the design effect into account) were based on data from an unpublished study in a different school district, and suggested that 10 schools per group would allow us to detect a 5-minute difference in MVPA (with 80% power).

Middle and High School Selection: Because differences in PE based on the presence of a specialist weren't relevant in middle/high schools (all of which had specialists), a smaller sample of 4 middle and 4 high schools was selected, based on students' average aerobic capacity scores from the previous 3 school years (fitness testing is mandatory in California in grades 5, 7 and 9). We selected the 2 schools with the lowest scores, 1 with scores closest to the 50% percentile, and 1 with the highest scores, to obtain a sample representing the range of student fitness performance across the district.

Principals at schools selected for inclusion were invited to participate in the study. All principals assented. Study measures involved observations of 5th, 7th, and 9th grade PE classes and interviews with all observed teachers.

Elementary Teacher Selection: Schools applied for a PE specialist and were selected based on need and the school's willingness to adopt the PE specialist program, which included a part-time PE specialist, district-adopted curriculum, equipment, and professional development. PE specialists provided lesson planning assistance, equipment and behavior management techniques, and strategies for implementing quality physical education. PE Specialists worked full time and rotated between 1-3 schools, teaching at each school between 1-5 days per week (reaching each classroom of students an average of once/week). All PE Specialists have a teaching credential with a specialty in PE and receive approximately 70 hours of district-led PE professional development annually. In the 36 elementary schools without a district-provided PE specialist, PE was taught by classroom teachers or an adult with physical activity experience (like coaching), but no teaching credential (hereafter called a PE leader).

Researchers observed a maximum of 2 teachers per elementary school, depending on the number of teachers teaching 5th grade PE (Figure 1). At the 10 schools with a PE specialist, researchers observed classes taught by the specialist and one randomly-selected 5th grade classroom teacher. In the 10 non-specialist schools, if there was a PE leader, we observed him/her and also observed randomly selected classroom teachers.

Middle/High Teacher Selection: In middle/high schools, researchers observed up to 3 PE specialists each in the 7th and 9th grades, respectively. When more than 3 PE specialists taught PE, we randomly selected specialists for observation (Figure 1).

Measures

PE Schedules: The district's PE Department provided researchers with schedules for all PE specialists at the beginning of the school year. Researchers obtained school-level PE master schedules (which contain PE times for all classes in the school), when available. Because elementary school teachers' PE schedules often differed from the master schedule, we additionally contacted all 5th grade classroom teachers individually to obtain their personal PE schedules.

SOFIT: We used the System for Observing Fitness Instruction Time (SOFIT) to collect data on observed lesson length, proportion of lesson in MVPA, and the lesson context in which activity occurred. Detailed SOFIT methodology has been described elsewhere.(12) In short, prompted by an audio recording, observers coded activity levels of four randomly selected students (two girls and two boys) using momentary time sampling (10-second observation, 10-second record

intervals) for the entire PE lesson. Activity levels (coded 1-5 for lying, sitting, standing, walking, and very active) have been validated using accelerometry.(13) Activity levels 4 and 5 are considered moderate and vigorous physical activity, respectively. Lesson context (classroom management, knowledge acquisition, fitness, skill drills, game play, and free play/other) was recorded simultaneously with activity levels. The scheduled lesson length was noted and the observed lesson length was recorded (the number of minutes that PE actually occurred, with observations beginning when 50% of students had entered the PE area and stopping at the lesson's termination, per SOFIT protocol).

Procedures

SOFIT: For each teacher, researchers observed PE lessons on three randomly selected days on which PE was scheduled. If a lesson did not occur, that lesson was considered a "no-show," and the researcher returned to observe on another random day. In elementary schools, 2 classroom teachers in specialist schools and 7 classroom teachers in non-specialist schools had no pre-set PE schedule, so researchers set up specific times to observe PE lessons. These lessons were not included in the proportion of no-shows.

Teacher Interviews: After PE observations were complete, we asked teachers questions adapted from the Physical Education module of the School Physical Activity Policy Assessment (S-PAPA)(14) regarding their training, years of experience with PE, and perceived support from their administration for PE.

Data Analysis

We used linear mixed models to examine the primary outcomes of scheduled lesson length, observed lesson length, and proportion of lesson time spent in MVPA (based on SOFIT). We used logistic mixed models to examine the secondary outcome of time spent in specific lesson contexts (using a binary yes/no variable for each lesson context). Given that PE specialists trained classroom teachers at specialist schools, we considered the presence of a specialist (school-level) and teacher type within elementary schools (teacher-level), as predictors in separate models. We also examined school type (elementary, middle, or high) as a predictor. We additionally used linear mixed models to examine associations between teacher-level characteristics and PE quantity. All mixed models included random effects for teacher and school to account for correlations within these domains. We checked residuals from all models, and all met the normality assumption. We also conducted sensitivity analyses using robust standard errors as a check on violations of the mixed model assumptions, with completely consistent results. We used t-tests to assess differences in length of scheduled class time versus actual class time, as well as differences in school demographic data between specialist and non-specialist elementary schools and between school types (elementary, middle, and high). All analyses were performed using Stata/MP version 11 (StataCorp LP, College Station, TX).

RESULTS

On average, study schools were diverse and low-income; 88% of enrolled students were non-white and 62% qualified for free or reduced price meals, reflecting the district's overall demographics. School demographic data did not differ significantly between specialist and non-specialist elementary schools or by school level (with the exception of student enrollment, which

differed between elementary, middle, and high schools - Table 1).

Researchers observed a total of 154 PE lessons; 91 fifth grade lessons (27 specialist observations and 21 classroom teacher observations at specialist schools and 43 non-specialist observations at non-specialist schools), 36 seventh grade lessons, and 27 ninth grade lessons.

Elementary Schools

Only 4 (20%) of the elementary schools complied with the California state mandate of 100 minutes of PE/week based on teachers' PE schedules, 3 of which were specialist schools. Master PE schedules were available at all 10 specialist and 2 non-specialist schools. While Master PE schedules for the 10 specialist schools showed 100 scheduled mins/week of PE, teachers' individual schedules reflected 78.0 mins/week. The 2 master schedules at the non-specialist schools reflected an average of 88 minutes of PE/week while the teachers' schedules reflected 84 mins/week; the remaining 8 teachers' schedules reflected 71.1 minutes of PE/week.

Overall, 33% of PE class observations resulted in no-shows, excluding lessons that did not happen due to standardized testing, fitness testing, or inclement weather. (11 teachers had 1 no-show, 1 teacher 2 no-shows, and 1 teacher had 3 no-shows.) Recurrent reasons for no-shows included: school events, field trips, and teacher absences. Based on observations, only 1 of 20 elementary schools (a non-specialist school) met the mandated 100 minutes of PE/week.

When PE lessons did occur, students spent 54% of observed lesson time in MVPA; an average of 17 minutes of MVPA/lesson. Proportion of observed lesson time in MVPA did not significantly

differ between specialist and non-specialist schools (Table 2) or across teacher type (Table 3). Average observed lesson length was 5 minutes shorter than scheduled lesson length ($p<0.001$) (Table 2), resulting in an average 70 minutes of actual exposure to PE/week. Accounting for both no-shows and actual lesson length, elementary students received an average of 45 minutes of PE/week.

At specialist schools, students spent more time in skill development (21% vs. 3%, $P<0.001$) and less time in game play (19% vs. 38%, $p=0.003$) than students in non-specialist schools. This difference persisted when comparing classroom teachers at specialist schools to classroom teachers at non-specialist schools (Table 3).

Middle and High Schools

According to master schedules, all middle and high schools complied with the mandate of 200 minutes of PE/week; 7th graders had a mean 237 minutes and 9th graders had a mean 234 minutes of scheduled PE/week. (Because of block scheduling at middle and high schools, teacher schedules conformed to master schedules.) Only 3% and 0% of PE classes were no-shows at middle and high schools, respectively. Observed lesson length was approximately 10 minutes shorter than scheduled lesson length ($p<0.001$; Table 2).

Seventh and 9th graders spent 51%-56% of observed lesson time in MVPA, respectively (Table 2), equal to an average of 98 minutes of MVPA from PE/week for 7th graders and 114 minutes for 9th graders.

Middle school PE lessons were largely spent in management tasks such as giving directions and behavior management (31% of lesson time) and free play/other (27% of lesson time). High school lessons were spent primarily in fitness activities such as running, stretching, and calisthenics (33% of lesson time) and free play/other (28% of lesson time; Table 3).

Teacher Interviews

Teacher characteristics (teacher sex; years of PE teaching experience; self-reported enjoyment of teaching PE; training; and enjoyment for being physically active) were not associated with minutes of PE/week or proportion of lesson time in MVPA.

DISCUSSION

While 7th and 9th grade students had PE scheduled according to California state mandates, schedules for 5th graders fell far short of the required minutes, corroborating previous research showing that PE is under-scheduled at the elementary level based on administrator report,(6, 7, 15) and extending the literature by demonstrating a further deficiency in PE minutes based on direct observation. Among the 12 elementary schools that had a master PE schedule, teachers uniformly scheduled fewer minutes of PE than master schedules indicated. Given that many published reports of PE minutes rely on school principal (or district-level administrators) rather than teacher estimates,(6, 15, 16) current reports likely overestimate the number of actual minutes of PE students receive. Furthermore, the observed 33% no-show proportion for PE in elementary schools that suggests that published reports based on self-report could overestimate time in PE by as much as 50%.

During observed PE lesson time, students at all grade levels exceeded the recommended 50% of lesson time in MVPA. While this high proportion has been previously demonstrated,(17, 18) most research shows that students spend less than 50% of class time in MVPA.(19-22) Several factors could help explain our higher MVPA levels, such as: grades observed (other studies observed younger students or multiple grades within a school-level);(19, 20) number of lessons observed (we observed up to 3 lessons per teacher, as opposed to only 1);(19) gender (we observed both boys and girls),(22) and geographic variation (ours was a temperate climate).(19, 20, 22) Because PE occurred infrequently for 5th graders, PE did not substantially contribute to the recommended 60 minutes of daily MVPA;(23) students received an average of only 36 minutes of MVPA per week from PE. While much PE research has focused on increasing student MVPA levels when class occurs,(20, 21) to our knowledge, solid interventions to increase PE policy implementation and adherence to minute requirements have not been developed and rigorously tested. Further research is needed to identify viable methods to increase mandate compliance.

In the present study we did not find differences in MVPA based on the presence of a PE specialist. This finding, suggesting that classroom teachers were as successful as PE Specialists in engaging students in MVPA, is encouraging. An observational study involving third grade PE lessons also found no significant difference in mean MVPA between PE specialists and non-specialists.(19) However, a multicenter randomized trial of the CATCH PE intervention demonstrated greater levels of MVPA in specialist-led PE.(24) That study also demonstrated that exposure to PE Specialists was associated with more time spent developing motor skills, as we found in our study. This is an important finding given that fundamental skills taught in PE have

been shown to predict higher levels of participation in organized physical activity during adolescence.(25) Notably, even classroom teachers in specialist schools spent more time developing students' motor skills than teachers in non-specialist schools, suggesting a positive effect of classroom teachers' exposure to training by PE specialists. If budget constraints continue to limit schools' abilities to hire full-time PE Specialists, further work should identify best practices for sharing PE Specialists' time across schools.

At the middle/high school levels, students spent a considerable proportion of PE lesson time in free play and virtually no time in skill development. While free play can provide an excellent opportunity for MVPA accrual,(26) it relies on students' self-motivation to engage in activity. Students who enjoy being active may get more MVPA during free play than students who do not like to move, students who are overweight, or students who have few physical skills.(27) An increased focus on skill development or structured non-competitive game play could increase PE's reach.

Consistent with other studies, time was lost at the beginning and end of most scheduled PE lessons due to transitioning from classroom to playground or changing clothes (in middle and high school).(20) Researchers have examined innovative ways to decrease changing time between classes and maximize scheduled PE time to increase the physical activity that occurs during PE, including using instant activities that take place as soon as students enter class and using music during changing time to encourage quicker transitions.(28, 29)

While previous research has shown that lower resource schools have less or poorer quality

PE,(30) neither teacher- or school-level demographic information were associated with PE minutes or student MVPA levels in the present study. However, all schools had diverse student bodies and a high proportion of students eligible for free or reduced-price meals.

Limitations

One limitation of this study is the restriction to a single school district and a relatively small sample, which may limit the generalizability of the results. Yet, the study district's size, diversity, and urban location make it comparable to many districts across the state and country and we expect that our finding that reported minutes of PE are greater than observed minutes would be readily reproduced in other districts. While we did not use objective measures of MVPA such as accelerometers, we did use a systematic observation system that has been widely used in PE research, allowing for the comparison of effect sizes across studies. Finally, the cross-sectional nature of this study does not allow us to draw causal relationships.

Conclusions

In the present study, elementary schools did not meet California state PE requirements, and teachers did not regularly adhere to PE schedules, contributing to the growing evidence that PE mandates are not being met. Non-compliance was much greater when PE time was measured objectively than when assessed by self-report (master schedules), suggesting that more accurate measures of PE reporting are necessary. New methods to assess PE policy compliance, such as having district administrators systematically collect PE data, need to be developed and validated. Middle and high schools did meet the PE mandate; block schedules may help ensure that PE occurs with regularity. At the elementary level, it is promising that classroom teachers can

successfully engage students in MVPA during PE, but even if students are able to achieve a high proportion of PE lesson time in MVPA, if adequate PE minutes are not scheduled and if teachers do not adhere to schedules, PE may do little to contribute to students' overall health. Further research is needed to determine best practices for increasing compliance with PE policy so that elementary students receive adequate PE.

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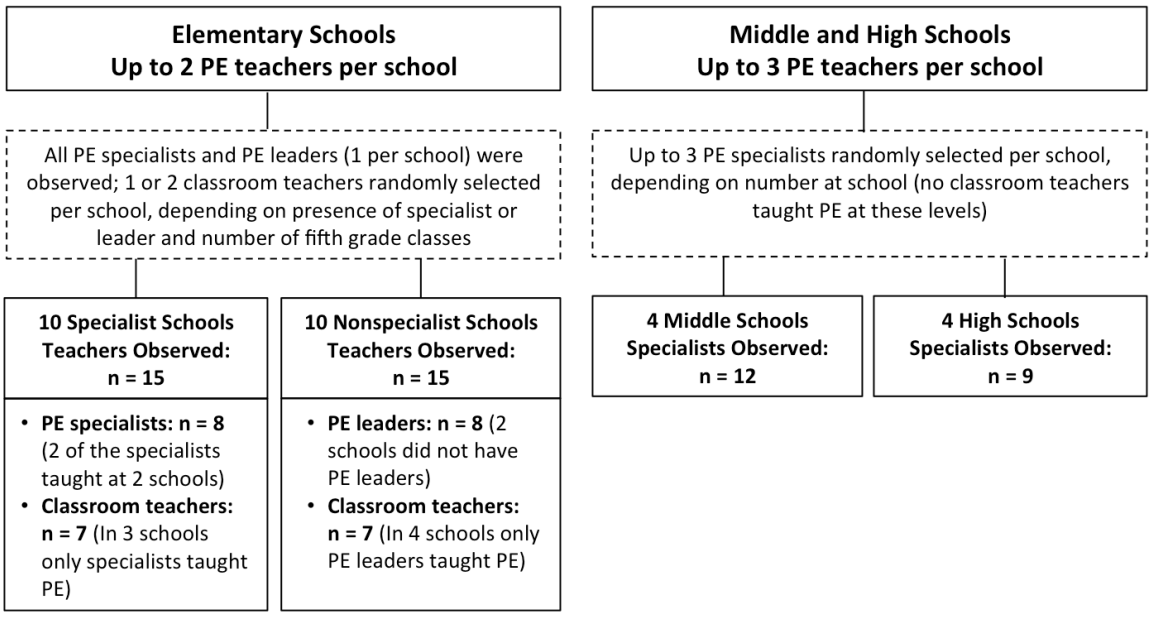
Figure 1A: Selection of 5th, 7th, and 9th grade Physical Education (PE) Teachers for Observations



Note: A PE specialist is credentialed teacher with a specialty in physical education. A PE leader is an adult who has no teaching credentials but has experience in teaching physical activities, such as coaching.

Table 1A: School Demographic Information[a] (mean ± SD)

	Elementary Schools				Middle Schools	High Schools
	All (n=20)	Specialist Schools (n=10)	Non-specialist Schools (n=10)	p-value[b]	(n=4)	(n=4)
Enrollment, #	391 ± 150	363 ± 150	419 ± 153	0.42	739 ± 360†‡	1,232 ± 900†
Proportion of students eligible for free or reduced price meals, %	60 ± 22	59 ± 22	61 ± 23	0.85	69 ± 14	65 ± 17
Non-White Race/ Ethnicity, %	87 ± 11	86 ± 11	87 ± 11	0.82	90 ± 6	94 ± 6
African American	12 ± 14	16 ± 11	9 ± 16	0.27	11 ± 8	13 ± 8
Asian	30 ± 29	30 ± 27	29 ± 31	0.94	33 ± 32	41 ± 17
Latino	29 ± 25	21 ± 17	37 ± 29	0.17	37 ± 30	24 ± 15
White	13 ± 11	14 ± 11	13 ± 11	0.82	10 ± 6	6 ± 6
API Score[c]	812 ± 92	804 ± 100	820 ± 88	0.70	753 ± 114	715 ± 163
Proportion of students in Healthy Fitness Zone for Aerobic Capacity[d], %	63 ± 17	62 ± 16	64 ± 20	0.80	63 ± 19	58 ± 18

[a] Demographic information from the 2010-2011 school year

[b] P-value for difference in means between specialist and non-specialist elementary schools; $p<0.05$ indicates statistical significance; † indicates a statistically significant difference in means between elementary and middle/high schools, ‡ indicates a statistically significant difference in means between middle and high schools.

[c] Academic Performance Index base score, a California-wide measure of a school's academic performance and growth on a variety of academic measures. Possible scores range from 200 – 1,000.

[d] The state-wide fitness test, the FITNESSGRAM, uses Healthy Fitness Zones to evaluate fitness performance in 5th, 7th and 9th graders. These zones are criterion referenced standards and represent minimum levels of fitness for age and gender that offer protection against the diseases that result from sedentary living. Aerobic capacity (VO2 max) reflects the maximum rate of oxygen uptake and utilization during exercise.

Table 2A: PE Lesson Time in Moderate-to-Vigorous Physical Activity (MVPA), mean ± SD (range)

	Elementary Schools[a]				Middle Schools	High Schools
	All (n=20)	Specialist Schools (n=10)	Non-specialist Schools (n=10)	p-value for difference (95% CI)[b]	(n=4)	(n=4)
Scheduled lesson length in minutes	36.4 ± 7.4 (25.0 – 55.0)	35.6 ± 6.6 (25.0 – 55.0)	37.3 ± 8.1 (30.0 – 55.0)	0.40 (-7.2, 2.9)	50.1 ± 2.1 † (40.0 – 57.0)	58.0 ± 20.0 † (30.0 – 95.0)
Observed lesson length[c] (minutes)	31.4 ± 7.9 (10.0 – 53.7)	32.0 ± 7.6 (10.0 – 50.0	30.7 ± 8.3 (12.3 – 53.7)	0.62 (-3.6, 6.1)	39.9 ± 3.6 † (28.0 – 48.3)	48.7 ± 17.8 † (20.0 – 90.3)
Observed proportion of lesson time in MVPA, %	54.0 ± 12.9 (22.1 – 81.0)	55.0 ± 12.9 (22.1 – 80.0)	53.0 ± 12.9 (25.0 - 81)	0.55 (-.02, .12)	51.2 ± 12.0 (26.5 – 76.0)	55.7 ± 18.4 (0.7 – 79.1)
Calculated minutes of MVPA per lesson, #	16.6 ± 4.6 (6.0 – 26.3)	17.2 ± 4.6 (7.0 – 26.3)	15.9 ± 4.5 (6.0 – 24.7)	0.36 (-1.3, 3.6)	20.4 ± 5.2 †‡ (10.0 – 31.3)	27.5 ± 14.1 † (0.3 – 53.3)

[a] A max of 2 teachers were observed per elementary school and a max of 3 teachers were observed per school for middle and high schools; all teachers were observed up to 3 times each.

[b] P-value and 95% confidence interval for difference in means between specialist and non-specialist elementary schools accounting for clustering by teacher and school; $p<0.05$ indicates statistical significance; † indicates a statistically significant difference in means between elementary and middle/high schools, ‡ indicates a statistically significant difference in means between middle and high schools.

[c] Lesson observation began when 50% of students had arrived at the PE area.

Table 3A: PE lesson characteristics in elementary lessons taught by classroom teachers,[a] by school type, mean ± SD (range)

	Specialist Schools (n=10)	Non-specialist Schools (n=10)	
	Classroom teachers (n=7)	Classroom teachers (n=7)	p-value[b]
Scheduled lesson length in minutes	36.4 ± 8.4 (30.0 – 55.0)	37.1 ± 8.2 (30.0 – 55.0)	0.88
Observed lesson length (minutes)	30.7 ± 9.0 (14.7 – 50.0)	29.1 ± 8.3 (12.3 – 47.3)	0.71
Observed[c] proportion of lesson time in MVPA, %	55.4 ± 14.9 (24.3 – 79.5)	51.6 ± 9.7 (36.5 – 73.1)	0.49
Calculated minutes of MVPA per lesson, #	16.5 ± 5.1 (8.3 – 26.0)	14.9 ± 4.4 (7.0 – 22.0)	0.41
Proportion of time spent in lesson contexts, % ± SD			
Management	28.9 ± 45.3	23.4 ± 42.4	0.06
Knowledge	12.8 ± 33.4	8.5 ± 27.9	0.45
Fitness activity	15.3 ± 36.0	21.9 ± 41.3	0.68
Skill drills	**19.2 ± 39.4** ‡	**2.5 ± 15.5**	**0.03**
Game play	17.8 ± 38.3 ‡	38.1 ± 48.6	0.05
Free play/ other	6.0 ± 23.8	5.6 ± 23.0	0.54

[a] Teachers were observed 3 times each for a total of 21 observations at specialist schools and 21 observations at non-specialist schools

[b] P-value for difference in means between teacher types, accounting for clustering by teacher and school; $p<0.05$ indicates statistical significance (SS)

[c] Lesson observation began when 50% of students had arrived at the PE area.

CHAPTER 2

Lessons Learned: A Strategic Alliance to Improve Elementary Physical Education in an Urban School District

Hannah R. Thompson, Robin Haguewood, Nicole Tantoco, Kristine A. Madsen

ABSTRACT

Background: Physical education (PE) is an important public health tool, but is often under-prioritized and lacking in schools.

Objectives: To detail the actions, impact, and successes of a strategic alliance formed by 3 collaborating organizations to improve PE in a large California school district.

Methods: Semi-structured interviews with alliance members, principals, and teachers in 20 elementary schools, three years post-alliance formation.

Lessons Learned: Interviewees reported district-level increases in priority and funding for PE and attributed improvements to the alliance's collection and dissemination of local data on the status of PE. Common goals, trust, and open communication within the alliance were seen as critical to the alliance's success. However, changes in district- or school-level accountability measures for PE were not reported.

Conclusions: This strategic alliance succeeded in promoting district-level priority and funding for PE. Ongoing alliance work will focus on increasing accountability measures for PE, which may take longer to implement.

INTRODUCTION

Health experts recommend youth participate in at least 60 minutes of daily moderate-to-vigorous physical activity (MVPA) for optimal health.(1) However, children are far from meeting this recommendation, and significant disparities exist by age, race/ethnicity, sex, and income.(2-4) The Institute of Medicine recently identified school physical education (PE) as a primary focus for increasing youth physical activity levels, as PE provides an ideal opportunity for all students to be active.(5-7)

Despite the importance of PE, programs across the country are underfunded and under-prioritized.(8, 9) While 44 states (86%) have policies mandating minimum levels of PE,(10) compliance with PE policies is suboptimal.(11-13) California, which educates 1 in 8 children in the US, mandates an average of 200 minutes of PE every 10 days in elementary school, and 400 minutes per 10 days in middle and high school.(14) However, like other states, California has low PE policy compliance,(15) likely because PE is under-supported and because policy implementation is not regularly monitored or enforced.(16, 17)

Strategic alliances represent groups of organizations voluntarily collaborating to address problems that are too large or complex for any one organization to solve independently.(18) Such alliances are an increasingly popular strategy for community health improvement. Analyzing the process by which strategic alliances facilitate change, as well as the barriers and facilitators that affect such change, may help improve community health.

Utilizing local resources and harnessing collective interest, a strategic alliance was formed in fall 2010 to assess local PE practices in the San Francisco Unified School District (SFUSD), with the primary goal of improving adherence to the state PE mandate. Alliance members included: SFUSD (which provided an on-the-ground perspective and access to schools); the local Department of Public Health (DPH – which staffs the Shape Up San Francisco Coalition, a multidisciplinary partnership to address chronic disease prevention –which convened alliance members and disseminated study results); and a university/academic partner (who advised on and conducted research) (HT, KM). A 2011 study by the alliance demonstrated that only 20% of elementary schools in the study sample were in compliance with California's PE mandate.(19) The objectives of this manuscript are to detail the alliance's actions to improve PE subsequent to the study in 2011; to describe the alliance partners' impressions of district- and school-level changes in PE; and to identify lessons learned (including barriers and facilitators to the alliance's success) that could aid others in achieving greater PE policy compliance.

METHODS

This study employed participatory action research to collaboratively examine and improve PE in SFUSD. The SFUSD Research, Planning, and Accountability Department and the Institutional Review Boards at UCSF and UC Berkeley approved all research.

Alliance Actions

Upon completion of the 2011 observational study, the alliance disseminated the study's results in an effort to increase adherence to state standards for PE minutes by: convening the alliance to discuss study results and create a dissemination plan; working together to share the study results

within the school district (including the Board of Education, top district administrators, and teachers/principals); sharing the results publicly through reports and a press-release; interviewing key stakeholders (described herein); and repeating the observational study to assess school-level changes in PE quantity (ongoing) (Table 1).

Interviews

In spring 2013, we conducted semi-structured face-to-face interviews with key alliance members and principals/teachers from the 20 schools in the 2011 observational study. We gathered qualitative data on key features of the alliance that may have fostered or impeded change and on the alliance's impact on PE in SFUSD.

Alliance member interviews were conducted by one researcher (HT), lasted approximately 1 hour, and included questions adapted from an interview guide developed for school-based strategic alliances.(18) Questions focused on: (1) motivations for alliance formation; (2) facilitators and barriers to the alliance's operation, progress, and success; and (3) changes to PE within the district since the 2011 observational study. Principal and teacher semi-structured interviews were adapted from the Physical Education module of the School Physical Activity Policy Assessment (S-PAPA).(20) These interviews were conducted by 5 trained researchers, lasted approximately 20 minutes, and assessed changes in PE over the 2 years since the observational PE study in 2011, as well as barriers to and facilitators of PE change.

All interviews were audio recorded, transcribed, and coded by three researchers (RH, NT, HT). We used a combination of the constant comparative method (to generate new grounded theories

from the data) and a thematic analysis approach to segment, categorize, and link aspects of the data based on pre-determined theories established using interview data from the 2011 observational study.(21) During a first phase, using pre-defined themes defined by the interview questions, we coded all transcripts. During this process, we allowed room for additional themes to emerge. During a second phase, through an iterative process including discussions with the research team, we refined and synthesized the themes by deleting, combining, and separating themes where necessary, to produce a final codebook. We used this codebook to double-code all interviews, extracting salient quotations to illustrate key findings.

RESULTS

Alliance members from SFUSD (n=7), hereafter called "district partners," included an assistant superintendent, the director of the PE department, and two elementary-school PE implementation specialists. Alliance members from DPH, hereafter called "DPH partners," included the director and a staff member of Shape Up San Francisco, a coalition that works towards improving the city's physical activity and nutrition environments. A professor from the university's School of Public Health (KM) was the final alliance member interviewed. Alliance members averaged 6 years of experience (range 3–9) in their positions.

Principals (n=20) averaged 6 years of experience (range 1–18) and teachers (n=50) averaged 7 years of experience (range 0.5–27; Table 2). Seventy-one percent of principals and teachers were at the same school during both the 2011 observational study and the interviews in 2013.

Facilitators and barriers to positive changes to PE

District-level.

All district partners, the majority of principals, and half of teachers reported positive shifts in priority for PE at the district level since the alliance began its work. Interviewees cited increases in the number of conversations about PE, the number of professional development trainings dedicated to PE, and the value and importance of PE as an academic subject (as opposed to an extra-curricular). As one district partner put it, "PE's now got a place at the table, so to speak, in terms of what's valued in terms of use of time." (See Table 3 for additional interview quotations.)

District partners, principals, and teachers discussed positive district-level changes to PE funding. SFUSD has a unique elementary PE implementation model that takes advantage of limited funding for full-time PE teachers. In this model, credentialed PE teachers (called PE specialists) work full time for the district and rotate among 1 to 3 schools, teaching at different elementary schools from 1 to 5 days per week (reaching each classroom of students an average of once per week). Interviewees reported that disseminating results from the 2011 observational study, which highlighted PE-minute deficiencies, encouraged SFUSD to increase the number of elementary PE specialists from 15 during the 2010-11 school year, to 19 during the 2011-12 school year, and to 26 during the 2012-13 school year.

All district partners highlighted the specific role that dissemination of the observational study results played in changing priority and funding for PE. One partner shared, "having hard numbers [and] shining a really public light on it was really critical to the district paying more

attention to [PE].” District partners also discussed that the data were used to initiate a positive conversation; according to one district partner, “Anybody could have taken the view that the data could have been used just to embarrass the district or shame it into action, and that was never anyone’s intention … in fact it became a productive spark in the conversation because it helped to see the problem identified clearly.”

All alliance members felt that without the alliance’s actions, priority and funding for PE in SFUSD would not have changed. As two district partners put it, “at the elementary level, PE just never would have been a part of the conversation with principals,” and “PE would never have been mentioned by the associate superintendent–we’d be cut during this budget crisis, and we wouldn’t be a priority.”

Alliance partners, principals, and teachers described a lack of meaningful changes in accountability for PE (such as monitoring systems or consequences/rewards for non-compliance/compliance) at the district-level. According to one principal, “We have benchmark assessments for other content areas and we don’t have that around PE.” While there was talk of increasing accountability for the state-mandated PE minutes, no specific systems were created during the 3-year period post-alliance formation. As a district-level alliance member put it, “Has the district planted seeds toward changing implementation and the accountability part? Yes, and I think [the alliance] helped that. It just hasn’t been set in place yet.” The PE department has since implemented a district-wide system for collecting master PE schedules for all elementary schools, which went into effect during the 2013-14 school year.

School-level.

It did not appear that priority for PE increased at the school-level to the same extent it was elevated at the district-level. When asked if the priority for PE in their school has changed over the past two years, approximately half of principals and teachers cited positive shifts at the school level. As one district partner explained it, "Schools have so many priorities. They know they are supposed to do [PE], but it's not their main priority."

Interviewees discussed the critical role funding played in PE implementation. Despite increases in funding, only 10% of study schools had a full-time PE specialist (25% had a part-time specialist) and changes to the PE program model caused some specialists to move on to work with new schools, leaving several study schools without a specialist. According to one principal, "I think having a full time and a highly qualified PE specialist for the amount of time that we had him really changed the mindset and culture of people and myself of … how we view PE in the general school day, but now he's gone." When asked, "What is the number one thing that could be done to improve PE at your school," the most commonly expressed desire by principals and teachers was to have a full-time PE specialist or teacher at their school.

Facilitators and barriers to alliance's success

Due to the known difficulty of generating significant change within a large school district, success was loosely defined as positive improvements in PE in SFUSD. All alliance members cited the clear identification of common goals, trust between the alliance partners, and the collection and dissemination of local data as keys to the alliance's achievements. One DPH partner said, "I think the process of building trust, the attempts to be ego-less, and again having a

shared mission, have helped contribute to the alliance's success." Another DPH partner said, "You know before PE wasn't on [the district's] radar and it was noise. And when we first started this work and doing all that stuff with [PE], it was painful. And it was because it was noise … I feel like now there's so much more cooperation and interest in partnering and there're common goals."

Collaboration and open communication were also cited as critical. According to one district partner, "Decisions are made collaboratively – it's been beneficial to hear from the different stakeholders and then hopefully have a consensus as a group to determine effective action steps so that it's not just different stakeholders saying it should be done this way. There has to be a shared and common understanding of decisions." Being sensitive to partners' needs and taking others' opinions and needs into account proved important to the alliance's success.

Barriers to success included difficulties with communication and differences in data dissemination priorities. Five alliance members noted struggles around communication styles, and four described difficulty in balancing the desire to publicly share data as quickly as possible to ignite action, against the district's desire to first share data internally. As one partner said, "There were a lot of politics involved," which included internal district politics related to bureaucracy, difficulties setting up meetings with high-level district personnel, and getting time on the Board of Education's agenda.

DISCUSSION

The formation of a strategic alliance between the school district, DPH, and a research university appears to have elevated the priority and funding for PE in a large urban school district. There are several key factors that contributed to the alliance's success, with the most important piece being the collaborative collection and dissemination of local data to foment change.

Many of the pieces critical to the alliance's function were similar to those described as important in other health partnerships, including: (1) forming the partnership around common goals (i.e., everyone was interested in improving PE in San Francisco); (2) the significance of trust in the formation and maintenance of the partnership (i.e., never sharing study results outside the alliance before sharing/discussing with the alliance first); and (3) the importance of open communication (i.e. being willing to talk about uncomfortable issues or share data that did not demonstrate what partners had hoped to see).(22-24)

Research on school-based health alliances is not yet well established. Wohlstetter et al(18) developed a model for strategic alliance evolution within the unique context of charter schools that also included common goals, trust, and open communication as key components. Wohlstetter's model also highlights the importance of a single leader during partnership initiation, establishing internal governance, leadership structures and processes, and the establishment of an accountability plan to monitor progress; however we did not find these aspects necessary to the success of our alliance. These pieces may not be critical in all settings. For example, our alliance was relatively small, and therefore a formal governance structure was unnecessary, although it might be important in larger groups. Similarly, establishing an

accountability plan - a framework that delineates group goals, responsibilities, and consequences for failure to meet established goals - could be more helpful when working with a larger group that could be harder to manage informally.

While alliance members noted changes in PE at the district level, including increased funding for PE teachers, more professional-development time dedicated to PE for principals, and increased conversations and awareness around PE, it is not clear that these changes have resulted in similar school-level changes. Additionally, even though funding for PE teachers increased by nearly 75% from the alliance's formation in fall 2010 to the spring of 2013, 26 PE teachers for 72 schools is still far from optimal.

It may be too soon to assess change at the school level, as modifications may take longer to work their way down from the district level. This research on the alliance's impact took place three years post-alliance formation and only one and a half years after the majority of the alliance's work took place. A study assessing the impact of a district-level PE policy change in Los Angeles similarly found limited impact of the policy two years after its passage, though longer-term data are not available.(11) In these large districts with complex hierarchies, change at the school level may come slowly. Additionally, it appeared that new district-level accountability mechanisms for PE had not been established by the time these interview data were collected.

While well-intended state-level accountability measures exist, they do not sufficiently and accurately assess compliance. Despite the fact that our observational study in 2011 showed only 20% of elementary schools in the study were in compliance with existing PE policy,(19) SFUSD

passed the California Department of Education's PE audit two years later. The disconnect between the reality of PE in schools and current accountability measures warrants further action. In addition to improving the state audit system, next steps for increasing PE minutes could include: improving classroom teachers' PE training and skills through train-the-trainer models, team-teaching, or professional development; increasing district-level and administrator support for PE through regular meetings and by involving the local Board of Education; increasing academic priority for PE by making it a core competency with common assessments; or including PE as part of state-wide school success measures (like California's Academic Performance Index score,(25) which measures the scholastic performance and growth of schools), which would necessitate first developing a realistic and accurate measure of PE quantity and quality.

There are several limitations to this research. First, we cannot be sure if reported changes resulted from the alliance's actions or from other unidentified factors. Despite this uncertainty, the alliance members strongly attribute the positive changes in PE to the work of the partnership. Second, while this work represents participatory action research, each alliance is composed of unique individuals and their impact may not be replicable across cities. Additionally, SFUSD is a single school district, which may limit the generalizability of these findings. Finally, while this research includes the opinions of key stakeholders at multiple levels of schools and the district, it does not include student voices, which may differ from those of adults. The next step for this research is to analyze observational data collected in 2013 to examine quantitative changes in PE minutes and class quality, subsequent to the alliance's actions.

Increasing PE will benefit children's health, but creating change within a school district is complicated. Alliances may promote positive change because members are able to act at multiple levels to encourage shifts in priorities and actions. Alliance partners represent differing perspectives and expertise, but share a common goal. Establishing trust, collecting and using local data, and communicating clearly and openly, were key to this alliance's success. Local data can be useful in clarifying and promoting discussions at a district level, yet school-level change may take longer to occur and may require improved accountability measures. Future research should focus on methods to realistically and cost-effectively increase PE policy compliance, locally and nationally, thereby increasing access to regular physical activity for youth.

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Table 1B: Timeline of Key Alliance Events

Date	Event
May 2010	• DPH convenes the first PE Advocates Meeting • Alliance between Research University, DPH, and School District is formed
May 2010 - present	• Ongoing monthly or bi-monthly PE Advocates Meetings
June 2010	• Alliance decides to focus efforts on research study • DPH applies for funding from California Obesity Prevention Program
Aug 2010	• DPH is awarded funding • Alliance receives approval from District for study
Oct 2010	• Alliance presents study plan to the Board of Education
Feb - May 2011	• Initial research study takes place in the District
Sept 2011 - Present	• Alliance convenes to discuss study results and next steps
Oct 2011	• Researchers send reports on study results to all participating study schools • Researchers present results to the PE Department
Aug 2011	• DPH holds public forum where researchers present results of study to district teachers and principals
Dec 2011	• Alliance presents study results to District Administrators, including Assistant Superintendents and District Research Department
Jan 2012	• Alliance presents study results to the Board of Education
Feb 2012	• Alliance holds a press conference at a school site to publically share results of the study • DPH/PE Advocates release report on study results and increasing access to physical activity in school • Alliance presents study results at meetings with all District elementary school principals
May 2012	• Screenings of video case studies created by DPH to highlight successful elementary PE programs in District at schools and local sports store
July 2012	• Alliance decides to conduct follow-up study in elementary schools • DPH screens video case studies at local health forum
Aug – Dec 2012	• DPH and PE Department secure funding for the follow-up study
Sept 2012	• PE Department meets with Associate Superintendents about PE • DPH press release on PE video case studies at District PTA meeting
Nov 2012	• PE Department holds professional development meetings on PE with elementary school principals and showed video case studies
Feb-May 2013	• Follow-up study takes place in elementary schools in the school district
Mar 2013	• PE Department meets with Associate Superintendents about PE
Aug 2013 - Present	• Alliance convenes to discuss follow-up study results and determine next steps

Abbreviations: DPH (Department of Public Health); PE (Physical Education)

Table 2B: Description of Alliance Members, Principals, and Teachers Interviewed

	Description	Number	Female n (%)	Years of experience[A] Mean (range)
Alliance Members	Total	7	6 (86)	6 (3 – 9)
	PE Department	3	3 (100)	6 (3 – 9)
	Assistant Superintendent	1	0 (0)	3
	Department of Public Health	2	2 (100)	7 (5 – 9)
	University researcher	1	1 (100)	7
Principals	Total	20	12 (60)	6 (1 – 18)
	Principal	19	11 (60)	6 (1 – 18)
	Assistant Principal	1	1 (100)	7
Teachers	Total	50	30 (60)	7 (0.5 – 27)
	PE teacher[B]	6	2 (33)	4 (1 – 6)
	PE consultant[C]	10	2 (20)	5 (0.5 – 10)
	Classroom teacher (5th grade)	18	11 (60)	8 (1 – 22)
	Classroom teacher (2nd grade)	16	14 (88)	9 (0.5 – 27)

[A] Number of years working in same or similar capacity as teacher, principal, school administrator, district administrator, Department of Public Health, or university researcher
[B] A credentialed PE teacher hired by the school district
[C] A non-credentialed PE teacher hired by the school

Table 3B: Salient Quotations from Alliance Member, Principal, and Teacher Interviews

Interviewee Type	Theme	Quote
Facilitators and Barriers to Changes in PE		
District Partner	Priority for PE	There's definitely been more support from the associate superintendent and the superintendent, because as you know in the past, PE was never mentioned by either two. And it's definitely been mentioned more by either two in the last two or three years
District Partner	Priority for PE	So [the study and partnership] then led to a series of principal meetings and thinking about how to get the PE department time with principals, and then what I thought was probably most important was to articulate the set of goals related to PE that coming year and we drew out of the study to do that. Not sure that prior to that, principals had a clear sense of any fixed set of expectations for improving PE practice before.
District Partner	Funding	More money would really help, because right now we're just giving crumbs to some of the school sites. I mean some of them have a staff of 25 teachers and we're giving them [a PE teacher] once a week. A classroom is only going to see a PE teacher once a month … If our goal is to really have more PE from a credentialed PE teacher, we need more crumbs.
Principal	Funding	For us, just sharing the information that the district is going to be providing this funding and support, not just saying "do it" without a model, has really helped our teachers to buy-in.
PE Teacher	Funding	If they want to really have quality PE and have the kids get all the minutes, it's very difficult to do that when you're only at a school one day a week or even three days a week like I am here.
District Partner	Accountability	We haven't sort of bothered to collect master schedules from principals and we're not out there doing walk-throughs. So I guess I can describe the set of actions we took to elevate PE to principals, but if they had an impact, we'll find out.
Facilitators and Barriers to Alliance's Success		
District Partner	Using and sharing local data	Our plan to disseminate the results of the study, I think, is what was sort of a big catalyst for the school district to pay attention and to say let's work with them to figure out how we can best figure out, see how this data is going to ultimately improve PE for our students.
DPH Partner	Using and sharing local data	I would say the dissemination is far more important than the actual doing at some levels. Because you do it and if no one sees it, then it makes no difference. So I think communicating the results, and then communicating how the district is positively acting on them was really important in keeping them as an ally and as willing partners.
District Partner	Trust	We aren't formally held accountable for our performance in the partnership. It's based on trust.
District Partner	Common goals and collaboration	With the initiation and the partnership it was a catalyst of bringing awareness about what PE should look like and there were more voices from different stakeholders, health advocates, PA advocates, and as a result the district was like, 'we need to hear you out now'.
University Partner	Communication	So, I am someone who is fairly quick about responding to emails and communicating quickly and in the moment because that's when I tend to think about things. But that's not always the case for other partners who are very busy and have other things going on.

Abbreviations: DPH (Department of Public Health); PE (Physical Education)

CHAPTER 3

The Use of Public Disclosure to Improve Physical Education in an Urban School District: Results from a 2-year Quasi-experimental Study

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ABSTRACT

Background. Physical Education (PE) is an important tool for maintaining and improving children's health, yet elementary schools frequently do not adhere to PE requirements. Public disclosure of PE data, in which the amount of PE that schools actually provide is disseminated to the public, could foster improvements in PE.

Purpose. To evaluate 2-year changes in PE among 5th grade classes, following participatory action research efforts to improve PE quantity and policy compliance that focused on public disclosure of PE data.

Methods. Data were collected at 20 elementary schools, in the spring of 2011 (Time 1) and 2013 (Time 2). PE schedules (school master schedules and individual teacher's schedules) were collected and PE classes were directly observed (Time 1, n= 30 teachers; Time 2, n=33 teachers). Data on the proportion of schools meeting state PE mandates at Time 1 were disclosed within the school district and to the general public in fall 2011 and spring 2012.

Results. From Time 1 to Time 2, PE increased by 11 minutes per week based on teachers' schedules (95% CI: 3.0, 19.6) and by 14 minutes per week (95% CI: 1.9, 26.0) based on observations. The proportion of schools meeting the California state PE mandate increased from 20% to 30% ($p < 0.03$).

Conclusions. Positive changes in PE were seen over a two-year period after the public disclosure of locally collected data highlighting poor PE policy compliance. Partnerships that

collect and publicly disclose PE compliance data could be a method for improving PE and ensuring greater policy adherence.

INTRODUCTION

Physical education (PE) has been identified as a primary public health tool for increasing youth physical activity levels.(1-4) PE can provide the opportunity for students of all abilities and backgrounds not only to be physically active, but also to obtain the skills and knowledge that can facilitate a lifetime of physical activity.(5, 6)

In 2012, 44 states (86%) had education policy mandating the minimum minutes of PE that students should receive.(7) In California, the state with the largest number of public school students, education policy requires that elementary students receive 200 minutes and middle/high school students receive 400 minutes of PE every 10 days.(8) Yet PE policy compliance both nationally and in California is low, particularly at the elementary level.(9-15)

Little is known about how to increase schools' compliance with PE policies. PE-related research to date has largely focused on increasing the percent of PE class time spent in moderate-to-vigorous physical activity (MVPA).(16-18) However, even when interventions to increase MVPA during PE prove efficacious, they may contribute little to students' overall health if PE is scheduled infrequently, as happens in elementary schools.(19, 20)

Public disclosure involves identifying information that is not typically widely known and releasing that data to the public. While public disclosure operates differently in various settings and fields, it typically involves drawing the attention of the wider public to behavior that is inconsistent with a desirable target, with the idea that shedding light on the problem is "the most efficient policeman."(21, 22) Public disclosure has been successfully used in the health care

setting to promote greater adherence to guidelines, improve hospital performance, and improve patient outcomes.(23-26) Although less tested in the education setting, public disclosure has been used to identify 'failing' teachers and schools in an effort to improve school effectiveness, to some controversy and without studied impact.(27-29) While no known research has focused on the effect of public disclosure on PE-policy compliance, shining a public light on non-compliance could motivate districts and schools to implement required PE minutes.

In an effort to better understand and improve PE and PE policy compliance in the San Francisco Unified School District (SFUSD), the school district, the Department of Public Health, and a research university formed a strategic alliance. The alliance used participatory action research methods,(30) including deliberate power sharing, shared decision-making, and collaboration between all partners (including the researchers and the research target (SFUSD)), to determine a best approach. The alliance chose collecting local data on PE policy compliance as their initial step. The observational study conducted in 2011 demonstrated that 80% of elementary schools were not meeting the state PE mandate, based on classroom teachers' weekly PE schedules.(31) The strategic alliance then elected to disseminate the study results within the school district and to the general public through reports and a press release, which resulted in newspaper, TV, and radio coverage.(32-35) In reflecting on the participatory action research, alliance members felt that the public disclosure of PE data resulted in increased priority and funding for PE.(36)

The present study sought to evaluate quantitative 2-year changes in PE in 5th grade classes, following the participatory action research efforts that publicly disclosed local PE data in SFUSD. Specific outcomes included both scheduled and observed minutes of PE per week, as

well as the proportion of schools meeting the state PE mandate.

METHODS

Setting

The setting for the study was the San Francisco Unified School District (SFUSD), an urban district with nearly 56,000 students, 88% of whom are non-white and 60% of whom qualify for free or reduced price meals.(37) SFUSD's Research Department and the UC San Francisco and UC Berkeley Institutional Review Boards approved all study procedures.

Design

This participatory action research involved a quasi-experimental design. Baseline data were collected in the spring of 2011 (Time 1), public disclosure took place between August 2011 and March 2012, and follow-up data were collected in the spring of 2013 (Time 2).

Sample

School Selection: There were 72 elementary schools in SFUSD in 2011. Twenty elementary schools were selected for study inclusion using stratified random selection based on the presence of a PE specialist (a district-provided PE teacher holding a teaching credential with a specialty in PE and approximately 70 hours of district-led PE professional development annually).(31) Sample size calculations (taking the design effect into account) were based on data from an unpublished study in a neighboring school district, and suggested that 10 schools per group would allow for the detection of a 5-minute difference in MVPA (with 80% power). All principals at schools selected for inclusion agreed to participate at both Time 1 and Time 2.

Teacher Selection: Researchers observed PE classes for up to 3 teachers at each study school. Three types of adults led PE (hereafter called PE leaders): PE specialists; classroom teachers (holding a multi-subject teaching credential, but little to no PE-specific training); and/or PE consultants (no teaching credential but training in leading school-based physical activity). Details on teacher selection have been previously described.(31) In short, PE leaders at each school were sampled to ensure that at least one of each type was observed. If schools had only classroom teacher leading PE, researchers observed 2 randomly-selected classroom teachers. If schools had a PE specialist and/or PE consultant, researchers observed the specialist/consultant and 1 randomly-selected classroom teacher. At Time 2, two schools had both a PE specialist and a PE consultant, and both were observed, as well as one randomly-selected classroom teacher. If a PE leader was observed at Time 1 and was still teaching in the school at Time 2, s/he was observed at Time 2.

Procedures

PE Schedules: If available, researchers obtained school-level PE master schedules, which contain PE times for all classes in the school. Eleven schools had master PE schedules at both Times 1 and 2; 2 schools had a master schedule at Time 1 only, and 4 schools at Time 2 only; 3 did not have a master schedule at either time. Additionally, researchers contacted *all* 5th grade classroom teachers individually to obtain their classroom's PE schedule. At Time 1, five 5th grade classroom teachers did not have a PE schedule; all 5th grade classroom teachers had a PE schedule at Time 2. The California state PE mandate(8) specifies PE minutes per 10-day period (primarily to accommodate middle/high schools that use block scheduling, which often leads to

10-day rotating schedules). All PE schedules in study schools were kept on a weekly basis, so data herein is reported by week.

PE class observations: For each PE leader selected for study participation, researchers attempted to observe PE classes on 3 randomly selected days on which PE was scheduled. If a PE class did not occur as scheduled, the class was considered a "no-show," and researchers returned on another random day to observe PE. Classes that did not occur because of rain or standardized testing were not considered no-shows. In order to observe 3 classes per PE leader during the study period, some observations were arranged ahead of time (n=8 at Time 1; n=4 at Time 2). Observations were also arranged ahead of time for the 5 PE leaders who did not have a set PE schedule at Time 1. PE observations that were arranged ahead of time were not included in the proportion of no-shows.

Measures

SOFIT: The System for Observing Fitness Instruction Time (SOFIT) was used to collect data on observed PE class length and proportion of class in MVPA. Detailed SOFIT methodology has been described elsewhere.(38) In short, prompted by an audio recording, observers coded activity levels of four randomly selected students (two girls and two boys) using momentary time sampling (10-second observation, 10-second record intervals) for the entire PE class. Activity levels coding for moderate and vigorous physical activity have been validated using pedometry(39) and accelerometry.(40) The scheduled class length and observed class length (the number of minutes that PE actually occurred, with observations beginning when 50% of students

had entered the PE area and stopping at the class's termination, per SOFIT protocol) were recorded.

Public Disclosure

As part of the participatory action research process, the research partners shared results from Time 1 with the strategic alliance partners in June 2011. The alliance partners discussed results and identified key talking points, as well as the appropriate process and context for presenting and sharing results. The alliance then shared results within the school district (Board of Education, top district administrators, and teachers and principals) through meetings, reports, and presentations from August 2011 through March 2012. Through an iterative writing and editing process, the alliance published a report on the study results in February 2012.(41) A press release was used to publically disclose the study results in March 2012, which resulted in local media coverage.(32-35)

Data Analysis

Linear mixed models were used to examine change in the primary outcomes of scheduled minutes of PE/week (based on classroom teachers' and master schedules – models 1 and 2) and estimated minutes spent in PE per week (based on observations – model 3). Model 1 included random effects for school and classroom teacher, model 2 included random effects for school, and model 3 included crossed random effects for school and PE leader to account for the fact that some PE leaders switched schools between Time 1 and Time 2. Model 3, which estimated minutes of PE, accounted for no-shows (PE classes that did not occur as scheduled) as follows: if a PE leader had 1 no-show out of 4 total attempted observations (show proportion of 75%) and

100 minutes of scheduled PE/week, she had 75 observed minutes of PE/week.

Logistic mixed effects models were used to estimate the proportion of classroom teachers and schools meeting California's PE mandate (models 4 and 5). A school was determined to meet the California state PE mandate if, on average, 5th grade classroom teachers at that school provided 200 minutes of PE/10 days on their schedule. Model 4 included random effects for school and classroom teacher; model 5 included random effects for school.

Secondary analyses included examining the observed proportion of lesson time in MVPA (based on SOFIT) using linear mixed models including crossed random effects for school and PE leader. All analyses were performed using Stata/IC version 13.1 (StataCorp LP, College Station, TX).

RESULTS

School-level demographics did not differ between study and other elementary schools in SFUSD. SFUSD elementary schools have lower enrollment and a greater proportion of African-American and Asian students than California elementary schools in general (Table 1).

Researchers observed a total of 30 PE leaders (91 class observations) at Time 1 and 33 PE leaders (101 class observations) at Time 2. Of the 30 PE leaders observed at Time 1, 16 were observed at follow-up; 13 were at the same school, and 3 were in different schools. Seventeen new PE leaders were observed at follow-up. At both times nearly half of PE leaders were female and had, on average, 8 years of teaching experience.

According to classroom teachers' individual PE schedules, PE increased by 11.3 minutes/week between Times 1 and 2 (95% CI: 3.0, 19.6; Table 2). At Time 1, 15% of classrooms met the PE mandate versus 37% at Time 2 (p = 0.03). Based on the average of classroom teachers' schedules across schools, the number of *schools* meeting the PE mandate increased from 20% to 30% between Times 1 and 2 (p=0.27). Based on master schedules, however, there was a 10.6-minute decrease in the number of weekly PE minutes, though this difference was not statistically significant (Table 2). At Time 1, 10 of the 13 schools with master schedules (77%) met the PE mandate; at Time 2, 8 of the 15 schools with master schedules (53%) met the mandate.

Based on observations of PE class, and taking into account the proportion of no-shows (averages of 21% at Time 1 and 14% at Time 2), the estimated minutes spent in PE increased from 56.5 to 70.0 minutes per week (95% CI for change: 1.9, 26.0).

The proportion of observed lesson time students spent in MVPA increased from 54% at Time 1 to 61% at Time 2 (95% CI for change: 3%, 10%). At both Times 1 and 2, students spent more than the recommended 50% of class time in MVPA.

DISCUSSION

Over a 2-year period, daily minutes of PE in San Francisco schools significantly increased, as did the proportion of schools meeting California's PE mandate, based on classroom teachers' PE schedules. These changes occurred against the backdrop of participatory action research that

used public disclosure as its main tool.

While the absence of a control group limits our ability to draw causal inferences, this line of research is critically important to identifying successful methods for improving PE and increasing youth physical activity. In both school and community settings, advocates and practitioners are actively working towards working towards implementing policy to change environments and create opportunities for physical activity. Even though PE policies already exist in the majority of states, adherence to those policies is inadequate, making policy less effective.(7, 10, 11)

It is noteworthy that in the present study, at both Times 1 and 2, students spent more than the nationally recommended 50% of class time in MVPA.(42) In fact, the proportion of observed class time students spent in MVPA increased by 7% at Time 2, demonstrating that PE leaders and schools were able to increase PE quantity without compromising quality.

To date, most PE research has been conducted with an eye to observing current PE practices,(43-45) improving class quality when PE occurs,(18, 20, 46) and the associations between PE-related laws and policies and schools' or districts' self-reported quantity of PE.(47-49) Few studies have focused on PE policy compliance.

There have been attempts to increase PE policy compliance, but known efforts have focused on a more litigious route.(50, 51) A campaign brought against the Los Angles Unified School District (LAUSD), which was conducted by a diverse coalition of stakeholders (including lawyers,

teachers, parents, and community activists) and that threatened litigation,(50) resulted in LAUSD passing a new PE policy mandating, among other things, that LAUSD meet the California state PE mandate. Research conducted 2 years after the policy was passed demonstrated an increase of almost 10 minutes in the mean duration of PE classes in high-income elementary schools, but did not see increases in lower-income schools.(12) The results suggested that the LAUSD policy had not been fully implemented in all schools throughout the district, despite schools being required to have the policy requirements in place.

Legal action may be a lengthy and expensive process, and has the potential to alienate the very school-based allies needed to implement improvements in PE. In the case of Doe v. Albany,(51) a parent sued the Albany Unified School district for not meeting the California State elementary PE mandate, and won, but the school districted publicly labeled the lawsuit as a tremendous waste of school resources.(52) As yet there is no published data on the impact of the lawsuit on PE minutes in the school district.

Public disclosure has been successfully used in other health-related fields, under the theory that publically sharing relevant information on performance will drive out low quality providers or stimulate them to improve.(23) Studies suggest that the publication of comparative performance information has led hospitals to strengthen internal monitoring and initiate improvements in patient care.(53) However, public disclosure efforts have also been criticized as being poorly implemented, inaccurate, or at odds with the principals of quality improvement efforts.(54-56) As with most public health interventions, it is clear that a one-size-fits-all model doesn't readily apply, as multiple factors can impact success.

This is the first known study to examine the impact of public disclosure of local PE data on PE quantity and policy compliance. Lessons learned show that in order for public disclosure to achieve desired outcomes, certain factors may be necessary.(36) First, the appropriate stakeholders need to be "at the table," including those directly involved with PE implementation and support services, as well as those advocating for PE from outside the district (i.e. public health practitioners and concerned community members). Second, the ongoing collection or identification of data is necessary in order to assess progress, and may be an important component of the intervention. Third, a commitment to data sharing is needed, not in an effort to shame schools or administrators, but to instead bring attention to the value of PE, with the ultimate goal of improving PE programs. With myriad competing priorities within school systems, it is likely necessary for outside advocates to consistently and collectively apply pressure to maintain a sustained focus on PE.

While effective in the present study, the magnitude of the effect of public disclosure is likely influenced by multiple factors, and may not produce success in all situations. In 2010 the *Los Angeles Times* published value-added rankings of teachers and schools in an effort to improve school and teacher performance.(27) Yet the validity and reliability of the statistical methods used to create the rankings were brought into question,(57) and the impact of the data disclosure was not assessed. Rigorously evaluating the results of public disclosure efforts, regardless of their assumed level of impact, is critical to developing a strong theory about how, when, and in what circumstances these efforts are successful. Further, testing public disclosure methods in other school districts and/or states to ensure their reproducibility and to better understand the

strengths and weaknesses of different mechanisms on improving PE quantity and policy compliance in different contexts is necessary.

Limitations

There are several limitations to this research. First is the difficulty of determining causality; it is uncertain if these changes resulted directly from the public disclosure efforts to improve PE or from other unidentified factors. Despite this uncertainty, qualitative data attribute the positive changes in PE to the work of collecting and disseminating local data.(36) Secondly, the restriction to a single school district and a relatively small sample, may limit the generalizability of these results. Yet, the study district's size and urban location make it comparable to many districts across the state and country. Lastly, because this was participatory action research, the intervention was not defined *a priori*, rather it evolved through discussions among the alliance. Therefore, it is difficult to pinpoint the specific impact of any singular intervention component.

Conclusions

Significant positive changes in PE were seen over a two-year period after the public disclosure of locally collected data highlighting poor PE policy compliance. To the extent that this reflects the impact of public disclosure efforts, sharing PE-related data could be a method for improving PE quantity and ensuring greater policy adherence. Continued attention to approaches that will both ensure schools and teachers are simultaneously supported in the implementation of and held accountable to mandated PE minutes, is necessary.

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Table 1C: Baseline Demographic Characteristics, 2010-11 school year

Demographic Characteristics	Study Schools (n = 20)	Non-study SFUSD elementary schools (n = 52)	All CA elementary schools (n=4,450)	Study vs. non-study schools in SFUSD, p-value[A]	Study vs. all CA schools, p-value[AA]
School enrollment, mean (SD)	391 (150)	370 (145)	565 (200)	0.60	< 0.01
Students eligible for free or reduced price meals, % (SD)	60 (22)	65 (24)	60 (30)	0.84	0.74
Student race/ethnicity, % (SD)					
African American	12 (14)	13 (18)	7 (10)	0.85	0.01
Asian	30 (29)	31 (26)	9 (14)	0.64	< 0.01
Latino	29 (25)	26 (26)	52 (30)	0.81	< 0.01
White	13 (11)	14 (14)	26 (24)	0.47	0.04
Academic Performance Index base score[B], mean (SD)	812 (92)	795 (103)	810 (75)	0.52	0.93
Students in Healthy Fitness Zone for Aerobic Capacity[C], % (SD)	63 (17)	61 (18)	62 (17)	0.67	0.86

[B] A California-wide measure of a school's academic performance and growth on a variety of academic measures. Possible scores range from 200 to 1,000.

[C] The state-wide fitness test, the FITNESSGRAM, uses Healthy Fitness Zones to evaluate fitness performance of fifth graders. These zones are criterion-referenced standards and represent minimum levels of fitness for age and sex that offer protection against the diseases that result from sedentary living. Aerobic capacity reflects the maximum rate of oxygen uptake and use during exercise.

Table 2C: Changes in Physical Education Minutes

	Time 1 (2011)		Time 2 (2013)		Change (From Time 1 to Time 2)		
	Mean ± SD	Range	Mean ± SD	Range	Mean	95% CI	p-value
Scheduled minutes of PE/week ***(based on school's master schedules)***[A]	98.3 ± 8.6	80 - 113	87.7 ± 34.3	30 - 175	- 10.6	-29.1, 7.9	0.261
Scheduled minutes of PE/week ***(based on classroom teacher's schedules)***[B]	71.3 ± 34.4	15 - 175	82.6 ± 24.2	30 - 125	**11.3**	**3.0, 19.6**	**0.008**
Estimated minutes spent in PE/week ***(based on observations)***[C]	56.5 ± 33.4	15 - 175	70.0 ± 29.9	0 - 125	**14.0**	**1.9, 26.0**	**0.023**

[A] Eleven schools had master schedules at Time 1 and Time 2; 2 schools had master schedules at Time 1 only; 4 schools had master schedules at Time 2 only; 3 schools had no master schedule. P-value for change in means assessed using a linear mixed effects model with random effects for school.

[B] At Time 1, five 5th grade classroom teachers did not have a set PE schedule; all 5th grade classroom teachers had a set PE schedule at Time 2. P-value for change in means assessed using a linear mixed effects model with random effects for school and PE leader.

[C] Takes into account proportion of no-shows (times observer went to watch a randomly selected class and the class did not occur). P-value for change in means assessed using a linear mixed effects model with random effects for school and PE leader.

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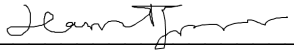
Author Signature  Date 2/24/14