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Lindsey Turner
Boise State University

Tyler G. Johnson
Boise State University

Hannah G. Calvert
Boise State University

Frank J. Chaloupka
University of Illinois at Chicago

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Stretched too thin? The relationship between insufficient resource allocation and physical education instructional time and assessment practices

Lindsey Turner [a,*], Tyler G. Johnson [b], Hannah G. Calvert [c], Frank J. Chaloupka [d]

[a] College of Education, Boise State University, 1910 University Drive, #1740, Boise, ID 83725-1740, USA
[b] Boise State University, 1910 University Drive, #1710, Boise, ID 83725-1710, USA
[c] Boise State University, 1910 University Drive, #1740, Boise, ID 83725-1740, USA
[d] Institute for Health Research and Policy, University of Illinois at Chicago, 1747 W. Roosevelt Road, #558, Chicago, IL 60608, USA

HIGHLIGHTS

- Many elementary schools do not provide students adequate physical education time.
- Equipment budgets for physical education programs are minimal, or nonexistent.
- Physical education-specific continuing education was required by half of schools.
- Most schools that required continuing education provided financial support.
- When teaching loads are too high, physical education practices are not optimal.

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ABSTRACT

With provisions in the Every Student Succeeds Act, attention to physical education (PE) programs in school will be crucial for developing well-rounded students. We assessed the availability of resources that have the potential to impact PE (staffing, continuing education, annual PE equipment budgets) in a nationally-representative sample of 640 U.S. public elementary schools. Higher student-to-PE teacher ratios were associated with students not receiving adequate instruction. Equipment budgets were minimal (median = $500) and 30% of schools had no budget at all. Additional financial support from federal and state education agencies would help schools to better meet recommendations for PE.

Physical education (PE) in schools is a key aspect of providing children with the knowledge and skill to be physically active for a lifetime, and there is strong evidence that healthy children are better learners (Basch, 2011; Institute of Medicine, 2013). PE and school-based physical activity (PA) improves academic outcomes, including students' scores on standardized tests of achievement (Centers for Disease Control and Prevention [CDC], 2010). PE has received renewed support recently, due to increasing recognition of the importance of supporting the whole child in education settings, which has been articulated by the Association for Supervision and Curriculum Development (ASCD) and CDC in the "Whole School, Whole Community, Whole Child" model (2015). In addition, supporting the whole child has received national support through an emphasis on well-rounded education in the Every Student Succeeds Act (2015). In other words, it is clear that—much like other content areas such as mathematics, science, or civics—PE should also be part of the educational experience for all students, rather than being considered an optional subject or one that is eliminated due to budgetary challenges. Like all other teachers, PE teachers provide instruction on a formal content area with standards, curricula, and assessments to measure student outcomes (SHAPE America, 2015). Resources are necessary for all teachers to accomplish these goals, regardless of content area. However, thus far, few studies have examined the nationwide allocation of resources to PE programs in schools, nor the impact on characteristics

* Corresponding author.
E-mail addresses: lindseyturner1@boisestate.edu (L. Turner), tylerjohnson6@boisestate.edu (T.G. Johnson), hannahcalvert898@boisestate.edu (H.G. Calvert), fjc@uic.edu (F.J. Chaloupka).

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Abbreviations

CE	continuing education
CSPAP	comprehensive school physical activity program
PA	physical activity
PE	physical education

of those PE programs according to resource allocation.

PE is the cornerstone of the comprehensive school physical activity program (CSPAP) approach that has been recommended by the Society of Health and Physical Educators (SHAPE America, 2013). A CSPAP is a multi-faceted, collaborative effort designed to increase the number of opportunities for students to engage in PA at school, including five components: (a) quality physical education; (b) PA during school; (c) PA before and after school; (d) staff involvement; and (e) family and community involvement.

PE serves a crucial role in the CSPAP model because it is the only component that includes a structured, developmentally appropriate curriculum taught by a state-certified or licensed teacher. During PE class, the teacher is expected to maximize students' opportunities to be active, and to teach them the necessary skills, knowledge, and dispositions to be physically active now and into the future (CDC, 2013; SHAPE America, 2015). Professional organizations have identified four essential components of PE programming: policy and environment; curriculum; appropriate instruction; and student assessment (SHAPE America, 2015). Each of the four components contains additional recommendations for improving PE, with the following strategies being crucial for providing PE in K-12 schools: employing state-licensed or -certified teachers who are endorsed to teach PE; maintaining reasonable teaching loads; providing adequate funding for PE equipment and supplies; offering students the recommended number of minutes/week of PE instruction; and assessing key PE outcomes such as students' knowledge of PA concepts and principles, and students' health-related physical fitness.

Previous research has demonstrated that the presence of full-time, well-trained PE teachers on staff at elementary schools is associated with important elements of instruction such as adequate duration and frequency of PE classes (i.e., PE instructional time per week), using evidence-based curricula, and incorporating health-related physical fitness testing, as well as providing other PA opportunities before, during, and after the school day (Turner, Johnson, Slater, & Chaloupka, 2014). Furthermore, research has shown that human resources such as student-to-PE teacher ratio, and physical resources such as access to adequate PE equipment and facilities, are associated with students having more PE class time and being more physically active during PE class (Bevans, Fitzpatrick, Sanchez, Riley, & Forrest, 2010).

It is clear that PE teachers are essential personnel at the school level for educating children about why and how to be active (e.g., Castelli & Rink, 2003; Dyson, 2014; SHAPE America, 2015). As others have noted (McCaughtry, Martin, Kulinna, & Cothran, 2006), although the overall education literature is clear that well-trained educators and resources are necessary for effective instruction in all content areas, more detailed study is needed to understand how the availability of resources might specifically impact PE specialists. Prior work has shown that instructional resources—specifically, a new PE curriculum and $3500 worth of PE equipment—enabled physical educators to better meet student needs and keep students more physically active in class (McCaughtry et al., 2006), and importantly, it also yielded emotional benefits such as more enthusiasm for PE among students and teachers.

PE teachers are uniquely positioned to be leaders in the implementation and support of broader elements of PA promotion throughout the school (Beighle, Castelli, Ernst, & Ernst, 2009; Castelli, Centeio, & Nicksic, 2013; Erwin, Beighle, Carson, & Castelli, 2013). Yet, it has also been acknowledged that in doing so, PE teachers face challenges such as a lack of resources, time and decision-making authority, and that many PE teachers may not have received sufficient professional preparation for leadership roles (Goc Karp, Scruggs, Brown, & Kelder, 2014). In many schools, providing even the basic elements of PE (e.g., instruction and student assessment) may be challenging due to resource and capacity limitations.

Unfortunately, given national economic issues over the past decade, many local education agencies have faced budgetary challenges necessitating difficult decisions regarding the prioritization of academic content and priorities. Some recommendations (e.g., Picus & Odden, 2011) regarding strategies to cope with budgetary shortfalls specifically target specialized programming such as PE, and recommend approaches such as reducing teacher coverage and cutting the school-day time and budgetary resources allocated to such programs. While budgetary constraints are very real challenges to the education system in this country, such approaches to cost containment severely compromise PE programs on a large scale. In addition, most states now mandate that students receive PE, although only 19 specify a minimum amount of time required for PE in elementary schools (SHAPE America, 2016). When districts and schools provide inadequate PE programming it not only violates such laws, but non-compliance can also negatively impact student fitness outcomes (Sanchez-Vaznaugh, Sánchez, Rosas, Baek, & Eggerter, 2012).

The purpose of this study was to examine elementary school PE resources across the country, and to explore how resources are associated with PE programming, using data from a 2013–2014 survey of a nationally-representative sample of US public elementary schools. In this work, PE resources relates to issues of PE staffing, teaching loads, opportunities for continuing education (CE), financial support for CE, and PE-related budgets. This category includes the allocation of district or school-level resources to ensure that PE programs have the necessary infrastructure in place to offer a quality education to students. With regard to PE programming, we examined instructional time/frequency and in-class student assessment practices. It was hypothesized that schools with more PE resources would be more likely to meet national recommendations (e.g., SHAPE America, 2015) for PE programming.

1. Methods

Data were gathered as part of a multi-year project that tracked school health-related policies and practices in elementary schools. These analyses use data collected by survey in the spring of the 2013-14 school year. This study was approved by the Institutional Review Boards at the University of Illinois at Chicago (where data collection occurred) and at Boise State University (where data analysis occurred). A waiver of documentation of informed consent was granted, as consent was implied by return of the survey.

1.1. Sampling and weighting

The sample was developed by survey experts at the Institute for Social Research at the University of Michigan, based on a sampling frame drawn from the Common Core of Data from the National Center for Education Statistics. The sample was developed to be nationally representative of public elementary schools (containing 3rd grade) from the contiguous United States. All public elementary schools with at least 20 students in 3rd grade were eligible for sampling. The sample included 1045 elementary schools. Surveys were returned by 640 schools (response rate = 61.2%). Analytic weights allowed for inference to schools nationwide, and weights were calibrated to adjust for potential non-response bias.

1.2. Procedure

Surveys were mailed to schools in January 2014, with subsequent follow-up by mail, e-mail, and telephone until recruitment ended in July. Instructions requested that the survey be completed by the principal or other staff with knowledge of school health practices and programs, and encouraged the respondent to consult with other personnel as necessary. At most schools, several individuals contributed to the completion of the survey, including a principal at 79.2% of schools. In addition, the PE teacher assisted with completion of the survey at 19.8% of schools. A $100 incentive was offered to the respondent or the school for returning the survey.

1.3. Measures

At the start of this project, survey items were selected by a multidisciplinary team of researchers with expertise in health, social science, education, survey research, and other disciplines; thereafter, the survey was reviewed by several experts on school health. Items used in the current analyses were drawn from existing surveys, including the CDC's School Health Policies and Programs Study 2000, which was extensively validated (Brener, Kann, & Smith, 2003), and the long-term Youth, Education & Society survey (Johnston, Delva, & O'Malley, 2007). Additional items about PE resources were identified based on constructs identified in the School Physical Activity Policy Assessment (S-PAPA; Lounsbery, McKenzie, Morrow, Holt, & Budnar, 2013), described below.

1.4. Contextual variables: school characteristics

School-level demographic and socioeconomic data were obtained from public use Common Core of Data files from the National Center for Education Statistics. These variables were used as sample descriptors and as covariates in regression analyses. U.S. census region was classified as Northeast, Midwest, South, and West. Locale was classified as city, suburban, town, or rural. The total number of students at each school was used as an indicator of school size. School characteristics based on the student body were racial/ethnic composition, proxied by the percentage of White non-Latino students, and socioeconomic status (SES), which was proxied inversely by the percentage of students eligible for free or reduced-price lunch (FRPL), coded as ≥50% FPRL (lower SES) or <50% (higher SES).

1.5. Physical education resources

PE teacher credentials was measured with one item with four yes/no checkboxes, “Do physical education staff at your school have any of the following credentials?” Response options were: a) state certification/licensure; b) Director of Physical Activity (DPA) certification from SHAPE America; c) youth sport coaching certification (e.g., American Sport Education Program); and d) other credentials. It is important to note that the DPA certification has been renamed as Physical Activity Leader (PAL), which we use in this article, but at the time of the survey, the DPA acronym was used.

PE teaching load was assessed with one item, worded “Currently, how many physical education teachers are employed at your school? Please provide a response as percentage full-time equivalents (i.e., one full-time teacher = 100% FTE; one full-time and one half-time teacher = 150% FTE).” This was used to create a measure indicating teacher workload, calculated as the total number of students at each school, divided by the FTE of PE teachers. This is similar to the calculation of “number of students per PE teacher FTE” in other research on human resources for PE (Bevans et al., 2010).

PE continuing education (PE-CE) was assessed with an item asking “are physical education teachers at your school required to earn continuing education credits *on physical education topics?*” Response options were yes, no, and don't know. Affirmative responses were followed with two additional items: **PE-CE amount** was assessed with one item asking “how many hours of continuing education (professional development) *on physical education topics* do physical education teachers receive each year?” and **PE-CE financial support** was assessed with one item drawn verbatim from the S-PAPA, worded “does your school or school district provide financial support for physical education teachers' professional development” (i.e., CEU registration, conferences). Response options were yes, no, don't know.

Annual PE budgets at each school were assessed with one item based on the S-PAPA, asking “is there a school budget specifically for physical education equipment and supplies, and if yes, how much is allocated annually?” If there was no budget allocated, this was coded as zero.

1.6. Physical education outcome variables

1.6.1. PE class frequency/duration

Due to variability in scheduling by grade, two items pertaining to frequency and dosage of PE were anchored to third-grade students. The lead-in asked respondents to “provide the following information about scheduled physical education class (excluding recess) during a typical week *for 3rd grade students*:” (a) “how many days per week is PE conducted?” and (b) “how many minutes is each PE class?” It is worth noting that the data yielded therefore pertain to the frequency and total duration of PE *for students*, not whether *classes* are scheduled daily, nor how frequently the *teachers* see each class. The recommendations of SHAPE America (2015) and other organizations pertain to how frequently each student should have PE class (daily), and for how many total minutes per week (150). Thus, three variables were created: (a) whether 3rd grade students had PE on five days per week (i.e., daily PE); (b) whether 3rd grade students received ≥ 150 min/week of PE; and (c) whether 3rd grade students received ≥ 60 min/week of PE, which is recommended as a minimum by the Healthy Schools Program (Alliance for a Healthier Generation, 2014). All PE outcome variables were binary, coded 1 for yes and 0 for no. This coding was chosen to allow the use of logistic regression models to calculate the percentages of schools meeting these guidelines.

1.6.2. PE assessment practices

Several PE assessment practices were also examined. One item asked “Is student physical fitness measured for students in elementary grades” with responses of “yes, for students in all elementary grades,” “yes, for students in some grades only,” “no,” and “don't know.” Responses of “yes” (coded = 1) were compared with “no” (coded = 0). Subsequently, a series of yes/no checkboxes were used to obtain details on other assessment practices. The stem asked “Are any of the following assessments used in physical education programming?” with options of: a) FitnessGram® (including tests such as the PACER); b) AAHPERD Sport Skills Test; c) PE Metrics; d) written tests of student knowledge regarding physical activity/movement; and e) pedometers/accelerometers for assessing physical activity.

1.7. Data analysis

Analyses were conducted in STATA/SE 13.0. Because of the sampling design the survey (*svy*) command was used, with analyses accounting for sampling stratum and clustering of schools within districts.

First, the sample characteristics were tabulated. Then the prevalence of school resources was examined. We were also interested in examining the prevalence of PE programming characteristics, while accounting for covariates (i.e., school characteristics) that might account for differences in these characteristics. Therefore, a series of multivariate logistic regressions were calculated, with one separate model for each of the PE outcomes. In these models, all predictors were entered simultaneously, including controls for school characteristics. Control variables were dummy coded, with referent categories selected based on preliminary analyses examining associations between school characteristics and the outcome variables. For example, daily PE is most common in the South versus other regions, so the control variable for region was coded as 1 = South versus 0 = other regions. These models were then re-computed with the addition of the school resource predictors, to examine whether resources were associated with outcomes. Among the resource variables, only teaching load was statistically significant in these models and showed a reliable and noticeable pattern of association with PE outcomes. Summary statistics from the regression models are presented in tables, and the pattern of prevalences of outcomes, by each school's PE teacher load, are graphically depicted in figures. We used an alpha level of 0.05 as a criterion for testing statistical significance, but due to the potential for significance testing to overstate the importance of results that are not practically significant (e.g., Kirk, 1996; Zhu, 2012), we used adjusted prevalences to examine the pattern of results. While there are no ideal statistics to indicate total amount of variance explained in a weighted logistic regression model (i.e., a summary statistic analogous to an R^2 in ordinary least squares multiple regression), the Hosmer-Lemeshow test for sample survey data (Archer & Lemeshow, 2006) was used to examine goodness of fit of the logistic regression models.

Table 1
Demographic characteristics of participating U.S. public elementary schools (n = 640).

	n (unweighted)	% (weighted)
Region		
Northeast	152	23.8
Midwest	175	27.3
South	209	32.7
West	104	16.3
Locale		
City	144	22.5
Suburb	233	36.4
Town	82	12.8
Rural	181	28.3
School size: number of students		
Smaller (<550 students)	215	63.2
Larger (≥550 students)	422	36.8
Percentage of students eligible for FRPL		
< 50%	300	46.9
≥ 50%	336	52.5
Student race/ethnicity		
% Non-Latino White students	Mean = 58.6%	SE = 1.3%

Note. Percentages sum to 100 within section, but due to rounding and small amounts of missing data (size and FRPL), totals may not sum to exactly 100. FRPL = free/reduced-priced lunch.

2. Results

Table 1 presents the demographic characteristics of participating schools. Schools were distributed across all regions of the country, with a variety of racial/ethnic student compositions, and approximately half served a majority of lower-income students (≥50% eligible for FRPL). Next, we examined the variables that we conceptualized as representing PE resources (Table 1).

2.1. PE teacher staffing

At 10.2% of schools, respondents indicated that the school had no PE teachers; however, PE was offered in these schools, but presumably by non-specialists (e.g., classroom teachers). In other words, PE was taught by specialists at 89.8% of elementary schools. In terms of PE teacher staffing capacity, the modal response (at 44.7% of schools) was a 1.0 FTE PE teacher; 12.1% of schools had a part-time (i.e., less than 1.0 FTE) PE teacher; 11.8% of schools had more than 1.0 but less than 2.0 FTE PE teachers; 13.8% of schools had 2.0 FTE PE teachers; and the remaining 5.8% of schools had more than 2.0 FTE PE teachers.

2.2. PE teaching load

PE teaching load was calculated as the total number of students at school, divided by the FTE of PE teacher(s) at the school. This ranged from 85:1 at a small school with 127 students and 1.5 PE teachers, to over 4185 (a school with 837 students and a 0.20 teacher, shared among multiple schools in the district). The median load was 400 students per full-time teacher ($M = 471.5$, $SD = 341.9$). Load was broken into four groups, based on how many total students were to receive instruction by one FTE teacher. These cutpoints were established to create four groups with similar percentages of schools: fewer than 275 students (21.4% of schools); 275 to 400 students (29.0%); 401 to 550 students (26.1%); and more than 550 students (23.5%). Data were missing for 14.1% of schools.

2.3. PE staffing and teacher credentials

PE teacher credentials were assessed at schools that employed any PE teachers. Where responses were missing or there were no PE teachers, these were counted as a response of “no.” At 83.5% of all schools, there was a PE teacher who was state certified or licensed. At 18.5% of schools, the PE teacher had youth sport coaching certification. The PE teacher had certification from SHAPE America as a DPA (now PAL) at only 1.6% of schools.

2.4. PE-CE

At 50.4% of schools, respondents indicated that PE teachers are required to earn CE credits on PE topics; this was not required at 31.7% of schools, and not known at 12.5% of schools. Where CE was required, respondents were asked to indicate how many hours teachers received annually. Nearly 1 in 4 respondents (27.6%) left this item blank or indicated that they did not know. Among those responding (n = 231), the median was 12 h (*mean* = 16.6, $SD = 15.1$). Counting the cases where CE was *not* required as having zero hours of CE (excluding those that skipped or did not know whether any CE was required), 46.5% reported that no CE was required; 16.9% reported that between 1 and 8 h of CE (i.e., one day) was required; 17.5% reported that between 9 and 16 h (i.e., two days) of CE was required; 7.9% reported that between 17 and 24 h of CE was required; and 11.2% reported that 25 h or more was required. Among the 322 schools where CE was required, respondents at 74.2% of schools reported that the school or district provided financial support (i.e., registration, conference fees), 18.0% reported no financial support, and 7.8% did not know.

2.5. PE budgets

At a majority (59.2%) of schools, there was a specific budget for PE equipment and supplies, but no dedicated budget at 29.9% of schools; at 6.9% of schools, respondents did not know whether there was a PE budget, and the item was skipped by 3.9%. Fifty of the respondents who indicated that their school had an equipment budget did not know the amount of the budget, but 351 respondents provided information on the amounts. These ranged from $100 per year to $7000 per year, with a median and mode of $500 per year, and a mean of $915 per year ($SD = $876). To account for variations in budget by school size, a measure of per-student PE budget was calculated. Again, most schools did not allocate any money for a PE budget or did not know this information, but among the 51.2% that reported providing funding for PE equipment, there was a very skewed distribution (skew = 2.65), with a median of $1.30 per student and an interquartile range from $.75 to $2.14 per student.

2.6. PE programming

It was uncommon for schools to provide 3rd grade students with PE class on a daily basis (21.7% of schools), or for a total of 150 min each week (20.9% of schools); however, most schools (79.3%) provided students with at least 60 min of PE class per week. Fitness testing occurred in many schools, with respondents at 46.8% of schools indicating that all students are tested, and 37.1% indicating that some grades are tested. Testing did not occur at 9.2% of schools, and respondents did not know or did not answer at 6.9% of schools. With regard to assessment strategies, the use of AAHPERD's Sports Skills Test was uncommon (3.7% of schools), as was PE Metrics (3.7% of schools). FitnessGram® was used at 38.4% of schools. Written tests of knowledge were used at 26.0% of schools and activity monitors (pedometers/accelerometers) were used at 29.2% of schools.

2.7. Associations between PE resources and programming

First, the bivariate associations were examined between PE resources (teaching load, CE requirements, and PE budget) and each of the binary outcomes. These analyses were used to build multivariate models, which examined associations between resources and PE programming outcomes, while accounting for school characteristics as contextual covariates (locale, region, school size, student race, and student eligibility for FRPL). In bivariate analyses, PE outcomes were all consistently related to teaching load but not to CE requirements or PE budgets. Results are shown in Tables 2 and 3 and Figs. 1 and 2. All final models fit well, as indicated by a non-significant Hosmer-Lemeshow goodness of fit test for weighted survey sample data. Given the low prevalence of use of the AAHPERD Sports Skills Test and PE Metrics (both <5%), these variables were deemed unsuitable for consideration in regression models. The use of written tests of knowledge or FitnessGram® was not significantly associated with PE resources.

3. Discussion

The health and academic benefits of PE in schools is indisputable (Institute of Medicine, 2013), but many elementary students do not receive adequate time in PE class. The current study assessed PE resources in a nationally representative sample of U.S. elementary schools, and examined the associations between resources and practices. Perhaps not surprisingly, it was evident that schools that have higher levels of PE staffing—that is, where each full-time PE teacher provides instruction for a total of fewer than 550 students—were more likely to provide students more time in PE class, and to assess some types of PE outcomes. In other words, these data indicate that schools with higher PE teaching loads (i.e., student-to-teacher ratios) are less likely to meet recommendations for PE instructional time and are less likely to assess students' physical fitness.

Table 2
Results of three logistic regression models to examine adjusted prevalence of physical education class timing and duration.

Predictor variable	MODEL 1 Daily PE class for 3rd grade students				MODEL 2 150+ minutes/week of PE class for 3rd grade students[a]				MODEL 3 60+ minutes/week of PE class for 3rd grade students[a]			
	OR	95% CI	AP[b]	95% CI	OR	95% CI	AP[b]	95% CI	OR	95% CI	AP[b]	95% CI
Race												
% White students	0.31	0.09, 1.09			0.24	0.08, 0.77			0.19*	0.07, 0.52		
Locale												
Urban/suburban			15.5	10.3, 20.7			20.4	15.1, 25.7			76.1	
Town/rural	2.05*	1.05, 4.01	26.0	17.9, 34.0	1.36	0.72, 2.57	24.9	17.8, 32.2	1.58	0.86, 2.91	82.8	70.3, 81.9
FRPL eligibility												77.3, 88.4
< 50%			18.5	11.3, 25.7			19.6	12.6, 26.5			81.2	75.9, 86.6
≥ 50%	1.06	0.57, 1.99	19.5	14.5, 24.1	1.28	0.69, 2.35	23.1	18.0, 28.1	0.70	0.38, 1.29	75.9	69.5, 82.3
Region												
Northeast, Midwest, West			12.4	8.0, 16.7			13.7	8.8, 18.6			76.8	71.3, 82.3
South	2.99*	1.57, 5.68	28.4	20.0, 36.7	3.49*	1.83, 6.66	33.3	25.2, 41.4	1.38	0.75, 2.54	81.6	75.3, 87.9
PE teaching load												
< 275 students			31.1	20.2, 41.8			38.2	28.8, 47.7			92.0	87.3, 96.6
275 to 400 students	0.43*	0.20, 0.90	17.3	10.8, 23.8	0.34*	0.17, 0.70	19.9	12.3, 27.6	0.42*	0.20, 0.89	83.0	76.6, 89.5
401 to 550 students	0.38*	0.17, 0.85	15.8	9.0, 22.6	0.27*	0.13, 0.58	16.7	9.6, 23.8	0.31*	0.14, 0.69	78.5	71.1, 85.9
> 550 students	0.33*	0.14, 0.81	14.3	6.8, 21.8	0.27*	0.11, 0.65	16.7	8.5, 24.9	0.13*	0.06, 0.28	60.9	51.4, 70.3
Overall adjusted prevalence[b]			19.9				22.7				78.9	

Note. All predictors entered simultaneously in each of the three models.
OR = odds ratio; CI = confidence interval; AP = adjusted prevalence; FRPL = free/reduced-priced lunch.
*$p < 0.05$.
[a] Adequacy of gymnasium excluded from Model 2 and Model 3 because inclusion caused the model to fail the goodness-of-fit test; this variable was highly correlated with demographic covariates.
[b] AP = Adjusted Prevalence: Estimates are adjusted for all other covariates in model, and represents the percentage of schools with each outcome.

Table 3
Results of logistic regression models to examine adjusted prevalence of physical education assessment practices.

Predictor variable	MODEL 1 Physical fitness testing				MODEL 2 Pedometers or accelerometers to assess PA			
	OR	95% CI	AP [a]	95% CI	OR	95% CI	AP [a]	95% CI
Race								
% White students	1.0	0.26, 3.92			1.74	0.72, 4.19		
Locale								
Urban/suburban			92.1	89.0, 95.3			38.4	32.3, 44.5
Town/rural	0.55	0.26, 1.16	86.8	80.8, 92.7	0.46*	0.28, 0.73	22.7	17.0, 28.4
FRPL eligibility								
<50%			88.2	83.0, 93.3			36.2	28.2, 44.2
≥50%	1.64	0.77, 3.49	92.3	89.0, 95.6	0.73	0.42, 1.25	29.4	22.9, 35.9
Region								
Northeast, Midwest, West			89.3	85.6, 93.0			31.0	25.3, 36.6
South	1.46	0.67, 3.18	92.3	88.0, 96.6	1.21	0.71, 2.05	34.9	26.6, 43.3
PE teaching load								
<275 students			97.1	94.7, 99.5			42.4	31.2, 53.7
275 to 400 students	0.44	0.15, 1.31	93.7	90.0, 97.4	0.79	0.43, 1.47	37.1	28.2, 46.0
401 to 550 students	0.20*	0.07, 0.54	87.0	80.9, 93.1	0.47*	0.24, 0.89	26.0	18.3, 33.7
>550 students	0.14*	0.05, 0.39	83.1	75.4, 90.8	0.44*	0.22, 0.89	25.2	17.0, 33.4
Overall adjusted prevalence [a]			90.2				32.3	

Note. All predictors entered simultaneously in each of the three models.
OR = odds ratio; CI = confidence interval; AP = adjusted prevalence; FRPL = free/reduced-priced lunch.
*$p < 0.05$.
[a] AP = Adjusted Prevalence: Estimates are adjusted for all other covariates in model, and represents the percentage of schools with each outcome.

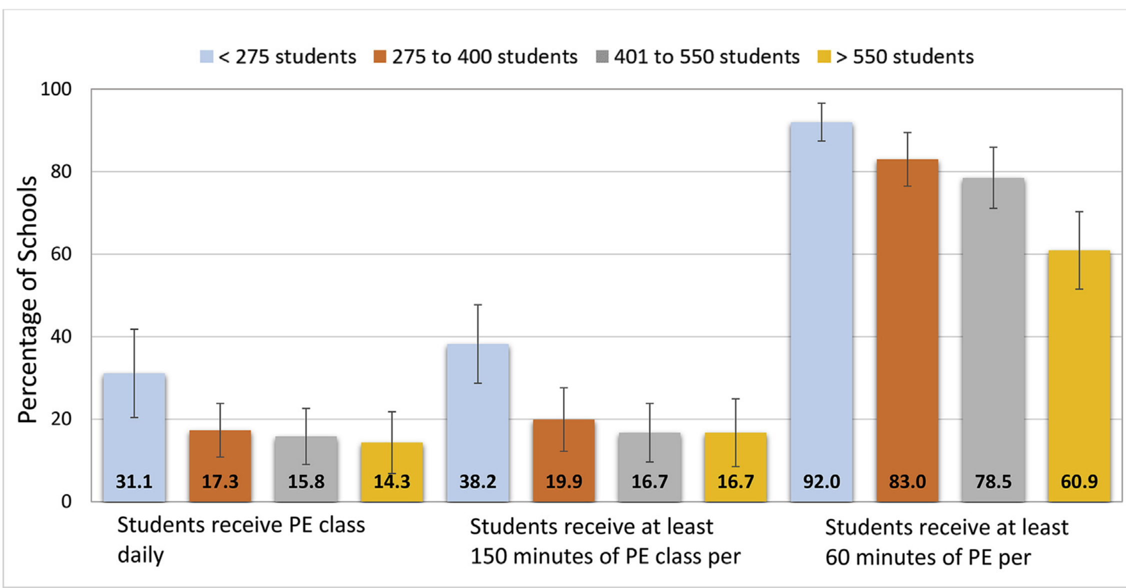

Fig. 1. Prevalence of schools engaging in PE practices, by teacher workload (number of students per full time teacher at school).
Note: Percentages shown here are adjusted for school characteristics (as shown in Tables 2 and 3). Bars show 95% confidence intervals.

3.1. *Prevalence of PE resources*

SHAPE America (2016) has issued a charge for K-12 schools to hire state-licensed or state-certified teachers who are endorsed to teach PE. We found that PE was taught by an individual with state certification or licensure at 83.5% of schools. This estimate is similar to another nationwide survey in 2014, which found that 91% of elementary schools reported that PE was taught by a PE teacher or specialist (CDC, 2015). These results are not surprising since most states (70%) require elementary PE teachers to be licensed, certified, and/or endorsed to teach PE (SHAPE America, 2016), but there is room for improvement in ensuring that all students have the opportunity to receive instruction from certified PE specialists.

Thus far, limited national data have been available about the employment practices of elementary schools with regard to PE teachers, and no research has examined the association between the adequacy of PE teacher employment and school practices. Perhaps this should be a relatively intuitive association, because without well-trained personnel resources (i.e., teachers), it is likely to be challenging—if not impossible—to deliver quality educational programming. However, with budgetary challenges over the past decade, and a focus on academic achievement scores, some districts and schools have reduced the allocation of resources to PE programs, both in terms of reducing teacher coverage, as well as cutting the school-day time and budgetary resources allocated to such programs. Such strategies have been specifically articulated as recommended ways to address funding shortfalls (Picus & Odden, 2011), however, they neglect to attend to the abundant research

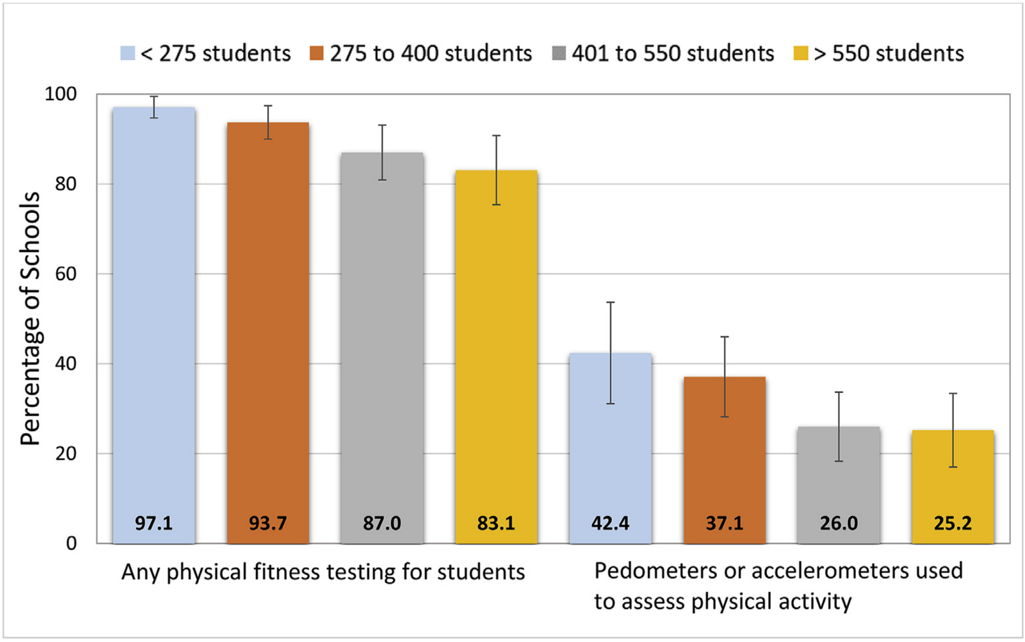

Fig. 2. Prevalence of schools using assessment during PE class, by teacher workload (number of students per full time teacher at school).
Note: Percentages shown here are adjusted for school characteristics (as shown in Tables 2 and 3). Bars show 95% confidence intervals.

demonstrating the crucial academic benefits of keeping students healthy (Basch, 2011; CDC, 2010; Institute of Medicine, 2013).

This study attempted to obtain a deeper understanding of PE teaching loads at elementary schools, defined as the number of students divided by the FTE of PE teacher(s) at each school. This was spurred by prior research showing that during 2009–2012, only 69% of elementary schools employed a full-time PE teacher, but having a full-time PE teacher (versus part-time or not at all) was associated with a higher likelihood of providing adequate time in PE class, and additional PA opportunities during the school day, such as classroom activity breaks and PA outside of PE class (Turner et al., 2014). Based on that research clearly demonstrating the crucial role of PE teachers, we sought to gather detailed information on the ways in which schools' hiring practices (e.g., allocation of budgetary resources to PE specialist positions) may ultimately impact the educational experience for students.

The current study demonstrated that while 45% of elementary schools have one full-time PE specialist (1.0 FTE) and 32% have more than that, 22% of schools across the country have lower levels of staffing, either because they do not have PE specialists or because these individuals are part-time or shared across schools. In small schools, shared staffing arrangements can be adequate, but if one teacher is expected to provide PE instruction at two or more large schools within a district, this will reduce students' opportunities to receive PE instruction. Indeed, our analyses indicate a consistent linear association between teaching load and PE practices. Teaching load—conceptualized here as the total number of students at each school for whom one full-time PE teacher must provide instruction—was inversely associated with providing students with daily PE, with providing students either 60 min or 150 min of PE class time per week, and with conducting physical fitness testing and using objective activity monitors during PE class.

3.2. Physical activity leadership and continuing education

The low prevalence of DPA/PAL certification among PE teachers (1.6%) highlights an important area of CE that should continue to be emphasized by professional organizations, administrators, and state PE coordinators. It has been noted elsewhere that physical activity leaders play a crucial role in implementing the CSPAP model (CDC, 2013). However, it is also worth noting that some teachers and teacher education students may not welcome assuming a leadership role (Goc Karp et al., 2014). In part, this may be due to philosophical perspectives about the role of PE teachers, but it may also be due to feasibility issues, given that many teachers already have a lengthy list of responsibilities at their school, often without the resources necessary for success. A detailed study of ten in-service teachers with DPA/PAL certification found that all had successfully reshaped their roles as teachers to include a broader leadership role in the school, and that such efforts resulted in benefits for the school and the students (Centeio, Erwin, & Castelli, 2014). However, a key element of that study was the conclusion that teachers continue to focus on quality PE first, and then on implementing and sustaining other CSPAP components, as they are suitable within the context of each school.

As research continues to grow on the elements of effective professional development for in-service PE teachers (e.g., Bechtel & O'Sullivan, 2006; Centeio et al., 2014), it becomes increasingly clear that CE must include opportunities for teachers to build the knowledge, confidence and skills to implement CSPAPs. However, when PE teachers are already burdened with high teaching loads and obligations to—first and foremost—ensure an optimal PE experience for students, adding leadership expectations to their role might not only be unrealistic, but it could contribute to burnout and departure from the profession, which must be avoided.

The results regarding CE in this study are novel in several ways. First, these data provide new information about how much CE in-service teachers are receiving, specifically on PE-related topics. Often, due to the organizational structure of educational agencies and a lack of economies of scale for providing PE-specific professional development for multiple teachers, CE opportunities may not be PE-specific, yet it is one of the crucial elements of effective professional development for in-service PE teachers is that it should be based within a community of physical educators (Armour & Yelling, 2004). We found that 50.4% of schools required CE on PE-related topics. This is lower than earlier estimates also using a national survey in 2009–12, where 69.7% of schools required CE on PE topics. Although we used the same sampling approach (i.e., mail-back surveys of a nationally-representative sample), the item wording was different. Previously, researchers had asked whether *newly hired* PE teachers are required to earn CE credits on PE topics (Turner et al., 2014). In the current study, the item pertained to all PE teachers, and was embedded within a set of items about PE staffing and resources; it is possible that the PE teacher was more involved in helping with this survey, resulting in more-accurate responses. Furthermore, respondents at 12.5% of these schools indicated that they did not know the answer to the item about CE-PE. Because most respondents were principals who should—presumably—know about the supports available to and expected of their teachers, the high rate of unawareness on this topic is troubling.

Yet another possibility is that some schools have reduced their support for PE-CE. A national survey in 2014 (CDC, 2015) found that 58.7% of all schools (57.5% of elementary schools) reported that PE teachers are required to obtain CE credits on PE related topics, as compared to 62.9% in 2006 (Lee, Burgeson, Fulton, & Spain, 2007). This was a small drop, but combined with our results, it appears that it is far from the norm that in-service PE teachers are expected to continue their professional development on PE topics, or are provided support to do so. With regard to the extent of CE-PE, we found a wide range of hourly CE-PE, with a median of 12 h annually. Notably, most schools that require CE-PE did provide financial support, but 18% of schools that require CE-PE indicated that financial support is not provided. In other words, many PE professionals are expected to obtain CE, but to pay for it from their own salaries, which may reduce the willingness of teachers to participate in CE-PE. Participating in CE can improve the success of all teachers; specific to PE, it has been shown to help teachers to maximize student learning opportunities, teach diverse learners, and improve classroom safety (McCaughtry et al., 2006). Without the opportunity for continued professional development, teachers are unlikely to be able to learn about changes in PE standards, pedagogical practices, or assessment strategies, nor can they learn about innovations in practice such as the use of pedometers or other technologies for engaging students. Further, without CE teachers may not receive information about developments such as the CSPAP model and research demonstrating the value of PA for academic outcomes, which could help them to more-effectively advocate for resources for their programs. A lack of allocation of resources to CE may reduce the likelihood that PE specialists can engage in training on topics such as leadership skills, which may limit their opportunities for school or district-level leadership positions.

In addition to providing funding for teachers to obtain CE, annual PE budgets are another crucial element of maintaining suitable equipment and supplies for PE. Approximately half of schools allocated an annual budget to PE programs, with a median amount of $500. Calculated as a per-student amount, this was most commonly between only $.75 and $2.14 per student—a very paltry amount for instructional materials. This overall funding amount per school is similar to the median of $460 per school found in a smaller sample of U.S. elementary schools (National Association for Sport and Physical Education, 2009). Unfortunately, however, the current data also showed that many schools do not have even a minimal amount of funding available for PE expenses; approximately one-third of schools had no PE budget. With some schools allocating no annual PE budget and others allocating very minimal funds, it is unlikely that PE teachers will be able continue to provide good instruction, because of inevitable wear and tear on equipment, and the need to continue to update supplies for PE programming, as with any content area in education. Lack of adequate equipment has been noted as a contributing factor to management issues and poor student behavior in PE class, particularly in settings where there is not enough equipment for all students to participate (Morgan & Hansen, 2008).

Physical fitness testing has been, and continues to be, an emphasized component of PE programs and is encouraged by SHAPE America (2016), but the current data show that fitness testing was not implemented by all schools. Objective measurement of physical activity levels through motion sensors has become increasingly popular in the general population due to the availability of commercial “fitness trackers.” Utilizing feedback from affordable but accurate research-grade pedometers and heart rate monitors can be integrated easily and effectively in PE curricula (Nichols, Davis, McCord, Schmidt, & Slezak, 2009; Pangrazi, Beighle, & Sidman, 2007), but teachers need equipment budgets to enable the purchasing of such equipment, and time to allow them to utilize these devices in class. We found that respondents at 29% of schools reported that pedometers are used in PE class. This area of practice could be expanded, given the potential value of providing students with objective information about their activity levels.

3.3. Limitations

We have empirically examined the ways in which resource limitations are associated with PE practices in a nationally-representative sample of elementary schools; however, we also recognize that this might be a spurious correlation (i.e., driven by a third variable, such as a lack of recognition of the value of PE among school or district leadership, which could lead to low resource allocation, and inadequate PE practices). Several additional limitations impact the conclusions of the current study. The data are cross-sectional, which makes it problematic to infer causality or direction of the associations. The use of survey methodology may result in inaccurate data due to incomplete knowledge, or social desirability bias. It is important to note that these data predominantly represent the views of school administrators, who may not have complete knowledge of PE practices. Survey respondents were encouraged to consult with additional staff as needed, and although PE teachers were involved at nearly 20% of schools, it would have been ideal to have more involvement from PE specialists in this type of inquiry. Other work has found that administrator and teacher perceptions differ with regard to questions such as whether PE increases physical fitness or improves children's sport skills (Lounsbery, McKenzie, Trost, & Smith, 2011). Although such questions involve value judgments that clearly vary by respondent role, those topics are far more subjective than the current items regarding PE scheduling.

The survey items regarding how frequently and how much PE students receive is relatively objective information that can also be derived from a school's master calendar. The items could have been misinterpreted as a question about when PE classes are taught, rather than how often students have PE class; however, pre-testing showed no problems, the items have been used and the frequencies are similar to other studies that assess how often third grade students have PE class (Chriqui, Eyler, Carnoske, & Slater, 2013; CDC, 2015). In addition, we acknowledge that principals may lack knowledge about which specific assessment tools (e.g., FitnessGram® or PE Metrics) are used in PE classes, but because the purchase of such tools is likely approved by the principal, we expect that many principals would know this information or could obtain it easily.

Furthermore, one of the key PE practices examined in the current analyses was how much time 3rd grade students have in PE class; however, for schools to simply provide students PE time does not necessarily translate to effective instruction. The time spent in PE class time must provide students with exposure to meaningful content, appropriate instruction, and the opportunity to participate in physical activity (SHAPE America, 2015). This is best accomplished when taught by certified physical education specialists (McKenzie, 2007). PE programs are most effective in promoting student learning outcomes when those programs have administrative support and are perceived as an integral part of the educational process, rather than being marginalized as a subject that is less deserving of instructional time and resources (Castelli & Rink, 2003).

Finally, it is worth considering whether assessment is a crucial aspect of PE. In this study, we have conceptualized in-class practices—such as the assessment of student knowledge, physical fitness, and physical activity—as valuable practices, but some may not agree on this point. According to SHAPE America (2015), the formative and summative assessment of student progress is an important part of PE. However, it is crucial to remember that while such assessment provides useful information for tailoring instruction, it should not be used for assigning grades, but only to teach students about how to set goals and monitor their progress toward those goals (Institute of Medicine, 2012; National Association for Sport and Physical Education, 2010; SHAPE America, 2015). Additionally, the value of such assessments depends on whether they are done accurately.

4. Conclusions

This research empirically examines PE teacher workloads in a nationally-representative sample of public elementary schools, and investigates whether resources are associated with practices. We find an inverse association between workload and PE practices. In other words, when teaching loads are too high, PE practices are not optimal. Most likely, this is a result of districts and schools trying to preserve PE programming by stretching their limited financial resources—either by hiring fewer teachers, or by having their existing teachers cover more students. Our point is not to criticize school districts; the past decade's financial recession has been devastating to many districts. Educational funding to schools declined in nearly all states in the first part of this decade (Leachman & Mai, 2014), and many schools are taking measures that impact all students and content areas or academic subjects, such as increasing class size, cutting extracurricular activities, reducing staff, and cutting professional development expenses (Hull, 2010). This has compromised the quality of educational opportunities in a variety of content areas, including “core subjects” such as mathematics and English language arts, as well as the other crucial elements of well-rounded education. However, given abundant evidence that healthy children are better learners (Basch, 2011; CDC, 2010), allocating resources to PE programs supports teachers, and provides important benefits to students, not only for their physical health but also for their academic performance. Financial support is essential for schools to be able to employ a sufficient number of well-trained PE professionals, and to provide instructional resources such as PE equipment. We urge administrators to prioritize students' current and future health and academic outcomes by supporting PE teachers in providing PE programming that teaches children the knowledge, skills, and dispositions to be active for a lifetime.

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