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Funding our Future: Investing in School-Based Health

By

Anne Lionberger Reed

A dissertation submitted in partial satisfaction of the

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Committee in Charge:

Professor Kristine A. Madsen, Chair

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Summer 2018

ABSTRACT

Funding our Future: Investing in School-Based Health

by

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Doctor of Public Health

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Despite the link between health and learning, school districts typically do not have the resources or incentives to address the health conditions that influence academic performance. Although most educators understand that health is a condition of learning, they are often reluctant to reallocate limited education dollars from the classroom to invest in student health, which may have the unintended consequences for academic outcomes. Recognizing the reciprocal relationship between health and education, this dissertation explores strategies for and outcomes of funding for school-based health initiatives in an effort to identify practical opportunities to reduce health and education disparities among current and future generations of US children.

Using cases from around the country, Paper 1 reviews successful strategies that education stakeholders have used to fund school health initiatives that address “educationally-relevant” health disparities. These cases share three common facilitators: 1) a local champion, 2) alignment with district priorities, and 3) nontraditional funding mechanisms, including: “braiding” education dollars; local tax revenue; Medicaid; and cross-sector partnerships.

Paper 2 investigates whether California school districts are investing in Physical Education (PE), which has been cut disproportionately in schools serving predominately low-income students, and what characteristics are associated with those districts that do invest in PE. California, which in 2013 overhauled its school finance formula and now provides additional funding to districts serving more “disadvantaged” students, offers a unique opportunity to examine how school districts serving low-income students prioritize funding for health given more funding and flexibility for how it is spent. Controlling for other district-level characteristics, the paper concludes that districts with high percentages of disadvantaged students had greater odds of investing in PE compared to districts with lower percentages of disadvantaged students.

Paper 3 examines whether PE investments are associated with changes in students’ cardiovascular fitness levels. Controlling for other district-level characteristics, this paper finds that PE investments are associated with modest increases in student fitness levels among districts with fewer than 6,350 students (75th percentile of mean statewide enrollment), while among

districts with 6,350 students or more, PE investments are associated with modest decreases in fitness levels. Consistent with prior research, this study also documents persistent and troublesome disparities in fitness levels between students in low- and high-income districts. Finally, the study finds great variability in the cardiovascular fitness data over time, particularly among small districts, which raises important questions regarding the value of the *FITNESSGRAM* aerobic capacity test to reliably monitor student health outcomes.

You can't educate people that are not healthy. But you certainly can't keep them healthy if they're not educated.

- Jocelyn Elders, 2005

By systematically addressing educationally relevant health disparities, schools can reduce both educational and health disparities. But this will not occur efficiently with the current strategy of investment in school health programs.

- Charles Basch, 2010

The goal of school finance policy in particular is to provide the resources to offset pre-existing inequalities in the likelihood that one child has a greater chance of achieving the desired outcome levels than any other.

- Bruce Baker, 2015

We are bringing government closer to the people, to the classroom where real decisions are made, and directing the money where the need and the challenge is greatest. This is a good day for California, it's a good day for school kids and it's a good day for our future.

- Gov. Jerry Brown, 2013

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List of Abbreviations

CDE	California Department of Education
CPS	Chicago Public Schools
ESSA	Every Student Succeeds Act
GPA	Grade Point Average
HFZ	Healthy Fitness Zone
IDEA	Individuals with Disabilities Education Act
IEP	Individualized Education Plan
K-12	Kindergarten – 12 th grade
LCFF	Local Control Funding Formula
LCAP	Local Control and Accountability Plan
MVPA	Moderate to Vigorous Physical Activity
NCLB	No Child Left Behind
PE	Physical Education
SES	Socioeconomic status
SY	School Year
VAPA	Visual and Performing Arts

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INTRODUCTION

Former U.S. President Barack Obama said "education is no longer just a pathway to opportunity and success, it's a prerequisite for success".¹ Educators widely agree that "success" is defined more broadly than preparing students for higher education and the workforce; "there is a much larger purpose to educating our next generation to make a living, a life, and a difference."² Just as schools are critical for preparing students academically, they are essential for conferring the knowledge and skills necessary for children to live healthy lives.³

The U.S. invests over \$600 billion each year in elementary and secondary public education to ensure that every student has the opportunity to be successful.⁴ However, this investment does not yield equal outcomes for US students, compromising the success of current and future generations of Americans.^{5,6} Black and Hispanic students in the US have consistently lower academic outcomes than their white and Asian peers.⁷ Known as the "achievement gap", this phenomenon describes differences in academic performance between groups of students, usually measured by standardized test scores.⁸

While many factors influence student achievement, health is among the most fundamental. In fact, the relationship between education and health is reciprocal: children who are unable to attend school or focus in the classroom due to illness cannot fully benefit from their education.⁹ Likewise, educational attainment is a strong predictor of health status over the life course. Despite the inextricable link between health and learning, the distinctions between the health and education fields have led to separate policy and funding mechanisms.^{10,11} As a result, few efforts to reduce disparities in student achievement have addressed health.⁹

Despite strong evidence that healthy students are better learners, "many administrators, parents and concerned citizens remain unconvinced that an investment for improving learner health status will pay dividends in enhanced performance on proficiency tests and overall academic achievement."¹² The lack of prioritization of and investment in school health initiatives extends into what had long been considered a key subject in US schools – physical education (PE). Research shows that notwithstanding a belief among school administrators of its importance for student health and learning, budgets and time allocated for PE have been cut across the country.¹³ The Centers for Disease Control and Prevention reports that only 4% of elementary schools, 8% of middle schools and 2% of high schools provide daily PE.¹⁴ A lack of support and funding for PE may limit its potential contribution to student health factors that moderate academic achievement.

Recognizing that educators' "bottom line" is academic achievement, it is unlikely that administrators operating in resource-constrained environments would choose to invest resources in initiatives that do not support students' academic outcomes. This research represents an important step in making the case for investing education resources in school-based health initiatives that may reduce health disparities and mediate academic achievement. Thus, the purpose of this research is to explore the value of, and mechanisms for, investing education resources to reduce health disparities.

Specifically, this dissertation first seeks to identify current opportunities for leveraging nontraditional funding for schools to invest in health initiatives. Second, using California's recent school finance reform as an example, this research explores whether California school districts leveraged the increased flexibility of a new funding formula and, in the case of those that serve greater numbers of disadvantaged students, more funds, to support PE. Finally, this dissertation undertakes to address whether prioritization of and investments in PE among California districts are associated with changes in students' cardiovascular fitness levels.

This research helps fill an important gap in the literature about how education funding can be used to improve health among U.S. children. This complements efforts to explore how strategies to reduce health disparities can be employed to reduce disparities in student achievement.

PAPER 1

Nontraditional Funding for School-Based Health

Abstract: Despite the link between health and learning, school districts typically do not have the resources or incentives to address the health disparities that influence academic performance. Although most educators understand that health is a condition of learning, they are often reluctant to reallocate limited education dollars from the classroom to invest in student health, which may have the unintended consequences for academic outcomes. Using cases from around the country, this paper reviews successful strategies that education stakeholders have used, which share three common facilitators: 1) a local champion, 2) alignment with district priorities, and 3) nontraditional funding mechanisms, including: “braiding” education dollars; local tax revenue; Medicaid; and cross-sector partnerships.

Since the release of the Coleman Report in 1966, which first documented what is now known as the achievement gap, US education policy and funding have shifted from a whole child approach to a more narrow focus on academic achievement.¹⁵⁻¹⁸ But research unequivocally shows that student achievement is not only a function of curriculum and instruction, it is also influenced by factors such as students’ neighborhood, socioeconomic status (SES), and family educational attainment.⁷ Health, which is linked to SES and education, is also an important driver of achievement; poor health can compromise children’s ability to attend school and to focus in the classroom when they are in school.¹⁹ Despite the link between health and learning, historically school reform efforts have not included health, and current education funding and accountability systems do not incentivize schools to address the health conditions that influence academic performance.^{10,11,20} The federal Every Student Succeeds Act (ESSA), which replaced No Child Left Behind in 2015, acknowledges the importance of health for student learning, but allows states to determine how and to what extent schools should address it.²¹ This lack of focus on health may limit schools’ ability to improve academic outcomes.²⁰

Schools alone cannot overcome health conditions that compromise learning, which are influenced by myriad factors. Health providers, insurance companies, city planners, elected officials and other stakeholders must take a coordinated approach to ensure that children are healthy and able to fully benefit from their education. However, schools are uniquely positioned address a number of health conditions that are associated with learning. Based on their prevalence among low-income minority youth, their direct link to learning and the availability of school-based initiatives to address them, Dr. Charles Basch of Columbia University Teachers College has identified eight “educationally relevant health disparities”, or “health problems that disproportionately affect low-income urban minority youth as measured by incidence, prevalence, and educationally relevant consequences”, that schools can tackle to improve student achievement. These include: vision, asthma, teen pregnancy, aggression and violence, physical activity, breakfast, inattention and hyperactivity, and oral health.²⁰ (See this [2013 article by Basch](#) in *School Administrator* for more information.)

Schools that serve students with the greatest educationally relevant health disparities are often the same schools where students face the greatest gaps in achievement. These schools also lack the resources to sufficiently address the needs of their students.²² Understandably, in these resource-constrained environments, educators, who are held accountable for students’ academic

outcomes, may be unwilling to shift limited funding to health.¹² However, nontraditional strategies should be identified to support school-based health efforts if educators are serious about closing disparities in achievement.²⁰

Strategies for Funding School Health

So how can education systems invest in school health without displacing the money that supports the fundamental educational mission of schools? Many schools and districts turn to grant funding, which can be critical for incubating new initiatives, but typically has a short lifespan. Instead, as evidenced by examples from around the country, education stakeholders can pursue nontraditional strategies to fund health initiatives that directly support educational outcomes.

The preponderance of the examples below share three common characteristics that, combined, facilitate execution of nontraditional strategies to address educationally relevant health disparities: 1) a local champion, 2) alignment with existing district priorities, and 3) nontraditional funding mechanisms. Champions are critical for identifying and pursuing alternative strategies for school health; even the best ideas will not reach fruition without a champion to move the often-formidable work forward. The second characteristic, alignment with existing district priorities ensures that health initiatives are complementary – and not extraneous – to the mission of the district or school. If health initiatives are not aligned with educational priorities and do not practically fit within the scope of the school day, decision-makers will not be able to justify the time and resources required for student health. Finally, nontraditional funding mechanisms, which are described below, ensure that health initiatives can be sustained over time and do not reduce the money available for instruction.

Of these three characteristics, securing nontraditional funding mechanisms to address educationally relevant health disparities may be the most challenging for education stakeholders because it requires identifying and pursuing resources that may not be immediately available. However, school districts and their partners around the country have identified nontraditional approaches to funding school health, including: 1) “braiding” education dollars; 2) local tax revenue; 3) Medicaid; and 4) cross-sector partnerships.

While not exhaustive, these examples illustrate first and foremost how education stakeholders are using nontraditional funding mechanisms to address educationally relevant health disparities. Where relevant, they also call out the role of the champion and how the health initiative was strategically aligned to the educational priorities of the district. The cases below were identified largely through word-of-mouth as no repository for this information currently exists; districts and partners were interviewed via phone. Though the examples are predominantly from large, urban school districts where educationally relevant health disparities are most pronounced, the funding strategies are likely applicable across different localities.

“Braiding” Educational Dollars

The education sector is experienced at braiding funding, or weaving together education funding streams to support the total cost of a service or program like special education, job training, and early childhood.²³⁻²⁵ This approach, which is promoted by the Every Student Succeeds Act as a strategy to coordinate comprehensive services, can also be applied to school health to reduce educationally relevant health disparities.²⁶

- San Diego Unified School District: [School Nursing and Wellness Department](#) Manager and district champion Michelle Bell centralized funding for school nurses to ensure equitable distribution of nursing services across the district. By braiding a combination of federal Title I, IDEA, general funds, and capitalizing on principals' interest in using discretionary funds to buy-out a portion of their nurse time, Bell has facilitated a 22% increase in school nurse positions (from 113 to 138) between 2012 and 2017, even in the face of a district-wide budget deficit.

Moreover, recognizing that nurses are underutilized allies in supporting schools' educational mission, Bell and her team aligned the responsibilities of nurses with the goals of the district to increase attendance. Bell launched the [Chronic Absence Pilot \(CAP\)](#) in 27 schools in Fall 2017, which tasks nurses with directly supporting attendance, including convening and/or participating in the school's [Attendance Team](#), calling home when students miss school, and proactively addressing the health-related barriers of the 10 most chronically absent students in their schools. By increasing average daily attendance, Bell and her team support increased revenue generation for the district. (Educationally relevant health disparities: asthma, vision, dental, teen pregnancy, aggression and violence, inattention and hyperactivity)

Considerations for replication:

- Districts can seek to braid federal funding sources, state block grants, and local general funds.
- Braiding requires that districts and schools maintain the original intention of the funds, and thus must tailor the work to meet goals of each specific funding source.

Local Tax Revenue

While local property taxes account for approximately 36% of education financing nationwide, additional local taxes can be levied to support school health, including bond measures and tax increment financing.²⁷ These funding mechanisms require support from city leadership and, in the case of bond measures, voters.

- New York City: In the 2015-2016 school year, Mayor Bill de Blasio championed school health by allocating \$6 million from the city budget to establish [PE Works](#), a pilot in 400 schools to revitalize physical education. PE Works includes funds for hiring and providing ongoing training for certified PE teachers to ensure their efforts are aligned with district goals, such as high quality instruction and meeting state requirements for PE frequency and duration. De Blasio subsequently increased the investment to \$100 million to expand the initiative Citywide in 2016-17.²⁸ (Educationally relevant health disparity: physical activity)
- San Francisco: In 2016 voters approved [Prop A, a bond measure](#) that increased property taxes by \$15.90 per \$100,000 of assessed property value for a variety of capital investments for the district, including \$20 million to improve school kitchen equipment, cafeterias and dining spaces as part of a district effort to improve the meal experience for SFUSD students.²⁹ The investment in School Nutrition Services, which was championed

by the district's operations leadership, who made the case for the importance of school food to key decision-makers, is aligned with the district's goal's to "to strengthen academic performance by promoting good eating habits and providing access to high quality nutritious food that appeals to the district's diverse community of students", including increased access to school breakfast.³⁰ (Educationally relevant health disparity: breakfast)

- Seattle: The [Families and Education Levy](#), a property tax levy approved by Seattle voters in 2011, builds on past levies and commits \$235 million over seven years for a variety of services aimed at preparing students to enter kindergarten ready to succeed, reducing gaps in student achievement, and preparing students to graduate ready for college or career. The levy earmarks \$8 million for health, including funding for school-based health clinics that provide [physical and mental health services](#), sexual health education, and [oral health services in schools](#).³¹ Administered by the Seattle and King County Department of Public Health, the levy is aligned to the goals of the school district by framing health as an academic intervention. School-based health providers are held accountable for education outcomes; 25% of provider funding is contingent on student grades and attendance. (Educationally relevant health disparities: asthma, vision, oral health, teen pregnancy, aggression and violence, inattention and hyperactivity)

Due to the accountability requirements and corresponding data collection established by the levy, the academic outcomes associated with this investment have been the subject of rigorous evaluation. A 2010 study of 9th grade Seattle students that examined SBHC use as a predictor of academic outcomes found that while the effect sizes were low to moderate, SBHC use is significantly associated with attendance and grade point average (GPA). Specifically, medical use of SBHC services was most strongly associated with increases in attendance while mental health use was more strongly associated with increases in GPA.³² A subsequent longitudinal study published in 2011 found that low to moderate SBHC use among Seattle high school students was associated with a 33% reduction in dropout compared with non-SBHC users. The effects were especially pronounced among students at higher risk for dropout (including attendance less than 90%, grade point average less than 2.5, free/reduced lunch status, being African American, and being Hispanic).³³ These findings support the notion that an investment in health is an investment in education.

Considerations for replication:

- Identify funding within existing tax code that may be allocated to school health.
- Find an elected official to champion new opportunities to support school health.
- Collect and use data to measure outcomes and encourage sustainability.

Medicaid

Particularly in districts with high concentrations of low-income students, Medicaid represents a significant funding source to offset the costs of existing and provide new school-based health services without compromising budgets for education initiatives.³⁴ With the passage of the Affordable Care Act, which emphasizes improved access to health services, schools and their partners are now able to leverage Medicaid for a wider range of services and activities.³⁵

- Lane County, Oregon: The Lane County Department of Health and Human Services works with Trillium Community Health Plan, the county's Medicaid Coordinated Care Organization, to support training and implementation of the [Pax Good Behavior Game](#) and the [American Institutes for Research Good Behavior Game](#), both evidence-based programs that equip teachers to support student self-regulation and have been shown to decrease substance abuse, prevent social or psychological disorders, and support teachers' classroom management. [The program](#) is offered to elementary schools across the county's 16 school districts using funds from a \$1.33/member set-aside to fund programs that "prevent chronic disease and help Trillium members live healthier lives". Since its inception in 2012, the county has seen a 30% decrease in classroom disruptions among trained teachers. (Educationally relevant health disparity: inattention and hyperactivity, aggression and violence)
- Chicago: Recognizing the link between vision and learning, the State of Illinois requires that all students entering kindergarten and entering the State of Illinois for the first time at any grade level (K-12) present proof of a comprehensive vision exam upon enrollment or no later than October 15th.

With strong advocacy from the Chicago Department of Public Health and the district's Office of Student Health and Wellness, the Chicago Public Schools (CPS) responded to this requirement, established in 2008, by leveraging federal grant funds to develop a [comprehensive vision service program](#) that includes vision screening, referrals and case management, comprehensive eye exams, and dispensing of eyeglasses. Since it was established, the program has transitioned to a largely Medicaid-funded model: the district provides initial vision screenings, for which it bills Medicaid, and contracted optometrists assigned to schools with the Chicago Department of Public Health bill Medicaid or private insurance of school-based vision exams. Using the same funding structure, CPS offers a year-round, stand-alone vision clinic (school-linked) in partnership with the Illinois Eye Institute that is open daily for any student who needs an exam.²⁶

While over 80% of the district's student body is considered low-income, only 60% of students are enrolled in Medicaid at the time of service. To that end, the district proactively works to enroll eligible students and their families in public insurance to ensure health care access for the children and to support the sustainability of the student health services provided (i.e. audiology/ear/nose/throat exams, dental exams, vision exams, vision and hearing screening). Through private grants, the district's partners are able to cover the cost of serving students who are uninsured. (Educationally relevant health disparity: vision)

- Boulder, Colorado: In Colorado, the Medicaid State Plan requires school districts to allocate reimbursement for services to students with an Individual Education Plan (IEP) to provide health services for all students based on a local needs assessment. [Boulder Valley](#), which serves 30,000 students and receives approximately \$1.5M annually in Medicaid reimbursement, has used the funds to meet five identified needs that also align

with the goals of the district’s strategic plan to improve the health and safety of students: social emotional health, health education, access to care, access to insurance, and coordination of services. The plan, spearheaded by Health First Coordinator Liz Clark (whose position is funded through Medicaid reimbursement), establishes a coordinated response to student health that includes covering the cost of six school nurses positions, 3.5 behavioral health providers for students and families, and a 0.6 “resource nurse” to assist with case management for students. Additionally, the district assists student and families with accessing health insurance and provides vouchers for services for those students who are not Medicaid-eligible. The district also provides mental health first aid training for over 500 district staff, sets aside funds for establishing and remodeling school-based health centers, and in response to the primary health concern identified in their needs assessment, has partnered with nonprofit dental providers to provide oral health services to students across the district. (Educationally relevant health disparities: asthma, vision, oral health, teen pregnancy, aggression and violence, inattention and hyperactivity)

Considerations for replication:

- Partner with organizations such as healthcare providers, health systems and public health agencies that have an incentive to prevent chronic illness to reduce costs and improve quality of care. These organizations bring extensive Medicaid expertise and can help strategize about how to use Medicaid funds for school health.
- Implement strategies to maximize Medicaid reimbursement (e.g. increase enrollment among Medicaid-eligible students, assess current billing practices, hire providers to increase billing and address unmet health needs) that can be used to cover costs of program administration.

Cross-Sector Partnerships

While partnerships are an important feature of many nontraditional funding examples, in some cases, they are the key ingredients for funding school-based health programs.

- Chicago: [Space to Grow](#) is a unique partnership between the City’s Department of Water Management, the Metropolitan Water Reclamation District of Greater Chicago (MWRD), and the Chicago Public Schools. The initiative transforms flood-prone schoolyards into spaces for children to learn and play. Each schoolyard costs around \$1.5 million to design and build, shared equally between the three capital partners.³⁶ Learn more about schoolyard redesign initiatives in [this national report](#). The partnership was brokered by Healthy Schools Campaign and Openlands, two nonprofit organizations that synthesized relevant research from other similar programs around the country, identified the funding opportunity, convened the partners, facilitated consensus-building, and supported a formal agreement between the three public entities. (Educationally relevant health disparity: physical activity)
- Toledo, Ohio: Fueled by Superintendent Dr. Romules Durant’s strong commitment to address the growing health needs of students, [Toledo Public Schools partnered with nonprofit health system ProMedica](#) in 2015 to invest \$600,000 in 12 additional school

nurse positions, thereby ensuring that all 40 elementary schools have a full-time nurse on-site.³⁷ Like all nonprofit hospitals, ProMedica is required by federal tax law to spend some of their surplus on “community benefits,” which the organization used to fund 9 of the 12 nurses for three years (the other three nurses were hired by TPS as a condition of the partnership). TPS methodically aligned the program deliverables to the [district strategic plan](#), the [Lucas County Community Health Improvement Plan](#), and [Healthy People 2020](#) goals for adolescent health. (Educationally relevant health disparities: asthma, vision, dental, teen pregnancy, aggression and violence, inattention and hyperactivity)

- Miami: Every year, 2,500 students from Miami-Dade Public Schools participate in [Anchors Away](#), a sailing program for middle and high school students with special needs that meets the district’s equity goals. Jayne Greenberg, former Miami-Dade Public Schools Director of Physical Education and Health Literacy, facilitated a partnership between the Aventura Marketing Council, which has contributed over \$500,000 and 37 boats since the program began, three local sailing clubs that donate their space each weekday, and the school district, which provides six full-time teachers and bussing for students through IDEA funds. (Educationally relevant health disparity: physical activity)
- Sevier County, Tennessee: In 2007, Sevier County Public Schools Superintendent and School Health Coordinator Don Best realized that their students were suffering from a variety of unmet health needs. That realization led them to make a one-time investment of \$750,000 in infrastructure and equipment for a [telehealth program in partnership with Cherokee Health Systems](#), the largest nonprofit health provider in the area. The school district has funded additional nursing positions to ensure full-time coverage at each of its 27 schools, an increase from 13 roving nurses to 46 positions (most of which are part-time). Nurses facilitate telemedicine visits for students and employees while Cherokee Health bills Medicaid or private insurance for the medical care and largely covers the cost of uninsured visits with community benefit dollars. Since the program’s inception, Cherokee has begun to provide on-site mental health services for all five of the district’s high schools. (Educationally relevant health disparities: asthma, vision, oral health, teen pregnancy, aggression and violence, inattention and hyperactivity)

Considerations for replication:

- Successful partnerships allow partners to accomplish their respective goals by leveraging their complimentary assets and limitations.³⁸
- Consider how funding school health priorities can benefit partners, including tax deductions positive media coverage.
- Strong relationships are essential to building viable, lasting partnerships.

Challenges

While the examples above outline promising opportunities to invest in school health, they are not without their limitations. First, the funding mechanisms described above may not cover the full cost of school-based health services, leaving districts to identify additional funding or only partially implement interventions. Second, in order to maximize the effectiveness of limited resources, it is essential that efforts to address educationally relevant health disparities are

coordinated, ideally by someone who can use data to understand the prevalence of educationally relevant health disparities and who can use the Center for Disease Control's [Whole School, Whole Community, Whole Child model](#) to lead "the different programs, services, and policies and how they can be linked together".^{20,39} In New York City, the Department of Education and the Department of Health and Mental Hygiene jointly fund the [Office of School Health](#), including its leadership positions and several of its programs. Similarly, in 2012 the Chicago Public Schools and the Chicago Department of Public Health, with funding from the Sprague Foundation, created a [Chief Health Officer](#) position to coordinate health services and programs across the district. With a dual reporting role between CPS and CDPH, responsibility for funding the position has since been assumed by the two agencies.

While educators are not explicitly held accountable for student health outcomes, efforts to address disparities in academic performance will likely not succeed until the health disparities that influence achievement are addressed.²⁰ Thus, education leaders have an imperative to invest in student health. The examples outlined above highlight nontraditional strategies education stakeholders across the country are using to address educationally relevant health disparities, including the critical function of coordination of services across schools. In most of these examples, local champions have identified opportunities to capitalize on nontraditional funding sources to invest in school health, and have tailored the efforts to align with the academic priorities of school districts to ensure their long-term sustainability.

PAPER 2

Taking Steps to Reduce Health Disparities: Investing in Physical Education in California

Abstract: Despite evidence that it is linked to health and academic outcomes, Physical Education (PE) has been cut substantially across the country, disproportionately affecting schools serving predominately low-income students. California, which in 2013 overhauled its school finance formula and now provides additional funding to districts serving more “disadvantaged” students, offers a unique opportunity to examine how school districts serving low-income students prioritize funding for PE given more funding and flexibility for how it is spent. This study used data coded from Local Control and Accountability Plans, a document developed annually to outline priorities for district expenditures, from 71 California school districts to characterize the strength of school districts’ investment in PE. District-level demographic and school finance data was used to examine whether California school districts are investing in PE and what characteristics are associated with those districts that do invest in PE. Of the 71 districts in the sample, 32 (45%) made a commitment to invest in PE. Controlling for other district-level characteristics, districts with high percentages of disadvantaged students had greater odds of investing in PE compared to districts with lower percentages of disadvantaged students (OR = 1.3, 95% CI = 1.0, 1.7). This study suggests that given increased funding levels and flexibility for how to spend it, districts serving disadvantaged students may prioritize funding for PE.

Background

Despite strong evidence that healthy students are better learners, many educators are hesitant to dedicate scarce education resources to address health conditions that may compromise academic outcomes.^{12,40} Schools that serve large populations of low-income children typically have fewer resources than wealthier schools and face more political, social, and economic pressures, resulting in fewer courses and services that are not directly linked to accountability measures.⁴¹ This trend is evidenced in a lack of prioritization and funding for physical education (PE): schools across the country have made cuts to PE despite mounting evidence that quality PE can improve fitness levels and is positively related to academic achievement.⁴²⁻⁴⁴ These reductions have been most significant among schools serving predominately low-income students.⁴⁵

In California, where over 59% of the state’s 6.2 million students are considered low-income⁴⁶, limited funding, competing academic pressures, and a lack of enforcement at the state level have contributed to deficient quality and quantity of PE, particularly at the elementary level and in schools serving low-income and minority students.^{47,48} A 2011 study showed that only 5% of California elementary schools were in compliance with state education code requirements, which mandate that students in grades 1-6 receive a minimum of 200 minutes of PE every ten days.⁴⁹ In a 2010 survey conducted among California School Board members, lack of funding was the most cited (88%) barrier to addressing PE at the district level.⁵⁰

California now offers a unique opportunity to examine how school districts serving low-income students prioritize funding for PE given more funding and flexibility for how it is spent. Until 2013, the state’s school finance system was highly centralized and included over 50 categorical

programs that were closely regulated by the state.⁵¹ With the adoption of the Local Control Funding Formula (LCFF) in 2013, school districts have considerably more flexibility for how they spend their funds to meet the needs of their students. Additionally, LCFF significantly increases funding for districts serving higher numbers of disadvantaged students (defined as low-income, foster youth and English learners).^{52,53}

The flexibility introduced by LCFF may prompt California districts to invest in PE, as might external incentives and pressures. First, the federal Every Student Succeeds Act (ESSA), which replaced No Child Left Behind in 2015, broadens the focus of curriculum to include PE, allows federal education funds to be used to support PE, and holds districts accountable for multiple measures of student achievement that could include health.⁵⁴ Second, the widespread noncompliance with state-mandated elementary PE requirements prompted legal action against over 100 California school districts.^{55,56}

While LCFF emphasizes flexibility of the use of funds, it also requires all districts to complete a Local Control and Accountability Plan (LCAP), a three-year plan that describes the district's goals, actions, and spending priorities. LCAPs document planned expenditures for state funds *and* local tax dollars – about 85% of total district funds.⁵⁷ This study represents the first known attempt to take advantage of the new LCAPs to examine whether, with increased accountability and flexibility, California school districts are investing in PE and what characteristics are associated with those districts that do invest in PE. Based on LCFF's weighted funding formula, which provides more funding for students who are considered disadvantaged, it was hypothesized that districts serving high concentrations of disadvantaged students, where PE has been most deficient, would use their increased discretionary funding to invest in PE.

Methods

Participants

Using stratified random sampling, 71 elementary and unified school districts were selected for the analysis based on tertiles of total student enrollment, student free and reduced-price meal eligibility (a proxy for socioeconomic status), and *FITNESSGRAM* aerobic capacity test scores (in order to explore outcomes of PE investments in future research). Districts for which *FITNESSGRAM* results were missing each year between SY2013-14 and SY2015-2016 or for which the mean score for students in the Healthy Fitness Zone was zero between SY2010-2011 and SY2015-2016 were dropped due to implausibility. Because PE is most deficient at elementary level, high school districts were excluded from the analysis. Additionally, “basic aid” districts, which do not receive state aid, were excluded because their revenue did not shift as a result of the transition to LCFF.⁵⁸

Instrumentation

Explanatory Variables

The following data were obtained from publicly available databases managed by the California Department of Education (CDE): 1) percentage of disadvantaged students (defined as students enrolled in free and reduced-price meals, English Learners, or foster youth); 2) total district enrollment (including enrollment by race/ethnicity); 3) average class size; and 4) per pupil expenditures. A county-level indicator for rural, urban cluster (at least 2,500 and less than 50,000

people), or urbanized areas (50,000 or more people) was obtained through the US Census Bureau.⁵⁹ Baseline demographic data are from SY2014-2015.

Response Variables: LCAPs and Documented Commitment to Physical Education

LCFF requires that every school district complete an LCAP each year that outlines its goals, actions, and related expenditures for the following three years. Districts are held accountable by the state for the activities outlined in their LCAPs; those that do not meet the goals specified in their LCAPs and fail to improve educational outcomes receive additional support from the CDE.⁶⁰ The activities and expenditures outlined in the LCAP should align with district budgets, although there is currently no mechanism at the state level for ensuring that districts' written plans documented in LCAPs are reflected in their LCFF budgets.⁶¹ Thus, in the absence of transparent financial data, LCAPs were coded to capture districts' level of "documented commitment" to PE as a proxy for planned expenditures.

LCAPs for districts in the sample were accessed through a publicly available database managed by the Education-Trust West.⁶² LCAPs from the first year of LCFF implementation (SY2014-2015) were excluded from the analysis because of the significant "learning curve" in completing LCAPs for the first time and short timeframe (four months) for completion, which may have resulted in LCAPs that do not fully reflect the scope of district efforts.

To generate the dependent variable for this study, LCAPs for SY2015-2016 and SY2016-2017 were reviewed and binary indicators were coded for references to PE across three dimensions of investment: personnel (i.e., recruiting or hiring new PE teachers), professional development (i.e., training for PE and/or classroom teachers to improve PE instruction), and equipment/materials (i.e., purchasing jump ropes for PE instruction). While many districts chose to include information in addition to the template approved by the state, coding was limited to the information included in the official LCAP template. Two outcome variables were generated: a binary variable indicating any "Documented PE Commitment" across the three dimensions of investment in both years, and a "Documented PE Commitment Score" – the sum of the binary indicators for personnel, equipment/materials, and professional development across SY2015-2016 and SY2016-2017 (possible range from 0 to 6).

LCAPs were also reviewed for commitment to Arts Education. Like PE, Arts Education was cut significantly over the last 20 years, particularly in districts serving disadvantaged students, due to decreased budgets and narrowed accountability.^{63,64} Those same districts, which have experienced large influxes of funding through LCFF, may choose to reinstate some or all of the subjects that were cut. Thus, understanding district investments in Arts Education is important for two reasons. First, it controls for unobserved confounders that may influence Documented PE Commitment, such as district leadership and values. Uncovering whether there is an association between commitments to PE and Arts will isolate whether low-income districts are prioritizing the reinstatement of a single subject or are taking a "whole child" approach that promotes a comprehensive curriculum that includes PE and Arts. Second, analyzing what district characteristics are associated with documented commitments to Arts will illuminate whether there are differences between districts prioritizing Arts versus PE, and may help explain why. It was hypothesized that districts serving high percentages of disadvantaged students would use their increased discretionary funding to invest in Arts at lower rates than PE due to the specificity

of PE requirements in California school code and the pressure exerted by the legal action to comply with those requirements.

Like PE, two outcome variables to measure Documented Arts Commitment were generated: a binary Arts indicator for any commitment to Arts and an ordinal indicator for Documented Arts Commitment Score. To create these variables, LCAPs for SY2015-2016 and SY2016-2017 were coded for any references to Arts terms, including “Arts”, “Visual and Performing Arts (VAPA)”, and “Music” (which are considered comparable courses that fall under the umbrella of “Arts Education”) across the three dimensions of investment: personnel, professional development, and equipment/materials. Individual “Documented Commitment Scores” were created for Arts, Music, and VAPA by summing binary indicators for personnel, equipment/ materials, and professional development across SY2015-2016 and SY2016-2017. A binary “Documented Arts Commitment” variable was created for any commitment (i.e., score above zero) to Arts, VAPA, or Music across the two years that was used in bivariate analysis. An ordinal “Documented Arts Commitment Score” was created for multivariate analyses by taking the mean of a district’s Documented Commitment Scores for Arts, Music, and VAPA.

Districts must engage stakeholders, such as teachers, principals, administrators, local bargaining units, parents, and pupils, in developing their funding priorities and document how constituent input influenced their LCAP.⁶⁵ The LCAP’s “Stakeholder Engagement” section describes how districts engage these constituents, and how that input influenced the resulting LCAP.⁶⁶ LCAPs were coded for and a binary indicator was generated to reflect whether a reference to PE or Arts (including Arts, Music, and VAPA) was found in the Stakeholder Engagement section, noted as “Stakeholder Investment.”

Additional variables

The percent change in student enrollment between 2013-2014 and 2014-2015 was calculated to examine whether anticipated changes in enrollment, which drives school funding in California, is associated with district commitments to PE and Arts.

Statistical analysis

Logistic regression examined bivariate associations between Documented PE Commitment and district characteristics. To explore a dose-response effect accounting for *level* of Documented PE Commitment, ordered logistic regression was used with the Documented PE Commitment Score as the outcome, controlling for demographic and school funding factors. The same bivariate and multivariate models were run using binary and ordinal predictors, respectively, for Documented Arts Commitment.

Because the relationships between Documented Commitment Scores and the primary predictors were not linear, ordered logistic regression was used. Ordered logistic regression treats the response variable, Documented Commitment Scores, as ordinal under the assumption that the levels are ordered low to high, but the distances between each level is unknown.⁶⁷ The assumption of proportional odds was satisfied for the data used in this study, meaning that the odds for the highest category vs. all lower categories combined was equivalent to the odds of the highest categories combined vs. the lowest category. Thus, the ORs can be interpreted as for a typical logistic regression model.⁶⁷

In exploratory analyses, class size and percentage urban population did not contribute to the results and thus are not shown in the adjusted models. Additionally, due to collinearity between the percent disadvantaged students and percent African American and Latino students ($\rho=0.74$), only percent disadvantaged students was used in the adjusted models.

Results

District characteristics at baseline were not significantly different from statewide averages for elementary and unified school districts with the exception of percent disadvantaged students and percent African American and Latino students (Table 2.1). These differences are expected as the sample was weighted to include more low-income districts, which is associated with higher concentrations of African American and Latino students.⁶⁸

Of the 71 districts in the sample, 32 (45%) districts documented a commitment to invest in PE, compared to 49 (69%) documenting a commitment to the Arts ($p=0.0$). Districts committed to personnel for PE and Arts at a greater rate than to professional development or equipment and materials (Table 2.2). Out of a possible range from 0 to 6, Documented PE Commitment Scores ranged from 0 to 4 and Arts scores ranged from 0 to 5 (Table 2.3).

Table 2.4 reports odds ratios for bivariate associations between any documented commitment to PE and Arts and various school characteristics. Percent of disadvantaged students enrolled (OR=1.5 for PE; OR = 1.4 for Arts) and percent of African American or Latino students (OR=1.3 for PE and Arts) were the two statistically significant demographic predictors of Documented Commitments to PE and Arts. Stakeholder engagement was significantly associated with Documented Commitments to PE (OR=23.8) and Arts (OR=2.9). Documented Arts Commitment was significantly associated with Documented PE Commitment (OR=9.2) and similarly, Documented PE Commitment was significantly associated with Documented Arts Commitment (OR=9.2).

Tables 2.5 and 2.6 report odds ratios for multivariate ordered logistic regression models that examine the associations between district characteristics and ordinal Documented Commitment Scores for PE and Arts, respectively. Table 2.5 reports odds ratios for district characteristics associated with Documented PE Commitment with 95% confidence intervals. After adjusting for all demographic covariates (Model 6), for every 10% increase in disadvantaged students enrolled, the odds for districts with the highest Documented Commitment Score versus districts in the three lower categories are 1.3 times greater (OR=1.3, 95% CI=1.0, 1.7) (See Figure 2.1). For districts whose constituents mentioned PE as part of the LCFE stakeholder engagement process, the odds of documenting a commitment to PE are 14.3 times greater for districts with the highest Documented Commitment Score versus districts in the three lower categories (OR=14.3, 95% CI= 1.9, 105.1). For districts that documented a commitment to Arts (Model 7), the odds of documenting a commitment to PE are 13.9 times greater for districts with the highest Documented Commitment Score versus districts in the three lower categories (OR=13.9, 95% CI=2.6, 72.9). When controlling for Documented Arts Commitment, the association between Documented PE Commitment and percent disadvantaged students is no longer significant.

Table 2.6 reports odds ratios for district characteristics associated with Documented Arts Commitment with 95% confidence intervals. After adjusting for demographic covariates (Model 6), for every 10% increase in disadvantaged students enrolled, the odds for districts with the highest Documented Commitment Score versus districts in the three lower categories are 1.6 times greater (OR=1.6, 95% CI=1.3, 2.1). Total student enrollment is significantly but not meaningfully related to Documented Arts Commitment (OR=1.0, 95% CI = 1.0, 1.0). For every additional 10% change in student enrollment, the odds for districts with the highest Documented PE Commitment versus districts in the three lower categories are 3.4 times greater (OR=3.4, 95% CI = 1.4, 8.5). For districts whose constituents mentioned Arts as part of the LCFF stakeholder engagement process, the odds of documenting a commitment to Arts are 2.4 times greater for districts with the highest Documented Arts Commitment Score versus districts in the three lower categories (OR=2.4, 95% CI= 0.9, 6.3).

For districts that documented a commitment to PE (Model 7), the odds of documenting a commitment to Arts are 2.4 times greater for districts with the highest Documented Commitment Score versus districts in the three lower categories (OR=2.4, 95% CI= 1.5, 3.9). When controlling for PE Commitment, the odds of elementary districts documenting a commitment to Arts is 2.9 times the odds of unified districts (OR = 2.9, 95% CI = 1.0, 8.1). The association between Documented Arts Commitment and per pupil spending is not significant.

Tables 2.7 and 2.8 present two sensitivity analyses excluding two districts with extreme changes in student enrollment (+/- 25%). Excluding these districts does not change the significance of relationships between Documented PE Commitment Scores and the explanatory variables (Table 2.7), though it slightly reduces the strength of the relationships with Stakeholder Investment (OR = 12.5, 95% CI = 1.6, 96.2) and with Documented Arts Commitment (OR = 12.9, 95% CI = 68.1).

The associations between Documented Arts Commitment (Table 2.8) remain consistent with the results from the full sample when excluding these two districts with two notable exceptions: changes in student enrollment and Stakeholder Investment both become insignificant.

Discussion

This study found a positive association between Documented PE Commitments and percentage of disadvantaged youth, even after controlling for variables associated with school funding. Additionally, both a Documented Arts Commitments and Stakeholder Engagement in PE are strongly associated with district Documented PE Commitments.

The results indicate that the most significant predictor of a Documented PE Commitment is a Documented Arts Commitment. This suggests that districts are taking a “whole child” approach, rather than concentrating funding on single subject or a pursuing a singular focus on student health. The whole child approach is endorsed by organizations such as the Association for Supervision and Curriculum Development that supports development of “successful young people [who] are knowledgeable, *emotionally and physically healthy*, motivated, civically inspired, *engaged in the arts*, prepared for work and economic self-sufficiency, and ready for the world beyond their own borders [emphasis added].”⁶⁹ Whether this approach is intentional or the

result of districts reinstating the courses that were most affected by the narrow scope of NCLB⁷⁰ and budget constraints pre-LCFF is not within the scope of the present study. A whole child approach likely also satisfies the diverse priorities of district stakeholders, a key feature of LCFF that is significantly associated with Documented Commitments to PE and Arts in the present study.

Because LCAPs did not exist prior to LCFF, there is no true “baseline” for a Documented PE Commitment prior to the implementation of LCFF. However, prior research does indicate that reductions in PE have been most significant among those serving predominately low-income students.⁷¹ Additionally, a 2012 study found that California districts that were compliant with state PE requirements had significantly lower percentages of students enrolled in free- and reduced-price meals, which is strongly correlated with the measure of percent disadvantaged students used in the present study.⁷²

The present study found that the percent of disadvantaged students in a district is a significant predictor of a Documented PE Commitment. Assuming that the documented commitments articulated in LCAPs are new activities, high-income districts were likely already providing PE and Arts at greater rates than low-income districts and thus did not include those activities in their plans. The present study suggests that the windfall of flexible funding experienced by California districts serving high concentrations of disadvantaged students may allow them to restore courses that were cut as a result of shrinking budgets and the narrow accountability measures imposed by NCLB. This is corroborated by recent research that finds that Los Angeles schools that experienced larger gains in LCFF funding expanded their course offerings more than schools that received less additional money.⁷³ In effect, these districts and schools are “catching up” to wealthier districts that maintained a broader course offering by providing what ESSA calls a “well-rounded” curriculum that includes PE and Arts.²¹

An alternative explanation for the association between Documented PE Commitment and the percent disadvantaged students is that LCFF’s weighted formula provides flexibility for districts serving disadvantaged students that may influence their Documented Commitment to PE and Arts. Districts receive “supplemental funds” equal to 20% above their base grant for every student who is considered disadvantaged; each disadvantaged student above 55% of enrollment generates 50% above their base rate, called a “concentration grant”.⁷⁴ All school districts must indicate in their LCAPs how they will improve or increase services specifically for disadvantaged students with their increased funding. While supplemental and concentration grants may be spent on district- and school-wide programs, districts that have fewer disadvantaged students receive less additional funding and have less flexibility for how to spend it since those dollars must be specifically targeted to meeting the needs of students who are low-income, foster youth, or English learners.⁷⁵ In effect, those districts may be unable to justify a commitment to PE or Arts as specifically meeting the needs of their disadvantaged students, leading to lower levels of Documented Commitments to PE and Arts.

While Documented Commitments to PE and Arts are both associated with greater enrollment of disadvantaged students, districts are more likely to invest in Arts than PE. As a result, collinearity between PE and Arts Commitments confounds the relationship between Documented

PE Commitment and percent disadvantaged students. Conversely, likely due to the higher rates of investment in Arts, the percent of disadvantaged students is significantly associated with Documented Arts Commitments even when controlling for stakeholder investment and Documented PE Commitment.

That districts are more likely to invest in Arts can likely be explained by the fact that cuts to Arts Education in California school districts were even deeper than those that made to PE. For example, between SY1999-2000 and SY2003-2004, student participation in music declined by 46.5% representing a loss 512,366 students, compared to a decline of 125,000 students (5.2%) enrolled in PE during the same time period.⁷⁶ Like PE, inadequate funding has been identified as the main reason for these declines in Arts Education in California, which was exacerbated by the state budget crisis.⁶⁴⁻⁷⁷ This is consistent with previous findings that wealthier districts have been shielded from extreme cuts by parents who have established groups to raise private funds to support Arts Education.^{78,79}

While the relationship between district type and Documented PE Commitment is not significant, this study found that unified districts are significantly more likely to document a commitment to Arts Education than elementary districts when controlling for Documented PE Commitment. This may be the result of more differentiated bureaucracies and stakeholder priorities in unified school districts, which tend to be larger than elementary districts and allow for investment in more diverse priorities.⁸⁰

Contrary to expectations, Documented PE Commitments are not strongly associated with district characteristics that are traditionally related to school funding, such as total enrollment and per pupil funding. Rather, it is district characteristics that drive LCFF funding, namely percentage of disadvantaged students, that are most predictive of Documented PE investments.

Limitations

This study is not without limitations. First, the analysis is limited by the lack of baseline data regarding districts' commitment to PE prior to LCFF implementation. Thus, the present study does not allow for conclusion of causal relationships between Documented PE Commitments and demographic or school funding variables. The lack of baseline data also makes it difficult to distinguish between spending for existing versus new commitments.⁸¹ While the study assumes that documented commitments represent new strategies, it is possible that these activities were underway prior to LCFF.

Second, it is plausible that districts receive funding for PE and Arts from sources other than LCFF such as bond measures or parent fundraisers and, as a result, related activities are not outlined in their LCAPs. However, the likelihood that this limitation undermines the validity of the findings is mitigated by the fact that low-income districts are less likely to engage in external fundraising efforts compared to higher income districts.^{82,83} Thus, PE and Arts related activities would likely be funded through LCFF and captured by a district's LCAP.

Because the sample includes elementary and unified school districts, which serve students K-12, it is possible that some of the Documented PE Commitments are not targeted to the elementary grades where PE is most deficient, thus measuring outcomes only for 5th grade students may not

capture the true impacts of PE investments. LCAPs were reviewed to determine which grades were targeted for PE investment. While not every district LCAP in the sample indicated the targeted grades, those that did specified an investment at the elementary grades or district-wide investments, which should impact the elementary levels.

Fourth, districts that were involved in the lawsuit for PE noncompliance were not excluded from the sample because doing so would have left few large school districts eligible for the study, thereby limiting its representativeness. As a result, the present study did not account for lawsuit participation, which may have influenced districts' decisions to invest in PE. Interestingly, of the 10 districts in the sample that were party to the lawsuit, only three made a Documented PE Commitment. This suggests that districts may not be dedicating additional resources to meet the requirements of the legal settlement, which require elementary school teachers to develop and publish a schedule for the minutes they spend teaching PE that is submitted to the school board for review, be subject to spot checks from principals, and, if they skip a PE class, note the reason why and report when those minutes were made up.⁵⁵

Finally, in the absence of alignment with districts' LCFF budgets or more robust reporting mechanisms, the LCAP only allows for reporting documented rather than actual commitments to PE. Thus, districts' Documented Commitment Scores may not be reflective of their practice.

Future research is needed to triangulate this analysis with qualitative interviews to understand whether activities documented in LCAPs are being implemented in practice, to determine whether LCAP activities represent new or existing commitments, and to examine the outcomes of documented commitments for children.

Conclusion

PE is the only established mechanism to sufficiently address the physical activity needs of nearly all children across the US.⁸⁴⁻⁸⁷ However, school districts have cut investments in PE over the last several decades in the face of shrinking budgets and narrowed accountability.^{88,89} This study suggests that given increased funding levels and flexibility for how to spend it, districts serving disadvantaged students may prioritize funding for PE. Additionally, investments in Arts Education are strongly associated with investments in PE, which suggests that California school districts are embracing the "well-rounded" curriculum encouraged by ESSA.

Implications for School Health

Providing additional funding, and the flexibility to determine how to spend it, may have critical implications for leveraging school settings to address health disparities. School health advocates should anticipate fluctuations in factors affecting school funding, such as district enrollment at the local level and the education budget at the state level, to help districts plan for sustainable PE programs. Finally, the best way to encourage investments in PE among low-income districts in California may be to promote a "whole child" approach that includes investments in multiple dimensions of a well-rounded curriculum.

The University of California Berkeley IRB determined that this study is not human subjects research.

Table 2.1: Descriptive Statistics

	Sample of 71		All of California		p-value for difference
	Mean	Std. Deviation	Mean	Std. Deviation	
Total Enrollment	6,383	10,990	6,625	27,042	0.62
% Disadvantaged Students	68.2	21.3	59.6	26.4	0.00
% African American/Latino	53.6	28.2	46.4	29.2	0.02
% Urban Population	84.1	16.3	84.2	18.4	0.86
% Change Enrollment SY1314-SY1415	0.2	7.5	1.0	12.3	0.62
Average Class Size	22.5	4.9	21.5	4.9	Data not available ^{uu}
Per Pupil Expenditures	9,685	1,977	10,662	4,047	0.16

NOTES: Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth
District-level class size data not available statewide

Table 2.2: Frequency of Documented Commitment to PE and Arts by Investment Type SY2015-2016 & SY2016-2017

	Personnel	Professional Development	Equipment/ Materials	Total (unduplicated)
PE	22 (31%)	9 (13%)	11 (15%)	32 (45%)
Arts/VAPA/Music	37 (52%)	9 (13%)	27 (38%)	49 (69%)
Total (unduplicated)	40 (56%)	15 (21%)	28 (39%)	

Table 2.3: Frequency of Documented Commitment to PE and Arts by Score SY2015-2016 & SY2016-2017

Documented Commitment Score	PE N = 32 (45%)		Arts N = 27 (37%)	
	Frequency	Percent	Frequency	Percent
0	39	55	44	62
1	11	16	11	15
2	15	21	11	15
3	3	4	2	3
4	3	4	2	3
5	0	0	1	1
Total	71	100	71	100

*Does not include distribution of scores for VAPA and music, which were averaged with Arts to generate Documented Arts Commitment Scores.

Table 2.4: Bivariate Associations: ORs for Any Documented Commitment to PE and Arts, with 95% confidence intervals

Predictor	PE Commitment Score	Arts Commitment Score
% Disadvantaged Students [□] (in 10% increments)	1.5** (1.1, 1.9)	1.4** (1.1, 1.8)
Per Pupil Expenditures (in 500s)	1.1 (.9, 1.2)	0.9 (.8, 1.1)
Total Enrollment (in 100s)	1.0 (.9, 1.0)	1.0 (1.0, 1.0)
% Change Enrollment SY1314 – SY1415 (in 10% increments)	3.3 (.9, 12.3)	3.1 (.8, 12.2)
District Type (Unified compared to Elementary)	0.8 (.3, 2.1)	2.4 (.8, 7.0)
Stakeholder Investment	23.8** (2.2, 262.2)	2.9* (1.1, 7.5)
Arts Commitment Score	9.2** (2.4, 35.2)	—
PE Commitment Score	—	9.2** (2.4, 35.2)
% Enrollment African American/ Latino (in 10% increments) [✓]	1.3** (1.1, 1.5)	1.3* (1.1, 1.6)
% Urban Population (in 10% increments)	1.0 (.8, 1.4)	1.2 (.9, 1.6)
Average Class Size	1.0 (.9, 1.1)	1.1 (1.0, 1.2)

Coefficients are provided with confidence intervals in parentheses. *p < 0.05; **p < 0.01.
 Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth

Figure 2.1: Relationship between Percent Disadvantaged Students and Documented PE Commitment Score

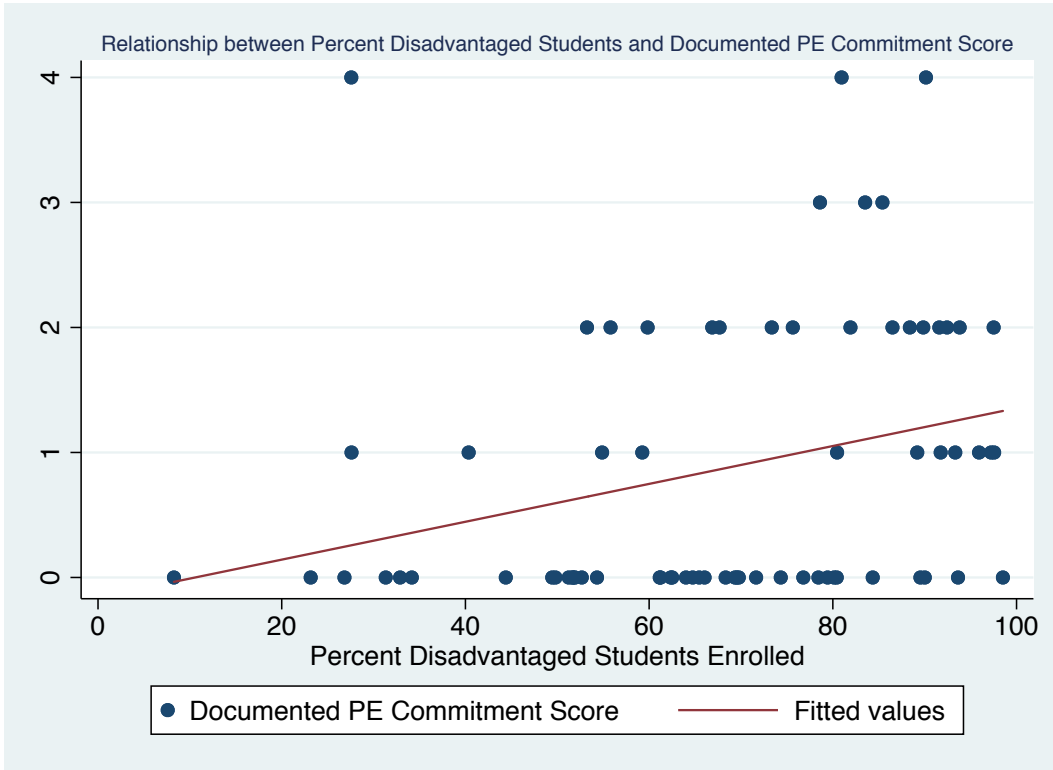


Table 2.5: ORs for District Characteristics Associated with Documented PE Commitment Scores, with 95% confidence intervals

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
% Disadvantaged Students (in 10% increments)	1.4** (1.1, 1.8)	1.4** (1.1, 1.8)	1.4** (1.1, 1.8)	1.4** (1.1, 1.8)	1.4* (1.1, 1.8)	1.3* (1.0, 1.7)	1.1 (0.8, 1.4)
Per Pupil Expenditures (in 500s)		1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.1 (0.9, 1.2)	1.1 (1.0, 1.2)
Total Enrollment (in 100s)			1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)
% Change Enrollment (in 10% increments)				3.4* (1.2, 9.5)	3.3* (1.2, 9.2)	2.7 (1.0, 7.5)	1.9 (0.7, 5.7)
District Type					0.8 (0.3, 2.4)	0.6 (0.2, 1.8)	0.4 (0.1, 1.3)
Stakeholder Investment in PE						14.3* (1.9, 105.1)	13.1* (1.7, 102.0)
Arts Commitment Score							13.9** (2.6, 72.9)

Coefficients are provided with confidence intervals in parentheses. *p < 0.05; **p < 0.01.

Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth

Table 2.6: ORs for District Characteristics Associated with Documented Arts Commitment Scores, with 95% confidence intervals

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
% Disadvantaged Students (in 10% increments)	1.4** (1.1, 1.8)	1.4** (1.1, 1.8)	1.6** (1.2, 2.0)	1.6** (1.2, 2.0)	1.6** (1.3, 2.1)	1.6** (1.3, 2.1)	1.5** (1.1, 2.0)
Per Pupil Expenditures (in 500s)		0.9 (0.8, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	0.9 (0.8, 1.1)	0.9 (0.8, 1.1)	0.9 (0.8, 1.1)
Total Enrollment (in 100s)			1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0* (1.0, 1.0)
% Change Enrollment (in 10% increments)				2.6* (1.1, 6.1)	3.0* (1.3, 7.3)	3.4** (1.4, 8.5)	2.0* (0.8, 4.9)
District Type					2.4 (0.9, 6.3)	2.4 (0.9, 6.3)	2.9* (1.0, 8.1)
Stakeholder Investment in Arts						2.1* (1.1, 4.1)	1.5* (0.8, 3.0)
PE Commitment Score							2.4** (1.5, 3.9)

Coefficients are provided with confidence intervals in parentheses. *p < 0.05; **p < 0.01.

Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth

Table 2.7: ORs for District Characteristics Associated with Documented PE Commitment Scores, Excluding Districts with +/- 25% changes in Enrollment, with 95% confidence intervals

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
% Disadvantaged Students (in 10% increments)	1.4* (1.1, 1.8)	1.4* (1.1, 1.7)	1.4** (1.1, 1.8)	1.4* (1.1, 1.8)	1.4* (1.1, 1.8)	1.3* (1.0, 1.7)	1.1 (0.8, 1.4)
Per Pupil Expenditures (in 500s)		1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.2)	1.1 (1.0, 1.2)	1.1 (1.0, 1.2)
Total Enrollment (in 100s)			1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)
% Change Enrollment (in 10% increments)				2.0 (0.5, 7.3)	1.9 (0.5, 7.0)	1.6 (0.4, 6.2)	1.5 (0.4, 5.5)
District Type					0.8 (0.3, 2.4)	0.6 (0.2, 1.8)	0.4 (0.1, 1.4)
Stakeholder Investment in PE						13.1* (1.8, 95.0)	12.5* (1.6, 96.2)
Arts Commitment Score							12.9** (2.4, 68.1)

Coefficients are provided with confidence intervals in parentheses. *p < 0.05; **p < 0.01. Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth.

Table 2.8: ORs for District Characteristics Associated with Documented Arts Commitment Scores, Excluding Districts with +/- 25% changes in Enrollment, with 95% confidence intervals

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
% Disadvantaged Students (in 10% increments)	1.4** (1.1, 1.7)	1.4** (1.1, 1.8)	1.6** (1.2, 2.0)	1.6** (1.2, 2.0)	1.6** (1.3, 2.1)	1.6** (1.3, 2.1)	1.5** (0.9, 1.7)
Per Pupil Expenditures (in 500s)		0.9 (0.8, 1.1)	1.0 (0.8, 1.1)	1.0 (0.9, 1.1)	0.9 (0.8, 1.1)	0.9 (0.8, 1.1)	0.9 (0.8, 1.1)
Total Enrollment (in 100s)			1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0** (1.0, 1.0)	1.0* (1.0, 1.0)
% Change Enrollment (in 10% increments)				1.9 (0.6, 6.4)	2.1 (0.6, 7.5)	2.5 (0.7, 9.4)	2.0 (0.6, 7.3)
District Type					2.4 (0.9, 6.2)	2.3 (0.9, 6.2)	2.9* (0.1, 1.4)
Stakeholder Investment in Arts						2.1* (1.1, 4.0)	1.5 (0.7, 3.0)
PE Commitment Score							2.4** (1.5, 3.9)

Coefficients are provided with confidence intervals in parentheses. *p < 0.05; **p < 0.01.

Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth.

PAPER 3

Taking Steps to Reduce Health Disparities: Investments in Physical Education and Student Fitness Levels

Abstract: Despite evidence that it is linked to health and academic outcomes, physical education (PE) has been cut substantially across the country, disproportionately affecting schools serving predominately low-income students. California, however, in 2013 overhauled its school finance formula and now provides additional funding to districts serving more “disadvantaged” students. Thus, California offers a unique opportunity to examine whether district investments in PE are associated with changes in student fitness, which is linked to improved health outcomes that may mediate academic achievement. This study used data coded from Local Control and Accountability Plans, a document developed annually to outline priorities for district expenditures from 82 California school districts, and publicly available Physical Fitness Test data to examine the association between PE investments and changes in 5th grade students’ fitness levels. Controlling for other district-level characteristics, unweighted and weighted models (based on number of students tested) show that PE investments are associated with modest increases in fitness levels among districts with fewer than 6,350 students (75th percentile of mean statewide enrollment), while among districts with 6,350 students or more, PE investments are associated with modest decreases in student fitness levels. Moreover, the study finds a concerning level of variability in the fitness data, particularly among small districts. This study suggests that, while there is some evidence that PE investments are associated with improved fitness for small school districts, the results must be interpreted with caution due to questions regarding the reliability of the fitness data.

Background

Facing insufficient funding and increasing accountability for student performance, education leaders in low-income schools are often hesitant to invest limited resources in courses that do not directly address academic outcomes.^{12,40,90} This trend is evidenced in a lack of prioritization and funding for physical education (PE): low-income schools have disproportionately made cuts to PE despite the fact that most children ages 6-17 do not meet current US guidelines to engage in at least 60 minutes of moderate to vigorous physical activity each day.⁹¹

Given that children spend upwards of seven hours in school every day, schools play a critical role in fostering healthy lifetime behaviors among children and thus can directly support increasing student physical activity levels that lead to improved fitness levels.⁹² While schools can offer physical activity to students through PE, recess, and classroom-based physical activity, PE is the only established mechanism to sufficiently address the physical activity needs of nearly all children across the US.⁸⁴⁻⁸⁷

Research shows that PE is an effective method for improving physical activity and fitness, which has important consequences for children’s health in the short- and long-term.⁹³ Physical activity in children is associated with reduced risk for developing hypertension and Type 2 diabetes,

improved cardiovascular and musculoskeletal functioning, and reduced stress and anxiety.⁹⁴ The benefits of childhood fitness extend into adulthood, including reduced risk of obesity and cardiovascular disease and improved bone health.⁹⁵ Funding for infrastructure to support PE may also positively influence student fitness levels; research shows that students who attend schools with a playground, track, or indoor/outdoor facilities are more likely to be aerobically fit.⁹⁶

In California, where over 59% of the state's 6.2 million students are considered low-income⁴⁶, limited funding, competing academic pressures, and a lack of enforcement at the state level have contributed to deficient quality and quantity of PE, particularly at the elementary level and in schools serving low-income and minority students.^{47,48} A 2011 study showed that only 5% of California elementary schools were in compliance with state education code requirements, which mandate that students in grades 1-6 receive a minimum of 200 minutes of PE every ten days.⁴⁹ In a 2010 survey conducted among California School Board members, lack of funding was the most cited (88%) barrier to addressing PE at the district level.⁵⁰

Fitness data collected through California's mandatory Physical Fitness Test are consistent with declines in PE among low-income schools. Research shows that 25.9% of African American students and 22% of Hispanic students in California met the test's six healthy fitness zones compared to 38% of White students.⁴⁵ Minority and low-income youth are less likely to be physically fit than their more advantaged peers.¹³

Changes to state and federal education legislation combined with a series of lawsuits involving districts not meeting state PE mandates may prompt California districts to invest in PE, which may in turn influence student fitness outcomes. First, the adoption of the Local Control Funding Formula (LCFF) in 2013, which overhauled school finance in California, means school districts have considerably more flexibility for how they spend their funds to meet the needs of their students.⁵¹ LCFF also significantly increases funding for districts serving higher numbers of disadvantaged students (defined as low-income, foster youth and English learners).^{52,53} Second, the federal Every Student Succeeds Act (ESSA), which replaced No Child Left Behind in 2015, broadens the focus of curriculum to include PE, allows federal education funds to be used to support PE, and holds districts accountable for multiple measures of student achievement that could include health.⁵⁴ Finally, the widespread noncompliance with state-mandated elementary PE requirements prompted legal action against over 100 California school districts.^{55,56}

California offers a unique opportunity to examine whether, given more funding and flexibility for how funding is spent, those school districts that prioritize funding for PE see greater improvements in student fitness levels. Additionally, this study examines trends in fitness based on the percentage of disadvantaged students in a district. This study represents the first known attempt to explore the outcomes of California school districts' investments in student health given the changes in funding and accountability at the federal and state levels. It was hypothesized that district investments in PE would be associated with improvements in students' fitness levels after LCFF implementation relative to the period before the new funding formula was in place.

Methods

Study Design

This study used secondary data analysis to explore whether investments in PE are associated with student fitness levels and was deemed non-human subjects by the University of California, Berkeley Committee for Protection of Human Subjects.

California's Mandatory Physical Fitness Testing

California education code requires that public school students in grades five, seven, and nine are evaluated using *FITNESSGRAM*, the designated assessment for the state's Physical Fitness Test, each year regardless of whether they are enrolled in a PE class. *FITNESSGRAM* consists of six tests, including a measure of aerobic capacity, assessed by one of three field tests: the one-mile walk; the one-mile run; or the PACER, a multistage fitness test that is progressive in intensity. Test results are converted to maximal oxygen uptake (VO₂ max).⁹⁷ Based on age- and sex-dependent standards developed by The Cooper Institute,⁹⁸ students are categorized as being in the "Healthy Fitness Zone" (HFZ) or needing improvement. Schools are required to administer the test between February and May of each year. The California Department of Education (CDE) collects and publishes aggregate school-level results on its website annually.

District-level fitness data were obtained from the CDE Physical Fitness Testing website.⁹⁹ Due to concerns about the validity of *FITNESSGRAM* data, including questions about fidelity of test administration and the dependency of test results on student effort, districts whose scores fell outside the median +/- 3x the interquartile range for any year in the study were excluded from the sample. Additionally, districts for which *FITNESSGRAM* results were missing each year between SY2013-14 and SY2015-2016 or for which the mean score for students in the Healthy Fitness Zone (HFZ) was zero between SY2010-2011 and SY2015-2016 were dropped due to implausibility.

Participants

Using stratified random sampling, 82 elementary and unified school districts were selected for the analysis from among the remaining eligible districts based on tertiles of total student enrollment and student free and reduced-price meal eligibility (a proxy for socioeconomic status) (Table 1). Because PE is most deficient at elementary level, high school districts were excluded from the analysis. Additionally, "basic aid" districts, which do not receive state aid, were excluded because their revenue did not shift significantly as a result of the transition to LCFF.⁵⁸

Data Sources

District-level data were obtained from publicly available databases managed by the California Department of Education (CDE), including the percentage of disadvantaged students (defined as students enrolled in free and reduced-price meals, English Learners, or foster youth) and total district enrollment (including enrollment by race/ethnicity). A county-level indicator for rural, urban cluster (at least 2,500 and less than 50,000 people), or urbanized areas (50,000 or more people) was obtained through the US Census Bureau.⁵⁹ Demographic data are from SY2014-2015. District participation in the lawsuit was determined using public records; 10 districts in the study sample were involved in the lawsuit.

LCFF requires that every school district complete a Local Control and Accountability Plan (LCAP) each year that outlines its goals, actions, and related expenditures for the following three years. Districts are held accountable by the state for the activities outlined in their LCAPs; those that do not meet the goals specified in their LCAPs and fail to improve educational outcomes receive additional support from the CDE.⁶⁰

LCAPs from SY2015-2016 and SY2016-2017 for districts in the sample were accessed through a publicly available database managed by the Education-Trust West.⁶² LCAPs from the first year of LCFF implementation (SY2014-2015) were excluded from the analysis because of the significant “learning curve” in completing LCAPs for the first time and short timeframe (four months) for completion, which may have resulted in plans that do not fully reflect the scope of district efforts. The activities and expenditures outlined in the LCAP should align with district budgets, although there is currently no mechanism at the state level for ensuring that districts’ written plans documented in LCAPs are reflected in their LCFF budgets.⁶¹ Thus, in the absence of transparent financial data, LCAPs were coded to capture districts’ level of “documented commitment” to PE as a proxy for planned expenditures.

LCAPs were reviewed and coded for references to PE across three dimensions of investment: personnel (i.e., recruiting or hiring new PE teachers), professional development (i.e., training for PE and/or classroom teachers to improve PE instruction), and equipment/materials (i.e., purchasing jump ropes for PE instruction). While many districts chose to include information in addition to the template approved by the state, coding was limited to the information included in the official LCAP template. A summary dichotomous variable indicating any “Documented PE Commitment” across the three dimensions of investment in both years was generated.

References to other district investments in physical activity were also coded to capture activities that may influence changes in fitness levels among 5th grade students. These included references to “recess”, “sports”, “playgrounds”, “fitness”, and “physical activity”. A binary “Documented Physical Activity Commitment” variable was generated to indicate any reference in a district’s SY2015-2016 and SY2016-2017 LCAP to personnel, professional development, or equipment/materials for recess, sports, or playgrounds. References to physical activity were not included due to zero incidence (n=0). References to fitness were omitted from Physical Activity Commitment as they were consistently treated as an outcome and not an investment in district LCAPs.

LCAPs were also reviewed for commitment to Arts Education. Like PE, Arts Education has been cut significantly over the last 20 years, particularly in districts serving disadvantaged students, due to decreased budgets and narrowed accountability.^{63,64} Those same districts, which have experienced large influxes of funding through LCFF, may choose to reinstate some or all of the subjects that were cut. Thus, including Arts Education in the current study controls for unobserved confounders that help explain other district or community level characteristics that may contribute to changes in fitness levels.

To create a dichotomous Arts Education variable, LCAPs for SY2015-2016 and SY2016-2017 were coded for any references to Arts terms, including “Arts”, “Visual and Performing Arts (VAPA)”, and “Music” (which are considered comparable courses that fall under the umbrella of “Arts Education”) across the three dimensions of investment: personnel, professional

development, and equipment/materials. Individual Documented Commitment indicators were created for Arts, Music, and VAPA by summing binary indicators for personnel, equipment/materials, and professional development across SY2015-2016 and SY2016-2017. A binary “Documented Arts Commitment” variable was created for any commitment (i.e., score above zero) to Arts, VAPA, or Music across the two years.

Statistical Analysis

Given the documented relationship between fitness, body composition, and income, analyses of fitness levels between high income (percent disadvantaged ≤ 20) and low income (percent disadvantaged ≥ 65) districts – unadjusted and adjusted for body composition – for the study period were conducted. Visual depictions were generated to explore the relationship between fitness levels and Documented PE commitment.

Random effects models were constructed to explore the association between Documented PE Commitment and changes in student fitness levels, controlling for demographic and relevant district-level factors, including participation in the PE lawsuit and Documented Arts Education Commitment. A binary time variable was created: a “pre” period spanning SY2010-2011 – SY2014-2015 and a “post” period (after LCFF implementation) spanning SY2015-2016 – SY2016-2017. For each district, the mean fitness level was calculated for pre and post periods. District enrollment was included as a time-varying variable. Cross-sectional data were used for percent urban population (determined every 10 years by census data) and the percent disadvantaged students (from SY2014-2015), a new measure created by the CDE for the purposes of LCFF. Due to collinearity between the percent disadvantaged students and percent African American and Latino students ($\rho = 0.74$), only the percent disadvantaged students were used in the adjusted models.

For all analyses, Models 1 and 1W (unweighted and weighted, respectively), adjust for time, percent of disadvantaged students, total district enrollment, percent urban population, involvement in the PE lawsuit; Models 2 and 2W (unweighted and weighted, respectively) adjust for all variables in Model 1 and for Documented Arts Education Commitment.

The following equation represents the analysis conducted to explore whether students’ fitness levels changed after LCFF implementation relative to the period before the new funding formula was in place, where Y_{st} is the percent of students in school s and year t whose scores are in the Healthy Fitness Zone, and X is a set of control variables:

$$Y_{st} = \beta_0 + \beta_1 \text{Time}_t + \beta_2 \text{PE Commitment}_s + \beta_3 \text{PE Commitment}_s * \text{Time}_t + X_{st} + \varepsilon_{st}$$

The β_3 coefficient estimates differential trends in those districts with Documented PE Commitment. Under the assumption that pre-commitment trends are similar in those schools with and without document commitment, and that X captures appropriate confounders, this β_3 coefficient indicates whether fitness improved after implementing the Documented PE Commitment.

Preliminary analyses demonstrated significant interaction in weighted models ($p < 0.001$) between district size and the association between fitness levels and Documented PE

Commitment; thus, the sample was subsequently stratified by districts with less than 6,350 students (75% percentile of mean California elementary and unified school district enrollment) and greater than or equal to 6,350 students. For the purposes of this study, districts with fewer than 6,350 students enrolled are referred to as “small”, while those over 6,350 are “large”.

To examine differences in outcomes for Documented PE Commitment and Documented Physical Activity Commitment, which may also influence student fitness levels, the same models were run with Documented Physical Activity as the primary predictor variable. To ensure that differences in fitness levels between districts that did and did not make a Documented PE Commitment in the first three years of the study period were not driving study results (Figure 3), a sensitivity analysis was conducted limiting the pre period to SY2013-2014 – SY2014-2015 in which the fitness levels were similar across the two groups.

Due to the variability of the number of 5th grade students who underwent fitness testing among districts in the sample, which is perfectly correlated with total district enrollment ($\rho=1.0$), models were run using frequency weights to adjust for the number of students tested. In effect, the weights duplicate the district level observation for each student tested, giving district with more students tested more statistical importance than smaller districts.¹⁰⁰

Finally, to explore the variability of the percent of 5th grade students in the Healthy Fitness Zone (HFZ) for aerobic capacity across districts, the standard deviation from the mean fitness level across years was calculated. To explore variability of the fitness levels within districts, the five districts with the lowest and highest standard deviations from mean fitness levels were identified.

Results

District characteristics for the study sample in the 2014-2015 school year were significantly different from statewide averages for elementary and unified school districts (Table 3.1). These differences are expected as large, low-income districts were intentionally over-sampled. More districts invested in Arts Education (n=58) than in PE (n=35) or physical activity (n=50; Table 3.2).

Figure 3.1 shows that the percentage of 5th grade students meeting the HFZ standards between SY2010-2011 and SY2016-2017 in the study sample was slightly lower than statewide averages ($p<0.001$ for differences in mean fitness over study period). Figure 3.2 demonstrates significant and consistent statewide disparities in 5th grade student aerobic capacity levels between high- and low-income school districts from SY2010-2011 to SY2016-2017 ($p<0.001$), even when adjusted for body composition. However, due to an imbalanced distribution of healthy body composition between high- and low-income districts (e.g., only 4% of high-income districts fell in the lowest 3 quintiles for healthy body composition), this adjustment may not fully reflect the true influence of body composition on aerobic capacity.

Table 3.3 reports coefficients for the random effects models using Documented PE Commitment as the primary predictor. Model 1, which presents results for unweighted models, shows a positive but insignificant relationship between changes in student aerobic capacity levels and Documented PE Commitment, controlling for district characteristics ($\beta=1.4$, 95% CI = -2.7, 5.4).

Model 1W, weighted for the number of students tested, shows a significant negative relationship between changes in student aerobic capacity levels and Documented PE Commitment, controlling for district characteristics ($\beta=-0.9$, 95% CI = -0.9, -0.8).

Models 2 and 2W in Table 3.3 report results for the same models controlling for Documented Arts Commitment in addition to other district characteristics. This adjustment does not change the magnitude or direction of relationships of fitness levels over time for districts that made a Documented PE Commitment. Model 2 shows that Documented PE Commitment is associated with positive but insignificant increases in aerobic capacity levels over time ($\beta=0.1$, 95% CI = -4.1, 4.2). Model 2W, weighted for the number of students tested, shows small but significant decreases in aerobic capacity levels for those districts that made a Documented PE Commitment ($\beta=-0.2$, 95% CI = -0.2, -0.1).

In models stratified based on district size (Table 3.4), the relationship between changes in aerobic capacity over time and Documented PE Commitment is consistently positive for small districts and negative for large districts. Model 1 shows that in small districts, Documented PE Commitment is associated with positive but insignificant increases in aerobic capacity after LCFF implementation ($\beta_3=3.5$, 95% CI = -2.6, 9.5). Model 1W, which is weighted for the number of students tested, shows a significant, positive relationship between Documented PE Commitment and fitness over time ($\beta_3=1.8$, 95% CI = 1.5, 2.2). Conversely, Model 1 indicates a negative but insignificant association between changes in fitness and Documented PE Commitment among large districts ($\beta_3=-1.2$, -4.2, 1.8). Model 1W shows that when weighted for the number of students tested, there is a significant negative relationship between changes in fitness and Documented PE Commitment among large districts ($\beta_3=-1.2$, 95% CI = -1.3, 1.2).

Models 2 and 2W in Table 3.4 examine the differences in fitness levels before and after LCFF implementation controlling for Documented Arts Education Commitment in addition to the other variables in Model 1. The addition of Arts Education does not influence the direction or magnitude of the relationship between changes in fitness and Documented PE Commitment for small or large districts. The association between changes in fitness Documented Arts Education Commitment is negative and insignificant for small districts in the unweighted Model 1 ($\beta_3=-5.3$, 95% CI = -11.7, 1.1) and significantly negative for Model 2, which is weighted for the number of students tested ($\beta_3=-11.3$, 95% CI = -20.1, -2.6). For large districts, Documented Arts Education Commitment is positively but insignificantly associated with changes in fitness in the unweighted Model 1 ($\beta_3=1.9$, 95% CI = -7.0, 10.9) as well as in Model 2, weighted for the number of students tested ($\beta_3=1.9$, 95% CI = -7.4, 11.3).

Across all models in Table 3.4, every 10% percent of disadvantaged students enrolled is consistently, though not always significantly, associated with fewer students meeting the HFZ standards among small and large districts. District enrollment is modestly positively associated with changes in fitness for small school districts in the weighted models ($\beta_3=0.6$, 95% CI = 0.5, 0.7). Involvement in the PE Lawsuit and urbanicity appear to have no significant influence on student fitness levels in the study sample.

Table 3.5 reports coefficients for the random effects models stratified by district size using Documented Physical Activity Commitment as the primary predictor. Model 1 shows a modestly

positive but insignificant association between Documented Physical Activity Commitment and fitness levels for small districts, controlling for district characteristics ($\beta_3=0.6$, 95% CI = -5.6, 6.7). Model 1W shows a significant positive association between Documented Physical Activity Commitment and changes in fitness levels among small districts, controlling for district characteristics ($\beta_3=1.8$, 95% CI = 1.5, 2.1). Controlling for Documented Arts Education Commitment does not influence the magnitude or direction of relationships between changes in fitness and Documented Physical Activity Commitment for small districts in Models 2 and 2W. Model 2W shows a large, significant negative association between Documented Arts Education Commitment and changes in fitness for small districts ($\beta_3=-11.0$, 95% CI = -19.8, -2.1).

Among large districts, Documented Physical Activity Commitment is consistently negatively associated with changes in fitness levels. Model 1 in Table 3.5 indicates a small negative and insignificant relationship between changes in fitness levels and Documented Physical Activity Commitment ($\beta_3=-0.5$, 95% CI = -3.5, 2.6). Model 1W, weighted for the number of students tested, shows a modestly negative and significant relationship between changes in aerobic capacity levels and Documented Physical Activity Commitment ($\beta_3=-0.4$, 95% CI = -0.5, 0.4). The strength and direction of these relationships is consistent when controlling for Documented Commitment to Arts Education in Models 2 and 2W.

Among large districts, every 10% percent of disadvantaged students enrolled is consistently associated with 3% fewer students meeting the HFZ standards. Total student enrollment is significantly but not meaningfully associated with changes in fitness for large districts. Involvement in the PE Lawsuit and urbanicity appear to have no significant influence on student fitness levels for small and large districts.

Table 3.6, which is stratified by district size, reports coefficients for the sensitivity analysis using just two years of data (SY2013-2014 and SY2014-2015) as the pre time period (with Documented PE Commitment as the primary predictor). Model 1, which presents results for unweighted models, shows a small but insignificant association between fitness and Documented PE Commitment for small districts ($\beta=1.7$, 95% CI = -5.4, 8.8). Regardless of weighting or controlling for Documented Arts Education Commitment, the magnitude of the relationship between changes in fitness levels and Documented PE Commitment is consistent, though weighted models (1W, 2W) are significant while unweighted models (1, 2) are not. Model 2W, which controls for Documented Arts Education Commitment and is weighted for student enrollment, shows a significant negative association between Documented Arts Education Commitment and changes in fitness among small districts ($\beta_3=-13.7$, 95% CI = -25.6, -1.8).

The sensitivity analysis presented in Table 3.6 show a consistently negative relationship between changes in fitness levels and Documented PE Commitment among large school districts. Model 1 shows an insignificant negative association between changes in fitness levels and Documented PE Commitment ($\beta_3=-3.5$, 95% CI = -7.0, 0.1), while Model 1W, weighted for the number of students tested, indicates a significant negative association ($\beta_3=-2.5$, 95% CI = -2.5, -2.5). Results for the models controlling for Documented Arts Education Commitment are similar (Models 2, 2W). Documented Arts Commitment is positively but insignificantly associated with changes in fitness for large districts.

Across all models in Table 3.6 for small and large districts, every 10% percent of disadvantaged students enrolled is negatively associated with changes in fitness. These results are significant among small districts for unweighted models (1, 2) and for all models for large districts, which consistently associated with between 3.6% and 3.8% fewer students meeting or exceeding the HFZ for every 10% increase in disadvantaged students enrolled. Involvement in the PE Lawsuit and urbanicity appear to have no significant influence on student fitness levels.

Figure 3.4, which presents baseline (SY2010-2011) fitness levels versus change in mean fitness levels between the pre-LCFF period (SY2010-2014) and post-LCFF (SY2015-2017) periods, suggests that no outliers influenced the results of the models described above.

Figures 3.5 and 3.6 depict fitness levels over time for the 5 districts that had the lowest and highest variability (i.e., standard deviation from mean) in fitness. Notably, the total number of students tested in the districts with the lowest variability is significantly larger than in the districts with the highest levels of variability ($p < 0.001$).

Discussion

This study sought to identify whether investments in PE, as measured by Documented PE Commitment in district LCAPs, are associated with changes in student fitness levels. It consistently finds that Documented PE Commitment is associated with increases in student fitness among small school districts and, conversely, with decreases in fitness among large school districts. Additionally, this study documents persistent disparities in fitness levels between students in high and low-income districts. Finally, the results of this study raise several concerns about the feasibility and validity of the *FITNESSGRAM* test for aerobic capacity, which raises the question of its value as a tool to measure and monitor student health.

Across all models, this study consistently found a positive relationship between Documented PE Commitment and changes in fitness among small school districts. The simplest explanation of this finding is that implementation of the PE investments outlined in small districts' LCAPs led to increased moderate to vigorous physical activity among students and, resultantly, improved fitness levels. Organizational literature supports that notion that small organizations face less inertia in implementing change, and therefore may experience greater gains in student performance.¹⁰¹ These increases in fitness in small districts may also reflect that students in districts that made a Documented PE Commitment had consistently lower fitness levels prior to LCFF implementation than those that in districts that did not make a Documented PE Commitment (Figure 3.7), and thus, had more room for improvement.

Documented PE Commitment among large school districts in the sample is associated with small but significant decreases in student fitness levels. This trend, which is cause for serious concern, may be explained by the education policy literature that explores the influence of district (and school) size on student performance. While this literature is limited to academic, not health, outcomes, it generally finds that the relationship between district size and student performance is contingent on students' socioeconomic status (SES). Specifically, the relationship between district size and student performance is negative among low SES districts, while for higher SES districts it is null or positive.¹⁰² Researchers posit that while large districts benefit from additional

resources achieved through economies of scale, they are constrained by the concentration of disadvantaged students whose non-academic needs detract attention from the district's core instructional focus.¹⁰³ These studies examine cross-sectional outcomes, and do not explore the role of district size in facilitating change at the school- or student-level. A 1998 paper that used survey responses (not data measuring actual changes) from district- and school-level administrators to measure implementation of changes in instructional standards found that large districts appear to be more adept in adopting reform, though poverty diminishes the advantages of district size.¹⁰³ Applied to the current study, this body of literature supports the notion that, among districts serving high percentages of disadvantaged students, PE investments by small districts are associated with gains in student fitness levels while PE investments in large districts may lead to reductions in fitness.

There are several plausible reasons for the decreases in student fitness among large districts in addition to the rationale presented above. First, it is possible that large districts are more inclined than small districts to benefit from external funding for PE, such as grants or voter-approved bonds. Thus, the PE activities of large districts may not be reflected in their LCAPs, which document LCFF expenditures. Because no baseline information exists for district PE programs prior to LCFF implementation, it is not possible to discern whether the activities documented in district LCAPs may reflect existing practices rather than new investments. This could explain, at the very least, why fitness levels did not improve as a result of PE investments. Second, the PE strategies implemented by larger school districts that made a Documented PE Commitment may not have been focused on increasing student fitness levels. For example, it is plausible that large districts, which are characterized by structural differentiation and complex bureaucracy¹⁰³, invested in district-level personnel to oversee PE rather than school-based PE teachers who would have greater influence over students' time spent in moderate-to-vigorous physical activity. It is also possible that, with additional support from new district-level PE administrators, schools in large districts increased the accuracy of fitness testing and reporting, which may explain the decrease in student fitness levels. More research is needed to explore the relationship between PE investment type and changes in student fitness levels.

Third, given the relationship between fitness and socioeconomic status, the decreases in fitness levels among students in large districts may be also driven by changes in community-level factors rather than school-level practices that are associated with income, such as neighborhood safety and access to recreational facilities and programs.¹⁰⁴ While the difference is not statistically significant, 69% of the students enrolled in the large districts that made a Documented PE Commitment (N=14) were considered disadvantaged, while 59% of students in large districts that did not make a Documented PE Commitment (N=14) were disadvantaged. It is plausible that, changes in community-level factors associated with fitness in communities served by large districts that made a Documented PE Commitment may have led to decreases in student fitness levels during the same time period. However, this conclusion is not supported by the same analysis for small districts, which shows 80% disadvantaged students in districts that made a Documented PE Commitment (N=21) versus 63% in those that did not (N=33; $p < 0.001$). Finally, there may be unobserved confounders unrelated to socioeconomic status that negatively influence fitness outcomes among the large districts that made a Documented PE commitment.

Like PE, the models for Documented Physical Activity Commitment suggest that investments in

Physical Activity contribute to increases in fitness among students in small districts, and declines among students in large districts. It is reasonable to conclude that these differences may be attributed to the same underlying mechanisms described for PE above. Future research is needed to determine whether Documented Physical Activity Commitment moderates the relationship between Documented PE Commitment and changes in student fitness.

This study identified a negative relationship between changes in student fitness and Documented Arts Education Commitment across all models, regardless of district size. Prior research exploring the district characteristics associated with Documented PE Commitments identified a strong and significant association between Documented PE Commitments and Documented Arts Commitments. The authors conclude that low-income districts in particular are using the influx of LCFF funds to take a “whole child” approach that promotes addressing students’ comprehensive needs, including health and engagement in the arts¹⁰⁵, rather than concentrating funding on single subject or a pursuing a singular focus on student health.¹⁰⁶ The current study finds no suggestion that a “whole child” approach to education accounts for the relationship between PE and student fitness.

This study consistently found that the percent of disadvantaged students enrolled in a district is negatively associated with aerobic capacity levels. This is consistent with prior research documenting disparities between minority and low-income youth and their more advantaged peers.⁴⁵⁻¹³ This trend may be partially explained by systematic cuts to courses such as PE and Arts over the last 20 years due to financial and accountability pressures, which disproportionately affected low-income school districts.³⁸ The persistent disparities can likely also be explained in part by mounting evidence that children’s fitness levels are associated with family SES.⁴¹⁻⁴³ For example, a 2007 study found that children who attend schools in higher-income communities were more fit and active in their PE classes than children whose schools were in lower-income communities.⁹³ Additionally, school-based physical activity likely does not reflect the full scope of influences on children’s fitness levels because higher income families likely have more resources to devote to their children’s participation in extracurricular physical activity. Adjusting for body composition does little to alter the gap, suggesting that disproportionate concentrations of heavier students in low-income districts do not explain this trend; rather, students in low-income communities are less fit, which has troubling implications for health disparities among the current generation of California public school students. Thus, despite investments in PE by low-income districts, any increases in physical activity resulting from additional PE may not be sufficient to overcome the social determinants that likely account for the persistent fitness disparities between high- and low-income communities.

Concerns regarding the validity of the *FITNESSGRAM* aerobic capacity data, used to calculate the fitness outcome variable for this study, suggest that the results should be interpreted with caution. First, the considerable variability of fitness levels over time, particularly among small school districts, exposes the vulnerability of the aerobic capacity field tests to detect true fitness trends in districts with small sample sizes. Second, the variability across years may also reflect teachers administering tests differently, primarily due to lack of teacher training to administer the test or report the results with fidelity. In California, where classroom teachers (i.e., not trained PE teachers) are often responsible for delivering elementary PE and, presumably, administering the state-mandated *FITNESSGRAM* test, teacher training may be particularly inadequate.¹¹⁰ Anecdotal evidence supports this conclusion: when asked how teachers administered the one-

mile walk-run, they reported that they had guessed that two times around the school gymnasium was equivalent to one mile. These challenges may be exacerbated by characteristics that mark many PE classrooms in California and could compromise fidelity to testing protocol, including over-enrollment (high student to teacher ratio) and overcrowding (insufficient space).⁹³

Problems inherent to the validity of the three field tests for aerobic capacity likely also confound the results of the present study. The tests used to measure aerobic capacity have only moderate validity in children over 10 years old; VO₂ max is estimated with an error of 10-15% for most children.¹¹¹ Additionally, there is significant variability in motivation among students; the results of the test are only as good as student effort. Additionally, the three tests do not always yield the same fitness classification due to differences in conversions to VO₂ max.¹¹¹ As a result, a student that is classified as being in “Meets or Exceeds” for the HFZ using the PACER test may fall into the “Needs Improvement” category with the One-mile run. If schools use different tests each year (also related to inadequate teacher training), this could explain some of the variability in results observed in the current study. Finally, because excess body fat reduces the estimate of VO₂ max, overweight children are at a disadvantage on tests of aerobic capacity.¹¹¹ Resultantly, children with higher BMI will have worse results for aerobic capacity tests than their leaner counterparts. Since childhood obesity disproportionately affects low-income populations, this may in part explain the dramatic and persistent differences in fitness outcomes between high and low-income California children displayed in Figure 2.2 and the consistently negative association between changes in student fitness levels and percent of disadvantaged students enrolled in the statistical models presented in this study.^{112,113}

FITNESSGRAM is used in over 67,000 schools in all 50 states,¹¹⁴ representing an enormous amount of public funding, time and resources dedicated to its use. The current study suggests that educators, state and district policymakers, researchers, and advocates should account for the instrument’s shortcomings when using *FITNESSGRAM* aerobic capacity data to inform policy and practice.

Limitations

Many additional limitations merit comment. First, the analysis is limited by the lack of baseline data regarding districts’ commitment to PE and physical activity prior to LCFF implementation, making it difficult to suggest any causal relationships between Documented Commitments and changes in student fitness levels. It is also plausible that LCAPs report existing and new investments and/or that districts receive funding for PE from sources other than LCFF such as bond measures or parent fundraisers and, as a result, related activities are not outlined in their LCAPs.

Second, because it does not account for activities outside of school that may influence fitness such as gym memberships or club sports, this study may overstate the relationship between Documented PE Commitment and changes in student fitness levels. However, this concern is likely mitigated due to the fact that low-income families have fewer resources to dedicate to extracurricular activities that may influence children’s fitness levels and thus the gains in fitness among students in small districts included in this study can reasonably be attributed to the physical activity offered at school.

Third, because the sample includes elementary and unified school districts, which serve students K-12, it is possible that some of the Documented PE Commitments are not targeted to the elementary grades where PE is most deficient, thus measuring outcomes only for 5th grade students may not capture the true impacts of PE investments. LCAPs were reviewed to determine which grades were targeted for PE investment. While not every district LCAP in the sample indicated the targeted grades, those that did specified an investment at the elementary grades or district-wide investments, which should impact the elementary levels.

Despite these limitations, this study contributes to the nascent literature examining the outcomes of education investments in student health outcomes. Given the declines in physical activity among US children and in PE provided by schools over the last several decades and the recent changes in school funding and accountability for California school districts at the state and federal level, attention to funding school-based health initiatives is likely to be important in future research to identify practices that are most effective in improving population health.

Future research is needed to explore whether *changes* in district investment in PE and physical activity are associated with changes in fitness levels, and whether those investments are associated with student academic outcomes. Additionally, the underlying mechanisms that contribute to the differences in the relationship between Documented PE Commitment and changes in student fitness levels between large and small districts merits further investigation.

Conclusion

Although PE is the only established mechanism to sufficiently address the physical activity needs of nearly all children across the US,⁸⁴⁻⁸⁷ it has been systematically cut over the last 20 years due to financial and accountability pressures. This study found that, among small school districts in California, investments in PE after education finance reform were associated with small but meaningful increases in student fitness levels. This is an important finding for efforts to address student health disparities that may influence academic achievement, particularly since of the 829 California school districts serving the elementary grades, over 75% have fewer than 6,350 students enrolled. More research is needed to elucidate the mechanism underlying the association between PE investments among large districts and decreases in fitness. Consistent with past research, the present study also identified significant and persistent disparities in student fitness levels between high- and low-income districts. Finally, in the process of examining whether district investments in PE are associated with changes in student fitness levels over time, this study also revealed serious shortcomings of *FITNESSGRAM* field tests to measure district-level trends in student fitness. Though it faces several limitations, most notably lack of baseline PE data and variable fitness outcome data, this study contributes to our understanding about the health-related outcomes of school district investments in PE.

Implications for School Health

This study suggests that when small school districts serving low-income students commit to invest in PE, there are meaningful improvements in student fitness levels. Conversely, large school districts that invest in PE must examine the quality of the PE that is being provided to students, particularly with respect to the amount of time being spent in moderate to vigorous physical activity, to ensure their investments lead to improved outcomes for students. Additionally, the significant disparities in fitness levels between students in high- and low-income demand that health and education advocates work to develop meaningful school- and community-based strategies to improve fitness levels among low-income children in an effort to support better health outcomes for future generations. Finally, this study calls for educators, state and district policymakers, researchers, and advocates to use caution when using *FITNESSGRAM* aerobic capacity data to inform policy or programmatic decisions.

The University of California Berkeley IRB determined that this study is not human subjects research.

Table 3.1: Descriptive Statistics for SY2014-2015

	<u>Study Sample</u>		<u>All of California^v</u>		<u>p-value for difference</u>
	n= 82		n=690		
	Mean	Std. Deviation	Mean	Std. Deviation	
Total Enrollment	12,437	19,651	6,421	24,625	0.00**
% Disadvantaged Students [^]	67.6	22.0	59.5	26.1	0.00**
% African American/Latino	54.1	28.0	45.8	29.1	0.00**
Number 5 th Grade Students Tested for Aerobic Capacity	924	1418	519	1719	0.02**
% 5 th Grade Students in HFZ for Aerobic Capacity	59.6	16.72	64.1	17.4	0.00**

^vExcludes high school districts

* p<0.05; **p<0.01

[^]Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth

Table 3.2: Frequency of Documented Commitment to PE, Physical Activity, and Arts SY15-16 & SY16-17

	Documented Commitment	No Documented Commitment
PE Commitment	35 (43%)	47 (57%)
Physical Activity Commitment	50 (61%)	32 (40%)
Arts Education Commitment	58 (71%)	24 (29%)

Figure 3.1: Percent 5th Grade Students in HFZ for Fitness in California (n=829) vs. Study Sample (n=82) SY2010-2011 - SY2016-2017

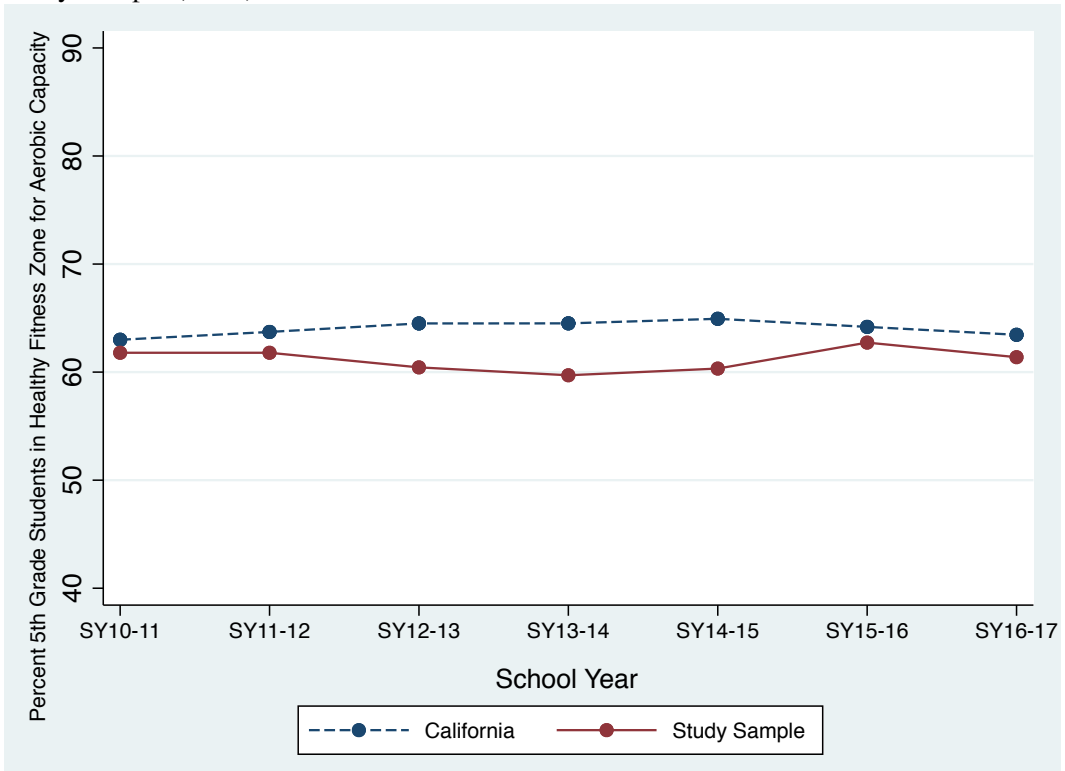
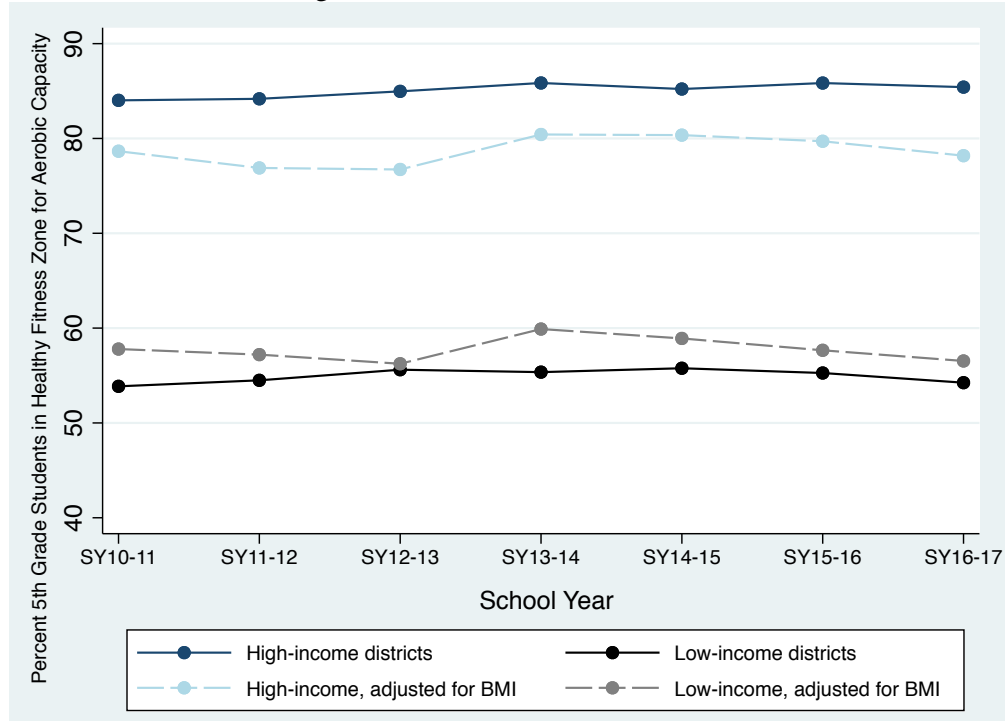


Figure 3.2: Percent 5th Grade Students in HFZ for Fitness in California Elementary and Unified Districts in high- vs. low-income districts



High income: <20% disadvantaged students, n=79); low income: ≥65% disadvantaged students, n=388. Adjusted for BMI (percent of Students in HFZ for Body Composition).

Figure 3.3: Average Percent of 5th Grade Students in HFZ for Aerobic Capacity SY2010-2011 – SY2016-2017, by Documented Commitment

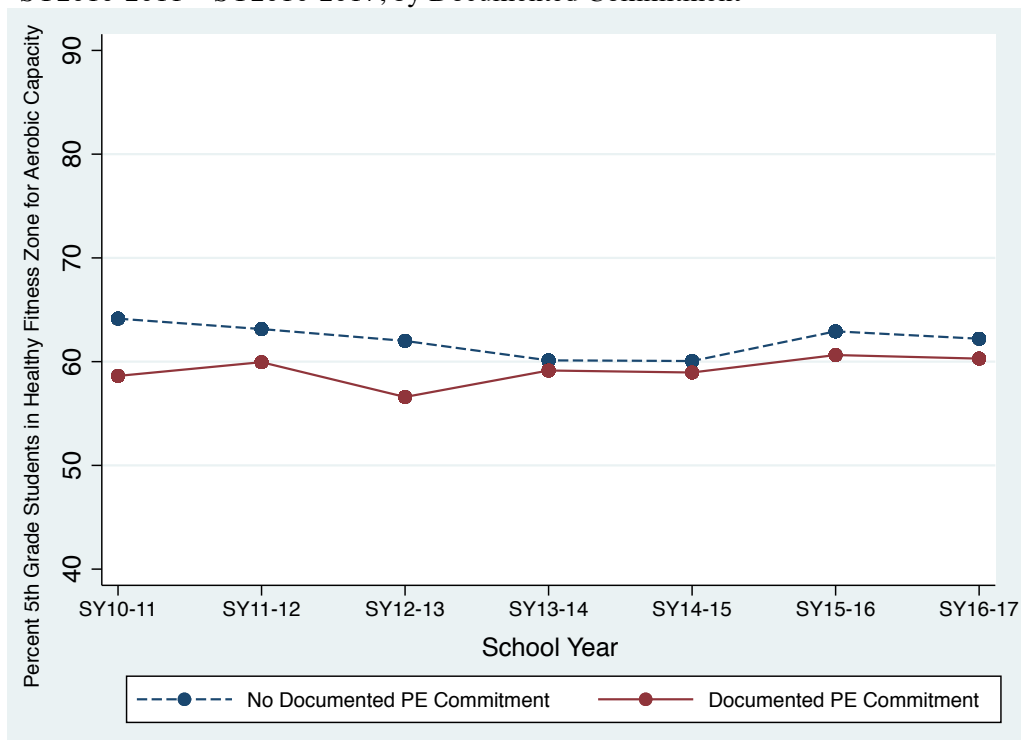


Table 3.3: Coefficients for Percent Students in HFZ for Fitness Associated with District Documented Commitment to PE, with 95% confidence intervals

Predictor	Model 1	Model 1W Weighted	Model 2	Model 2W Weighted
Time (post vs pre)	0.7 (-1.9, 3.4)	0.5** (0.5, 0.5)	0.7 (-1.9, 3.4)	0.5** (0.5, 0.5)
Documented PE Commitment	-0.2 (-5.1, 4.8)	1.0 (-3.6, 5.6)	1.3 (-3.9, 6.5)	2.5 (-2.3, 7.4)
Documented PE Commitment x Time	1.4 (-2.7, 5.4)	-0.9** (-0.9, -0.8)	1.4 (-2.7, 5.4)	-0.8** (-0.9, -0.8)
% Disadvantaged ^A Students (10% increments)	-2.7** (-3.67, -1.7)	-2.7** (-3.7, -1.7)	-2.6** (-3.6, -1.6)	-2.5** (-3.5, -1.5)
District Enrollment	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)
% Urban Population (10% increments)	0.7 (-0.8, 2.2)	0.4 (-1.0, 1.8)	0.8 (-0.7, 2.2)	0.5 (-0.9, 1.9)
Involvement in PE Lawsuit	3.4 (-3.7, 10.4)	-0.1 (-5.6, 5.5)	4.1 (-2.9, 11.1)	1.0 (-4.6, 6.5)
Arts Education			-4.4 (-9.6, 0.8)	-4.6 (-9.9, 0.6)

* p<0.05; **p<0.01.

Weights based on the number of students tested.

^ADisadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth

Table 3.4: Coefficients for Percent Students in HFZ for Fitness Associated with Documented Commitment to PE, Stratified by District Size, with 95% CI

Predictor	Model 1	Model 1W Weighted	Model 2	Model 2W Weighted
DISTRICTS WITH < 6,350 STUDENTS				
Time	0.76 (-3.0)	-0.2 (-0.4, 0.1)	0.7 (-3.1, 4.5)	-0.2 (-0.4, 0.0)
Documented PE Commitment	-4.0 (-11.0, 3.0)	-1.1 (-10.2)	-2.5 (-9.6, 4.7)	2.0 (-7.0, 10.9)
Documented PE Commitment x Time	3.5 (-2.6, 9.5)	1.8** (1.5, 2.2)	3.4 (-2.6, 9.5)	1.8** (1.5, 2.2)
% Disadvantaged^A Students (10% increments)	-1.8* (-2.6, 9.5)	-2.1 (-4.2, 0.1)	-1.6* (-3.0, -0.1)	-1.4 (-3.5, 0.6)
District Enrollment	-0.1 (-0.3, 0.1)	0.6** (-0.5, 0.7)	-0.1 (-0.3, 0.1)	0.6** (0.5, 0.7)
% Urban Population (10% increments)	0.8 (-10.5, 14.9)	-1.3 (-3.8, 1.1)	0.8 (-1.0, 2.5)	-1.1 (-3.4, 1.2)
Involvement in PE Lawsuit	2.2 (-10.5, 14.9)	-9.8 (-27.6, 8.0)	2.3 (-10.0, 14.7)	-8.3 (-25.2, 8.6)
Arts Education			-5.3 (-11.7, 1.1)	-11.3* (-20.1, -2.6)
DISTRICTS WITH ≥ 6,350 STUDENTS				
Time	0.3 (-1.8, 2.4)	0.5** (0.5, 0.6)	0.3 (-1.8, 2.4)	0.5** (0.5, 0.6)
Documented PE Commitment	1.6 (-5.6, 8.7)	3.7 (-3.1, 10.4)	0.7 (-7.5, 8.9)	2.8 (-5.0, 10.7)
Documented PE Commitment x Time	-1.2 (-4.2, 1.8)	-1.2** (-1.25, -1.2)	-1.2 (-4.1, 1.8)	-1.2** (-1.3, -1.2)
% Disadvantaged Students (10% increments)[□]	-3.6 (-4.8, -2.3)	-3.6** (-4.9, -2.3)	-3.5** (-4.7, -2.3)	-3.6** (-4.9, -2.4)
District Enrollment	0.0** (0.0, 0.0)	0.0** (0.0, 0.0)	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)
% Urban Population (10% increments)	4.7 (-3.1, 12.6)	3.9 (-4.3, 12.0)	5.4 (-2.8, 10.7)	4.5 (-4.2, 13.2)
Involvement in PE Lawsuit	4.3 (-2.2, 10.9)	1.8 (-4.4, 8.0)	3.9 (-2.8, 10.7)	1.4 (-5.0, 7.9)
Arts Education			1.9 (-7.0, 10.9)	1.9 (-7.4, 11.3)

*p<0.05; **p<0.01. Weights based on the number of students tested. ^ADisadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth.

Table 3.5: Coefficients for Percent Students in HFZ for Fitness Associated with District Documented Commitment to Physical Activity, Stratified by District Size, with 95% CI

Predictor	Model 1	Model 1W Weighted	Model 2	Model 2W Weighted
DISTRICTS WITH < 6,350 STUDENTS				
Time	1.8 (-3.1, 6.6)	-0.5** (-0.7, -0.3)	1.7 (-3.1, 6.6)	-0.5** (-0.7, -0.3)
Documented Physical Activity Commitment	-4.9 (-12.1, 2.2)	-2.4 (-12.0, 7.1)	-3.7 (-10.9, 3.5)	0.1 (-9.2, 9.4)
Documented Physical Activity Commitment x Time	0.6 (-5.6, 6.7)	1.8** (1.5, 2.1)	0.6 (-5.6, 6.8)	1.8** (1.5, 2.1)
% Disadvantaged^A Students (10% increments)	-1.6* (-3.1, 6.7)	-1.9 (-4.1, 0.2)	-1.4 (-2.8, 0.0)	-1.3 (-3.3, 0.8)
District Enrollment	-0.1 (-0.3, 0.1)	0.6** (0.5, 0.7)	-0.1 (-0.3, 0.1)	0.6** (0.5, 0.7)
% Urban Population (10% increments)	0.6 (-1.1, 2.4)	-1.5 (-4.0, 1.1)	0.6 (-1.1, 2.4)	-1.2 (-3.6, 1.2)
Involvement in PE Lawsuit	0.4 (-12.4, 13.2)	-11.1 (-29.7, 7.6)	0.7 (-11.8, 13.3)	-9.2 (-26.9, 8.6)
Arts Education			-4.7 (-11.0, 1.6)	-11.0* (-19.8, -2.1)
DISTRICTS WITH ≥ 6,350 STUDENTS				
Time	0.0 (-2.4, 2.4)	0.3** (0.3, 0.4)	0.0 (-2.4, 2.3)	0.3** (0.3, 0.4)
Documented Physical Activity Commitment	-2.5 (-9.6, 4.7)	-0.8 (-7.9, 6.4)	-4.5 (-12.6, 3.6)	-3.1 (-11.2, 5.1)
Documented Physical Activity Commitment x Time	-0.5 (-3.5, 2.6)	-0.4** (-0.5, -0.4)	-0.4 (-3.5, 2.6)	-0.4** (-0.5, -0.4)
% Disadvantaged^A Students (10% increments)[□]	-3.2** (-4.6, -1.7)	-3.3** (-4.8, -1.8)	-3.0** (-4.4, -1.6)	-3.1** (-4.7, -1.6)
District Enrollment	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)
% Urban Population (10% increments)	5.3 (-1.8, 12.4)	5.3 (-2.2, 12.9)	5.9 (-1.2, 13.0)	6.1 (-1.5, 13.6)
Involvement in PE Lawsuit	3.8 (-2.5, 10.2)	0.4 (-5.4, 6.1)	3.2 (-3.2, 9.1)	-0.2 (-6.0, 5.5)
Arts Education			4.6 (-4.2, 13.3)	5.1 (-4.1, 14.4)

*p<0.05; **p<0.01; Weights based on the number of students tested. Disadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth.

Table 3.6: Sensitivity Analysis with only two years of Pre-LCFF data: Coefficients for Percent Students in HFZ for Fitness Associated with District Documented Commitment to PE, Stratified by District Size, with 95% confidence intervals

Predictor	Model 1	Model 1W Weighted	Model 2	Model 2W Weighted
<u>DISTRICTS WITH < 6,350 STUDENTS</u>				
Time	2.3 (-2.2, 6.8)	-0.3** (-0.5, -0.2)	2.3 (-2.2, 6.7)	-0.3** (-0.5, -0.2)
Documented PE Commitment	-2.0 (-9.9, 5.8)	1.2 (-11.0, 13.5)	-0.8 (-8.8, 7.3)	4.9 (-7.2, 17.1)
Documented PE Commitment x Time	1.7 (-5.4, 8.8)	1.7** (1.4, 2.0)	1.7 (-5.4, 8.8)	1.7** (1.4, 2.0)
% Disadvantaged Students (10% increments)*	-1.9* (-3.5, -0.3)	-2.3 (-5.1, 0.6)	-1.7* (-3.3, -0.1)	-1.5 (-4.3, 1.3)
District Enrollment	-0.1 (-0.3, 0.1)	1.0** (0.9, 1.0)	-0.1 (-0.3, 0.1)	1.0** (0.8, 1.0)
% Urban Population (10% increments)	1.1 (-0.8, 3.1)	-2.1 (-5.3, 1.2)	1.1 (-0.8, 3.0)	-1.8 (-5.0, 1.3)
Involvement in PE Lawsuit	1.1 (-12.7, 15.3)	-16.7 (-40.7, 7.2)	1.4 (-12.4, 15.2)	-14.8 (-37.8, 8.1)
Arts Education			-4.3 (-11.5, 2.9)	-13.7* (-25.6, -1.8)
<u>DISTRICTS WITH ≥ 6,350 STUDENTS</u>				
Time	1.5 (-1.0, 4.0)	0.8** (0.7, 0.8)	1.5 (-1.1, 4.0)	0.8** (0.7, 0.8)
Documented PE Commitment	4.8 (-3.6, 13.1)	8.7* (0.2, 17.3)	3.6 (-6.0, 13.1)	7.6 (-2.4, 17.6)
Documented PE Commitment x Time	-3.5 (-7.0, 0.1)	-2.5** (-2.5, -2.5)	-3.4 (-7.0, 0.1)	-2.5** (-2.5, -2.5)
% Disadvantaged^A Students (10% increments)	-3.6** (-5.0, -2.3)	-3.8** (-5.4, -2.2)	-3.6** (-5.0, -2.2)	-3.8** (-5.4, -2.2)
District Enrollment	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0** (0.0, 0.0)
% Urban Population (10% increments)	4.2 (-4.9, 13.3)	2.4 (-8.0, 12.8)	5.1 (-4.6, 14.9)	3.3 (-7.8, 14.4)
Involvement in PE Lawsuit	4.9 (-2.7, 12.4)	-0.4 (-8.3, 7.4)	4.3 (-3.5, 12.1)	-1.0 (-9.1, 7.2)
Arts Education			2.7 (-7.7, 13.0)	2.7 (-9.3, 14.6)

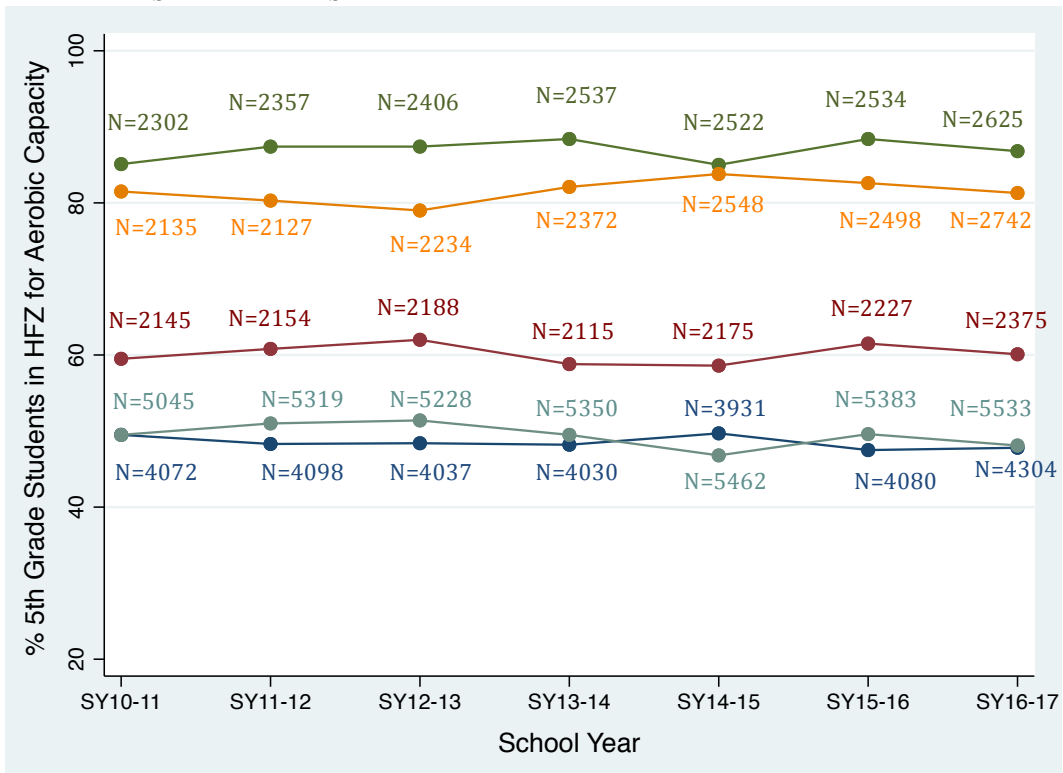
* p<0.05; **p<0.01 Weights based on the number of students tested. ^ADisadvantaged students include those who are enrolled in free- and reduced-price meals or are classified as English Learners or foster youth.

Figure 3.4: Mean Differences in % of 5th Grade Students in HFZ for Fitness SY2010-2014 and SY2015-2017 by Percent of 5th Graders in HFZ in SY2010-2011



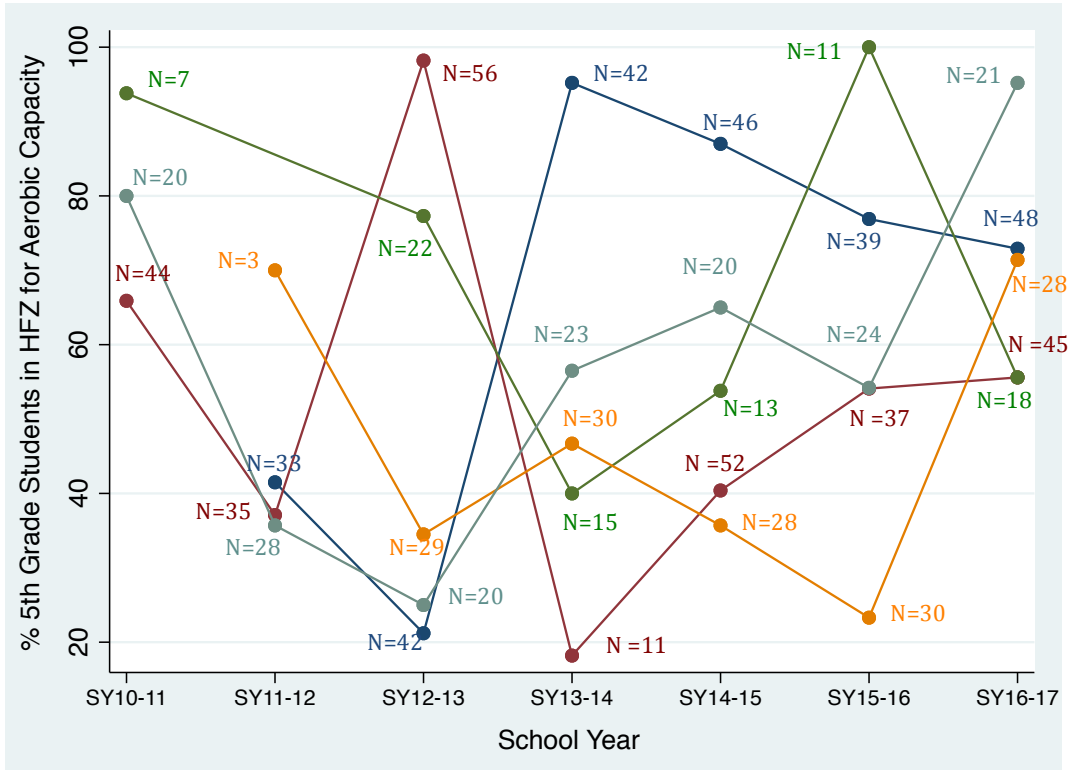
Size of shape indicates total student enrollment

Figure 3.5: Fitness Levels of Five Districts in study sample with Least Variability in fitness from SY2010-2011 – SY2016-2017



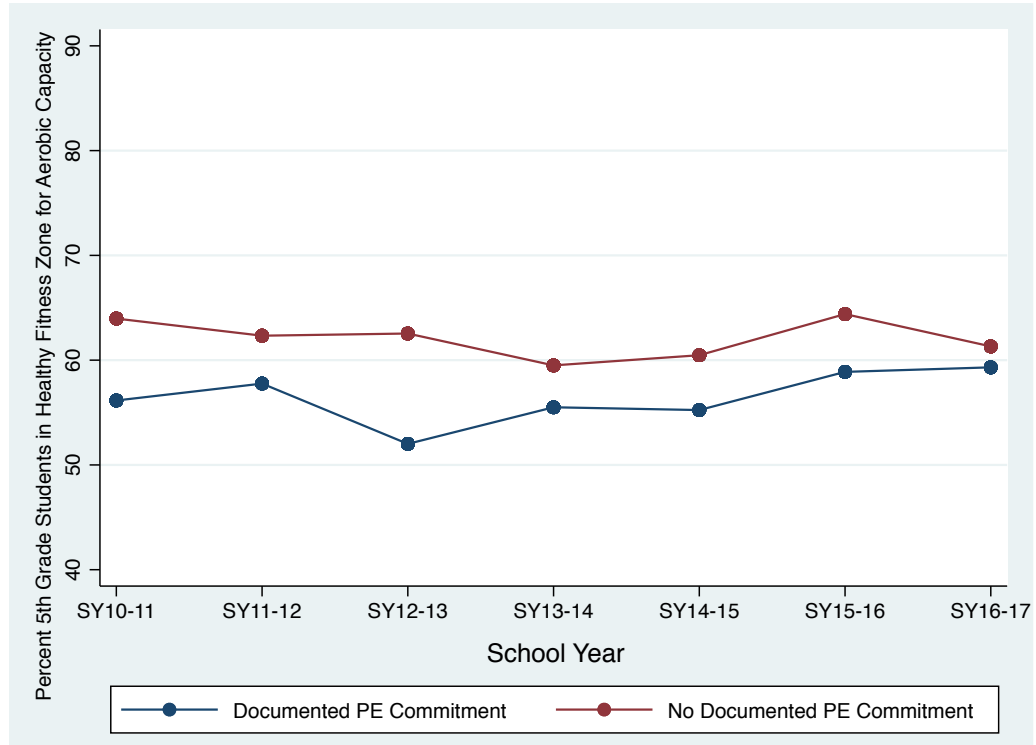
N indicates the number of students tested each year

Figure 3.6: Fitness Levels of Five Districts in study sample with Most Variability in Fitness from SY2010-2011 – SY2016-2017



N indicates the number of students tested each year

Figure 3.7: Mean Fitness Levels of Small Districts (N=54) by Documented PE Commitment Status SY2010-2011 – SY2016-2017



CONCLUSION

This dissertation sought to contribute to the nascent scientific literature that explores how education funding can be used to improve health among U.S. children.

Paper 1, which builds on the framework developed by Charles Basch, identified nontraditional, sustainable funding mechanisms for districts to invest in addressing “educationally relevant” health disparities. Using cases from around the country, the paper found four successful strategies that education and health stakeholders have used to support school-based health, including: 1) “braiding” education dollars; 2) local tax revenue; 3) Medicaid; and 4) cross-sector partnerships. While each of the examples are uniquely tailored to the needs and opportunities of each case, they all share three common facilitators: 1) a local champion, 2) alignment with district priorities, and 3) nontraditional funding mechanisms. While not exhaustive, the cases presented demonstrate that funding for school health can be complementary to, rather than competitive with, dollars dedicated to academic achievement. Additionally, this paper points to the practical need for documenting and disseminating innovative school health funding strategies more broadly to help inform educators’ decisions about how to invest in and allocate resources to school health.

Paper 2 examined whether low-income school districts in California prioritize funding for PE given more funding and flexibility for how it is spent after school finance formula reform, which resulted in additional funding for districts serving more “disadvantaged” students. Controlling for other district-level characteristics, this paper found that, as hypothesized, districts with high percentages of disadvantaged students had greater odds of investing in PE compared to districts with lower percentages of disadvantaged students (OR = 1.3, 95% CI = 1.0, 1.7). The findings suggest that the windfall of flexible funding experienced by California districts serving high concentrations of disadvantaged students may allow them to restore courses that were cut as a result of shrinking budgets and the narrow accountability measures imposed by accountability measures such as No Child Left Behind. Additionally, investments in Arts Education are strongly associated with investments in PE, suggesting that California school districts are embracing the “well-rounded” curriculum encouraged by ESSA. This study finds that given increased funding levels and flexibility for how to spend it, districts serving disadvantaged students may prioritize funding for PE and that the best way to encourage investments in PE among low-income districts in California may be to promote a “whole child” approach that includes investments in multiple dimensions of a well-rounded curriculum.

Paper 3 estimated the relationship between school district investments in PE and changes in students’ cardiovascular fitness levels before and after California school finance reform. Contrary to the expectation that PE investments would be associated with increased fitness levels for all districts, the analysis found that PE investments are associated with modest but meaningful increases in students’ aerobic capacity levels in small school districts, while PE investments among large districts are associated with decreases in aerobic capacity. Consistent with previous research, this study also identified persistent and troublesome disparities in fitness levels between students in high- and low-income school districts. In examining whether district

investments in PE are associated with changes in student fitness levels over time and in the process, this study also revealed serious shortcomings of *FITNESSGRAM* field tests to measure district-level trends in students' aerobic capacity.

While this dissertation begins to answer some important questions about how schools can finance school health and what are the associated health outcomes of those investments, it also raises many important questions for future research. These include, but are not limited to: 1) what are the health and academic outcomes of investments in school health presented in Paper 1; 2) given the increasing body of evidence about the association between fitness and academic achievement, what, if any, academic outcomes are associated with investments in student health; 3) what community-level factors are associated with persistent gaps in cardiovascular fitness levels between students in high- and low-income districts; 4) what explains the increases in cardiovascular fitness levels among students in small school districts after school finance reform and, conversely, the decreases among students in large districts; and 5) considering its shortcomings, how can educators, policymakers, advocates, and researchers reasonably use *FITNESSGRAM* aerobic capacity data to inform efforts to monitor and improve student health?

Over 90% of US children ages 5-18 attend public school each day, arguably making it the best place to address the health disparities that influence long- and short-term outcomes of the US population, including academic achievement. However, due to limited resources and competing priorities, educators are often reluctant to invest in addressing the health conditions that are associated with academic performance. Former US Surgeon General Jocelyn Elders famously said, "You can't educate people that are not healthy. But you certainly can't keep them healthy if they're not educated." This dissertation represents a meaningful step in identifying practical opportunities to reduce health disparities among current and future generations of US children to ensure they are healthy and ready to learn.

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