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Research report

# Translating school health research to policy. School outcomes related to the health environment and changes in mathematics achievement

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ABSTRACT

This paper describes an exploration of the relationship between mathematic achievement and the school health environment relative to policy-driven changes in the school setting, specifically with regard to physical education/physical activity. Using school-level data, the authors seek to understand the relationship between mathematics achievement and the school health environment and physical education minutes. This work provides a description of the aspects of the school health environment, an exploration of the interrelationships between school health and student achievement, and an assessment of the effects of the school health policy and practice on student performance and health status. Based on these findings, we identify additional research necessary to describe the relationship between obesity and learning in children.



## Introduction

Over 30% of the children and teens who live in the United States are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Studies have demonstrated that health behaviors as a child can affect health outcomes as an adult, and children are showing signs of chronic conditions such as Type II diabetes, hypertension, and bone and joint problems, that were once largely seen in adults only (Daniels, 2006). Further, childhood obesity is projected to nearly double in the next two decades, hence the urgency in addressing this public health issue (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). Physical diseases are not the only serious threats to the health and well being of our children; obesity has also been linked to cognitive deficits beginning in childhood and continuing across the lifespan (Li, Dai, Jackson, & Zhang, 2008; Smith, Hay, Campbell, & Trollor, 2011). Evidence consistently indicates that there is a symbiotic relationship between reducing inequities in health and addressing disparities in child education and academic achievement (Basch, 2011; Center on Society and Health, 2014; Fiscella & Kitzman, 2009). Better understanding of the correlations between obesity and academic achievement in children is becoming an urgent research concern, one that schools, school systems, and policy makers have an interest in exploring to improve both health and educational outcomes for children.

The reauthorization of the Elementary and Secondary Education Act in 2001 (known commonly as No Child Left Behind or NCLB) was designed to minimize academic disparities within and between schools through the implementation of high-quality educational standards, annual assessments of student achievement, and new requirements for teacher certification, among other provisions. The success of these measures is evaluated annually making use of publicly available, progress-based accountability requirements, and through this process researchers and the public are more informed that high-poverty schools, which typically also have a high percentage of minority students, struggle to meet the minimum academic proficiency requirements (Kim & Sunderman, 2005). Further, students of lower socioeconomic status, who tend to be enrolled in lower-performing schools, are also more likely to exhibit greater tendency toward higher rates of overweight/obesity status, especially African American and Hispanic children (Shrewsbury & Wardle, 2008; Vieweg, Johnston, Lanier, Fernandez, & Pandurangi, 2007). Academic and health disparities are a complex and significant concern for our nation's youth and evidence has shown substantial correlations between health status and academic achievement at the student level (Center on Society and Health, 2014).

Schools and school systems have served as a logical setting for addressing the childhood obesity epidemic since the introduction of Child Nutrition and WIC (Women, Infants, and Children) Reauthorization Act of 2004, which, among other provisions, required the development of school wellness policies for all schools participating in the National School Lunch program (USDA, 2014). School wellness policies typically include a number of provisions to address childhood obesity such as improved nutrition standards, nutrition

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education, physical education, and health promotion programs (Centers for Disease Control and Prevention & Bridging the Gap Research Program, 2014). Despite these guidelines, great variability exists among schools and school districts in terms of the strength, implementation, and evaluation of school health policies.

One provision receiving significant attention is the mandate to increase physical activity time either through structured physical education, structured recess, active fitness breaks, and/or before- and after-school activities (Kohl & Cook, 2013). Physical activity can not only improve children's physical health (Ekelund et al., 2012), but has also been linked to improving children's mental health and academic performance (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Etnier, Nowell, Landers, & Sibley, 2006; Hillman, Erickson, & Kramer, 2008; Sibley & Etnier, 2003; Singh, Uijtdewilligen, Twisk, van Mechelen, & Chinapaw, 2012; Taras, 2005; Tomporowski, 2003; Tomporowski, Davis, Miller, & Naglieri, 2008; Trudeau & Shephard, 2010). A review of over 850 experimental studies exploring the link between academic performance and physical activity led Strong et al. (2005) to conclude that additional physical education in school curriculum results in positive gains in academic performance, as well as improved physical fitness level, concentration, memory, classroom behavior, and intellectual performance. Research also suggests significant changes in cognitive function resulting from increased physical activity in adults (Etnier et al., 2006).

No Child Left Behind (2001) and the Child Nutrition and WIC Reauthorization Act of 2004 are policies that were implemented to each address issues of health or education inequality within the school setting. Local health policies, such as Washington, DC's Healthy Schools Act (HSA), have also been enacted in some areas of the country, but researchers must continue to elucidate the intersection of health and cognition as well as mitigate barriers of social and financial inequality. Evidence suggests that health may be a driver to academic success and the school setting may be an ideal location to address both (Vinciullo & Bradley, 2009). Therefore, we suggest that studies that examine the effect on both academic performance and health outcomes are important to the development of ongoing policies. These state and federal school policies are related to both educational outcomes and wellness policies. Missing from this discussion is whether there is a relationship between educational outcomes and wellness policies.

In addition to abiding by federal and state policy, urban school districts have the added responsibility to reduce inequalities among racially and economically diverse student populations. Researchers have been able to consistently demonstrate that, after adjusting for risk factors, there are neighborhood differences in health as well as education outcomes; place, race, ethnicity, and poverty lead to both health and educational disparities (Basch, 2011; Fiscella & Kitzman, 2009; Mikkelsen, Chehimi, & Cohen, 2007). Identifying strategies that promote healthful lifestyles and academic achievement, especially in the most vulnerable populations, means students might have a better opportunity to succeed throughout their school years.

The purpose of this study is to understand the association between the time spent in physical education and math proficiency levels at the elementary school level. We hypothesize that math proficiency rates will be higher, on average, in schools with higher reported weekly physical education minutes.

## Methods and materials

Washington, DC is home to a demographically diverse population with significant economic and health disparities across its eight wards of the city. In 2010, the District of Columbia (DC) City Council passed the Healthy Schools Act (HSA). This legislation was enacted to compel DC Public Schools (DCPS) and DC Public Charter Schools (PCS) to undertake a number of initiatives to advance the health of DC children, including improving school nutrition, expanding physical and health education, increasing student physical activity time, and monitoring the implementation of these provisions through an annual School Health Profile (SHP). The State Agency is charged with oversight of implementation, and schools are expected to abide by these provisions and to report on their progress and adherence to them through the annual SHP.

The SHP is a self-report survey measure, completed annually by the school principal and/or a designee. The SHP includes items related to the implementation of each of the provisions of the HSA, such as nutritional components of the school menu, minutes allocated toward physical and health education, curricular alignment with the city's health standards, and the presence of a school garden. In order to assess the level of implementation at each school, as well as the overall school district, the research team created a measure, called the Composite Score.

The Composite Score is a measure of the degree of implementation of the Healthy Schools Act (HSA) within each school at the building level. This instrument makes use of data from the SHP and is designed to provide a comprehensive assessment of the implementation of the HSA. The resulting Composite Score is directly linked to the provisions and requirements of the HSA and serves as a measure of how well the school is implementing the policy. Questions from the SHP include items that assess if the school provides the required amount of instructional time in health and physical education; if the school meals meet the USDA nutrient standards; the availability of a school nurse; whether or not the school has a wellness policy; and other similar questions. Most items are given either a "0" (absent) or "1" (present) indicating that the provision has been met or not; and a limited number of questions related to minutes of instruction are on a sliding scale, with a maximum score of three. These policy-driven questions assess the degree to which the school is compliant with the requirements of the HSA. The Composite Score range is from 0 points to a maximum of 33 points, with a higher score indicating stronger compliance with the policy. The categories for the Composite Score include Nutrition, Physical Education and Activity, Health Education, Health and Wellness, and Farm to School (Table 1).

The district has 139 elementary public and public charter schools, and this study makes use of data from the 120 schools that submitted the SHP. Physical education minutes were obtained from the SHP data for the 2012–2013 academic school year. Schools reporting more than 225 minutes of physical education per week were considered recording errors due to school bell schedules not confirming this amount of physical education and thus removed from the data pool.

The DC Comprehensive Assessment System Mathematics (DC CAS Math) assessment is a standardized test given at the end of the academic year and is designed to evaluate mathematics knowledge and skills at each grade level. Aggregated school scores were obtained from the State Agency which oversees the administration of the annual standardized exam. The DC CAS Math was part of DC's annual standardized testing battery, the DC CAS (DC CAS|OSSE, 2014).

**Table 1**
Provisions of the HSA Composite Score used to assess school compliance based on questions in the SHP.

| Provision title within the healthy schools act | Percent of total Composite Score | Overall possible points |
|---|---|---|
| School nutrition | 33.3% | 11 |
| Physical education and activity | 30.3% | 10 |
| Health education | 18.2% | 6 |
| Health and wellness | 15.2% | 5 |
| Farm to school | 3.0% | 1 |
| Total | 100% | 33 |