

A STUDY OF PHYSICAL EDUCATION AND PHYSICAL FITNESS AMONG YOUTHS IN
MIDDLE SCHOOL

by

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(Under the Direction of Janani Rajbhandari-Thapa)

ABSTRACT

To reduce childhood obesity and improve student health, in 2009, the Georgia General Assembly passed the School Health and Physical Education (SHAPE) Act. This act requires schools to conduct an annual fitness assessment for students enrolled in a physical education (PE) course taught by a certified PE teacher. However, in Georgia there is no requirement that middle school students take PE. This policy makes Georgia's middle school level unique since PE is required for elementary students annually and for high school students as a one-unit health and physical education graduation requirement. In Georgia, males have historically outperformed females on the FitnessGram[®] tests used for the annual fitness assessment, and males participate in PE at higher rates. This study utilized physical fitness, school characteristics, and PE participation data to study the association of school characteristics with PE participation and body mass index (BMI) and aerobic capacity fitness outcomes. Data for 315 middle schools, from the 2012 through 2017 school years, were merged and analyzed using descriptive statistics and multiple linear regression models in a cross-sectional study. An increase in the number of students receiving free or reduced lunch was associated with a decrease in PE participation for both males and females (-.014, $p < .01$) and a decrease in HFZ BMI achievement and HFZ aerobic

capacity achievement for all students (-.014 and -.039, respectively, $p < .01$). Furthermore, an increase in male PE participation was associated with increased HFZ aerobic capacity achievement for males only (.049, $p < .01$). Results showed an association between school socioeconomic status indicators and PE participation rates, and fitness outcomes. Associations with PE participation and HFZ achievement were also found for certain school-level variables, including number of full-time teachers, pupil-teacher ratio, and city and town school locations, compared to rural school location. Interventions to decrease health disparities as well as to remove barriers to PE participation and effective PE programming are needed at middle schools serving socioeconomically disadvantaged youth. In addition, middle schools should implement interventions to improve fitness outcomes for female students. Increasing resources at marginalized schools may also decrease health disparities.

INDEX WORDS: SHAPE Act, FitnessGram[®], Healthy Fitness Zone (HFZ), Aerobic Capacity, Body Mass Index (BMI), School Characteristics, National School Lunchroom Participation, Gender Differences, Health Disparities

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DEDICATION

This research is dedicated to the children and families of Georgia. I hope this research contributes to the improved health of Georgia's youth and the development of policies that effectively address youth physical activity and physical education needs while improving youth health outcomes.

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CHAPTER 1

INTRODUCTION

Young people have become increasingly more sedentary. According to the 2018 United States (US) report card on physical activity for children and youth, 76% of youth did not meet the recommended level of daily physical activity (National Physical Activity Plan Alliance, 2018). Physical activity levels vary significantly based on gender, race, age, ability, and household income (National Physical Activity Plan Alliance, 2018). Furthermore, according to the National Health and Nutrition Examination Survey from 2003-2004, children and adolescents are sedentary for seven waking hours daily (Barnett et al., 2018). This growth in sedentary time is in part due to increased access to technology, resulting in increased screen time, with television viewing being the most common measure of sedentary behavior in children (Barnett et al., 2018). Screen time is associated with adiposity, even after adjusting for diet and physical activity (Barnett et al., 2018). Physical activity is a “critical factor” in weight maintenance and obesity prevention, and physically active children experience increased health in adulthood (U.S. Department of Health and Human Services, 2018).

Limited physical activity has contributed to childhood obesity. Obesity can result in various immediate and future health risks. Children who have obesity are at increased risk for high blood pressure and high cholesterol, which can lead to cardiovascular disease (Cote et al., 2013). Children are also at risk for impaired glucose tolerance, insulin resistance, type 2 diabetes (Bacha & Gidding, 2016), and breathing problems like asthma and sleep apnea (Narang & Mathew, 2012). Additional issues include joint problems and musculoskeletal discomfort (Pollock, 2015), fatty liver disease, gallstones, and heartburn (Africa et al., 2016). Furthermore,

childhood obesity is associated with anxiety and depression, lower self-esteem, and lower self-reported quality of life, as well as social problems like bullying and stigma (Beck, 2016).

Childhood obesity can lead to obesity in adulthood (Gordon-Larsen et al., 2010), which increases the risk of developing more severe chronic diseases such as diabetes and cancer (Bass & Eneli, 2015).

According to the National Center for Health Statistics, from 2015 through 2016, 18.5% of young people in the US, ages 2 to 19, had obesity (Hales et al., 2017). Furthermore, for youth ages 10 to 17, the national youth obesity rate was 15.5%, according to the 2018-2019 National Survey of Children's Health, as analyzed by the Health Resources and Services Administration's Maternal and Child Health Bureau (Robert Wood Johnson Foundation, 2020a).

Within the population of youth ages 10 to 17, obesity rates vary by group with persistent racial, ethnic, and income disparities. In households with incomes at 400% or more of the federal poverty level, 8.8% of youth were obese (Robert Wood Johnson Foundation, 2020a), while in households with incomes under the federal poverty level, children had obesity at a rate of 21.5% (Robert Wood Johnson Foundation, 2020a). These disparities indicate the presence of inequities and solutions to childhood obesity must take these inequities into account.

Furthermore, obesity prevalence varies by geography and across the US, obesity rates differ by state. Figure 1 below provides a visualization of how US states compare on childhood obesity. Kentucky has the nation's highest obesity rate for youth ages 10-17 (23.8%), followed by Mississippi (22.3%), South Carolina (22.1%), Tennessee (20.4%), Arkansas (20.2%), Louisiana (20.1%), and West Virginia (19.6%) (Robert Wood Johnson Foundation, 2020a). The state of Georgia ranks number 24 out of the 50 states and D.C. with a 14.9% obesity rate for

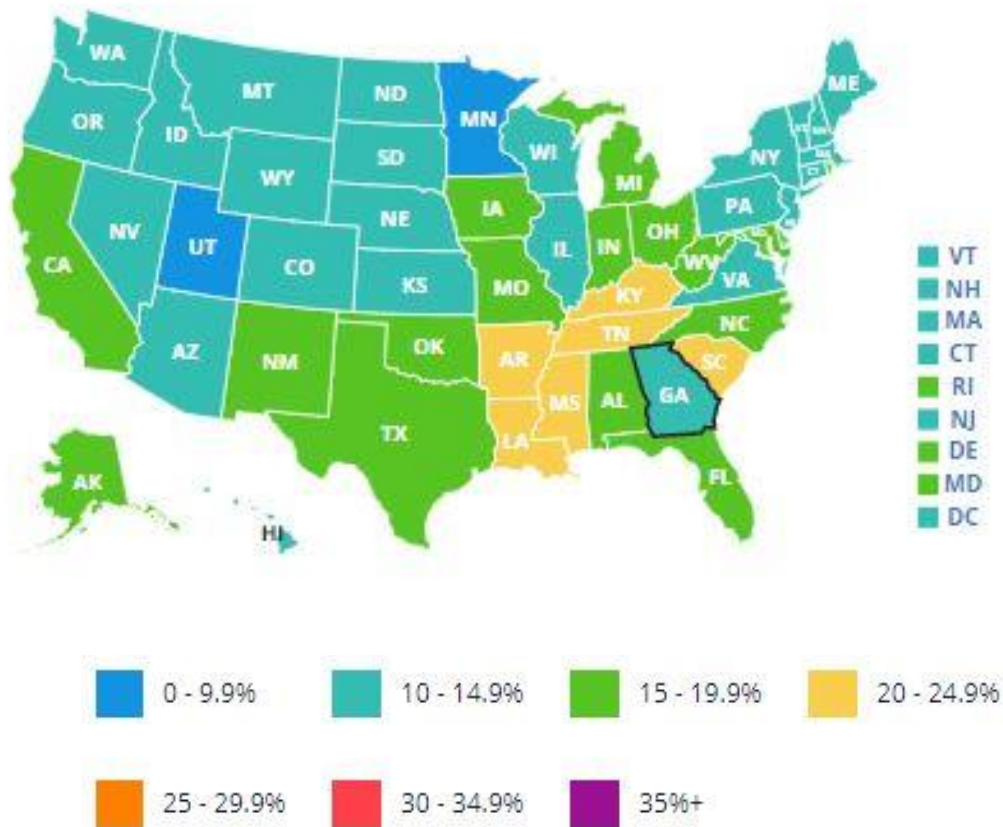


Figure 1. 2019 Nationwide Obesity Rates, Ages 10-17

(Robert Wood Johnson Foundation, 2020a)

youth ages 10-17, representing a downward trend from 2016 to 2019 (Robert Wood Johnson Foundation, 2020a). Although Georgia's obesity rate is lower than the national rate for 2018-2019, the difference between Georgia and the national rate is not statistically significant (Robert Wood Johnson Foundation, 2020a). The high rates of childhood obesity nationwide and the comorbidities mentioned above make the current landscape of childhood obesity a public health crisis. Overcoming this crisis will require the prioritization of programs and legislation to improve youth health outcomes.

State and federal governments in the US have implemented programs and policies to decrease the prevalence of childhood obesity. Legislation focused on reducing rates of childhood obesity has been of interest to many state legislatures. According to a 2008 study, from January 2003 through December 2005, 717 bills related to childhood obesity with a non-negative health impact were introduced in state legislatures in 49 states (Boehmer et al., 2008). The largest percentage of these bills, 30%, included content related to physical and health education curriculum and course credit. The makeup of these bills suggests that a large number of state legislatures are proposing to address the issue of childhood obesity through educational interventions. Of the 717 bills, 123 (17%) were enacted in 38 US states (Boehmer et al., 2008). Bill enactment was higher in the states of Colorado (75%), Louisiana (60%) and Georgia (56%), which had the highest percentages of bills enacted, while Illinois and California, the states with the most enacted bills, passed ten bills each. Across all states, 19% of enacted laws were related to physical and health education curricula and course credit (Boehmer et al., 2008).

Additional studies allow for consideration of how bill enactment has changed from year to year. According to Bleich et al., between November 2012 and December 2016, 1,206 bills related to childhood obesity were introduced in state legislatures across all 50 states, with a total of 112 childhood obesity bills enacted (Bleich et al., 2018). Furthermore, there was a significant (p -trend = 0.02) increase in the nationwide average state enactment rate across the years studied, with 11% of bills enacted at baseline, 16% in study year 1, 8% in study year 2, and 27% in study year 3 (Bleich et al., 2018). There was a significant increase in the percentage of bills containing elements focused on improvement of health equity (p -trend = 0.02) (Bleich et al., 2018). The increasing focus on health equity suggests that legislatures may be ready to address systemic factors that impact childhood obesity and lead to health disparities. However, the vast majority of

bills enacted focused on diet and nutrition with most bills impacting school and early child care environments (Bleich et al., 2018). Due to the increase in sedentary time and lack of physical activity among youth, policies focused on physical activity interventions must also be implemented.

According to data from all 50 US states maintained by the Centers for Disease Control and Prevention, from 2001 until 2017, in general 2,941 policies containing obesity legislation and 2,761 policies containing physical activity legislation were enacted nationwide (Centers for Disease Control and Prevention, 2018). Enacted policies containing obesity legislation peaked in 2010, with 822 policies enacted that year while physical activity legislation peaked in 2011, with 575 policies enacted (Centers for Disease Control and Prevention, 2018).

The number of bills and policies mentioned above in studies and databases examining time periods from 2003 until 2017, demonstrate that state governments are recognizing the need for laws to decrease obesity rates. This is an important indicator of readiness in the policy landscape, suggesting that states and legislators may be prepared to create real and lasting policy interventions focused on decreasing rates of childhood obesity.

In the state of Georgia, in 2009, the Georgia General Assembly passed the Official Code of Georgia Annotated § 20-2-777, known as the Georgia School Health and Physical Education (SHAPE) Act (State of Georgia, 2017). This act focuses on physical activity promotion and physical fitness assessment of k-12 youth. Under the SHAPE Act, local school systems must conduct an annual fitness assessment for students in grades 1st through 12th, provided those students are enrolled in a physical education (PE) class at any point during the school year (State of Georgia, 2017), taught by a certified PE teacher (Lyn et al., 2017; Vall et al., 2017).

Furthermore, the SHAPE Act also mandates that school systems provide the minimum requirements for PE as determined by the Georgia Board of Education (Lyn et al., 2017).

The Physical Activity Guidelines for Americans recommend that children and adolescents ages six through 17 obtain at least 60 minutes of moderate to vigorous-intensity physical activity every day through aerobic, muscle-strengthening, and bone-strengthening exercises (U.S. Department of Health and Human Services, 2018). According to the 2018 National Survey of Children's Health, only 23.2% of youth ages six through 17 report achieving this recommendation (Child and Adolescent Health Measurement Initiative, 2018). These low rates prevent many young people from receiving the benefits associated with physical activity, which go beyond the physical. For example, studies have shown that physical activity and physical fitness are associated with improved academic performance (SHAPE America, 2016).

Physical activity time is achievable through PE class in the education sector. PE provides an opportunity for students to gain exposure, experience, knowledge, and benefits associated with physical activity. Furthermore, PE participation is negatively associated with obesity (Ortega Hinojosa et al., 2018). It provides students with lifelong skills for health and well-being while positively influencing students' physical, emotional, and mental health (SHAPE America, 2016). Most youth in the US attend public schools, making the public school setting an environment that most Americans will pass through in life. According to the National Center for Health Statistics, in 2016, 91% of American youth attended public schools while 9% of American youth attended a private school (U.S. Department of Education, 2019). This makes the US school system a ready venue to engage students in dynamic programming to improve health outcomes with immense opportunities for PE class to serve as an intervention to decrease childhood obesity.

Despite the myriad potential benefits of PE and the scope available for PE interventions, in Georgia, students are not required to take PE at all stages of public school education. Elementary school students (grades kindergarten – 5th) in Georgia must receive a minimum of 90 contact hours of PE instruction in each grade. The PE requirement for middle schools (grades 6th – 8th) states, “each school containing any grade 6th -12th shall make available instruction in health and physical education” (Georgia Department of Education, 2018b). To make PE available, schools must offer the course but there is no statewide requirement for middle school students to take PE (Georgia Department of Education, 2018b; McGuire & Tenoschok, 2018). PE requirements are also relaxed at the high school level (grades 9th – 12th), requiring only one semester of a health-related fitness class (Georgia Department of Education, 2018b). As a result, the middle school level is the only k-12 stage in Georgia where PE class is not required.

Nationally, 72.55% of the 50 states and D.C., require that middle school students take PE class, placing Georgia in the minority for middle school PE policy at the nationwide level (Robert Wood Johnson Foundation, 2020b). Furthermore, of the 50 states and D.C., fewer states require middle school students to take PE than states requiring elementary (76.47%) or high (84.31%) school students, and 64.71% of states require PE at all three levels (elementary, middle, and high school) (Robert Wood Johnson Foundation, 2020b). With a majority of states requiring PE for elementary, middle, and high school students, states without these requirements should evaluate PE outcomes to consider if policies mandating PE at all school levels should be considered.

Socioeconomic disparities exist for PE participation. A study that surveyed over 500 schools and 54,000 students across multiple years, found that Hispanic students and Black students participate in PE at lower rates than White students, even when other variables are

controlled for (Johnston et al., 2007). Furthermore, this study found that PE participation in intermural sports decreased amongst students of lower socioeconomic status (SES). This study determined that less access to resources may be responsible for the observed disparity in PE participation for these racial groups and students of lower SES (Johnston et al., 2007).

In addition, there are also socioeconomic disparities for fitness outcomes. A 2015 study found that students at schools serving higher proportions of economically disadvantaged youth, had increased cases of obesity, despite an individual student's economic status or ethnicity (Springer et al., 2015). This study suggests the importance of environmental factors, as those of higher SES are still impacted when in lower SES neighborhoods (Springer et al., 2015).

Furthermore, there is an observable grade-related decline in PE participation in Georgia (McGuire & Tenoschok, 2018). This decline has also been found to exist at the US national level (Johnston et al., 2007). During the 2016-2017 school year in Georgia, PE participation rates decreased with increasing student grade-level and while 94.5% of elementary school students participated in PE, only 72.3% of middle school students, and 63% of high school students participated (McGuire & Tenoschok, 2018). This may be in part due to state policies that require more PE for younger children, those in elementary school, and less PE hours for older children, those in middle and high school. Furthermore, there could be school characteristics that are associated with PE participation. In addition to studying the factors associated with PE, the SHAPE Act allows an investigation of the association of PE participation with physical fitness among middle school students in Georgia.

Problem Statement

Due to the lack of a mandate for middle school students to take PE, middle school PE participation rates vary amongst schools and school districts (Georgia Department of Education,

2018b). Variation in PE participation and the absence of PE requirements creates an interest to study the variables associated with PE participation at the middle school level. Furthermore, it is unclear if PE participation is associated with and can explain changes in physical fitness outcomes for fitness measures in the state of Georgia as well as other states. School-level variables associated with physical fitness outcomes in Georgia need more research. This information could help influence future PE policy discourse and ensure that legislation is practical, results-driven, and focused on the right approach to improve student physical fitness.

Study Objective

The goal of this study was to inform physical activity promoting policies in the state of Georgia. This study explored the school-level variables associated with PE participation and achievement on measures of physical fitness. This study also examined the association between PE participation rates and physical fitness outcomes. The study objectives and the hypotheses are stated below.

Objective 1: To examine the association of school-level variables with PE participation and middle school students' physical fitness.

Objective 2: To evaluate PE participation as a predictor of middle school students' physical fitness.

Hypothesis 1: Schools with more resources and indicators of higher SES will have higher rates of PE participation and improved fitness outcomes.

Hypothesis 2: As PE participation rates increase at the school level, the percentage of middle school students achieving physical fitness will also increase.

Research Questions

Through the above objectives, this study will address the following research questions.

The school-level variables include items related to school size, socioeconomic status, gender, race & ethnicity, school resources, school year, and school location.

Research Question 1:

What is the association of school-level variables with PE participation in middle schools?

Research Question 2:

What is the association of school-level variables with fitness outcomes in middle schools?

Research Question 3:

How is PE participation associated with fitness outcomes in middle schools?

By answering these research questions, this study provides guidance for stakeholders that will improve physical activity and physical education policies with the goal of reducing childhood obesity and improving youth health outcomes.

CHAPTER 2

LITERATURE REVIEW

Student Achievement on Measures of Physical Fitness

Measures of physical fitness have been used in PE programs and schools to assess student physical aptitude and health (Institute of Medicine, 2012). Furthermore, measures of physical fitness are used in schools to monitor disease risk and fitness levels, to create plans for improving health, and to help determine appropriate activities for PE classes (Institute of Medicine, 2012). Physical fitness assessments have supported public health by allowing for surveillance and evaluation of youth well-being (Morrow et al., 2009). School-based physical fitness assessments offer surveillance opportunities in the education system (Cooper Institute, 2014). An overview of the FitnessGram[®] fitness assessment, a school-based surveillance opportunity, is provided below.

FitnessGram[®]

FitnessGram[®] is the official fitness assessment program used in Georgia (McGuire & Tenoschok, 2018). It is used in over 67,000 schools nationwide to assess the health of more than ten million students (Cooper Institute, 2007, 2014). To evaluate youth health, the FitnessGram[®] assessment uses criterion-referenced standards to place students in one of three zones on each test taken. These zones, described below in Figure 2, are the Healthy Fitness Zone (HFZ), Needs Improvement, and Health Risk (Cooper Institute, 2014). The goal is for students to perform in the HFZ on each test.

Healthy Fitness Zone	Needs Improvement	Health Risk
<p>This Healthy Fitness Zone® indicates that the student is considered to be fit enough for good overall health. Most students who are regularly active should be able to score within or above the Healthy Fitness Zone on most FitnessGram assessments.</p>	<p>This zone indicates a potential for future health risks if fitness doesn't improve. Increased activity as well as eating a healthy, controlled diet could delay or reverse this potential risk. Students in the Needs Improvement Zone will see messaging on their FitnessGram Student Reports explaining how they can move into the Healthy Fitness Zone.</p>	<p>The Health Risk zone suggests that the student has a probability for future health problems if they don't improve their physical fitness. The need for increased activity and eating a healthy diet is more urgent for students in this category than those in the Needs Improvement Zone.</p>

Figure 2. FitnessGram® Fitness Zones.

(Cooper Institute, 2014)

In Georgia, the FitnessGram® assessment is conducted annually. Students in grades 1st through 12th who take PE during the school year, taught by a certified PE teacher, are required to complete the assessment. Youth in grades 1st through 3rd only participate in the BMI assessment while students in grades 4th through 12th take part in the full battery of tests (Georgia Department of Education, 2018a), including assessments for aerobic capacity, muscular strength, muscular endurance, flexibility, and body mass index (BMI) (McGuire & Tenoschok, 2018). The FitnessGram® assessments demonstrate both reliability and validity (Morrow et al., 2010) and in extant studies, PE teachers reported positive reception to the use of FitnessGram® (Miller et al., 2016).

The aerobic capacity test measures the student's volume oxygen maximum (VO₂ max), indicating how well the body is able to utilize oxygen, as assessed by the Progressive Aerobic Cardiovascular Endurance Run (PACER) or the timed one-mile run (McGuire & Tenoschok, 2018). The PACER test requires students to complete timed laps with the time limit for successive laps shortening to increase intensity. If the school chooses to use the one-mile run to assess aerobic capacity, the student will complete the one-mile as quickly as possible in minutes

and seconds. Number of laps completed for the PACER or completion time for the mile run, is used to estimate the VO₂ max (McGuire & Tenoschok, 2018). The VO₂ max will determine which fitness zone the student is placed in.

The BMI test uses the student's height and weight, which is entered in the FitnessGram[®] software to calculate the student's BMI, which estimates appropriateness of weight based on height (McGuire & Tenoschok, 2018). For the BMI measure, the FitnessGram[®] fitness zones align with the Centers for Disease Control and Prevention's (CDC) weight status categories of underweight, normal or healthy weight, overweight, and obese, which, for children, are based on percentile ranges. Children are considered to be at a normal or healthy weight if they are in the fifth percentile to less than the 85th percentile (Division of Nutrition Physical Activity and Obesity, 2018). Fitness zones for BMI are predetermined and students will be placed in the zone corresponding with their BMI. The BMI measure is not perfect and can sometimes inaccurately assess health. For example, a student could have a heavier weight due to increased muscle mass, placing the student in the Needs Improvement or Health Risk categories when no weight issue exists, or a student could have a lower weight with little muscle mass, placing the student in the HFZ even though they may lack a healthy body composition (McGuire & Tenoschok, 2018).

In addition to aerobic capacity and BMI, the FitnessGram[®] also includes tests for muscular strength, muscular endurance, and flexibility. The curl-up is used to assess abdominal strength with the goal for students to complete 75 curl-ups in correct form to a pre-set rhythm, providing three seconds per curl-up (McGuire & Tenoschok, 2018). While the curl-up is used to examine abdominal strength, the 90° push-up is used to assess upper body strength. The goal of the 90° push-up is to complete as many correct-form repetitions as possible to a pre-set rhythm, with three seconds per push-up, or 20 push-ups per minute (McGuire & Tenoschok, 2018). For

the curl-up and push-up, the number of repetitions the student can complete will determine in which fitness zone the student is placed. Lastly, the sit and reach is used to assess flexibility. The flexibility exercise focuses mainly on the muscles in the back of the legs. To be in the HFZ, the student must be able to perform the sit and reach exercise on both legs (McGuire & Tenoschok, 2018). Individual student FitnessGram[®] outcomes are shared with the student's parents but are otherwise kept confidential while aggregate results are reported (McGuire & Tenoschok, 2018). Parents are also sent recommendations to improve their student's fitness level, where applicable.

FitnessGram[®] Data Trends

Broad use of FitnessGram[®] has resulted in a wealth of data on student physical fitness performance outcomes. To gather a better understanding of student performance on FitnessGram[®], performance outcomes from various studies are discussed below. One such study examined the aerobic fitness of 1,075 students in grades kindergarten through 12th in a St. Louis, Missouri school district. It was found that overall, only 49.8% of students achieved the HFZ for aerobic capacity. Males in this study met the aerobic capacity HFZ at higher rates than females, with 61.4% of males achieving the HFZ compared to 35.4% of females (Clark et al., 2015). Furthermore, studies have found that achievement of the HFZ decreases as students progress from elementary to middle to high school (Clark et al., 2015; Welk et al., 2010). A Texas study found that while 70% of elementary school pupils achieved the HFZ for aerobic capacity, only 46% of middle school pupils and 34% of high school pupils were in the aerobic capacity HFZ (Welk et al., 2010).

There are many reasons for the trends and achievement patterns observed in fitness and health data. In particular, in the St. Louis study mentioned above, researchers pointed to disparities to explain poorer health outcomes (Clark et al., 2015). Neighborhoods with fewer

healthy food options, issues of neighborhood safety, and less access to health care, paired with higher rates of poverty, often have higher rates of obesity compared to more affluent areas. These neighborhoods also have higher risk of mortality from chronic diseases like diabetes, stroke, heart disease, and cancer. This points to socioeconomic and ethnic disparities in health which impact outcomes for youth (Clark et al., 2015). United States data at the nation-wide level may help to further analyze trends in HFZ outcomes.

A National Football League (NFL) PLAY 60 FitnessGram[®] Partnership Project conducted by The Cooper Institute, creators of the FitnessGram[®], has provided access to national youth FitnessGram[®] data collected between 2010 and 2014 from 725 schools across the U.S. and 192,848 students in 1st – 12th grades (Bai et al., 2015). Table 1 below summarizes the data for 6th, 7th, and 8th grade male and female students who completed the aerobic capacity and BMI assessments, showing that aerobic capacity HFZ achievement decreases as students progress through middle school for both boys and girls. Furthermore, table 1 shows that boys consistently achieved the HFZ for aerobic capacity at higher rates than girls. Table 2 summarizes the percentage of students deemed high performers by passing all, or all but one, of the six tests administered in the study. According to Table 2, there was a larger percentage of high performing boys than high performing girls, with a difference between 6th, 7th, and 8th grade boys and girls of 3.4, 3.3, and 3.1 percentage points, respectively.

Table 1. Prevalence of FitnessGram[®] HFZ Achievement for Select Measures

		6 th grade	7 th grade	8 th grade
Gender	Test	Mean (SD)		
Boys	Aerobic Capacity	62.1% (1.4)	58.8% (1.8)	56.2% (1.6)
Boys	BMI	53.9% (0.9)	54.4% (1.0)	56.7% (1.0)
Girls	Aerobic Capacity	49.4% (1.4)	43.4% (1.5)	41.4% (1.6)
Girls	BMI	56.6% (0.9)	54.8% (1.0)	56.2% (1.0)

(Bai et al., 2015)

Table 2. Percentage of Students Passing 5 or 6 FitnessGram[®] Tests

	Boys			Girls		
	HFZ on 5 tests	HFZ on 6 tests	Total	HFZ on 5 tests	HFZ on 6 tests	Total
6 th grade	20.1%	13.0%	33.1%	17.7%	12.0%	29.7%
7 th grade	19.9%	12.8%	32.7%	17.5%	11.9%	29.4%
8 th grade	19.0%	12.5%	31.5%	17.4%	11.0%	28.4%

(Bai et al., 2015)

The HFZ “indicates that the student is considered to be fit enough for good overall health” (Cooper Institute, 2014) and “most students who are regularly active should be able to score within or above the HFZ on most FitnessGram[®] assessments” (Cooper Institute, 2014). Therefore, these tables reaffirm that nationally, many youth are not physically fit and not achieving enough regular activity, especially females. Furthermore, most students in this study were unable to pass five or six FitnessGram[®] tests.

This achievement gap in student physical fitness has led researchers to consider variables that impact performance. As mentioned above in reference to the St. Louis study (Clark et al., 2015), race and socioeconomic status are two variables that impact health outcomes. Below, these variables, as well as school level, school size, academics, and other variables, are discussed in further detail. Gender is also a significant factor that will be mentioned throughout this review.

Variables Impacting Physical Fitness

One goal of this research is to determine the association between school level variables and HFZ achievement. To ensure the correct school level variables are being considered in this study, it was important to determine which school level variables are believed to have some impact on HFZ achievement. Research was conducted with the intention of forming a clear

understanding of variables that impact physical fitness as well as assessing, where possible, the magnitude and direction of the relationships between health outcomes and school characteristics.

School Level

School level refers to the student's place within the education system, for example student grade and age or student school category, meaning elementary school, middle school, or high school. There are multiple studies showing an association between school level and student fitness outcomes. There has also been research conducted in Georgia, the state of interest in this study. This research found that in Georgia, student aerobic capacity achievement decreased as school level increased, with older students being less likely to achieve the HFZ for aerobic capacity (Bai et al., 2017). However, this association was not found with achievement of HFZ for BMI (Bai et al., 2017). To determine the reason for decreases in achievement as students age, further study of the impact of physical activity programs on elementary, middle, and high school students is suggested (Bai et al., 2017). Exploring the impact of PE participation on fitness outcomes, this dissertation study intends to contribute to the scholarly research available on this topic.

A multi-year study of data from the National Health and Nutrition Examination Survey allows a further comparison between Georgia and national data. This study of 2,997 multiethnic U.S. children ages 12 to 18, had students complete a treadmill exercise, calculating the VO_2 max for each study participant. The results showed a disparity between the performance of girls and the performance of boys, as well as differences based on participant age. This study found that the VO_2 max of boys ages 12 to 15 increased with increasing age and then became stable (Eisenmann et al., 2011). The opposite was found for girls, with VO_2 max of girls ages 12 to 18 decreasing with increasing age (Eisenmann et al., 2011). This study did not stratify by race

because no differences between Whites, Blacks, and Hispanics were found in the data (Eisenmann et al., 2011). Further information on race is discussed below.

Race

Contradictory information exists on the impact of race on physical fitness and further research is needed with a health equity lens. While some studies have found that race has an impact on the achievement of physical fitness measures (Bowser et al., 2016), other studies have not found an association between race and fitness outcomes (Eisenmann et al., 2011). Research conducted with 6th grade students in Wisconsin found an association between physical fitness outcomes and race. This study included students from the following racial groups: White non-Hispanic (55.6%), Black non-Hispanic (7.2%), Hispanic (20.8%), Multi-racial non-Hispanic (9.3%), American Indian non-Hispanic (1.5%), and a combined group of Asian and other non-Hispanic (5.8%). White non-Hispanic students were found to be the most active and fit, while students in the Asian and other non-Hispanic group (n=210) were the least active. According to VO₂ max data, the lowest fitness levels were for American Indian non-Hispanic students (42.6 ml/kg/min) and Black non-Hispanic students (42.7 ml/kg/min) (Bowser et al., 2016).

Interventions to decrease and eliminate disparities are necessary to improve health outcomes. Disparities in VO₂ max outcomes are concerning since poor VO₂ max has been associated with chronic disease later in life, for example, cardiovascular disease (Twisk et al., 2000).

Socioeconomic Status

Socioeconomic status (SES) is an essential factor impacting physical fitness and health outcomes. SES is typically defined as a combination of education, income, and occupation (Adler & Newman, 2002). Indirect pathways, tied to SES, also affect health. These pathways include “environmental exposures, social environment, health care, behavior and lifestyle, and

chronic stress” (Adler & Newman, 2002; McGinnis & Foege, 1993). These factors may impact physical fitness outcomes. Furthermore, according to McGinnis & Foege (McGinnis & Foege, 1993), behavior and lifestyle factors are responsible for about 50% of premature mortality. Lower SES is associated with consumption of less healthy foods and more sedentary behavior (Krebs-Smith et al., 1995). These outcomes may be due to less education, environments with fewer or poorly maintained recreational facilities, unsafe neighborhoods for physical activity, and less impactful physical activity environments at schools (Adler & Newman, 2002).

Achievement of the HFZ for aerobic capacity has been associated with SES. One study, looking at schools in the state of Georgia, found a significant association between the school’s HFZ achievement proportions at baseline and the school’s number of students eligible for free or reduced lunch. This study found that a 1% increase in number of students eligible for free or reduced lunch was associated with lower HFZ aerobic capacity achievement proportions at baseline for male and female students at .30% to .33% and .39% to .46%, respectively (Bai et al., 2017).

Achievement of the HFZ for BMI was also associated with SES. A 1% decrease in number of students eligible for free or reduced lunch was associated with higher HFZ BMI achievement proportions at baseline (Bai et al., 2017). This association was present for male and female students at all levels studied. For elementary school boys and girls, the association was .16% and .20% higher, respectively. The association was .13% higher for middle school boys and .22% higher for middle school girls. High school boys and girls had an association that was .10% and .20% higher, respectively (Bai et al., 2017).

A further study, looking at the association between SES and physical fitness, found a more significant association between the physical activity of girls and SES than was found

amongst boys. For boys, this study found SES to be a significant main effect for BMI and percent body fat only. One explanation proposed for the difference between boys and girls was that boys are more likely to participate in vigorous leisure-time activity irrespective of SES. However, this same likelihood is not present for girls (Bohr et al., 2013).

Students attending schools with higher income levels were found to be more active, based on a 1-day physical activity recall, than students attending schools with lower income levels. Students at higher income schools reported 73.3 minutes of activity on average, while students at lower income schools reported 68.2 minutes (Bowser et al., 2016). While higher SES schools had increased activity levels, when comparing racial minority groups across schools, higher SES schools and lower SES schools had a similar activity level. Furthermore, aerobic fitness levels were tied to SES with students in higher SES schools performing better on the PACER test than students in lower SES schools at 44.5 ml/kg/min and 43.4 ml/kg/min, respectively. For aerobic fitness levels, students at higher SES schools had better aerobic fitness than students at lower SES schools, even when stratified by race (Bowser et al., 2016). Studying the relationship between SES and health outcomes continues to be an important area of research. Due to the complexity of factors impacting SES, decreasing these disparities will require developed long-term solutions. As the impact of economic social justice programs may not be immediately seen, it is important to also develop interventions to shrink the physical fitness achievement gap between SES groups.

School Size

The impact of school population size should also be considered. A study of youth health outcomes in Georgia found that an increase in the number of students by 100, was associated with improved HFZ aerobic capacity achievement proportions for male and female students.

This study found a .49% increase for elementary school males and a .70% increase for middle school males in HFZ aerobic capacity achievement. Increases in achievement of .55% for elementary school females, .57% for middle school females, and .34% for high school females were also found (Bai et al., 2017).

This research also found an association between increased school size and higher HFZ BMI achievement proportions at baseline. A school size increase of 100 students was associated with a .33% increase in baseline achievement of HFZ BMI for middle school boys and a .24% increase for high school boys (Bai et al., 2017). The same increase in number of students was also associated with increased baseline HFZ BMI achievement of .34%, .46%, and .49% for elementary, middle, and high school girls, respectively (Bai et al., 2017).

Academics

There is a positive relationship between academic achievement and performance on measures of physical fitness. A study of middle school youth found that boys achieving the HFZ for aerobic capacity or muscular endurance were 2.5 to 3 times more likely to pass a state assessment of reading or math skills (Bass et al., 2013). Female students achieving the HFZ for aerobic capacity were 2 to 4 times as likely to meet or exceed the same state assessment of reading and math skills (Bass et al., 2013). These associations were still present after controlling for SES (Bass et al., 2013).

The relationship between academics and physical fitness was further explored by an additional study that found an effect for both 6th grade and 9th grade students. This study found an association between 6th grade students' improved FitnessGram[®] outcomes and improved performance on math and social studies standardized tests. For 9th grade students, there was an association between enhanced FitnessGram[®] results and enhanced performance on the

standardized math test. There was also an association between poorer FitnessGram[®] outcomes and worse performance on the social studies standardized test. Overall, this study found a positive association between physical fitness and academic performance. Furthermore, educational outcomes also improved with increasing socioeconomic status (Coe et al., 2013).

Other Variables

Other factors like vulnerability, self-esteem, and mental health have been studied. The Social Vulnerability Index (SVI) is often used in the field of emergency preparedness to identify communities that may be in greatest need following a disaster. A 2016 study examined the SVI as a tool for explaining variation in youth physical fitness levels (Gay et al., 2016). Using FitnessGram[®] data, the study found that the SVI explained physical fitness variation amongst male and female youth and that communities with the highest levels of vulnerability, according to the SVI, were also the communities with lower proportions of youth achieving the HFZ. Specific areas that explained youth physical fitness outcomes in this study were housing and transportation, minority status and language, and socioeconomic status (Gay et al., 2016).

Youth self-esteem, depression, physical self-concept, and body satisfaction are all impacted by physical fitness levels. A study of middle school students in Texas found that students achieving the HFZ reported better outcomes in these areas than students in the FitnessGram[®] needs improvement zone. After controlling for SES, the following associations were found when comparing groups in the HFZ to members of the same group in the Needs Improvement Zone. Students in the HFZ for BMI reported higher levels of self-esteem and body satisfaction, greater endurance, and more flexibility. Girls in the HFZ for aerobic capacity also reported higher levels of self-esteem, greater endurance, and body satisfaction. These girls also indicated lower levels of depression, and feeling stronger. Boys in the HFZ for aerobic capacity

reported greater endurance, increased satisfaction with their bodies, and feeling stronger (Greenleaf et al., 2010), showing that these variables may also impact physical fitness.

In light of the information discussed in this section, it is important to consider how programs and interventions can decrease disparities in physical fitness achievement. PE programming may be an important tool in efforts to increase health equity.

Physical Education Participation

PE participation is a diverse topic. It includes factors that impact enrollment and engagement in PE. This section will discuss these factors, including student PE disengagement, motivation, self-efficacy, school engagement, and gender.

The importance of quality PE class should not be understated. Quality PE programming is essential as part of a broader school physical activity program. Unfortunately, PE class time, as well as time for recess, is sometimes decreased to increase time for academic classes (Brusseau & Hannon, 2015). From 1991 to 2013, there was a decrease from 42% to 29% in students attending a daily PE class (National Physical Activity Plan Alliance, 2016). It is also important to note that PE participation rates provide the percentages of students who are enrolled in PE courses. These rates do not indicate PE participation and engagement levels or why students choose to participate. Considering what inspires and discourages involvement in PE class may contribute valuable information to the discussion of PE participation. The current body of research can provide insight regarding how and why students may or may not actively participate in PE.

Physical Education Disengagement

First, we can consider why students may choose not to participate in PE. Research has shown that students disengage from PE, sports, and physical activity for reasons that are similar

to those of students who drop-out of school (Christenson et al., 2012; Lawson & Lawson, 2013). According to Doll, Eslami, & Walters (Doll et al., 2013), students are pushed out, pulled out, or they fall out of physical activity programs. An example of a student being “pushed out” is being cut from a team or experiencing factors that make the environment less conducive for the student to participate. An example of “pulled out” could be a student’s inability to participate in physical activity because of at-home caretaking duties. Students may “fall out” due to lack of connection with teachers, coaches, and peers in the physical activity setting, or other factors that prohibit a sense of belonging (Doll et al., 2013). It has also been found that affective-emotional engagement, behavioral engagement, and cognitive engagement have contributed to long-term involvement in PE, sports, and physical activity (Doolittle, 2016).

Perceived benefits of physical activity also play a role in PE engagement. A 2009 study surveyed middle school youth to determine their views on the benefits of physical activity. The mean scores and standard deviations for the boys top responses for PE benefits included “improve or have more athletic skill” 3.50 (0.87), “take care of myself, stay in shape, and be healthier” 3.41 (0.76), “have a chance to play or be active” 3.32 (0.83), “have more energy” 3.28 (0.86), “have fun or be part of a fun group or activity” 3.18 (0.93), “make me happier” 3.17 (0.96), “prove to myself what I can do physically” 3.17 (0.94), and “look better” 3.14 (0.94). The mean scores and standard deviations for the girls top benefits included “take care of myself, stay in shape, and be healthier” 3.63 (0.63), “have a chance to play or be active” 3.42 (0.83), “prove to myself what I can do physically” 3.37 (0.87), “have more energy” 3.33 (0.92), “improve or have more athletic skill” 3.28 (0.93), “make me happier” 3.26 (0.90), and “have fun or be part of a fun group or activity” 3.25 (1.04) (Robbins et al., 2009).

Motivation

Motivation is another factor in physical activity participation (Cox et al., 2008). It is a positive predictor of leisure-time physical activity behavior. Students who enjoyed physical activity in their PE class were more likely to also enjoy physical activity outside of PE. Furthermore, perception, perceived competence, autonomy, and relatedness also predicted self-determined motivation (Cox et al., 2008). The SPARK Program examined the effect of a physical activity campaign on fitness outcomes and motivation. This program was able to have a greater impact on the physical activity and motivation of younger students (You et al., 2016). This finding could indicate that student age is a factor in motivation for PE engagement, which is supported by the decrease in PE participation as students age.

As discussed, attitudes towards physical activity may be a factor in PE participation. Chen & Gu (Chen & Gu, 2018) observed fitness-related factors and attitudes, finding that students who performed better on fitness measures also tended to have more fitness knowledge, better attitudes toward physical fitness, and less sedentary behavior. A 2017 study exploring the changes in attitudes towards physical activity from grades fourth through eighth found a significant decrease from grades fifth through eighth in positive attitudes toward PE, with a more striking decline amongst girls (Mercier et al., 2017). Furthermore, youth may be impacted by their peers. Research has found an association between the child's active friends, physical activity levels, and the child's enjoyment of physical activity (Barr-Anderson et al., 2017).

Self-Efficacy

Self-efficacy is also related to PE participation and engagement. Among high school students, it was found that physical activity can be increased through focusing on improved enjoyment and self-efficacy, thereby bettering physical activity intervention outcomes (Dishman

et al., 2005). A 2008 study by Haerens et al. also looked at the role of self-efficacy in achieving physical activity changes. They found that an intervention improving self-efficacy also increased physical activity. This same study considered other factors such as attitude, social support, and perceived benefits and barriers and found these factors less influential on physical activity than self-efficacy (Haerens et al., 2008).

School Engagement

In addition to health benefits, PE was found to have a positive impact on school engagement. A study of students aged 12 through 15 found that enjoyment of PE had a stronger impact on school engagement for children in early adolescence than enjoyment of math, science, English, French, and fine arts. This study found that students in early adolescence expressing high levels of engagement in PE were nearly 2.5 times more likely to report high levels of school engagement compared to students reporting middle to low engagement levels. For middle-aged adolescents, PE was not the most impactful subject but still had an impact, with students who reported a high level of enjoyment in PE being 2.3 times more likely to report high levels of school engagement than other middle-age adolescent students (Bengoechea et al., 2019).

Gender

Research also suggests ways to increase the PE engagement of girls. Craike et al., conducted a 2009 study that found seven key strategies to increase PE participation amongst females. These strategies were, (1) improving the girl's motivation to engage in physical activity, (2) allowing informal physical activity that doubles as an opportunity for socialization, (3) involving parents through parental education on the importance of physical activity, (4) dispelling and avoiding gender stereotypes that can discourage female athleticism, (5) educating PE teachers to understand gender issues and motivation of students engaging in less physical

activity, (6) accessibility to sports, facilities for physical activity, and opportunities in schools, and (7) making physical activity and sports a priority in schools (Craike et al., 2009). These strategies may help to decrease disparities in PE and fitness outcomes. In addition to strategies, interventions to increase physical activity are important to consider.

Females and at-risk middle school youth have experienced benefits from daily physical activity offered through the school venue (Erfle & Gamble, 2015). Erfle & Gamble conducted a quasi-experimental study offering a daily 30 minute school-based physical activity intervention. This study found that physical fitness outcomes, measured by the 1-mile run, the curl-up test, and the push-up test, showed improvement after the intervention and providing 30 minutes of physical activity every school day could present increased benefit for females and those at-risk (Erfle & Gamble, 2015).

With the disparity between male and female fitness achievement, this dissertation study is particularly interested in research that may suggest increased benefits for girls. Due to the important impacts of physical activity on youth outcomes, it is important to consider factors that may increase or decrease student engagement in PE, especially for females who lag behind their male counterparts. Further research is needed to continue exploring these variables.

Health Impacts of Physical Education Participation

Although benefits may vary from student to student, research can offer indicators of potential health improvements from PE participation. A 2018 study found that having PE class during the school day was associated with higher enjoyment of participating in PE, more days of physical activity for ≥ 60 minutes, and the ability to perform the plank fitness test for longer. There were increased benefits found with having PE daily and with having PE for ≥ 45 minutes

daily (Loprinzi et al., 2018). Therefore, not only are there benefits associated with PE class, but these benefits appear to increase with increased time in PE.

PE has been found to positively contribute to the amount of moderate-to-vigorous physical activity (MVPA) that students receive in a day, while not significantly increasing sedentary time (Chen et al., 2014). A 2014 study found that students in a PE class lasting an average of 41.5 minutes, spent an average of 15.9 minutes in MVPA, representing nearly 10% of daily MVPA and only 2% of daily sedentary time (Chen et al., 2014). Amounts of MVPA obtained during PE class varied amongst students. Less than half of students achieved MVPA for at least 50% of PE class time, which is the national standard; however, boys were more likely to meet this recommended level than girls at 46.9% of boys and 37.8% of girls. Boys engaged in MVPA for 42.3% of class time, and girls engaged in MVPA for 35.4% of class time (Chen et al., 2014).

A 2020 study examined the association between PE class characteristics and MVPA participation. Using the System for Observing Fitness Instruction Time (SOFIT), this study assessed physical activity levels, lesson context, and teacher behavior. This study also considered lesson location as a factor. The results of the study showed that PE classes with higher motor content and more teacher promotion of physical activity were more likely, at all school levels, to meet the recommended levels of MVPA (Kwon et al., 2020). For middle school students, an outdoor classroom location was strongly associated with meeting the recommended MVPA levels. Although some studies have found similar results at all school levels, this study found that different school levels, for example, elementary school, middle school, and high school, were impacted in different ways by the various elements (Kwon et al., 2020). This may demonstrate the need to modify PE curricula based on school level to achieve maximum effectiveness.

A 2012 study with a predominantly American Indian population found that boys accumulated 38% of their daily weekday steps at school while girls accumulated 35% (Brusseau et al., 2013). PE was found to be the largest source of physical activity during school time, with boys reaching 25% and girls reaching 23% of their school day steps during PE class (Brusseau et al., 2013). This study had students wear pedometers for seven consecutive days to determine how much activity students were achieving in PE class compared to other areas of life. The research focused on 5th and 6th grade American Indian students in the Southwestern United States (US). Furthermore, study participants were significantly less active during weekends. This study demonstrates the importance of PE, especially for groups who do not have opportunities for physical activity outside of PE class. In addition, with increased risk of hypokinetic diseases for American Indian children, ensuring receipt of physical activity is paramount for good health (Brusseau et al., 2013).

Physical Education Participation and Physical Fitness

It can be challenging to quantify the physical fitness benefits that result from PE participation. None the less, studies have sought to determine the physical activity impact of PE class. One such study examined the physical activity in a daily middle school PE class and found that activity location and time of year impacted physical activity (Brusseau et al., 2016). This study used NL-1000 piezoelectric pedometers to measure physical activity and found that activity levels were the highest during outdoor PE lessons taking place during the fall and lowest during indoor PE lessons focused on motor skill games in the spring (Brusseau et al., 2016).

Similarly, it has also been found that MVPA achieved in PE class declines over time during a semester (Burns et al., 2015). Furthermore, declines were statistically greater for students in the FitnessGram[®] needs improvement category (Burns et al., 2015). Factors that may

impact these findings include student intrinsic motivation and amotivation, student physical activity enjoyment, outdoor temperature, teacher motivation, and access to equipment and facilities (Burns et al., 2015). Findings like this reiterate that further efforts must be made to ensure the quality of PE class.

Quality physical education teaching (QPET) is associated with higher physical fitness levels (Chen et al., 2016). QPET is based on four teaching dimensions, task design, task presentation, class management, and instructional guidance. These four dimensions were found to be significantly associated with cardiovascular endurance, flexibility, and muscular strength and endurance. Students receiving high levels of quality education in these four dimensions had higher levels of physical fitness, based on FitnessGram[®] test results (Chen et al., 2016).

Some studies have found an association between PE and physical fitness. One such study considered the relationship between physical activity time in PE class, recess, physical play, sports/dance, total physical activity, and outcomes on the FitnessGram[®] assessment. This study focused on 5th grade students and determined physical activity time based on students' self-reported time recordings on a physical activity log and four FitnessGram[®] tests, the PACER, the curl-up, the push-up, and the trunk-lift. This study found a significant association between physical activity minutes in PE and FitnessGram[®] performance. This association was found for the full sample and girls individually, but not for boys. Significant associations were also found for recess, sports/dance outside school, and for the total amount of physical activity (Chen et al., 2018).

As discussed, various studies have explored the concept of PE participation. There are many different aspects of PE participation so research on this topic allows for a variety of approaches. For example, there are studies that examine the impact that state-level PE

requirements and laws have on PE participation. One such study found that laws and regulations that required PE participation for a specified amount of time, were helpful to increase PE attendance and physical activity. These laws were particularly helpful in improving girls PE outcomes. Girls in states with strong PE laws, in comparison to states without PE laws, self-reported more days of physical activity as well as increased attendance in PE class at ≥ 3 days of PE per week (Taber et al., 2013).

In states with specific PE requirements, the adjusted proportion of regular PE attendance was self-reported to be higher for girls (74.1%) than boys (70.8%) while in states without PE laws, the proportions were lower at 52.1% for girls and 57.6% for boys (Taber et al., 2013). Although this is encouraging, there is still a gap in the literature, as more evidence is needed to determine if PE laws improve health outcomes, for example, by decreasing student weight gain (Taber et al., 2013). This dissertation research intends to help fill this gap by examining the association between PE participation and health outcomes.

A further study explored how the adolescent physical activity levels of African American, Latino, and White females were impacted by variables at the school level. This study found that participation in PE as well as active transportation to school, were significant contributors to physical activity levels for females (Duncan et al., 2015). Participation in active transport resulted in higher physical activity factor scores for White females only, while also resulting in increased MVPA for African American females only (Duncan et al., 2015). Enjoyment of PE played an important role in this study, increasing recess activity time for African American and Latino females, and active transport to school for all females (Duncan et al., 2015). It appears that more enjoyment of PE increased engagement in other opportunities for physical activity.

According to Bailey (Bailey, 2006), outcomes from participation in PE and sports in schools, can be framed in regards to five domains. These five development domains are physical, lifestyle, affective, social, and cognitive development (Bailey, 2006). PE has the potential to offer benefits in all these areas, however not from PE participation alone. These benefits can be realized through focusing on student teacher interactions, as well as interactions with parents and sports coaches (Bailey, 2006). Positive experiences, enjoyment, effective teachers and coaches, and involved parents, as well as engagement and diversity, are all important in a truly beneficial PE program (Bailey, 2006). This information makes an important point about the quality of the PE program. While enrolling students in PE and requiring students to take PE as a class should increase physical activity, true achievement of the full benefits of PE must also focus on the quality of a robust PE program.

A 2019 study of Georgia Elementary school students, assessed the amount of time schools allocated for physical activity and the proportion of students with a healthy BMI or aerobic capacity, based on FitnessGram[®] outcomes (Cheung et al., 2019). Teachers from 905 Georgia elementary schools in this study completed surveys informing researchers of the opportunities for physical activity available to students before, during, and afterschool. This information was used to determine the weekly physical activity minutes available for students at each participating elementary school. This study also adjusted for school demographics and school characteristics. The results in this study showed that physical activity time offered during school hours was not associated with student fitness (Cheung et al., 2019). Schools offering physical activity opportunities before school had moderately higher achievement on the HFZ aerobic capacity test (Cheung et al., 2019). Every additional 30 minutes of recess time offered per week was associated with a $\leq 3\%$ increase in the proportion of students at the school with a

healthy BMI (Cheung et al., 2019). The major take-away from this study is that physical activity time available in Georgia elementary schools is not strongly associated with physical fitness at the school level (Cheung et al., 2019). Conducting a similar study at the middle school level will contribute to research on PE class and physical fitness outcomes.

There are limited studies examining the impact of middle school PE participation on physical fitness outcomes in the state of Georgia. Research exploring the effectiveness of PE class for Georgia middle school students, as determined by association of PE participation and FitnessGram[®] outcomes, will fill a gap in the literature and contribute to new knowledge. As evidenced by the current lack of mandated PE policies for Georgia middle school students, the limited emphasis on middle school PE may carry over to research where the impact of PE participation in Georgia's middle schools needs more study. Since PE policies and practices differ based on the laws governing schools in a particular jurisdiction, research in Georgia is needed to assess the effectiveness of the state's middle school PE programming.

CHAPTER 3

METHODS

This chapter will discuss the methods utilized to conduct this dissertation research and the rationale for using these methods. The strength of the study design is intended to ensure that the findings can be used to improve physical education (PE) and physical fitness programming. This chapter is organized into three sections, namely conceptual model, data, and data analysis. The conceptual model section presents the relationships between the study variables and provides background on the variables chosen for inclusion. The data section will share information on the sources of data for this study. Lastly, the data analysis section will explain the statistical tests used, and the data analysis procedures.

Conceptual Model

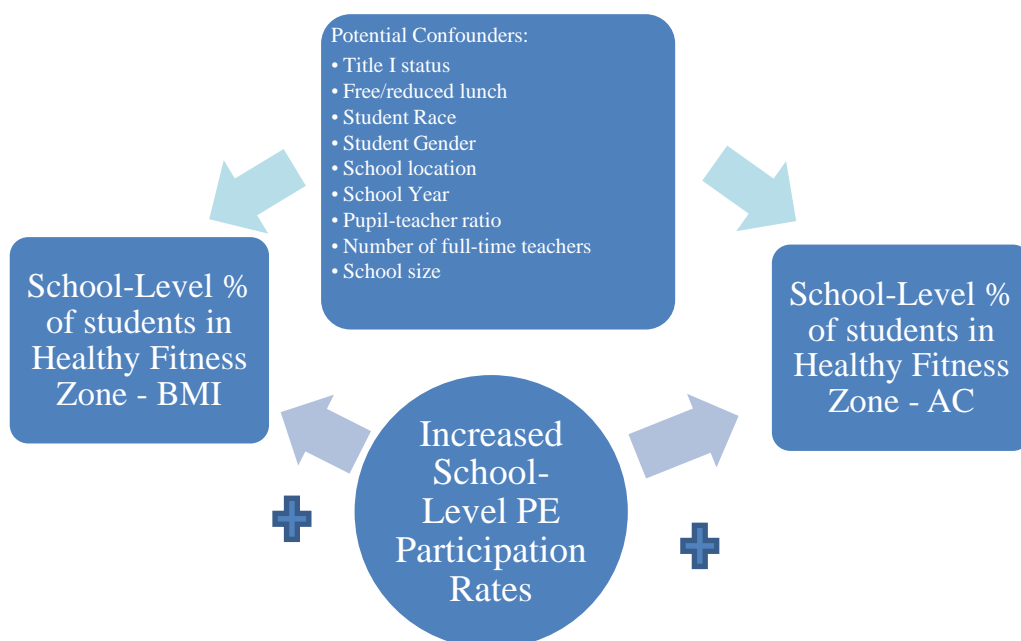


Figure 3. Relationship Between Physical Education Participation and Healthy Fitness Zone

Figure 3 above represents the study hypothesis regarding the relationship between PE participation and the Healthy Fitness Zone (HFZ), based on information contained in the literature review. We hypothesize that increased school-level PE participation is associated with a higher percentage of students in the HFZ for body mass index (BMI) and aerobic capacity. We hypothesize that this association is confounded by the school level variables, listed in the figure as potential confounders that impact the percentage of students in the HFZ. The potential confounders include Title I status, free/reduced lunch, student race, student gender, school location, school year, pupil-teacher ratio, number of full-time teachers, and school size. The research on the variables included in the conceptual model is discussed in the literature review and summarized below to justify the conceptual model and the hypothesis.

Multiple studies have examined the benefits associated with PE programming. Research has found a negative association between PE participation and obesity (Ortega Hinojosa et al., 2018). PE class helps to increase physical activity and improve fitness outcomes, with benefits increasing with more time in PE (Loprinzi et al., 2018). In addition, a significant association exists between PE minutes in physical activity and FitnessGram[®] outcomes (Chen et al., 2018). This finding ties back to the conceptual model where it is anticipated that increased school-level PE participation will result in an increased proportion of students in the HFZ.

The relationship between PE participation and HFZ outcomes is confounded by the continued existence of disparities. In regard to gender disparities, boys have been found to engage in more MVPA during PE than girls (Chen et al., 2014) and males still achieve the HFZ for aerobic capacity at higher rates than females (Clark et al., 2015). Racial disparities also exist. Black and Hispanic students have lower rates of PE participation compared to White students, even after controlling for other variables (Johnston et al., 2007). A difference in access to

resources may cause the observed disparities, especially for underrepresented racial groups and students of lower SES (Clark et al., 2015; Johnston et al., 2007). SES disparities are also present for fitness outcomes (Springer et al., 2015). Schools with a higher proportion of students receiving free and reduced lunch, also had lower achievement of the HFZ for aerobic capacity and BMI, compared to other schools (Bai et al., 2017). SES is represented in the conceptual model as Title I status and free or reduced lunch.

Research has also found that an increase in number of students, listed as school size in the conceptual model, is associated with improved HFZ aerobic capacity achievement proportions for male and female students (Bai et al., 2017). Geographic location is also a factor in health outcomes. For example, rates of obesity are higher among rural adults than urban adults (Befort et al., 2012; Patterson et al., 2004) and inactivity is higher amongst rural adults (62.8% inactive) compared to those living in an urban environment (59.3% inactive) (Patterson et al., 2004). Due to the impact of geographic location on obesity outcomes, school location is included in the conceptual model.

Another area that demonstrates disparities is school resources, represented in the conceptual model as pupil-teacher ratio and number of full-time teachers. At the national level, on average, schools with higher poverty rates have higher pupil-teacher ratios (Knight, 2019) while lower pupil-PE teacher ratio is associated with more PE class time, increased PE class physical activity, and less time required for PE class management (Bevans et al., 2010). Number of full-time teachers is also an indicator of school resource availability and the presence of more qualified and effective teachers has a positive impact on students.

The conceptual model also accounts for school year as our cross-sectional study utilizes data from multiple years. Including school year in the model allows the model to adjust for

changes over time. This is important due to factors not represented in the model, such as annual changes in childhood obesity rates, which reflect a consistent rise in obesity prevalence since 1999 (Wang et al., 2020).

Data

Three different datasets were used in this study. The three datasets are 1) PE participation data, 2) FitnessGram[®] data, and 3) school-level variables. The data variables included in this study are summarized below in Table 3.

Table 3. Study Variables

Variable	Variable Type	Description
PE participation (male or female)	Continuous	Number of male or female students enrolled in PE class at the school, divided by the total number of male or female students at the school to create a percentage.
HFZ – BMI (male or female)	Continuous	Number of male or female BMI test attempts in the HFZ at the school, divided by total number of male or female BMI test attempts at the school to create a percentage.
HFZ – aerobic capacity (male or female)	Continuous	Number of male or female aerobic capacity test attempts in the HFZ at the school, divided by total number of male or female aerobic capacity test attempts at the school to create a percentage.
Free or reduced lunch	numeric, discrete	Number of students at the school who receive free or reduced lunch.
Number of male or female students	numeric, discrete	Number of male or female students at the school.
No. full-time teachers	Continuous	Number of full time equivalent (FTE) teachers as reported by the school.
Pupil-teacher ratio	Ratio	Total number of students, divided by FTE classroom teachers.
School location	categorical, nominal	School geographical classification as city, suburb, town, or rural school location.
Title I status	categorical, nominal	School economic indicator for the majority of students at the school. Schools were classified as title I or not title I.
Largest racial group	categorical, nominal	Schools were classified as largest Black, largest White, or largest Hispanic or Asian/Pacific, based on which of these categories had the largest number of students.

School size	categorical, ordinal	Based on total number of students enrolled at the school, each school was classified as small, medium, large or extra-large school.
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Participation in physical education

Data on PE participation comes from the Georgia Department of Education and contains aggregate PE participation rates for 6th, 7th, and 8th-grade students by gender. The PE participation rate is the percentage of total students enrolled in PE class by gender and grade for each school year. Grade-specific PE participation data were aggregated to align with other datasets in this study, which were aggregated based on gender at the school level.

FitnessGram[®] assessment of physical fitness

Aerobic capacity and BMI are critical indicators of health in adults (Flint et al., 2010; Kodama et al., 2009; Shah et al., 2016). Among youth, there is a growing body of evidence focused on the importance of aerobic capacity and BMI and the impact of these measures on health (Ekelund et al., 2007; Welk et al., 2011). For these reasons, this study focused on two fitness measures: aerobic capacity and BMI.

The measures of physical fitness were from FitnessGram[®] HFZ data aggregated by gender at the school level. This dataset presented the overall number of male test attempts and the overall number of female test attempts at each school. It then indicated how many test attempts at the school were in the HFZ for each gender by test event. The number of test attempts in the HFZ was divided by total test attempts, creating a percentage of HFZ achievement for each gender and test event at each school. This data was provided by the Georgia Department of Education.

School characteristics

This dataset includes school-level variables publicly available from the National Center for Education Statistics Common Core of Data. The following measures of school characteristics were originally included: number of students receiving free lunch, number of students receiving reduced lunch, school Title I eligibility (schools meeting or not meeting Title I status), school Title I status (eligibility for specific Title I programs), overall male and female student counts and the total number of students, number of full-time teachers, pupil-teacher ratio, school geographical location, and student racial breakdown. The number of students receiving free lunch, and the number of students receiving reduced lunch were combined to create a variable for students receiving free or reduced lunch. Title I eligible schools and Title I status were combined to create a measure of Title I status. The school locations were initially subdivided into 12 categories including small, midsize, and large cities; small, midsize, and large suburbs; fringe, distant, and remote towns; and fringe, distant, and remote rural locations. These categories were combined to create four broad geographical categories: city schools, suburb schools, town schools, and rural schools. School racial demographics were classified into largest racial proportion, with schools being considered largest proportion Black, largest proportion White, or largest proportion Asian or Hispanic. A school size variable was created using the numerical range of total students at all schools. Schools were classified in the 25th percentile, 50th percentile, 75th percentile, and schools above the 75th percentile. These four classifications were used to label schools as small, medium, large, or extra-large.

All datasets contained data for the six years of this study, from the 2012 school year until the 2017 school year. For this research, the study years refer to school academic years. The 2012-2013 school year data will be referred to as the 2012 data or 2012 school year, and so on.

The Georgia Department of Education reported 488 middle schools in Georgia in 2017. However, the analytic sample of schools varied from 370 to 488 Georgia middle schools due to the variation in annual reporting across the six years of data and three datasets. Any school with a cell size of 17 or fewer students for a given year of FitnessGram[®] data was excluded. This exclusion was based on Georgia Department of Education Health and Physical Education policies, which excluded small group sizes of 17 or fewer from provided data due to the possibility that individual students may be identifiable in small groups. After data cleaning, there were 315 schools represented in the dataset. Only schools with complete data for all six years were included in the study. However, if a school had data for all six years for the girl's BMI test, this data would be included even if the same school did not have data for all six years for the girl's aerobic capacity test. All data were merged at the school level in STATA 16.0 using the school code and the school name as the merging variables while separating data for each test event, gender, and school year.

Data Analysis

This study examined the percentage of male and female students achieving the HFZ for aerobic capacity and BMI and the percentage of male and female students enrolled in PE across the study years, followed by regression analysis, as explained in the sub-sections below.

School-level factors associated with PE participation and HFZ

A multiple linear regression model was set up to analyze the school-level factors associated with PE participation. The outcome measure was the proportion of students participating in PE. The school-level factors were the exposure variables. The school year was included as year fixed effects. The model was applied two times, once each for male and female PE participation. The school-level variables included in the study and their expected associations

are presented in Table 4 below. As seen in Table 4, the school-level variables are presented in six categories including school size, socioeconomic status, student gender, student race and ethnicity, resources, and school location. Expected associations are provided for the relationship between the school-level variables, the independent variables, and PE participation, HFZ aerobic capacity, and HFZ BMI, the dependent variables. Expected associations are based on the body of research available and are summarized here.

In this study school size is represented by the number of students enrolled at the school. It is expected that number of students will have a positive association with HFZ aerobic capacity and HFZ BMI (Bai et al., 2017), as well as with PE participation. It is expected that socioeconomic status, represented by free or reduced lunch and Title I status, will have a negative association with the dependent variables (Bai et al., 2017; Bohr et al., 2013; Bowser et al., 2016; Clark et al., 2015). Increased number of male students is expected to have a positive association with PE participation and HFZ aerobic capacity (Clark et al., 2015). Whereas, increased number of female students is expected to have an opposite effect, namely a negative association with PE participation and HFZ aerobic capacity (Eisenmann et al., 2011).

It is expected that schools with the largest proportion Hispanic or Asian students, or the largest proportion Black students will have a negative association with the dependent variables while schools with the largest proportion of White students will have a positive association. This is based on research that shows Hispanic and Black students participate in PE at lower rates than White students (Bowser et al., 2016; Johnston et al., 2007). Number of full-time teachers is expected to have a positive association with PE participation and HFZ achievement for aerobic capacity and BMI. Conversely, pupil-teacher ratio is expected to have a negative association with the dependent variables. This is supported by a 2010 study that found low pupil to PE

teacher ratios to be associated with increased PE time and higher physical activity levels during PE class (Bevans et al., 2010; Knight, 2019). This study also found that accessible equipment and facilities for PE was positively associated with activity levels (Bevans et al., 2010; Knight, 2019). It is expected that city school location will have a negative association with PE participation and HFZ aerobic capacity. Suburb school location is expected to have a positive association with PE participation and HFZ aerobic capacity and BMI. Rural school locations are expected to have a negative association with the dependent variables. Research has shown an association between rural areas and less access to health resources. For example, a 2012 study found that obesity prevalence among adults was higher in rural areas compared to urban areas, even after controlling for demographics, diet, and physical activity (Befort et al., 2012; Patterson et al., 2004)). Furthermore, findings also showed that rural adults were physically inactive at higher rates (Befort et al., 2012; Patterson et al., 2004). Research suggests that childhood obesity is also higher in rural areas. A 2020 report from the Federal Interagency Forum on Child and Family Statistics, noted that from 2013 – 2018 children, ages 6 – 17, in nonmetropolitan counties had higher rates of obesity than children in metropolitan counties, at 25% prevalence compared to 19%, respectively (Federal Interagency Forum on Child Family Statistics, 2020).

School level factors, physical fitness, and physical education

Linear regression models were developed to find the association of physical fitness with PE participation. Physical fitness was measured by students achieving the HFZ for BMI and aerobic capacity; therefore, BMI and aerobic capacity were analyzed separately. At first, the models did not adjust for PE participation and focused on the association between school-level factors and physical fitness. The expected association of school-level variables with physical fitness is provided in Table 4 and was discussed above.

The models examining the association of school-level variables with achievement of HFZ for BMI and aerobic capacity were applied to the full data set. Further, it was also hypothesized that the association would differ by levels of PE participation. As such, the models were run with stratified data based on PE participation. Schools with $\geq 75\%$ and $< 75\%$ PE participation were separated. The cut off of 75% was based on a recent annual fitness assessment program report from the Georgia Department of Education, in which 72.3% of middle school students were enrolled in PE during the 2016 school year (McGuire & Tenoschok, 2018). This average enrollment, allows for a determination that PE enrollment above the average can be considered high and enrollment below the average can be considered low.

Lastly, a full model was developed with participation in PE as the primary exposure variable. This model adjusted for the school-level variables listed in Table 4 and was run for two different measures of fitness: HFZ according to BMI and aerobic capacity, separated by gender. The school year was included as year fixed effects in all models. All analysis was conducted using STATA 16.0. The level of significance is reported at p-value < 0.1 .

Table 4. School-Level Variables and their Expected Association with Participation in Physical Education (PE) and Percentage of Students in Healthy Fitness Zone (HFZ)

Variables	Expected association		
	PE participation	HFZ aerobic capacity	HFZ body mass index
School Size			
No. of students	+	+	+
Socioeconomic Status			
Free/reduced lunch	-	-	-
Title I status	-	-	-
Student Gender			
Number of male students	+	+	+/-
Number of female students	-	-	+/-

Student Race & Ethnicity				
	Largest proportion Hispanic or Asian	-	-	-
	Largest proportion Black	-	-	-
	Largest proportion White	+	+	+
Resources				
	No. full-time teachers	+	+	+
	Pupil-teacher ratio	-	-	-
School Location				
	City	-	-	+/-
	Suburb	+	+	+
	Town	-	-	-
	Rural	-	-	-

CHAPTER 4

RESULTS AND DISCUSSION

Physical education (PE) participation and healthy fitness zone (HFZ) achievement are important factors in determining the potential impacts of PE programming as well as future policy interventions to improve youth health outcomes and decrease childhood obesity. This chapter will present new knowledge in the field of PE and determine school level variables associated with PE and fitness outcomes. This chapter also includes findings on the role of PE in youth fitness outcomes. The findings will provide evidence to improve PE participation and achievement on indicators of physical fitness.

Table 5 shows a summary of characteristics at the school-level, referred to in this study as school-level variables. The school-level variables selected for this study included measures of school size, location, resources, and the sociodemographic characteristics of students at the school level. As shown in Table 5, the mean number of students was 855. School size across the sample ranged from 56 to 2,297 students. Gender was evenly distributed with 439 as the mean number of male students and 416 as the mean number of female students. The number of full-time teachers, ranged from 5 to 132 full-time teachers. Most middle schools in the dataset had largest proportion White student populations (57.35%), followed by largest proportion Black student populations (35.82%), and then by largest proportion Hispanic or Asian (6.83%) student populations. The geographical location of the schools in the dataset were classified as suburb, rural, town, or city. The largest classification was suburb schools at 42.01%, followed by rural schools at 32.91%, then city schools at 12.70%, and town schools at 12.38%. The majority of schools in the dataset were Title I schools (68.25%).

Table 5. Summary of School-Level Variables at All Schools (n=315)

School Characteristics		Mean	Standard Deviation	Range
School Size				
	No. of students	855	355	(56, 2297)
	<i>School Size Percentiles</i>	Percentage	No. of students range	
	Small size	25.40%	(56, 627)	
	Medium size	25.40%	(628, 815)	
	Large size	24.92%	(816, 1021)	
	Extra-Large size	24.29%	(1022, 2297)	
Socioeconomic Status				
	No. of students receiving free or reduced lunch	512	282	(53,1779)
Student Gender				
	Male	439	182	(28, 1216)
	Female	416	175	(27, 1142)
Resources				
	No. of full-time teachers	55	21	(5, 132)
	Pupil-teacher ratio	16	2	(8, 22)
Student Race & Ethnicity		Percentage		
	Largest proportion Hispanic or Asian/Pacific	6.83%		
	Largest proportion Black	35.82%		
	Largest proportion White	57.35%		
School Location		Percentage		
	City school	12.70%		
	Suburb school	42.01%		
	Town school	12.38%		
	Rural school	32.91%		
Socioeconomic Status				
	Title I status	68.25%		

There were 315 schools included in this study. The PE participation percentages were obtained from the data sources annually for the six years studied, for males and for females, resulting in 12 different PE participation percentages for each school, six for males and six for females. As a result, some school groups were in the $\geq 75\%$ PE participation group in one year or for one gender, and in the $< 75\%$ PE participation group in a different year or for a different

gender. In general, the data aligned with research and study findings that show PE participation rates to be higher amongst male students. For male students across the study years, 57.68% (293 schools) of the PE participation data was at $\geq 75\%$ male PE participation while 42.32% (215 schools) of the data was at schools with $< 75\%$ male PE participation. Contrary to this finding, for female students 44.86% (218 schools) of the data showed $\geq 75\%$ female PE participation while the majority of the female PE participation data across the six study years, 55.14% (268 schools), showed $< 75\%$ female PE participation.

Table 6 shows the summary of school-level variables at schools with $\geq 75\%$ male PE participation, high PE participation, while Table 7 shows schools with $< 75\%$ male PE participation, otherwise referred to as low PE participation. This allows for a comparison of findings regarding school-level variables at schools with high (Table 6) and low (Table 7) male PE participation. Comparing these two tables, there was a larger mean number of students (876 students) at schools with high male PE participation compared to schools with low male PE participation (818 students). Schools with high male PE participation have greater percentages of large (26.00%) and extra-large (26.67%) size schools and lower percentages of small (23.50%) and medium (23.83%) size schools. We see opposite trends at schools with low male PE participation, which have higher percentages of small (28.70%) and medium (28.12%) size schools and lower percentages of large (23.04%) and extra-large (20.14%) size schools.

Furthermore, there is a difference in number of students receiving free or reduced lunch at schools with high and low male PE participation. There is a mean number of 477 (27%) students receiving free or reduced lunch at schools with high male PE participation, compared to a mean number of 573 (35%) students at schools with low male PE participation. Socioeconomic status differences between schools with high and low male PE participation are also indicated in

percentage of title I schools. Schools with high male PE participation are 61.08% Title I schools compared to schools with low male PE participation which are 80.72% Title I schools. There are also trends amongst race and ethnicity. Schools with high male PE participation tend to have the largest proportion of White students at 64.42% followed by largest proportion Black students at 30.00% according to the data in this study. Schools with low male PE participation have largest proportion Black students (45.94%) and largest proportion White students (45.07%).

Lastly, trends are also observed for school location. Schools with high and low male PE participation have the highest percentage of suburb schools at 44.42% for high male PE participation schools and 37.83% suburb schools for low male PE participation schools. The second highest category is rural schools for both the high and low male PE participation groups, at 34.08% and 30.87%, respectively. The city schools percentage presents a notable difference between schools with high and low male PE participation. Of schools with high male PE participation, 9.58% are city schools, compared to schools with low male PE participation, of which 18.12% are city schools. At schools with high male PE participation, 11.92% of schools are town schools compared to schools with low male PE participation where 13.19% of schools are town schools. Similar comparisons can be made for female PE participation.

Table 6. Summary of School-Level Variables at Schools (n=293) with $\geq 75\%$ Male PE

Participation

School Characteristics		Mean	Standard Deviation	Range
School Size				
	No. of students	876	362	(56, 2297)
	<i>School Size Percentiles</i>	Percentage	No. of students range	
	Small size	23.50%	(56, 627)	
	Medium size	23.83%	(628, 815)	
	Large size	26.00%	(816, 1021)	
	Extra-Large size	26.67%	(1023, 2297)	
Socioeconomic Status				
	No. of students receiving free or reduced lunch	477	282	(53, 1779)
Student Gender				
	Male	450	186	(28, 1216)
	Female	426	178	(27, 1097)
Resources				
	No. of full-time teachers	56	22	(5, 132)
	Pupil-teacher ratio	16	2	(8, 21)
Student Race & Ethnicity		Percentage		
	Largest proportion Hispanic or Asian/Pacific	5.58%		
	Largest proportion Black	30.00%		
	Largest proportion White	64.42%		
School Location		Percentage		
	City school	9.58%		
	Suburb school	44.42%		
	Town school	11.92%		
	Rural school	34.08%		
Socioeconomic Status				
	Title I status	61.08%		

Table 7. Summary of School-Level Variables at Schools (n=215) with < 75% Male PE Participation.

School Characteristics		Mean	Standard Deviation	Range
School Size				
	No. of students	818	340	(214, 2254)
	<i>School Size Percentiles</i>	Percentage	No. of students range	
	Small size	28.70%	(214, 627)	
	Medium size	28.12%	(628, 812)	
	Large size	23.04%	(816, 1020)	
	Extra-Large size	20.14%	(1025, 2254)	
Socioeconomic Status				
	No. of students receiving free or reduced lunch	573	272	(72, 1638)
Student Gender				
	Male	419	175	(109, 1153)
	Female	399	167	(97, 1142)
School Resources				
	No. of full-time teachers	53	20	(14, 132)
	Pupil-teacher ratio	15	2	(10, 22)
Student Race & Ethnicity		Percentage		
	Largest proportion Hispanic or Asian/Pacific	8.99%		
	Largest proportion Black	45.94%		
	Largest proportion White	45.07%		
School Location		Percentage		
	City school	18.12%		
	Suburb school	37.83%		
	Town school	13.19%		
	Rural school	30.87%		
Socioeconomic Status				
	Title I status	80.72%		

Table 8 shows the summary of school-level variables at schools with $\geq 75\%$ female PE participation and Table 9 shows schools with < 75% female PE participation. Comparing schools with high female PE participation (Table 8) to schools with low female PE participation (Table 9) presents findings similar to those shared above for males. As seen in Table 8, schools with high female PE participation have a higher proportion of extra-large (32.30%) schools and a

smaller proportion of small (21.67%) and medium size (21.94%) schools, compared to schools with low female PE participation which are 19.09% extra-large size, 27.81% small size, and 27.64% medium size. Mean number of students is also higher at schools with high PE participation. The male and female means demonstrate this findings. For males, high PE participation schools have mean 876 students and low PE participation schools have mean 818 students. Similarly, high female PE participation schools have mean 908 students compared to low female PE participation schools that have a mean of 820 students. The socioeconomic indicators show that there are more students facing economic disadvantage at schools with low PE participation. The mean number of students receiving free or reduced lunch is 480 (27%) at schools with high female PE participation, compared to 532 (31%) at schools with low female PE participation. Furthermore, 58.28% of schools with high female PE participation are Title I schools compared to 74.72% of schools with low female PE participation. Table 8 shows that there are larger proportions of White students (62.31%) at schools with high female PE participation, compared to schools with low female PE participation (54.14%). By combining the percentages of non-white students at these schools, it is also observable that schools with low female PE participation have larger proportions of Hispanic or Asian/Pacific and Black students (45.86%) compared to schools with high female PE participation (37.69%). Lastly, schools with high female PE participation have a larger percentage of suburb schools (47.64%) compared to schools with low female PE participation (38.36%).

Table 8. Summary of School-Level Variables at Schools (n=218) with $\geq 75\%$ Female PE

Participation

School Characteristics		Mean	Standard Deviation	Range
School Size				
	No. of students	908	382	(56, 2297)
	<i>School Size Percentiles</i>	Percentage	No. of students range	
	Small size	21.67%	(56, 627)	
	Medium size	21.94%	(628, 815)	
	Large size	24.09%	(818, 1021)	
	Extra-Large size	32.30%	(1023, 2297)	
Socioeconomic Status				
	No. of students receiving free or reduced lunch	480	294	(53, 1779)
Student Gender				
	Male	466	196	(28, 1216)
	Female	442	187	(27, 1097)
Resources				
	No. of full-time teachers	58	23	(5, 132)
	Pupil-teacher ratio	16	2	(8, 21)
Student Race & Ethnicity		Percentage		
	Largest proportion Hispanic or Asian/Pacific	6.06%		
	Largest proportion Black	31.63%		
	Largest proportion White	62.31%		
School Location		Percentage		
	City school	11.44%		
	Suburb school	47.64%		
	Town school	9.42%		
	Rural school	31.49%		
Socioeconomic Status				
	Title I status	58.28%		

Table 9. Summary of School-Level Variables at Schools (n=268) with < 75% Female PE

Participation

School Characteristics		Mean	Standard Deviation	Range
School Size				
	No. of students	820	333	(161, 2254)
	<i>School Size Percentiles</i>	Percentage	No. of students range	
	Small size	27.81%	(161, 627)	
	Medium size	27.64%	(628, 814)	
	Large size	25.46%	(816, 1021)	
	Extra-Large size	19.09%	(1025, 2254)	
Socioeconomic Status				
	No. of students receiving free or reduced lunch	532	272	(72, 1722)
Student Gender				
	Male	421	171	(74, 1153)
	Female	400	164	(82, 1142)
Resources				
	No. of full-time teachers	53	20	(10, 132)
	Pupil-teacher ratio	15	2	(10, 22)
Student Race & Ethnicity		Percentage		
	Largest proportion Hispanic or Asian/Pacific	7.32%		
	Largest proportion Black	38.54%		
	Largest proportion White	54.14%		
School Location		Percentage		
	City school	13.51%		
	Suburb school	38.36%		
	Town school	14.30%		
	Rural school	33.83%		
Socioeconomic Status				
	Title I status	74.72%		

Figure 4 shows the changes in mean percentage of students that participated in PE across the six study years for male and female middle school students. Average female PE participation ranged from a low of 62.2% during the 2015 school year to a high of 70.3% during the 2017 school year. Average male PE participation was higher than female, however, the proportions followed a similar trend with 71% male PE participation during the 2015 school year, compared

to 81% male PE participation during the 2017 school year. Female PE participation was consistently below male PE participation.

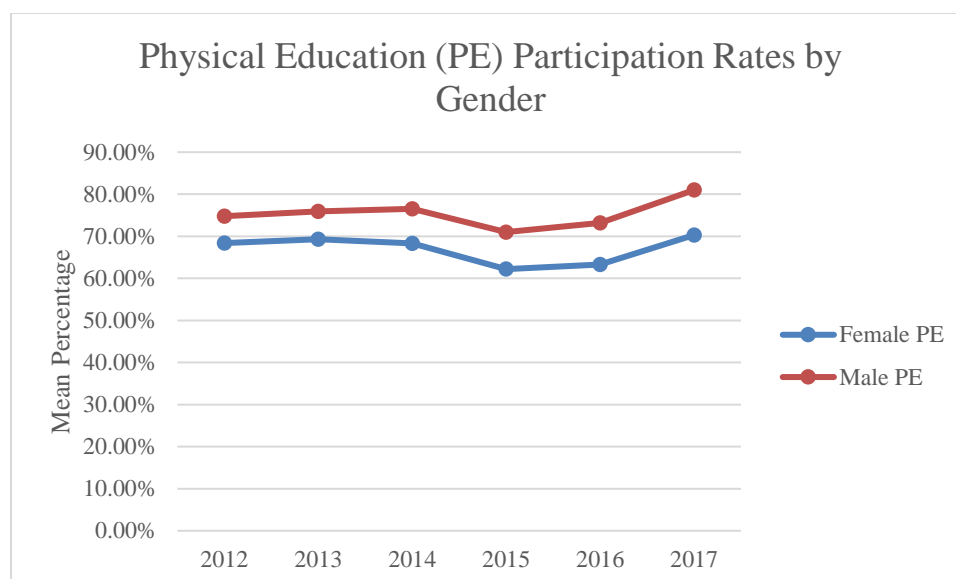


Figure 4. Physical Education (PE) Participation Rates by Gender (2012-2017)

(Georgia Department of Education, 2019)

Figure 5 and Figure 6 below show the proportion of students in the HFZ by gender for BMI and aerobic capacity, respectively, across the six study years. There was a disparity between males and females achieving the HFZ in aerobic capacity, with higher percentage of middle school male students achieving the HFZ for aerobic capacity (range 58.3% - 66.8%) compared to females (range 42.4% - 46.9%). There was little difference between males and females for achievement of HFZ for BMI. Mean males' HFZ achievement for BMI ranged from 43.6% (2013) to 63.3% (2015) and for females it ranged from 44.4% (2013) to 62% (2015). BMI saw improvements from the 2013 to 2015 school year and appears to be steadier in recent years.

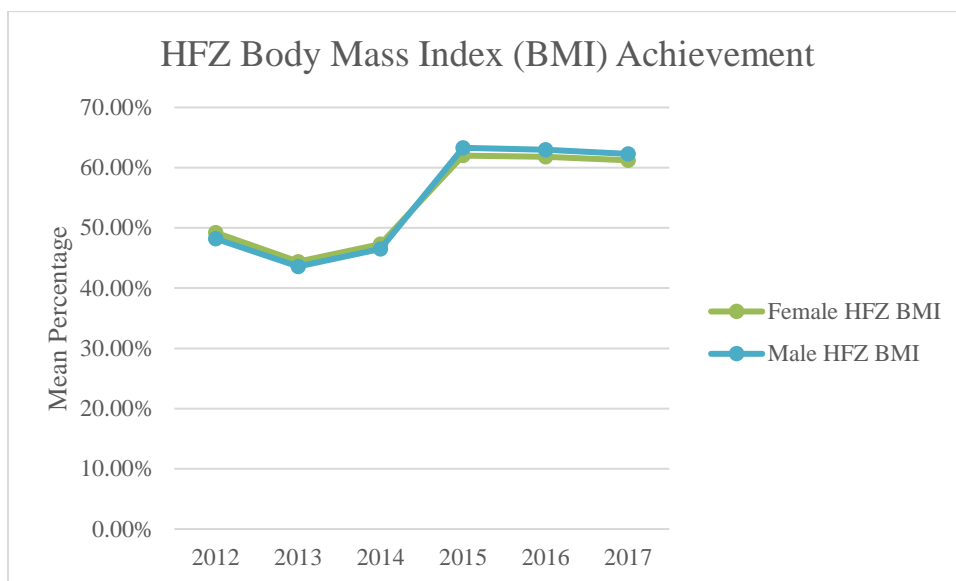


Figure 5. Healthy Fitness Zone (HFZ) Achievement for Body Mass Index (BMI) (2012-2017)
(Georgia Department of Education, 2019)

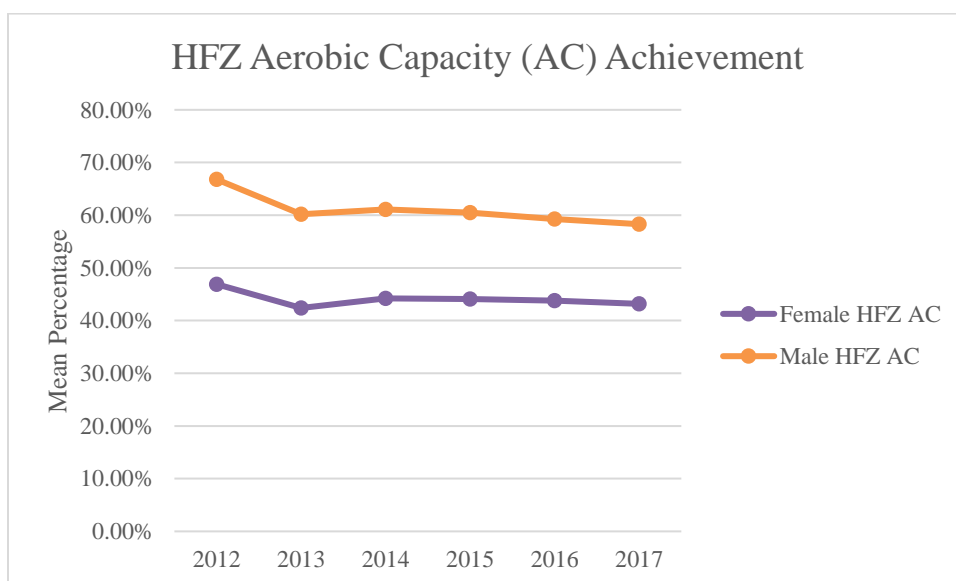


Figure 6. Healthy Fitness Zone (HFZ) Achievement for Aerobic Capacity (2012-2017)
(Georgia Department of Education, 2019)

Aerobic capacity saw a decline from the 2012 to 2013 school year with more steady percentages from 2014 onwards. The gender differences in aerobic capacity found in this study were consistent with the literature. Research showed that girls had lower odds of achieving the aerobic capacity HFZ compared to boys (Walker et al., 2020), however variability between boys and girls HFZ achievement was less profound for BMI test outcomes (Bai et al., 2015).

Figure 7a shows the distribution of PE participation rates by school size for male and female students for the 2012, 2013, and 2014 study years. Figure 7b shows the same distribution for the 2015, 2016, and 2017 study years. These figures demonstrate that males participated in PE at higher rates than females regardless of school size. Furthermore, male PE participation clustered from 60% to 100%, while female PE participation clustered at a wider range from 40% to 100%.

The data in this study showed that male and female students at schools with 75% or greater PE participation achieved the HFZ for BMI at an average of 54.3% for both genders and the HFZ for aerobic capacity at an average of 63.4% for males and 47.5% for females. At schools with less than 75% PE participation, male and female students achieved the HFZ for BMI at an average of 54.7% and 54.3%, respectively and the HFZ for aerobic capacity at an average of 56.9% for males and 41.9% for females. These descriptive statistics suggest that while school-level PE participation proportions appear not to have much association with HFZ achievement for BMI, schools with 75% or greater PE participation had higher achievement of the HFZ for aerobic capacity than schools with lower PE participation. Considering that females participate in PE at lower rates than males, one way to narrow the HFZ aerobic capacity gender gap could be by increasing female PE participation. Studies that investigate the role of PE participation on HFZ outcomes were lacking. This study has filled the gap and the results

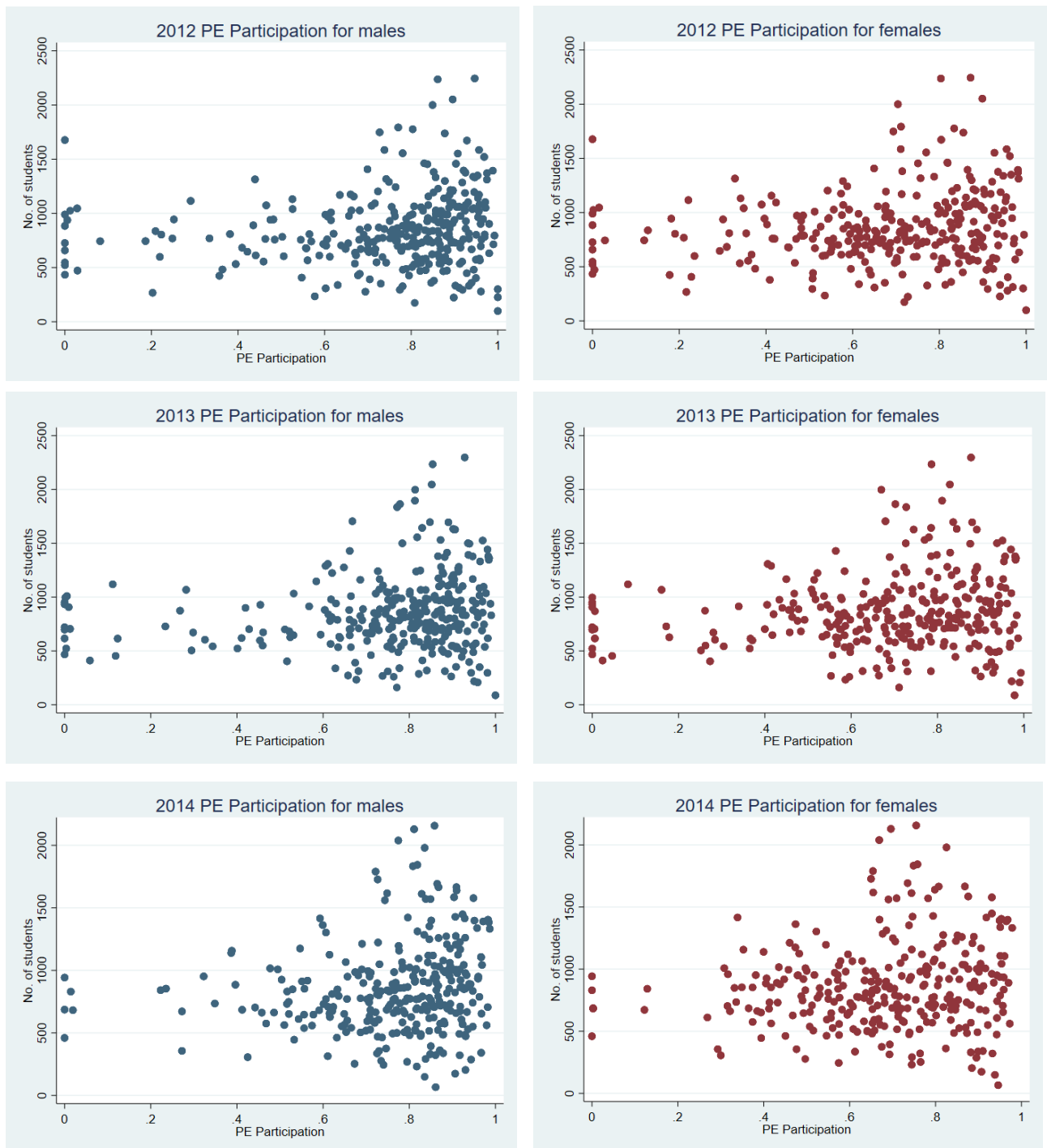


Figure 7a

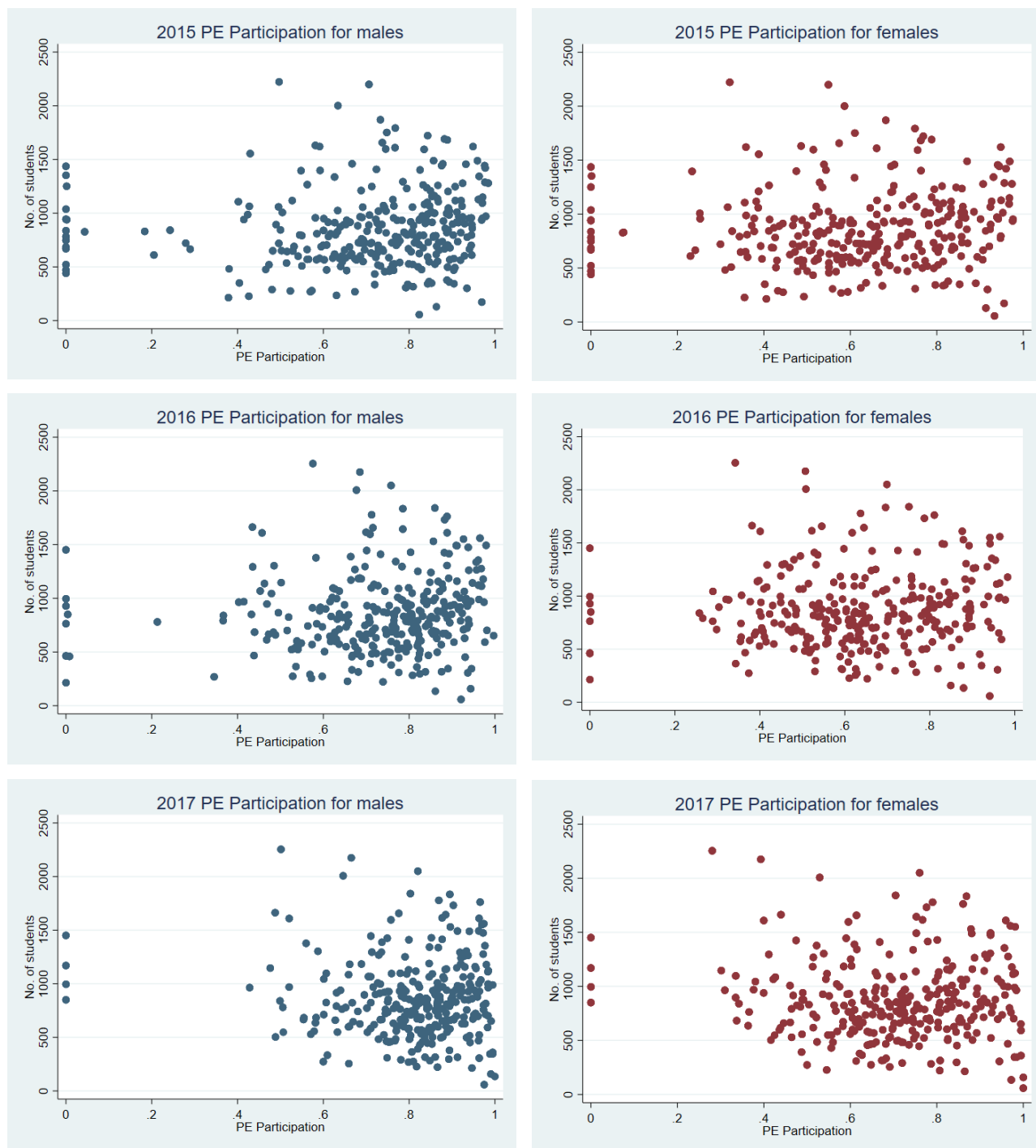


Figure 7b. Figure 7. Physical Education Participation Rates and School Size by Gender (2012-

2014, Figure 7a; 2015-2017, Figure 7b). (Georgia Department of Education, 2019)

from the investigation of PE participation as a predictor of HFZ outcomes are presented in the sections below.

School-level variables and its association with physical education participation

The results presented in Table 10 show the association of school-level variables with PE participation, separately for males and females. Proportion of students in the free or reduced lunch program was significantly associated with PE participation for males and females. An increase in 100 students receiving free or reduced lunch was associated with a decrease in both male and female PE participation by 1.4% ($p < .01$). Furthermore, an increase in the number of female students, number of full-time teachers, and pupil-teacher ratio was also significantly associated with PE participation for females. An increase of 10 female students was associated with a decrease in female PE participation by .58% ($p < .01$). An increase of 10 full-time teachers was associated with an increase in female PE participation by 5.4% ($p < .01$). An increase in pupil-teacher ratio by ten units was associated with an increase in female PE participation by 10.1% ($p < .05$).

PE participation for female students, was lower in schools in towns by 2.5% ($p < .05$) compared to rural schools. Conversely, PE participation for male students, was lower in city schools by 2.3% ($p < .1$) compared to rural schools. Title I status was negatively associated with PE participation for both male and female students, resulting in a decrease in PE participation by 4% ($p < .01$) and 2.6% ($p < .05$), respectively. Extra-large school size was positively associated with PE participation for female students, resulting in 4.8% ($p < .05$) higher female PE participation in extra-large schools compared to small size schools.

It is noteworthy that there were more school-level variables associated with female PE participation, than associated with male PE participation. This may suggest that female PE participation is more heavily influenced by school-level variables, compared to male PE participation. Understanding of school specific characteristics that are associated with female PE participation can inform policy action to promote female PE participation.

Table 10. Association of School-Level Variables with Physical Education (PE) Participation

VARIABLES ¹	PE Participation	
	Male	Female
Free or reduced lunch	-0.014*** (0.002)	-0.014*** (0.002)
No. male/female students ²		-0.058*** (0.014)
No. full-time teachers		0.539*** (0.114)
Pupil-teacher ratio		1.012** (0.419)
2014 school year ³	2.021* (1.102)	
2015 school year ³	-3.614*** (1.104)	-5.919*** (1.210)
2016 school year ³		-5.059*** (1.209)
2017 school year ³	6.315*** (1.105)	2.004* (1.209)
Town school ⁴		-2.473** (1.186)
City school ⁴	-2.302* (1.216)	
Title I status	-3.984*** (0.983)	-2.640** (1.078)
Extra-Large size ⁵		4.752** (2.208)
Constant	76.304*** (6.597)	53.942*** (7.093)

Observations	3,666	3,588
R-squared	0.091	0.076

Standard errors in parentheses

*** p<.01, ** p<.05, * p<.1

¹2013 school year, Suburb school, Largest Black, Largest White, Medium size, and Large size were not significant for male or female model and therefore not reported in this table.

²The male model included number of male students while the female model included number of female students.

³The reference group for school year was 2012 school year.

⁴The reference group for school location was rural school.

⁵The reference group for school size was small size.

School-level variables and its association with Healthy Fitness Zone

The results presented in Table 11 show the association of school-level variables with HFZ for BMI, for the full dataset and separately for males and females at schools with high ($\geq 75\%$) and low ($< 75\%$) PE participation.

Free or reduced lunch was negatively and significantly associated with achievement of HFZ for BMI in all models. An increase of 100 students receiving free or reduced lunch was associated with a decrease in students achieving the HFZ for BMI by 1.4% ($p < .01$) for the full data set. However, the decrease in percentage of students in the HFZ for BMI with increasing participating in free and reduced lunch program was the highest, nearly 2% ($p < .01$), for females at schools with low female PE participation.

An increase in number of female and male students, number of full-time teachers, and pupil-teacher ratio was also significantly associated with achievement of HFZ for BMI. For the full dataset, an increase of 100 female students was associated with an increase in achievement of HFZ for BMI by 2.1% ($p < .01$). For males at schools with high male PE participation, an increase of 100 male students was associated with an increase in HFZ for BMI by 6.9% ($p < .01$).

An increase of 10 full-time teachers was associated with a decrease in HFZ for BMI by 3.9% ($p < .01$) for males at schools with high male PE participation. This result, which was only observed for males at schools with $\geq 75\%$ PE participation, is counter intuitive and may suggest marginal effects of increasing number of full-time teachers. This may also reflect the complexity of BMI outcomes and the wide array of factors associated with childhood obesity. An increase in pupil-teacher ratio by 10 units was associated with an increase in proportion of students in the HFZ based on BMI by 7.7% ($p < .01$) for the full dataset, by 18% ($p < .01$) for females at schools with high female PE participation, and by 6.8% ($p < .1$) for females at schools with low female PE participation. These findings suggest that fitness outcomes are better when female students participate in PE in larger groups.

Title I status was negatively associated with achievement of HFZ for BMI, resulting in a decrease in HFZ BMI by 2.1% ($p < .01$) for the full dataset, by 2.8% ($p < .05$) for males at schools with low male PE participation, and by 3.4% ($p < .01$) for females at schools with low female PE participation.

Schools with largest proportion Black student populations were associated with higher percentage of students in the HFZ for BMI compared to schools with largest proportion Hispanic or Asian students, resulting in 1.9% ($p < .05$) higher HFZ for BMI achievement for the full dataset model. These results held true for male students regardless of PE participation rates.

Medium and large school size was negatively associated with percentage of students in the HFZ for BMI, resulting in more than 2% ($p < .01$) lower HFZ for BMI overall and nearly 2.5%, ($p < .05$) and ($p < .1$) respectively, lower HFZ BMI achievement for females at schools with low female PE participation, compared to small size schools.

Table 11. Association of School-Level Variables with Healthy Fitness Zone (HFZ) for Body Mass Index (BMI)

VARIABLES ¹	All ⁷	HFZ Body Mass Index (BMI)			
		Male ≥ 75% PE participation	Male <75% PE participation	Female ≥ 75% PE participation	Female <75% PE participation
Free or reduced lunch	-0.014*** (0.001)	-0.013*** (0.002)	-0.015*** (0.003)	-0.015*** (0.003)	-0.018*** (0.002)
No. male/female students ²	0.021*** (0.008)	0.069*** (0.016)			
No. full-time teachers		-0.393*** (0.129)			
Pupil-teacher ratio	0.772*** (0.234)			1.805*** (0.520)	0.680* (0.390)
2013 school year ³	-4.623*** (0.671)	-4.145*** (1.262)	-4.849*** (1.484)	-4.872*** (1.477)	-4.372*** (1.117)
2014 school year ³	-1.577** (0.671)	-2.409* (1.282)			
2015 school year ³	14.244*** (0.673)	16.535*** (1.364)	13.926*** (1.339)	14.466*** (1.621)	12.164*** (1.062)
2016 school year ³	13.947*** (0.673)	16.351*** (1.342)	13.017*** (1.363)	14.247*** (1.655)	12.074*** (1.054)
2017 school year ³	13.340*** (0.673)	15.262*** (1.241)	13.132*** (1.592)	12.315*** (1.522)	12.071*** (1.095)
Town school ⁴	-1.277* (0.659)		-3.192** (1.356)		
Suburb school ⁴	0.990* (0.529)				
City school ⁴	2.371*** (0.727)	2.616* (1.588)	3.594** (1.413)		2.573** (1.134)
Title I status	-2.110*** (0.599)		-2.751** (1.347)		-3.428*** (0.976)
Largest Black ⁵	1.854** (0.886)	3.142* (1.858)	5.209*** (1.776)		
Medium size ⁶	-2.206*** (0.654)				-2.475** (0.994)
Large size ⁶	-2.075** (0.812)				-2.437* (1.249)
Constant	35.478*** (3.954)	46.136*** (7.737)	48.128*** (8.649)	17.179* (8.761)	41.230*** (6.649)

Observations	3,654	1,175	673	719	1,087
R-squared	0.397	0.396	0.427	0.439	0.461

Standard errors in parentheses

*** p<.01, ** p<.05, * p<.1

¹Largest White and Extra-Large size were not found to be significant and are not included in this table.

²The all model and female models included number of female students while the male models included number of male students.

³The reference group for school year was 2012 school year.

⁴The reference group for school location was rural school.

⁵The reference group for student race & ethnicity was largest proportion Hispanic or Asian/Pacific.

⁶The reference group for school size was small size.

⁷Analysis performed on the full dataset.

The results presented in Table 12 show the association of school-level variables with HFZ for aerobic capacity. Free or reduced lunch was negatively and significantly associated with achievement of HFZ for aerobic capacity consistent with the results for HFZ for BMI. An increase of 100 students receiving free or reduced lunch was associated with a decrease in students achieving the HFZ for aerobic capacity by 3.9% (p<.01) for the full dataset model. The decrease was 3.2% (p<.01) and 4.3% (p<.01), respectively for male students at schools with high and low male PE participation, and by 4.1% (p<.01) and 4.5% (p<.01), respectively for female students at schools with high and low female PE participation.

An increase in number of full-time teachers and pupil-teacher ratio were both significantly associated with achievement of HFZ for aerobic capacity. An increase of 10 full-time teachers was associated with an increase in HFZ aerobic capacity achievement by 4.3% (p<.01) for the full dataset model, by 4.5% (p<.01) for males at schools with high male PE participation, by 3.2% (p<.1) for females at schools with high female PE participation, and by 6.5% (p<.01) for females at schools with low female PE participation. An increase in pupil-

teacher ratio by 10 units was associated with an increase in HFZ aerobic capacity by 11.3% ($p < .01$) for the full dataset model, by 13.1% ($p < .01$) for males at schools with high male PE participation, by 10.3% ($p < .1$) for females at schools with high female PE participation, and by 15.7% ($p < .05$) for females at schools with low female PE participation. Results suggest that aerobic capacity fitness outcomes improve with increase in number of teachers regardless of rates of PE participation.

HFZ aerobic capacity achievement for male students at schools with high male PE participation, was lower in schools in towns by 3.5% ($p < .05$), compared to rural schools. For female students at schools with high female PE participation, HFZ achievement for aerobic capacity was lower by 8.3% ($p < .01$) in town schools compared to rural schools. This was contrary to schools with low female PE participation where female HFZ aerobic capacity achievement was higher by 2.8% ($p < .1$) in town schools compared to rural schools. HFZ aerobic capacity achievement was consistently lower in schools in cities. For the full dataset model, HFZ aerobic capacity was lower by 4.4% ($p < .01$) and for males at city schools with low male PE participation, HFZ aerobic capacity was lower by 5.8% ($p < .01$). For females at city schools with low female PE participation, HFZ aerobic capacity was lower by 5.1% ($p < .01$), compared to rural schools. No association was found between city schools and aerobic capacity achievement at schools with high male and high female PE participation.

Schools with largest proportion Black student populations were negatively associated with HFZ achievement for aerobic capacity, compared to schools with largest proportion Hispanic or Asian students. The association was consistently negative and significant for males at schools with low PE participation and females at schools with high and low PE participation.

Similarly, schools with largest proportion White students were also negatively associated with achievement of HFZ aerobic capacity, compared to schools with largest proportion Hispanic or Asian students. Largest proportion White schools were negatively associated with achievement of HFZ aerobic capacity for the full dataset model, resulting in 4.6% ($p < .01$) lower HFZ aerobic capacity achievement, compared to largest proportion Hispanic or Asian student populations. Similarly, both schools with largest proportion Black or White students had a lower percentage of female students in the HFZ for aerobic capacity at schools with low PE participation, (8.8%, $p < 0.01$, and 6.1%, $p < 0.05$ respectively).

Large school size was positively associated with HFZ aerobic capacity for males at schools with low male PE participation, resulting in a 4.9% ($p < .05$) increase in HFZ aerobic capacity achievement compared to small size schools.

Table 12. Association of School-Level Variables with Healthy Fitness Zone (HFZ) for Aerobic Capacity (AC)

VARIABLES ¹	All ⁶	HFZ Aerobic Capacity (AC)			
		Male ≥ 75% PE participation	Male <75% PE participation	Female ≥ 75% PE participation	Female <75% PE participation
Free or reduced lunch	-0.039*** (0.002)	-0.032*** (0.002)	-0.043*** (0.004)	-0.041*** (0.003)	-0.045*** (0.003)
No. full-time teachers	0.425*** (0.094)	0.445*** (0.138)		0.320* (0.165)	0.646*** (0.174)
Pupil-teacher ratio	1.131*** (0.343)	1.312*** (0.494)		1.033* (0.618)	1.573** (0.617)
2013 school year ²	-4.965*** (0.988)	-6.109*** (1.349)	-6.882*** (1.950)	-4.579*** (1.764)	-3.471* (1.784)
2014 school year ²	-3.738*** (0.988)	-5.216*** (1.364)	-6.422*** (1.911)		

2015 school year ²	-4.288*** (0.990)	-7.652*** (1.449)	-4.560** (1.780)	-4.703** (1.929)	
2016 school year ²	-5.194*** (0.990)	-7.361*** (1.428)	-7.347*** (1.808)	-5.170*** (1.981)	
2017 school year ²	-6.033*** (0.990)	-9.135*** (1.317)	-8.743*** (2.129)	-4.987*** (1.820)	
Town school ³		-3.498** (1.376)		-8.331*** (2.135)	2.838* (1.567)
City school ³	-4.353*** (1.086)		-5.848*** (1.890)		-5.092*** (1.811)
Title I status	-1.575* (0.876)				-3.007* (1.543)
Largest Black ⁴	-5.610*** (1.295)		-10.055*** (2.343)	-4.429* (2.639)	-8.816*** (2.183)
Largest White ⁴	-4.627*** (1.417)		-13.050*** (2.751)		-6.110** (2.418)
Large size ⁵			4.902** (2.251)		
Constant	43.988*** (5.806)	50.332*** (8.286)	62.539*** (11.531)	27.401*** (10.414)	30.083*** (10.547)
Observations	3,600	1,154	664	710	1,072
R-squared	0.297	0.336	0.305	0.516	0.349

Standard errors in parentheses

*** p<.01, ** p<.05, * p<.1

¹ No. male/female students, Suburb school, Medium size, and Extra-Large size were not found to be significant and are not included in this table.

²The reference group for school year was 2012 school year.

³The reference group for school location was rural school.

⁴The reference group for student race & ethnicity was largest proportion Hispanic or Asian/Pacific.

⁵The reference group for school size was small size.

⁶Analysis performed on the full dataset.

Participation in physical education and physical fitness

The results presented in Table 13 show the association of PE participation with HFZ achievement for BMI and aerobic capacity, separately for males and females. PE participation was significantly associated with male HFZ aerobic capacity achievement. An increase in PE

participation by 10% was associated with an increase in male HFZ achievement by .49% ($p < .01$). No association was found between PE participation and HFZ achievement in the other models.

Table 13. Association of PE Participation with Healthy Fitness Zone (HFZ) for Body Mass Index and Aerobic Capacity (AC)

VARIABLES ¹	HFZ			
	Body mass index (BMI)		Aerobic capacity (AC)	
	Female	Male	Female	Male
<i>PE participation</i>				0.049*** (0.017)
Free or reduced lunch	-0.015*** (0.002)	-0.013*** (0.002)	-0.043*** (0.002)	-0.035*** (0.002)
No. male/female students ²		0.046*** (0.012)		
No. full-time teachers		-0.233** (0.098)	0.539*** (0.120)	0.360*** (0.112)
Pupil-teacher ratio	1.199*** (0.314)		1.395*** (0.441)	1.090*** (0.396)
2013 school year ³	-4.639*** (0.901)	-4.608*** (0.977)	-3.747*** (1.274)	-6.250*** (1.114)
2014 school year ³	-1.586* (0.901)			-5.529*** (1.114)
2015 school year ³	13.171*** (0.906)	15.256*** (0.981)	-2.195* (1.281)	-6.062*** (1.117)
2016 school year ³	12.940*** (0.905)	14.793*** (0.980)	-2.713** (1.279)	-7.460*** (1.116)
2017 school year ³	12.371*** (0.903)	14.244*** (0.984)	-3.390*** (1.277)	-8.927*** (1.121)
Suburb school ⁴	1.187* (0.712)			
City school ⁴	2.111** (0.976)	3.268*** (1.072)	-3.399** (1.397)	-4.640*** (1.239)
Title I status	-2.141*** (0.809)	-1.740** (0.877)		

Largest Black ⁵		4.499*** (1.298)	-7.131*** (1.664)	-4.582*** (1.467)
Largest White ⁵				-6.592*** (1.600)
Medium size ⁶	-2.858*** (0.881)			
Large size ⁶	-2.806*** (1.087)			
Constant	29.909*** (5.354)	46.809*** (5.944)	26.610*** (7.518)	52.492*** (6.803)
Observations	1,806	1,848	1,782	1,818
R-squared	0.438	0.389	0.415	0.335

Standard errors in parentheses

*** p<.01, ** p<.05, * p<.1

¹Town school and Extra-Large size were not found to be significant and are not included in this table.

²The female models included number of female students while the male models included number of male students.

³The reference group for school year was 2012 school year.

⁴The reference group for school location was rural school.

⁵The reference group for student race & ethnicity was largest proportion Hispanic or Asian/Pacific.

⁶The reference group for school size was small size.

Summary of Research Findings

The purpose of this study was to examine the association between PE participation and HFZ outcomes. An additional purpose of this study was to consider the association between PE participation and school-level variables as well as the association between HFZ outcomes and school-level variables. There were three different research questions presented. These research questions and findings are discussed below.

Research Question 1

What is the association of school-level variables with Physical Education participation in middle schools?

Participation in free or reduced lunch was consistently associated with PE participation. An increase in number of male or female students receiving free or reduced lunch was associated with a decrease in PE participation. School Title I status was also a significant variable associated negatively with PE participation for males and females. As proportion of students participating in free and reduced lunch and school Title I status are both measures of socioeconomic status, the findings showed that schools serving a higher proportion of students in low SES groups had lower PE participation.

In addition, an increase in the number of female students was associated with a decrease in PE participation for female students while extra-large school size was associated with an increase in PE participation for female students, compared to small size schools. The school resources variables, number of full-time teachers and pupil-teacher ratio, were both associated with an increase in female PE participation. Lastly, associations were found with school location. Town school location was associated with lower female PE participation while city school location was associated with lower male PE participation, compared to rural schools. The associations found for research question 1 are summarized below in Table 14.

Table 14. Summary of School-Level Variables Associated with Physical Education (PE)

Participation

Male PE Participation	Female PE Participation
Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • City school 	Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • No. female students • Town school
	Positively Associated: <ul style="list-style-type: none"> • No. full-time teachers

	<ul style="list-style-type: none"> • Pupil-teacher ratio • Extra-Large school size
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Research Question 2

What is the association of school-level variables with fitness outcomes in middle schools?

Free or reduced lunch was negatively associated with HFZ achievement for BMI and aerobic capacity for all models which points again to the significance of SES in impacting youth physical fitness outcomes. An increase in the proportion of students receiving free or reduced lunch resulted in a decrease in the percentage of students at the school achieving the HFZ for BMI or aerobic capacity. School qualification for Title I status also resulted in decreased achievement of the HFZ for BMI at schools overall and at schools with low male or low female PE participation. Furthermore, Title I status resulted in decreased achievement of the HFZ for aerobic capacity at schools overall and at schools with low female PE participation.

School resource variables were also found to be associated with HFZ achievement for BMI and aerobic capacity. An increase in number of full-time teachers was associated with an increase in achievement of the HFZ for aerobic capacity at schools overall, schools with high male PE participation, and schools with low or high female PE participation, with the greatest increase experienced at schools with low female PE participation. These same relationships also existed between HFZ aerobic capacity and the pupil-teacher ratio variable. The greatest increase in HFZ aerobic capacity as a result of increased pupil-teacher ratio was again associated with schools with low female PE participation.

Number of full-time teachers and pupil-teacher ratio were also associated with HFZ for BMI, although there were fewer associations present. An increase in number of full-time teachers was associated with a decrease in HFZ BMI for schools with high male PE participation. An increase in pupil-teacher ratio was associated with an increase in achievement of HFZ BMI at schools overall, and at schools with low or high female PE participation, with the greatest increase at schools with high female PE participation. Number of male and female students was also associated with HFZ BMI achievement. An increase in number of female students was associated with increased achievement of HFZ BMI at schools overall. An increase in number of male students was positively associated with HFZ BMI achievement for male students at schools with high male PE participation.

School location was associated with HFZ achievement for aerobic capacity and body mass index. Town school location, compared to rural schools, was negatively associated with HFZ aerobic capacity achievement at schools with high male PE participation, and at schools with high female PE participation. For schools with low female PE participation, town school location was positively associated with achievement of HFZ for aerobic capacity, compared to rural schools. For achievement of the HFZ for BMI, town school location was negatively associated at schools overall, and at schools with low male PE participation, compared to rural schools. Suburb school location, compared to rural schools, was positively associated with HFZ achievement for BMI at schools overall. For HFZ achievement for BMI, city schools were positively associated for the overall dataset, as well as at schools with high or low male PE participation, and at schools with low female PE participation, compared to rural schools. For

HFZ achievement for aerobic capacity, city school location was negatively associated for the overall dataset and for schools with low male or low female PE participation.

Largest Black and largest White school proportions or populations were both negatively associated with achievement of the HFZ for aerobic capacity, compared to schools with largest proportion Hispanic or Asian students. Largest Black population was negatively associated at schools overall, schools with low male PE participation, and at schools with high or low female PE participation. Largest White student population was negatively associated with HFZ aerobic capacity achievement at schools overall and at schools with low male or low female PE participation. For BMI, largest Black student population was positively associated with schools overall, and schools with high or low male PE participation. All race associations were in comparison to schools with largest proportion Hispanic or Asian populations.

Lastly, school size associations were also found. Large school size was positively associated with HFZ aerobic capacity achievement at schools with low male PE participation. For achievement of BMI, both large and medium school size was negatively associated with schools in general and schools with low female PE participation. The associations found for research question 2 are summarized below in Table 15 which shows the BMI findings and in Table 16 which shows the aerobic capacity findings.

Table 15. Summary of School-Level Variables Associated with Healthy Fitness Zone (HFZ) Body Mass Index (BMI) Achievement

All – Full dataset	High Male ≥75% Male PE Participation	Low Male <75% Male PE Participation	High Female ≥75% Female PE Participation	Low Female <75% Female PE Participation
Negatively Associated:	Negatively Associated:	Negatively Associated:	Negatively Associated:	Negatively Associated:

<ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • Town school • Medium size school • Large size school 	<ul style="list-style-type: none"> • Free/Reduced Lunch • No. full-time teachers 	<ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • Town school 	<ul style="list-style-type: none"> • Free/Reduced Lunch 	<ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • Medium size school • Large size school
Positively Associated: <ul style="list-style-type: none"> • Pupil-teacher ratio • No. female students • Suburb school • City school • Largest Black 	Positively Associated: <ul style="list-style-type: none"> • No. male students • City school • Largest Black 	Positively Associated: <ul style="list-style-type: none"> • City school • Largest Black 	Positively Associated: <ul style="list-style-type: none"> • Pupil-teacher ratio 	Positively Associated: <ul style="list-style-type: none"> • Pupil-teacher ratio • City school

Table 16. Summary of School-Level Variables Associated with Healthy Fitness Zone (HFZ)

Aerobic Capacity Achievement

All – Full dataset	High Male ≥75% Male PE Participation	Low Male <75% Male PE Participation	High Female ≥75% Female PE Participation	Low Female <75% Female PE Participation
Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • City school • Largest Black • Largest White 	Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Town school 	Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • City school • Largest Black • Largest White 	Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Town school • Largest Black 	Negatively Associated: <ul style="list-style-type: none"> • Free/Reduced Lunch • Title I status • City school • Largest Black • Largest White
Positively Associated: <ul style="list-style-type: none"> • No. full-time teachers 	Positively Associated: <ul style="list-style-type: none"> • No. full-time teachers 	Positively Associated:	Positively Associated: <ul style="list-style-type: none"> • No. full-time teachers 	Positively Associated: <ul style="list-style-type: none"> • No. full-time teachers

• Pupil-teacher ratio	• Pupil-teacher ratio	• Large size	• Pupil-teacher ratio	• Pupil-teacher ratio • Town school
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Research Question 3

How is Physical Education participation associated with fitness outcomes in middle schools?

This research question explores if PE participation is associated with HFZ achievement at the school level. The models created for this research question were intended to assess the association between PE participation and HFZ achievement for BMI and aerobic capacity while controlling for school-level variables that could act as confounders. This study found that PE participation was positively associated with male aerobic capacity achievement. An increase in male PE participation resulted in an increase in male achievement of the HFZ for aerobic capacity.

Discussion

This study found associations amongst school-level variables and PE participation as well as HFZ outcomes. This study also found an association between PE participation and HFZ outcomes. This discussion section will consider potential explanations for the study findings organized by the following categories: SES, school resources, student gender, school location, and PE participation.

Socioeconomic Status (SES)

The findings of this study are consistent with existent literature. Furthermore, the findings of this study demonstrate the association between SES indicators, PE participation, and health

outcomes. A 2016 study found that SES was consistently associated with aerobic capacity and body mass index health-related assessment outcomes (Bai et al., 2016). While poorer health is due to the interplay of a variety of factors, including genetics, physiology, culture, and the environment, SES plays a significant role (Caprio et al., 2008). Health disparities, often tied to SES, are a known predictor of health outcomes. Poor health outcomes continue to be higher amongst populations of lower SES (Adler & Newman, 2002).

SES is also a predictor of access to resources. Groups of lower SES have less access to quality health care, healthy foods, and tools to achieve improved health outcomes (Adler & Newman, 2002). This lack of access impacts HFZ achievement at the school level. Schools with higher SES levels may have more resources for PE class, including more staff, more equipment, and better facilities. More resources may increase enjoyment of PE, thereby increasing PE participation and engagement. A study of Georgia public elementary schools looked at school physical activity environments and found that disparities were related to SES (Van Dyke et al., 2018). Lower SES schools were less likely to have access to tracks and paved areas or black tops for student recreation, less likely to report “always/often” making PE or physical activity equipment available during recess, and less likely to report the existence of joint use agreements with community organizations, while higher SES schools were less likely to report having access to playgrounds. Furthermore, this study also found disparities along racial lines; for example, majority non-White schools were also less likely to report having joint use agreements with community organizations (Van Dyke et al., 2018). This ties back to the findings in the current study by providing context for why SES is associated with fitness outcomes and PE

participation. It may be that lower SES schools have less access to the resources necessary to create effective PE programs.

Research has shown that those of higher income, increased education, and with gainful employment, report better health, fewer impairments of physical functioning, lowered mental distress, and decreased depression symptoms compared to those without these indicators of socioeconomic success (Bailis et al., 2001). As a result, high-SES individuals are more likely than low-SES individuals to experience “perceived control over life events” (Bailis et al., 2001).

Research has found that differences in health and SES impact socio-political participation (Rodriguez, 2018). This is key because less political participation may decrease representation of lower SES individuals in policy-making, including PE policies. Detrimental differences in health cause lower-SES and less healthy individuals to die at earlier ages, decreasing the proportion of lower-SES individuals in the population and increasing the population proportion of high-SES participants (Rodriguez, 2018). Health disparities are responsible for 56% of the difference in socio-political participation between 10-year survivors and non-survivors and elimination of health differences would increase political participation by 28% as people age (Rodriguez, 2018). These disparities may result in marginalized groups receiving less consideration in the policy atmosphere due to less representation. As a result, legislation may cater to majority populations, without consideration of changes needed to make PE policies effective for all groups.

School Resources

The school resource variables in this study, represented by number of full-time teachers and pupil-teacher ratio, present some interesting associations. Both of these variables are

positively associated with female PE participation. It is important to note that an increase in pupil-teacher ratio means that class sizes are getting larger. This means that female PE participation increases when girls participate in PE in larger groups. Research on girls' participation in PE, especially for middle school girls, has emphasized the discomfort that girls may feel in PE class. A qualitative study focused on the "embodied identities" of girls in PE described that girls were concerned with how they were observed and judged by others during PE based on their class performance and skill ability (Fisette, 2011). Feelings of self-consciousness and an "all eyes on me" (Fisette, 2011) awareness during PE class may be somewhat mitigated by PE participation in large groups where girls can feel a sense of anonymity.

Conversely, an increase in number of full-time teachers increases female PE participation. Although this outcome appears contradictory to the one above, there is likely a separate effect occurring here. As shared earlier in this chapter, data in the current study shows that larger schools tend to have higher rates of PE participation. Therefore, the association between number of full-time teachers and female PE participation may be indicative of the fact that larger schools are likely to have more full-time teachers while also having higher rates of PE participation.

Student Distribution by Gender

An increase in number of female students was associated with a decrease in female PE participation. This effect may be due to less emphasis being placed on female PE participation in school environments with a large number of female students. Other research to this effect was not found so this may be an area for future study. An increase in number of male students was

associated with an increase in achievement of HFZ for body mass index at schools with high male PE participation. There may be a similar effect occurring in this scenario as well. Schools with larger numbers of male students may place more emphasis on physicality and athleticism, thereby increasing male participation in physical education, especially at schools with high male PE participation. Further research is needed to explore this potential effect.

School Location

Town school location and city school location were significant across multiple models, demonstrating the impact of school location on PE participation and HFZ achievement. According to the study findings, town school location was associated with decreased achievement of female PE participation and primarily decreased achievement of the HFZ for both male and female students, compared to rural schools. Town school locations are territories inside an urban cluster, at some distance from the urbanized area. City school location was associated with a decrease in male PE participation, a decrease in achievement of HFZ aerobic capacity, and an increase in achievement of HFZ BMI, compared to rural schools. City school locations are territories inside an urbanized area and inside a principal city with varying population sizes. It is not surprising that city locations are associated with HFZ BMI due to activity levels of people living in cities and active transport which allows for more opportunities for movement and physical activity in daily life. This is reinforced by a 2017 study that found opportunities for active transport were expected to be beneficial for physical activity levels in children and adults. The study showed a positive impact of walkability, as well as physical activity gains from improvements or creation of infrastructure for active transport (Smith et al., 2017). These geographic outcomes are likely a function of the larger issue discussed in this

study, namely SES. In addition, the role of property taxes and area investment should also be mentioned. In more wealthy areas, like suburbs, property taxes from home ownership tend to be higher, contributing more local funds to the education system. Schools in less wealthy areas, like some parts of cities or towns, may be less well-funded, thereby decreasing local contributions to the school system. In this fashion, SES impacts school budgets and school resources. A 2021 Georgia Budget & Policy Institute report on education funding in Georgia, reported that equalization and sparsity grants, intended to provide assistance to school districts with less local funding for education, have been underfunded since fiscal year 2011, resulting in \$961 million dollars in lost funding for Georgia's most in need schools (Owens, 2021). This decrease in funding means that school districts with less local funding, a function of property taxes, have fewer funds to support education thereby widening disparities (Owens, 2021).

Physical Education Participation

This study also examined the association between PE participation, school-level variables, and HFZ outcomes. The finding in this study that PE participation is positively associated with aerobic capacity for males only, paired with the information that males achieve the HFZ for aerobic capacity at higher rates than females, and the PE participation gap between males and females, necessitates a discussion of low rates of PE participation and effective PE participation among females. A 2015 study of gender norms, nutrition, and physical activity in adolescent girls, reviewed the literature and found 28 different documents that may explain why females do not receive the same benefits from PE as males (Spencer et al., 2015).

This study highlighted girls' relationships with physical activity and gender roles, the role of appearance and perception, and social influences, institutions, and the environment as key

themes. Due to the complexity of girls' relationships with physical activity and gender roles, girls benefit from and enjoy physical activity but feel pressure to appear feminine. Society does not present athleticism as a feminine trait. Girls who challenge these norms may be perceived as overly masculine and these external pressures may prevent girls from receiving the maximum benefit from PE class (Cockburn & Clarke, 2002; Spencer et al., 2015).

The middle school years may be marked by increasing interest in the opinions of peers, making this a particularly challenging time for the self-image of girls. The role of appearance and perception in influencing behavior is significant. Multiple studies have found that girls are uncomfortable engaging in physical activity and PE due to having to wear uniforms or athletic attire, discomfort with getting sweaty or dirty, and lack of time after physical activity for hygiene, resulting in feelings of vulnerability, discomfort, and self-consciousness (Flintoff & Scraton, 2001). Furthermore, girls sometimes modify their participation in physical activity by participating in large group activities, hoping to go unnoticed. Inhibited intentionality is a theory that girls may underestimate their ability and, as a result, underperform (Spencer et al., 2015). In addition, girls have expressed concerns about being watched by boys, being teased, and being inadequate in physical activity (Cockburn & Clarke, 2002; Spencer et al., 2015). Low confidence is another issue, and only 20% of girls without confidence were comfortable in PE class (Spencer et al., 2015).

Social influences, institutions, and the environment also play a key role. Schools are just one institution that can have a positive impact on these issues. Physical activity environments focused on fun and encouragement rather than athletic ability were seen to be helpful (Barr-Anderson et al., 2008). Furthermore, teacher's attitudes and expectations in PE, as well as

environments that support gender equality while fostering confidence, can also improve the outlook for girls and physical activity and education at the school level. This is a societal level problem that calls for a redefinition of gender roles and interventions to address multiple factors and agents, including peers, teachers, parents, and the media. The role of policy to impact the environment is significant (Spencer et al., 2015). PE participation and enrollment are largely a policy decision, as states, schools, and school districts, can determine policy for middle school student participation in PE.

Study Limitations

There were some notable limitations in this study. The FitnessGram[®] data in this study excluded schools with group sizes of 17 students or less due to the possibility of identifying individual students. Since smaller schools may present unique relationships between the variables, the exclusion of small group sizes results in loss of data that could indicate how this factor may impact the variables. Furthermore, since this study used aggregate data, we cannot account for individual student demographics or factors associated with each student. For example, prior health status, student age, and individual student race is not included in this study.

Lastly, this study is unable to include PE teacher effectiveness as a variable since data on effectiveness was unavailable. Future studies may benefit from addressing these limitations.

CHAPTER 5

CONCLUSION, PUBLIC HEALTH IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to examine the association of school-level variables with physical education (PE) participation and student physical fitness and to evaluate PE participation as a predictor of physical fitness outcomes. With the study findings in mind, this chapter will discuss implications for public health and recommendations for how the findings can be applied to future public health work and research.

Implications for public health

Childhood obesity and physical education programs

Childhood obesity continues to be an epidemic that impacts the lives of youth, families, communities, and society. Further developed programs and interventions are needed to decrease childhood obesity prevalence. The findings in this study, including limited associations between PE participation and achievement on measures of physical fitness, imply that public health should focus on the effectiveness of PE programs to improve outcomes for all groups.

This study found that PE participation is associated with increased healthy fitness zone aerobic capacity achievement for males. This outcome indicates that PE participation yields positive outcomes, at least for male aerobic capacity. This finding, along with the body of research, suggests that PE may be a venue for achieving physical fitness, however modifications to PE policies and programs are needed to ensure effectiveness for all groups. Furthermore, this study suggests the importance of school resources, and school location. These findings may

indicate schools that have lower rates of PE participation as well as poorer health outcomes. These schools may benefit from increased support.

In addition, body mass index is a key factor in classification of childhood obesity. It is notable that no associations were found between PE participation and achievement of the healthy fitness zone (HFZ) for body mass index. If PE is to be a tool to decrease childhood obesity, PE must focus on programs that can be effective in improving BMI and helping youth to achieve a healthy body weight. PE programs have yet to reach their full potential. In addition to the impact on lower SES schools, PE program hindrances can also be seen for female students in general through societal gender norms that discourage female athleticism and limit female PE participation and achievement on measures of physical fitness. If changes are not made, individuals in these at-risk groups may continue to be at higher risk for childhood and adult obesity as well as chronic health issues, increasing the health burdens in these communities and on society.

The PE participation findings in this study show that males participate in PE at a higher rate than females. Furthermore, PE participation is lower in Title I schools and schools that serve more students who receive free or reduced lunch. These disparities in PE participation must be addressed and will be discussed later in this chapter. First, a potential way forward regarding childhood obesity prevention involves reconstructing frameworks.

Equity-Oriented Obesity Prevention Framework. Youth at lower SES schools have decreased rates of PE participation and lower achievement on measures of physical fitness, thereby exacerbating childhood obesity prevalence at these schools. This is due to the relationship between SES and health as well as health disparities. Kumanyika, a childhood

obesity prevention scholar, argues that public health efforts must ensure interventions are effective for groups disproportionately impacted by childhood obesity (Kumanyika, 2019). To decrease disparities, Kumanyika suggests the use of an Equity-Oriented Obesity Prevention Framework. Essentially, the framework approaches obesity prevention by implementing multiple policy and system level changes while simultaneously reducing deterrents or barriers to success (Kumanyika, 2019). For example, a parks and recreation facility can be built to increase opportunities for physical activity but if the deterrent of community safety at the facility is not addressed, community members may not use the facility due to safety concerns. Therefore, policies must pro-actively address and reduce barriers to improve outcomes.

PE program improvement starts with removing funding barriers. PE programs must be equipped with the tools and resources necessary for effectiveness. Funding must be adequate to provide equipment, personnel, and facilities. Equipment can ensure that students have the choice to engage with a variety of PE activities, increasing the likelihood of each student finding a PE activity that they enjoy. For example, students may like jumping rope, playing basketball, or practicing and learning gymnastics. If the school does not have enough jump ropes, basketballs, tools, facilities, and the right personnel to teach certain skills, these hindrances become barriers to success. Funding must meet the needs of the school, including a consideration of the number of PE teachers necessary to achieve successful PE implementation. PE personnel should receive regular continuing education to ensure the use of best practices to encourage the PE participation of all students, especially girls.

Facilities should be adequate to manage class sizes and offer a variety of activity options. Facilities may include gym spaces, outdoor spaces like tracks and football fields, paved areas or

black tops, swimming pools with lifeguards, weight rooms, and other facilities. As mentioned earlier in this study, lack of facilities to ensure student hygiene deter students from participating in PE. Private and individual clothing changing spaces and shower spaces should be available to remove this barrier to PE participation. Students must also be provided with adequate time for hygiene, before and after PE class.

Physical activity is an important component in decreasing childhood obesity. This study suggests that for PE to have the greatest impact on childhood obesity, PE programs should be tailored to address the needs of all groups. Addressing the childhood obesity epidemic will require focused interventions to meet the unique needs of different populations. PE can be used to decrease childhood obesity if stakeholders are willing to consider innovative new PE policies that may increase program effectiveness.

Physical education policy

This study has direct implications for PE policy. The important role of PE is an example of the school's contribution to advancing public health. By teaching students healthy living behaviors through physical education programming, schools contribute to the current health of young people as well as their health into adulthood. PE serves multiple purposes including providing education for leading a healthy life, sharing with students best practices to obtain physical activity, providing education in sports, offering a means to improve student physical fitness, and program delivery as an intervention for the public health crises of childhood obesity and physical inactivity. To be effective, PE programs must be specific about intended goals.

According to the Society of Health and Physical Educators America (SHAPE America), there are five national PE standards. These standards are listed in Figure 8 below. Many states,

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

Standard 3: The physically literate individual demonstrates the knowledge and skills to achieve and maintain a health-enhancing level of physical activity and fitness.

Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.

Standard 5: The physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression and/or social interaction.

Figure 8. Society of Health and Physical Educators America, Physical Education Standards (Society of Health and Physical Educators, 2020)

including Georgia, utilize some form of these standards. In Georgia, a further goal of PE is for students to spend 50% of PE class time engaged in moderate to vigorous physical activity (MVPA) (Georgia Department of Education, 2018c). There is some local control over PE programming. According to the Georgia Department of Education, Comprehensive Health and Physical Education Program Plan, each local school board is to develop and implement a comprehensive health and physical education program (Georgia Department of Education, 2018b). Growing the benefits associated with PE participation, should include further consideration of the standards, goals, and intentions of PE class.

Mandatory Physical Education. One direction for PE policy is that of mandatory PE at all school levels. Studies have shown that states with mandatory PE laws, including time requirements, have better PE attendance and increased physical activity, especially among girls, with attendance rates for girls rivaling, and in some cases exceeding, the rates for boys (Taber et al., 2013). Even states with weaker PE laws have better PE attendance and physical activity than states with no laws at all (Taber et al., 2013). A potential way forward for PE in Georgia, and states desiring to improve the effectiveness of PE, is to add a PE time requirement to state regulations for middle school students. Requiring PE for all Georgia middle school students would ensure that students are taking PE class, increase the amount of physical activity received by students, minimize the chances that schools of lower SES might have lower PE participation rates, and increase equity in PE policy.

Physical Education Engagement. Effective PE participation also requires student engagement in PE. It is important to address this element since mandatory PE requirements will only ensure enrollment. Although engagement in PE class was not the major focus of this study, there is research available on this topic. According to Doolittle, PE engagement is comprised of affective-emotional, behavioral, and cognitive elements (Doolittle, 2016). Affective-emotional engagement is achieved by creating a positive strengths-based environment where students feel welcomed, included, recognized, and rewarded (Doolittle, 2016). This component includes relationships focused on respect which lead to positive interactions (Doolittle, 2016). Engagement in PE is improved through avoidance of comparisons and a focus on confidence building with appropriate expectations that account for different strengths and weaknesses, aided by the teaching of positive social skills (Doolittle, 2016).

Behavioral engagement of students requires the use of choice and differentiated task options, individual accountability, assessment of improvements, inclusion, and community resources which include finding chances for advanced students to excel in sports in the local community, and engaging with community experts, venues, programs, and funding (Doolittle, 2016). Lastly, cognitive engagement can be achieved through the request for student input through surveys and then integration of student suggestions where appropriate. A variety of teaching approaches is also helpful. Incorporating technology and instructional tools should also be considered when focusing on student engagement (Doolittle, 2016).

To improve the participation of girls in PE, schools should normalize the importance of PE for student health and should prioritize PE participation. Participation in PE should be encouraged for all students, with limited approved reasons for students to opt-out of PE class. Due to the self-consciousness that less athletic students may feel in PE class, PE programs must adopt a growth mindset that encourages less athletic students to continue practicing physical activity to achieve growth. Female students have reported enjoyment of certain PE activities, for example, group activities that allow for socialization (Craike et al., 2009), so it is important that PE programs make space for the physical activity of girls at all different physical activity levels. Schools can also consider incentives and rewards for adequate PE participation. For example, students are given rewards, like the honor roll, for academic achievements. PE achievement recognition could encourage student participation in PE class. PE engagement could also be increased through peer-to-peer support. The typical middle school has opportunities for student leadership and involvement in various clubs. Opportunities could be provided for student leadership opportunities in the PE program. The involvement of athletic or engaged female

students as PE ambassadors and role models could encourage other female students to increase their engagement in the school's PE program.

Health and Wellness Committees. In present day, schools and school districts utilize Health and Wellness Committees of school and school district staff to address school health and student well-being. School wellness committees and PE teachers could be tasked with creating school-wide programs and campaigns to increase PE participation and engagement through a variety of approaches. The state department of education could provide resources for schools to use to implement a PE participation and engagement program and schools could choose the resource options that work best for their unique school environment. Through adoption of new ideas, resources, and a unified PE policy, states, school systems, educators, and public health can increase the impact of PE programs. In Georgia, multiple organizations are actively working on decreasing childhood obesity.

Health and wellness committees can use existing resources to engage youth and improve programming. For example, The Georgia Department of Public Health (GDPH) is a key stakeholder working in childhood obesity prevention. GDPH is home to the Georgia Shape initiative, a state-wide collaboration involving partners who work together to decrease childhood obesity in Georgia. Georgia Shape offers public schools across the state an opportunity to apply for Shape school grants to support the expansion and enhancement of school-based nutrition and physical activity programming. Funded schools are provided technical assistance and training, including participation in an annual healthy schools summit (Georgia Department of Public Health, 2021).

HealthMPowers, another Georgia resource, is a non-profit providing nutrition education and physical activity programs in schools, childcare centers, and out of school time programs. A Georgia school can become a Health Empowered school, which provides the school with support to develop a culture of health and help students improve eating, increase water consumption, and increase physical activity (HealthMPowers, 2021).

In partnership with Georgia Shape, HealthMPowers also offers Power Up for 30, a behavior change program that trains school educators to find creative ways to help students achieve 30 minutes of physical activity before, during, or after school. Another program from HealthMPowers is Girls Empowering Movement (GEM), a state-wide program created by girls and for girls to encourage female physical activity participation and engagement. A collaboration with multiple partners, GEM is set to launch in 2021 (HealthMPowers, 2021). These programs are available to support health and wellness committees as well as school programming.

Physical Education Interventions

Studies have been conducted to assess the effectiveness of school-based interventions to decrease childhood obesity and improve youth physical fitness. The next step for public health may entail choosing effective PE intervention programs and implementing them in schools to improve youth health, physical fitness, and in turn, outcomes on the FitnessGram[®] assessment.

The Active Schools Program (ASP) is one intervention that could show promising results (Erffle & Gamble, 2015). The intervention was implemented in middle schools in 2009 by the Pennsylvania Department of Health. This program provided 30 minutes of daily PE class with the goal of decreasing childhood obesity. An evaluation of the program found that 30 minutes of daily PE could be an effective program in middle schools, especially for at-risk adolescents and

females. Students involved in this intervention saw significant improvement in the areas of BMI percentile, curl-ups, push-ups, and the mile run. This evaluation utilized a control group and saw greater improvements amongst students involved in the intervention (Erflle & Gamble, 2015).

The Active Schools Program makes a case for interventions providing daily PE for middle school students. This is just one PE intervention program that could be utilized.

A database of evidence-based PE intervention programs may help schools to choose and implement effective PE programs. A database would serve as a helpful tool for PE programs to review program options and choose a program that works best for their school's unique needs. Allowing PE teachers and school wellness committees to choose the PE program that best meets their school's needs would also increase buy-in amongst school PE teachers and school staff. Based on the chosen program and an inventory of current supplies at the school, the additional supplies needed for program success could be obtained or provided, as determined by available funding. Through an interdisciplinary approach, and multiple professionals working together, solutions that adequately address the needs of youth can be created. There are various stakeholders that should be considered in this process.

Stakeholders

It is important to include relevant stakeholders in the discussion of PE programs, PE policies, and childhood obesity. Collaborators include public health experts, educators, legislators, families, non-profits, and community programs and organizations. Public health experts should use the findings in this study to consider the current landscape of childhood obesity prevention. Public health can work with school systems to strengthen PE, participation and engagement programming, and physical activity programs in schools. To alleviate funding

issues, public health can provide funding to school systems to improve the quality of PE programs.

The educator umbrella includes all personnel associated with schools, from teachers, to principals, to school system administrators. Educators can use the study findings to indicate the effectiveness of their PE programming, based on their school-level variables, and determine ways to improve outcomes. For example, this study presents school-level variables associated with HFZ outcomes. School systems can use these indicators to predict which schools may need more support for their PE programs. Schools with larger numbers of students receiving free or reduced lunch are likely to have lower rates of PE participation and poorer HFZ outcomes. School systems can be pro-active by providing extra support for PE and physical fitness programming at these schools. Schools can also improve the school-level variables that are in their control. A school could consider a pilot program offering larger class sizes for female PE classes to see if the increase in pupil-teacher ratio improves female PE participation, as suggested by the findings in this study.

Educators may also consider other ways to increase physical activity opportunities for students in an effort to improve fitness outcomes. Out-of-school time (OST) programs are one tool that schools have to provide extra support to students. OST programs offer more flexibility than the average school day schedule because OST program facilitators can offer a wide variety of programming based on student needs and interests. OST can be a valuable tool for youth physical fitness through sports clubs, dance clubs, exercise programs, and other types of physical activity.

Educators with the state department of education can also utilize these findings. At present, there are no requirements for middle school students to take PE class. Since the SHAPE Act requires school systems to follow the PE recommendations set by the Georgia Board of Education (Lyn et al., 2017), the Georgia Board of Education could consider a policy change to require PE for students at all levels of the k-12 education system, especially middle school students. However, prior to such measures being taken, it is important to put policies in place to ensure the effectiveness of the PE program.

Legislators can use these findings to inform and support policy changes. The disparity between schools of varying SES levels can indicate where additional support is needed. By allocating more funding to PE programming and supporting efforts to improve outcomes associated with PE participation, legislators can support policies with a focus on equity.

The public health sector must champion this cause. As the sector responsible for protecting and improving the health of communities, this is a prime opportunity to carry out this mission. The public health sector, in collaboration with other stakeholders, can create the tools necessary to educate communities about the importance of PE programming, disseminate messages that inform stakeholders who the most vulnerable populations are, and provide resources for schools and school systems to achieve effective PE programming.

Recommendations for Future Researchers

Future research should consider the components necessary for an effective PE intervention program for economically disadvantaged students and female. There are existing evidence-based interventions that can be used to move forward in this area. A database of evidence-based PE interventions should be created as a tool for schools and school systems.

Future researchers should review the existing evidence-based PE intervention programs and choose interventions to fit specific school and district profiles, offering differentiated instruction options (Doolittle, 2016). The topic of differentiation, places students in specific classes or groups based on their learning level. This same concept could be applied to PE interventions, offering programs for different student groups, and creating class groups based on the level of intervention needed. More research is needed on this concept and the feasibility of offering differentiated learning in PE classrooms.

Some schools utilize a version of differentiated learning in PE which involves teaching students in single-gender PE classes. The thought behind this type of instruction is that single-gender PE classes may increase student comfort and place students in class groups of a similar skill level. One unintended consequence of single-gender PE classes could be the alienation of non-binary students. There is not much research on best practices for making PE inclusive for non-binary students. Existing non-binary student research is focused on the concepts of creating policies that affirm a student's gender identity in schools, but not specifically in PE class (Kenan & Wayne, 2020; Meyer & Keenan, 2018). Available research addresses the creation of gender inclusive policies in schools. Since school policy in the area of gender inclusiveness for non-binary students is still being formulated, the research has not substantially advanced to the subject of gender affirming practices for non-binary students in PE class. This is an area for future research.

This study did not include variables for PE teacher effectiveness. Adding teacher effectiveness variables for future studies may improve the richness of data. Furthermore, getting qualitative feedback from PE teachers and PE students is important in the creation of any PE

plan so adding this type of research to inform future programming is important. Lastly, this study found a positive association between male PE participation and HFZ outcomes for male aerobic capacity. Further exploration to determine why this finding is present for males but not for females would be helpful to add to the understanding of factors impacting PE in Georgia.

Conclusion

Policy changes at the state level will support the findings of this study. Better resourced PE programs will help improve engagement of students in PE. This study aligned resources with number of full-time teachers and pupil-teacher ratio, which were variables that improved outcomes for female students. More funding allocated at the state and local levels could allow PE programs, as well as schools, to improve resources available for PE.

This study demonstrates the complex factors at play in creating changes for student health. Despite the complications presented, there are still actions that can and should be taken. Based on the findings of this study and the recommendations shared, policies to support HFZ achievement and PE participation for females and lower SES groups may result in improved health outcomes for youth and decrease the prevalence of childhood obesity. Furthermore, programming to normalize and encourage physical fitness and athleticism in females may also help decrease the gender gap in fitness achievement.

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