The Impact of Physical Education on Childhood Obesity in Ohio School Children

by

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Abstract

Childhood obesity has become a significant public health problem over the past 35 years. According to the Surgeon General report on Childhood Obesity from 2010, obesity that starts in childhood or adolescence creates greater risk for adult health problems such as heart disease, arthritis, stroke, and cancer. The literature shows that childhood obesity increases most rapidly during the early elementary school years. While obesity and its etiology are certainly multifaceted, at best, several studies have linked many social and environmental determinants of health. The research has shown strong links to factors such as socioeconomic status, the community type, and amount of physical activity through organized curriculum, intervention, and recess. The sample was a systematic stratified random sample of Ohio schools that reported their 3rd grade BMI scores for 2009-2010 school year to the Ohio Department of Health. The sample included 25 schools and 1,006 students. Those schools selected were contacted via phone to ask how many minutes per week schools allocated to physical education in grades K-3, and how many minutes per day was allotted for recess in grades K-3. Other data in the data set were the percentage of students receiving free or reduced lunch; the school building academic performance designations were acquired from the Ohio Department of Education. Zero-order Correlations were run for all variables. Those that were significantly correlated to BMI percentile adjusted for age and sex correlations were selected to run sequential multiple linear regression. Those variables were minutes of daily recess in the third grade, children receiving free or reduced lunch and the type of community. There were two sets of regression analyses. The first set was run at the

student level. The first model at the student level, with the all three independent variables, resulted in an $R^2 = 0.011$, $F(3, 1001) = 3.726$, $p = 0.011$. Model two at the student level, with the subtraction of the Community Type variable, revealed a less powerful $R^2 = 0.009$, $F(2,1003) = 4.481$, $p = .012$. When this regression was run at the school level, neither regression was significant. The first model at the school level, with the all three independent variables, resulted in an $R^2 = 0.304$, $F(3, 21) = 3.058$, $p = 0.051$. Model two, run at the school level, with the subtraction of the Community Type variable, revealed a less powerful $R^2 = 0.198$, $F(2,22) = 2.715$, $p = .088$. These results suggest that the model run at the student level accounts for approximately 1% of the variation in BMI; the model run at the school level was not a significant predictor of the variance. While the model included for Ohio students did not indicate a strong predictor for childhood obesity, schools can play a significant role in the childhood obesity issue.

Dedications

I would like to dedicate this to Christina, my lovely wife of over 22 years. You are my best friend and my lifelong companion. For you to work with me to complete this journey at this point in our family life is astounding. You have had to act as if you were single parent quite often. This is something I could never repay, only to say that I am eternally grateful for you. I would also like to dedicate this to our children, Nadia, Nico and Mila. While Nico and Mila are too young to understand that they had to be patient for their father, Nadia knew all too well. Even at 7 she understood, when she would rather have me play with her. She knows that this is very important to her Dad and was willing to exhibit uncommon patience for a young child. I will make it up to her and her brother and sister. I would also like to dedicate this to my parents Nicholas V. Cascarelli, BSE ’65 (1932-1991) and Sandra D. Cascarelli (1941-1991). I would not be here if it weren’t for them. And if even they are no longer of this Earth, their spirit lives on in me and motivates me to do my best every day. I would also like to dedicate this to my sisters, Lisa, Pam, Carla and Angie. I feel closer to you now more than I ever have. You have continued to provide support not only for this part of my journey, but most of my adult life.

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Chapter 1

Statement of the Problem

Childhood obesity has become a significant public health problem over the last 35 years. According to the 2007-2008 National Health and Nutrition Examination Survey (NHANES), the prevalence of obesity among children two to 19 years old was approximately 18% (Ogden, Carroll, Kit, & Flegal, 2012). This represents approximately a 300% increase from the obesity prevalence from 1980 (Flegal, Carroll, Kuczmarski, & Johnson, 1998; Flegal, Carroll, Ogden, & Johnson, 2002). While the etiology of obesity is multifaceted, it is likely rooted in the social and behavioral determinants of health. For example, a recent meta-analysis aimed to determine the sources of a sedentary lifestyle in school-aged children ages five to 17 found that watching two hours or more of television per day was associated with obesity (Tremblay et al., 2011). Several studies included in the meta analysis were interventions to combat childhood obesity and were successful to varying degrees

Childhood obesity has consequences that affect long term impact children's health. Children who are obese tend to be more at risk for hypertension, hyperlipidemia (high cholesterol), pre-diabetes/diabetes, bone and joint problems, sleep apnea, and psychological issues associated with being overweight (Freedman, Zuguo, Srinivasan, Berenson, & Dietz, 2007; Li, Ford, Zhao, & Mokdad, 2009; Center for Disease Control (CDC), 2010; Dietz, 2004). In a population-based study of 5-17 year olds, over two thirds of obese children had one or more risk factors for cardiovascular disease (Freedman et al., 2007)

The most fundamental of the findings is that obese children and adolescents are more likely to become obese adults (Guo & Chumlea, 1999). The Office of the Surgeon General (2010) released a report that this obesity, which starts in childhood or adolescence, puts obese adults at greater risk for adult health problems, most notably, heart disease, stroke, arthritis, and cancer.

Over the last 35 years, at the same time we see childhood obesity prevalence trending upward, (1980- current), U.S. children's achievement in crucial subjects, such as reading and math, have been falling behind other Office of Economic Cooperation and Development (OECD) countries(Gostin & Pomeranz, 2009). In response to falling behind reading and math, some of the more recent iterations of The Elementary and Secondary Education Act, most notably the No Child Left Behind (NCLB) Act of 2001 required schools to become more accountable for the success of their students(Gostin & Pomeranz, 2009). Schools across the United States began narrowing the focus of their curricula. These policy changes may have had some unintended consequences as NCLB proved to be counterproductive to schools that were trying to increase health and physical education activities. Schools have some capacity to make a difference in the fight against childhood obesity. According to Kahan and McKenzie (2015), if schools would implement nationally recommended physical education standards from grades 1-10, students could expend an additional 35,000 to 90,000 kilocalories than compared to students who just receive instruction.

Purpose of the Study

The purpose of the study is to quantify the extent to which a school's physical education curriculum impacts a child's propensity for being overweight or obese, defined

by Body Mass Index percentile (BMI percentile). The proposed research will further examine modifying factors (rate of students receiving free or reduced school lunch, which type of community the school district exists, the time in the curriculum dedicated to health education, and the school district performance) that may mediate the relationship between the curriculum time dedicated to the physical education in K-third grade and a child's BMI in the third grade. The scope of the study is limited because the BMI data are collected in the third grade.

Research Questions and Hypotheses

1. Aim 1: To examine if the amount of physical education a school provides has an impact on a child's BMI.
    a. Aim 1, hypothesis 1 : There will be an inverse relationship between the amount of physical education offered in school and the child's resulting BMI.
2. Aim 2: To examine the modifying effects of the association between BMI and the amount of physical education?
    a. Aim 2, hypothesis 1: Rural or urban school districts will impact the relationship between physical education and students' BMI by contributing to higher BMI rates than suburban districts.
    b. Aim 2, hypothesis 2: A school district's academic performance will negatively impact the relationship between physical education and students' BMI.

c. Aim 2, hypothesis 3: The percentage of free or reduced lunch recipients in the school will negatively impact the relationship between physical education and students' BMI

Significance of the Problem

It has yet to be demonstrated that reducing the amount of time in the curriculum dedicated for physical education in favor of other subjects, such as math and reading, improves academic performance (Trudeau & Shepherd, 2008). On the other hand, other studies have found positive associations between physical activity, cognition, and academic performance (Castelli, Hillman, Buck, & Erwin, 2007; Donnelly & Lambourne, 2011). Thus, schools can be part of the solution to, and an excellent venue for, addressing childhood obesity (Brescoll, Kersh, & Brownell, 2008). While Brescoll et al. (2008) acknowledged there is not one magic bullet for this issue, interventions that change policy in the elementary school environment would have the most impact on reducing childhood obesity. Children spend a great deal of their lives in school.

The body of literature on childhood obesity interventions implemented in schools is vast. Brownson, Chiquri, Burgeson, Fisher, and Ness (2010) found that a good, school-based, physical education program should have more time dedicated to it than what schools currently dedicate Making policy changes can be limited by constraints in which schools operate i.e., the need to demonstrate adequate yearly progress(AYP).

Cawley, Frisvold, and Meyerhoefer (2012) found that at the fifth grade level, an increased amount of PE time increases the likelihood a child will be within a healthy weight, according to the BMI scale. This data were collected from 2004, thus, after the

passage and at the implementation of No Child Left Behind (2001). They also found that, if schools, on average, would increase their amount of weekly physical education time by 50 minutes, it could significantly reduce BMI percentages. One other point this research makes is that socioeconomic status (SES), and the level of intensity of physical activity, can be potential moderators to this relationship between physical education and obesity.

Physical education is a substantial factor in impacting childhood obesity. Examining this as a causal relationship, however, is not very common. Mediating variables, such as SES, school performance, location of school, or health education curriculum are acknowledged in the literature. This research attempts to take into account all of these variables and examine the relationships. The intended outcome of this research is to aid in changing policies in schools to increase, not necessarily the time, but the quality and the focus of physical education instruction. This is extremely crucial, now that there is an increased emphasis on subjects such as math and reading, which has resulted in reduced time allotted to other subjects, including physical education.

While the purpose of the current research does not test for social cognitive theory, directly, the various constructs can be used as a backdrop to explain the current situation, as well as a solution (Bandura, 2004). One of the key constructs to social cognitive theory is self-efficacy. A research of 479 elementary schools grades four to six, from the southwestern United States, consisted of students completing a validated socio-cognitive instrument and a pedometer (Ramirez, Kullina, & Cothran, 2012). The research found that self-efficacy of using the pedometer was a strong predictor for three other social cognitive theory constructs: social supports, barriers to exercise, and outcome

expectations (Ramirez et al., 2012). Another study looked at four public health strategies for combating childhood obesity: limiting television viewing, encouraging daily physical activity, increasing fruit and vegetable intake, and increasing water consumption. There were 159 fifth graders assessed on these four behaviors testing self-efficacy as a predictor. While all self-efficacy was shown to be a significant predictor for all four behaviors, it is significant to note that the number of physical education sessions offered to the students was significantly related to self-efficacy (Sharma, Wagner, & Wilkerson, 2006). It is clear from these studies that motivation by school staff and a provision of more physical education can increase the ability to be confident with being physically active .

Limitations and Delimitations

Although the research will attempt to acquire a broad section of school districts through systematic stratified random sampling, there may be some limitations on generalizability of the results. The generalizability may be limited to Ohio schools, since this is the focus of the study. Also, depending on the number of schools that report their third grade BMIs, a random sample may not be possible.

A delimitation of the study is that the mediators tested for this study may not be the only mediators that could impact the relationship between the time allotted for physical education and the students' BMIs. This research attempts to capture some more powerful mediators, as evidenced by the literature, by collecting demographic variables, such as socioeconomic status, by incorporating the percentage of students receiving free or reduced lunches, and type of community, as well as the school's report card, or the

time allotted to health education in the second grade. The researcher acknowledges this is not the entire population of mediators.

Another delimitation of the study is that the research will only examine third grade students. This grade was chosen because that is when BMIs are more assessed.

Definition of Key Words

Appalachian district- A school district that is located within the Appalachian portion of Ohio.

Body Mass Index (BMI) percentile – A measure used to determine healthy weight. In children, it is based upon the height and weight compared to other children of the same sex and age. A child whose BMI is at or above the 95th percentile for sex and age is considered obese. Because children are still growing, BMI for children takes into account the comparison with other children, whereas adult BMI takes into account height and weight only (Barlow & The Expert Committee, 2007).

Physical education – Teacher-instructed physical activity that is part of the normal curriculum and not an extra-curricular activity.

Rural district – A school district as defined by the Ohio Department of Education (ODE) that is situated in a community where there is a very low average daily attendance and has average to high levels of poverty (ODE, 2015).

School performance designation – Rating of the school district from the ODE (2015).

Suburban district - A categorization of school district defined by the ODE as primarily consisting of students living in a suburb of a city in which the majority of children are not living in poverty (ODE, 2015).

Metropolitan district – A categorization of school district defined by the ODE that primarily consists of children living in a city, and, that, typically, has higher levels of poverty among its students (ODE, 2015).

Summary

Chapter 1 introduces the problem of childhood obesity. This section discusses the significance and relationship of childhood obesity with school districts. It begins the discussion of how school policy and curriculum can be instrumental in being, if not a solution, a viable instrument for the reduction of childhood obesity in Ohio. Also in the section are parameters in which the study occurs, including an acknowledgement of limitations and some working definitions paramount to the research. The research looks to explain some of the problems associated with obesity drawing from various constructs of Social Cognitive Theory. And while the intent of the research is not to indict schools as a cause of the childhood obesity problem in the United States, they can be included and can be a key component to a solution.

The research will attempt to examine the direct relationship between physical education in elementary schools and the BMI of the student. The research will also examine various factors that could modify that relationship. Those factors include, the type of community in which the school is located, the health education curriculum in grades K-3, and the SES of the children indicated by percentage of students on free/reduced lunch and the school performance. A goal of this research will also be to

justify the importance of continuing BMI measurements in schools and the reporting to parents.

Chapter 2

Literature Review

This section includes the review of literature related to the research that will be presented. Discussion of the epidemiology and the problems related to the prevalence and incidence of childhood obesity will continue. Examination of the literature, related to physical education and its impact on BMI and the concept of BMI in children, as it relates to the moderating variables used in the study, including SES, community type, health education, and school district performance also continues. There will also be an examination into legal support for BMI surveillance, and reporting in schools, as an intervention. Research will be presented on schools' levels of success in conducting other types of interventions, including increasing exercise, and health education related to nutrition.

Childhood Obesity

Childhood obesity increases most rapidly during elementary school years. In a study of data from the Early Childhood Longitudinal Study using the kindergarten data during the 1998-1999 school year, 14.9% and 12.9% of children entering kindergarten were overweight or obese, and 20.8% reached obesity by the eighth grade (Cunningham, Kramer, & Venkat Narayan, 2014). Cunningham et al. (2014) also noted that they found no significant increases in prevalence of obesity between the ages of 11-14. Consequently, this demonstrates that most of the weight gain actually occurs in the early elementary years, and provides rationale for the importance of recognizing and planning interventions to prevent or address obesity for children during early elementary school years. Another problem associated with early childhood obesity is early onset in puberty,

especially in girls (Kaplowitz, 2008). Thus furthering the importance of understanding childhood obesity into the early elementary years.

SES and Childhood Obesity

One major moderator of childhood obesity is the socioeconomic status of the child. Gundersen, Mahatmya, Garasky, and Lohman (2011), conducted a meta-analysis that indicated that psychosocial stressors, which occur to a greater degree in low SES households, are causal agents in poor health indicators, most notably, obesity.

Disadvantaged children often attend school districts that have less than optimal resources and facilities conducive to the best physical education. Fernandes and Sturm (2010) found that schools that did not have gymnasiums provided close to 10 minutes less, per week, of physical education time than their counterparts that had gymnasiums.

In a study of Massachusetts' families with children, 109,634 children from grades 1, 4, 7, and 10 had BMI measurements taken in schools during the 2009 school year. There was an inverse relationship between income and percentage of children with BMIs above the 85th percentile, which is the BMI level for overweight (Eagle et al., 2012).

Community Type and Childhood Obesity

There tends to be some overlap with SES and the community environment, as many people of lower SES also live in urban or rural areas. One of the problems with urban areas is that the "built environments", in which they are contained, do not often have characteristics conducive to physical activity. Built environments refer to infrastructures that are conducive to exercise, such as sidewalks, parks, and recreation centers. These built environments in lower SES communities are not often safe, contain

poor housing, and have little or no access to sidewalks, parks, or recreation centers (Singh, Siahpush, & Kogan, 2010; Wolch et al., 2011). Children in these environments are anywhere from 20% to 60% more likely to be overweight, or obese, than their counterparts in suburban environments. The effects found by Singh et al. (2010) were greatest for younger children and female children.

Rural areas, at first glance, may appear to be more conducive to physical activity than urban areas. However, Moore, Brinkley, Crawford, Evenson, and Brownson (2012) found that there were no differences in Body Mass Index (BMI) between rural and urban youth. Moore et al. studied rural, middle school youth, and middle school youth at an adjacent urban school district. One of the considerations for no differences in BMI was that the urban students averaged more time (19.2 min/day) in moderate to vigorous physical activity compared to the rural students' (15.9 min/day).

Another important aspect related to physical activity also involves the level of vigor of the physical activity. One study of rural, Oregon elementary students found a significant inverse association of students, who were involved in moderate to vigorous physical activity (MVPA), were more likely to have lower BMIs (Gunter, Nader, & John, 2015). These findings were independent of sex and grade. The authors' recommendation was that rural schools are falling short of the recommended 60 minutes of MVPA/day, as 38.4% of students were overweight, and 19.4% were obese. They need to place more emphasis on opportunities for MVPA. Other studies of rural environments showed high rates of obesity. Greening, Harrell, Low, and Fielder (2011) conducted a study of 450 rural Mississippi children, ages 6-10, to measure the effectiveness of a school-based, obesity intervention program. Over 50% of these children were overweight/obese. This

research did not yield statistically significant differences in BMI when comparing the experimental group with a control group pre- and post-intervention. However, there were statistically significant differences between groups when it came to increasing physical activity and improved dietary habits. The duration of this study was nine months. Perhaps a one-time intervention is less preferable to institutionalizing a greater emphasis on physical activity.

The Importance of Physical Education

Lee, Burgeson, Fulton, and Spain (2007) surveyed 988 schools and 1,194 physical education teachers across the United States. They found that less than 50% of schools in the United States were required to offer physical education in kindergarten. This percentage reaches its peak in the sixth grade, at 68.1%. After that, it falls to 20.4%, by the time a child reaches the twelfth grade. With this inconsistency in reinforcement of healthy lifestyles across the grades, and, the fact that, at its best, only 68% of schools are required to offer physical education, this may contribute to a sedentary lifestyle. Because children spend a great deal of time in school, it is plausible to argue that the limited amount of physical education children receive in school is part of the problem with child obesity rates in schools.

In a study of kindergarten and first grade students, Datar and Sturm (2004) argued that expanding physical education in elementary schools, to at least five hours a week, can significantly combat obesity among overweight, or at-risk, overweight children. This effect was found to be significant for girls. It can be argued that there many other factors that could account for obesity in children. Many of those will be explored here.

One way to address the reduction in time allotted for physical education and increasing the health benefit is to increase the intensity of the exercise for students (McKenzie et al., 2004). Using schools as the unit of analysis, McKenzie et al. (2004) found that standardizing training for physical educators, to incorporate more moderate to vigorous exercise activities into their curricula, can improve the quality of instruction to middle school students. Providing more staff development time to physical education teachers, for this and other purposes, is both a feasible and impactful policy change to address childhood obesity (Brescoll et al., 2008)

Physical Fitness and Academic Achievement

Children who have a sedentary lifestyle will be at higher risk for becoming overweight or obese. Using a Randomized Control Trial (RCT) design, Davis et al. (2011) evaluated differences of 171, 7-11-year-old, sedentary, overweight children, and exposed the test group to 13 weeks of an exercise program for 20-40 minutes of per day that the control group did not receive. Davis et al. (2011) used blinded, standardized, psychological evaluations that assessed cognition and academic achievement. They also used functional, magnetic resonance imaging (MRI) to measure brain activity during executive functioning tasks. They concluded that executive function and brain activation changes were observed in the test group. Increasing the amount and vigor of PE time provide both positive health outcomes and positive educational outcomes, especially for elementary, overweight children (Castelli et al., 2007; Davis et al., 2011; Donnelly & Lambourne, 2011).

Obesity and physical activity were found to influence the relationship between childhood motor function and academic achievement in adolescents (Kantomaa et al.,

2012). In a 1986 birth cohort of 8,061 children, born in northern Finland, physical activity was associated with a higher grade point average, and obesity was associated with lower grade point average.

As obesity and physical activity were considered influential factors in Kantomaa et al. (2012), the proposed research will test the relationship between physical activity and obesity rates. Community type, academic achievement, SES, and gender will be treated as mediators.

BMI as a Screening Tool in Schools

The Institute of Medicine has recommended school-based BMI screening programs. The major rationale behind this is because BMI is not routinely collected and shared with parents in medical care settings (Dietz, Story, & Leviton, 2009). The body of research on parental perception of students' weight is that they tend to underestimate the weight status of their children. So, basically, screening a child's BMI and then reporting it to the parents can better educate the parents on their child's actual weight status and associated health risks, as a result of carrying additional weight. To complicate this issue further, there are health-equity issues as many other determinants of health. Minority populations are impacted by childhood obesity, disproportionately. This, in turn, further complicates the health consequences of parental misperception of health weight status.

One of the greatest limitations and source of challenges to using BMI, and its validity, is that BMI does not measure body fat directly. It is also unable to determine associated health risk factors such as blood pressure, or cholesterol levels. In addition to the raw BMI score, itself, the parent would be given a percentage where his or her child falls in comparison to other children. This would compare the percentage of children

who have a greater BMI to other children his or her age. Although a child whose BMI is at, or above, the 95th percentile has increased body fat, there are no effective standards that are used statistically, nor are there any good cutoff points to determine percentage of body fat per-percentile-ranking of BMI measurements. Thus, great care is needed when it comes to understanding this potential shortcoming of BMI measurements by clinicians, school personnel, parents, and children. The latter, depending on the child's age and true ability to understand the concept of overweight or obesity, may not be as crucial. Some other body fat measure, such as waist circumference measurement, used in conjunction with BMIs, would be useful to differentiate the degree of obesity. Conducting an additional test in a school setting, however, may not be a practical undertaking.

Schools as a Change Agent

Several studies show that schools have been effective in the reduction of BMI in those children who are overweight or obese. A meta-analysis that was conducted on 43 published studies between 1991 and 2010 found a statistically significant overall effect of 0.17 with $p<.001$ (Lavelle, Mackay, & Pell, 2012). The research did consist of only three educational interventions, 11 physical activity interventions, and 29 physical activity and nutritional interventions. The effect was largest for those that used the combination of a physical activity and the nutrition component for all students. Interventions that targeted overweight/obese children had an even greater effect, .35 with a $p=.003$.

Other studies that looked at other biomarkers, besides BMI, also showed promise. The meta-analysis conducted by Ho et al. (2013) that looked at interventions targeted only at obese/overweight students from 1975-2010, used randomized control trials that compared diet only, combination diet and physical activity, and physical activity, only.

The resulting meta-analysis consisted of 15 studies that found the largest impacts with the diet-physical activity combination interventions. Over a six-month period, another factor used to decide included the diet-physical activity combination, resulting in a 3.89 mg/dL increase in High Density Lipoprotein cholesterol, a decrease of 2.16mg/dL in fasting glucose, and 2.75µIU/mL decrease in fasting insulin.

While the previous meta-analysis looked at one-time interventions, there are some further benefits when a school changes its culture toward more physical activity. A study in Canada showed the benefits of looking at enculturating healthy food choices and physical activity. Fung et al. (2012) looked at comparing students from 10 Alberta schools that implemented a program called Alberta Project Promoting active Living and Healthy Eating (APPLE) and randomly selecting 150 Alberta schools not implementing the program. They used interventions based upon a previous program, called the Annapolis Valley Health Promoting Schools (AVHPS) that was evaluated as a best practice for reducing excess body weight in school children. Fifth graders were surveyed in 2008 and 2010 using the Harvard Youth/Adolescent Food Frequency Questionnaire. While the students at the APPLE schools had a higher rate of obesity (12.5%) in 2008 than the average school in Alberta (6.9%), the APPLE Schools' obesity rate decreased to 10.7%, and the average Alberta Schools' obesity rate increased to 8.8% in 2010. Fung et al. 2012 also found that the APPLE students were not as active in 2008 as the average Alberta student, but by 2010, raised their level of activity to the same level as the average Alberta student.

This research will address the potential need for additional time allotted for physical education in elementary school settings. This may not be an answer to the

childhood obesity problem in Ohio, or the country. Klaak, Chinapaw, Heidemann, and Wedderkopp (2013) studied the effect of having physical education once a day, versus once a week, on composition and weight status of male children, 8-13 years old. They compared six intervention schools that had once-a-day physical education, and four schools that did not receive the once-a-day physical education program. They found no significant intervention effect on BMI or total body fat percentage, p=.49. However, the authors noted significance when looking at the intervention schools in the prevention of children becoming overweight or obese, p=.01.

Legal Basis and Implications for Mandating BMI Screening in Schools

Childhood obesity is, verifiably, a formidable public health opponent in this first 16 years of the 21st century. With this fact in mind, it is conceivable that schools can justify conducting BMI screenings and reporting of the results to parents. There are two legal concepts, police power and parens patriae, whereby BMI screenings can be mandated for states. Both of these 10th Amendment concepts can provide necessity and justification. When a state mandates that school districts conduct BMI screenings, they are, in fact, invoking both of these concepts. The police power authorizes the state to intervene on behalf of the health welfare of its residents (in this case, the threat of childhood obesity), and parens patriae allows the state to maintain a safe environment by acting in loco parentis (Ryan, 2009).

Opponents of school initiatives, such as mandating BMI measurement, argue that schools cannot cure everything, much less educate students on everything, including health education (Fleischhacker, 2008). No Child Left Behind (2001) mandates dictated the makeup and changes to curriculum across the country, over the

past 15 years. These mandates often resulted in the expendability of subjects, such as health and physical education. Schools have to achieve in these subjects or face serious consequences; however, subjects, such as reading and math take precedence. Opponents of BMI assessments in schools argue that being overweight is a medical issue, not an academic one.

While public health advocates may support mandated BMI measurements, there may be some unintended consequences school districts may endure by doing this. Parents may take issue with the school conducting BMI measurements and informing parents of the children's results, usually via a letter from the school, regarding their child's BMI. The parents may feel that the school is criticizing them as parents (Flaherty, 2013). Some other unintended consequences, including eating disorders, and bullying, which is perhaps as pervasive in schools as childhood obesity, can occur as results of students teasing other students about their weight (Wiley, 2012).

The Impact of Policy

The focus of the literature up to this point is on how many things can impact the student, either by determinants of health, and interventions that schools can implement to address this issue. Historically, policy has been very successful in bringing about health behavior change over the last 50 years. Perhaps the most successful are the reduction of tobacco use and seat belt use.

Schools can help provide some equity in terms of both health and education for those who, disproportionately, have negative outcomes for each.

However, with more than 50 million students spending a significant

> Portion of their daily lives in school, this social context is surely one of the most powerful social institutions shaping the next generation of youth. By systematically addressing educationally relevant health disparities, schools can reduce both educational and health disparities. If a health problem is the cause of the educational disparity, the health problem must be statistically and temporally associated with the unfavorable educational outcomes. (Basch, 2011, p. 594)

Basch's (2011) statement spoke to the fact that healthy students learn better and, subsequently, will perform better on standardized testing. The investment in schools to bring about long, sustainable changes in this arena of improving the health outcomes of its students must be addressed to a greater degree than it has been.

In examining school policies that work, schools can add physical activity to the curriculum without the threat of falling reading and math scores (Story, Nanney, & Schwarz, 2009). Policy leadership for these types of issues starts at the school district level. That is to say, local school districts and states have the most to say as far as physical education curriculum is concerned, with the Federal government having very little. Schools tend to do what the state, or the district, mandate in terms of curriculum requirements for physical activity. Schools were more than two-times likely to have the CDC recommended level of 150 minutes of physical education per week, if, in their curriculum, there was a state law or school district policy mandating so, than those who did not (Slater, Nicholson, Chriqui, Turner, & Chaloupka, 2012).

There is some research that suggests caution when trying to assume physical activity in schools will solve the childhood obesity singularly. Williams et al. (2013) conducted a meta-analysis on schools that had policies in place related to nutritional offerings and/or a physical activity component to reduce obesity in children. The focus was children in primary schools. They found that significant reductions in weight-related outcomes were demonstrated. However, when programs were either diet only, or physical activity only, there was not sufficient proof of significant benefits for overweight or obese children. A more comprehensive program is necessary to realize those benefits.

One of those other interventions is the routine screening and reporting of students' BMI scores. While the research here will contain less controversial, unidentified, surveillance data of children's BMI, the actual screening and reporting of BMI in students might serve as an important step in engaging the family in the child's health (Soto & White, 2010). Screening does not come without controversy. There is concern for teasing of students, parents' misconceptions about their child's weight, and children exhibiting unhealthy eating habits to obtain a healthy weight.

Current Investigation

Childhood obesity has been widely studied. The various determinants of health are, typically, the conduit for an explanation of childhood obesity. The current investigation will address a gap in the literature by assessing, on a large scale, the difference allotted for physical education in the curriculum as it relates to obesity rates among elementary school children in Ohio. The intention is not to indict schools as the cause of childhood obesity. The intention is to demonstrate that schools can be a larger

part of the solution. It will also take into account several mediating variables that are commonly discussed in the review of literature.

The previous research is tied to the current research in examining the relationship between physical education and childhood obesity. This will entail looking at this relationship, tying in some of the more predominant mediating factors, such as SES, Community type, school performance, and, one of the lesser studied factors, the amount of health education in the curriculum in elementary schools.

Summary

Chapter 2 presents literature relevant to the current research. Research related to health effects of obesity, and the schools' role in curriculum and policy was presented. It was the intention to include the relationship between obesity and variables, and mediating factors were presented. Also, interventions related to programming and surveillance, and subsequent reporting of BMIs is discussed.

Chapter 3

Methodology

Design of the Study

This study is an ex post facto quantitative design to determine the impact of the devoted to weekly physical education and recess grades K-3 on the BMI of the students in the third grade. Because there are many factors that contribute to childhood obesity, other factors such as community type, percentage of children eligible for free or reduced lunch and school performance designation will be examined as mediators.

Sample

The sample was a systematic stratified random sample of Ohio public elementary schools that reported their 3rd grade BMI scores for 2009-2010 school year to the Ohio Department of Health. Recognizing that this was a random sample among schools that reported BMI, it was not random to all Ohio elementary schools of convenience, and because schools had the ability to opt out, avoiding challenges to external validity may be a challenge. The data were stratified to rural, Appalachian, suburban, and metropolitan school districts.

Data Collection

The independent variables were the amount of time, in minutes per week, devoted to physical education grades K-3. Daily recess in grades K-3 will also be examined as independent variables. The researcher contacted each school district using a prepared script to describe the purpose of the study, to assure the school district will be identified in the study, and to ask him or her the two questions related to curriculum for that school year. The data regarding the schools' performance were acquired from the Ohio

Department of Education. The balance of the data, including the BMI measurements of the children, type of community (metropolitan, Appalachian, suburban, or rural), free or reduced lunch, and demographic variables were included in the data from the Ohio Department of Health.

Data Analysis

Descriptive analysis. Frequency distributions were developed for all variables in the study. Ranges and appropriate measures of central tendency and standard deviations were also included as part of the descriptive analysis. In addition to running descriptive statistics on the entire sample, the same data, above, were also run, separating the sample into the stratified groups, i.e., rural, Appalachian, suburban, and metropolitan school districts.

Measures of skewness and kurtosis were run to determine normality of the distribution (Field, 2009). The BMI variables, were evaluated for the normalcy of distribution using the Kolmogorov-Smirnov (K-S). In addition to the normal distribution assumptions, the sample as a whole, and then, the individual strata samples were tested for the homogeneity of variance assumption.

Zero- order correlations were run on the BMI adjusted for age and sex and all the potential independent and mediating variables. New variables will also be calculated by adding the time for recess and the physical education to get a total weekly physical activity variable for each grade. These will also be included in the correlation. Only those significantly correlated will be used in further analysis.

Inferential data analyses. As indicated, a regression analysis was run on the BMI adjusted for age variable as the dependent variable and the variables significantly

correlated to the BMI variable as factors. If any other variables become not significantly correlated in the regression, a new regression will be calculated removing that variable.

While it would not be possible to establish a causal relationship between the time dedicated to health and physical education, and the average BMI, the inclusion of mediating factors in the relationship can help establish the level of influence the independent variable has on the dependent variable.

Chapter 4

Data Analysis

The purpose of the current research was to examine if the amount of physical education a student received had any impact on the students' propensity for being overweight or obese. Because childhood obesity is multifaceted, it was also prudent for the current research to take into account some potential mediating factors, specifically, the setting of the school, the school performance, socioeconomic status, and amount of recess the child gets.

The data for the current research were collected from primarily three sources, Ohio Department of Health, the Ohio Department of Education, and schools contacted by the researcher, randomly selected to be a part of the study. The Ohio Department of Health provided BMI data from over 360 elementary schools on greater than 17,000 third-grade students from the 2009-2010 school year. This school year was chosen because it was the last school year the Ohio Department of Health received a robust sample size. The Ohio Department of Health also provided for the community type of setting in which the school was located. Socioeconomic indicators and the school performance designation data for that school year were found on The Ohio Department of Education website. The time allotted for physical education and recess for grades K-3 was ascertained by the researcher by contacting each school building for those selected as part of a systematic stratified stratified random sample. The stratified random sample included 60 school buildings – 15 from Metropolitan, Suburban, Appalachian, and Rural areas. Twenty-five (41.67%) of the 60 selected in the sample responded to the questions

about physical education, curriculum, and recess. These schools accounted for 1,006 students.

The BMI and community type data provided by the Ohio Department of Health were placed into an SPSS 23.0 ® database. The school-level contact information and data, poverty and school performance designation, retrieved from the Ohio Department of Education website, were first organized into an Excel spreadsheet and then incorporated into an SPSS database. The times allotted for physical education and recess in grades K-3 were entered into the database when the researcher contacted the school for the information.

Descriptive Statistics

Table 1 is a breakdown of students by gender.

Table 1. *Gender of Children*

Gender	Frequency	Percent
Female	494	49.1
Male	512	50.9

Based on the full set of data, from which the random sample was drawn, the distribution of gender for the students included in the current investigation was consistent with the full population of potential participants.

The BMI data provided included a raw BMI and a BMI percentile adjusted for age and sex. In an effort to analyze the data, BMI percentile adjusted for age and sex was chosen over raw BMI because (a) there was no consistency when the BMIs were conducted in one school from the next, (b) because children are still growing, and (c) adjusted BMI is a more accurate measure to adjust for age (in months) and sex when calculating the BMI. Table 2 is a listing of where the children, included in the analysis,

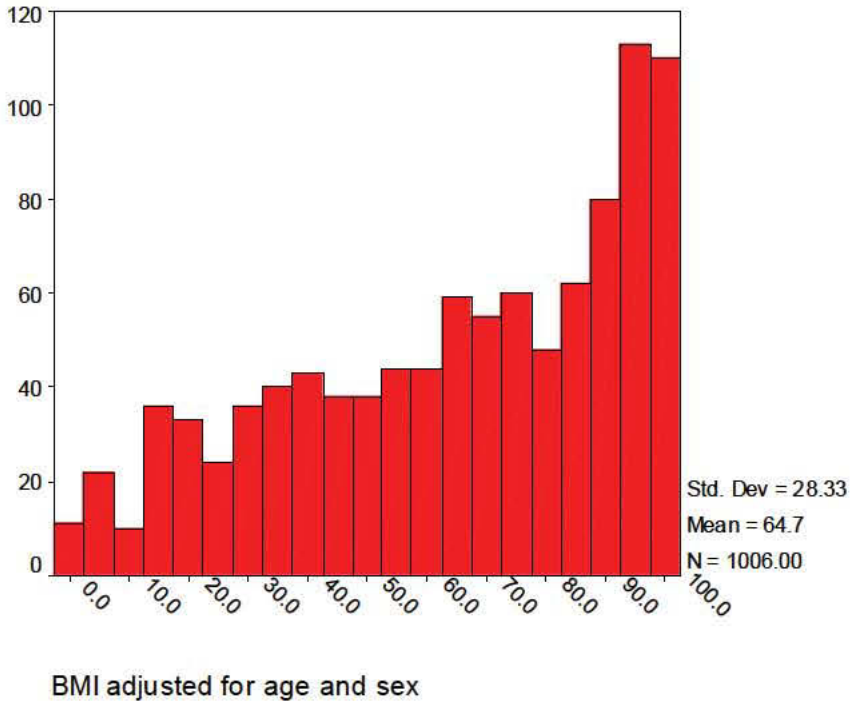
were in terms of their BMI percentile - underweight, healthy weight, overweight, or obese.

Table 2. *BMI Percentile Adjusted for Age and Sex*

BMI Percentile	Frequency	Percent
Underweight (<5%)	17	1.7
Healthy Weight (5-84%)	653	64.9
Overweight (85-94%)	158	15.7
Obese (>85%)	178	17.7

While Table 2 appears to show that most of the children were at a healthy weight, Figure 1 graphically shows the distribution of children across the continuum. This histogram is skewed to the right with over 1/3 (33.4%) of the children in the sample either overweight or obese.

Figure 1. BMI Percentile Adjusted for Age and Sex



This adjusted BMI distribution was consistent with the population of data from which the random sample of participants was drawn. The rest of this section includes all of the independent or mediating variables. All of these, except Table 5 Children in Poverty, were broken down by school and student. As previously indicated, 60 schools (with equal representation from metropolitan, suburban, rural, and Appalachian) were contacted to be a part of the study. A total of 25 schools responded, a 41.67% response rate. Table 3 displays the breakdown by community type.

Table 3. *Community Type*

	School		Student	
Community type	Frequency	Percent	Frequency	Percent
Metro	6	24.0	169	16.8
Suburban	8	32.0	437	43.5
Appalachian	5	20.0	198	19.7
Rural	6	24.0	202	20.0

The distribution of the community type was reasonable in light of the stratification across community type for the purposes of random selection.

In Table 4, the school performance designations for the 2009-2010 school year are displayed by both school and student.

Table 4. *School Performance Designation*

	School		Student	
School Designation	Frequency	Percent	Frequency	Percent
Academic emergency	2	8.0	45	4.5
Continuous improvement	3	12.0	92	9.2
Effective	9	36.0	282	28.0
Excellent	8	32.0	495	49.3
Excellent with distinction	3	12.0	90	9.0

It is important to note that almost half of the students in the sample attended a school with an excellent designation, while this accounted for a little less than 33% of schools that responded.

Table 5 provides the breakout of children reported living at the poverty level.

Table 5. *Children in Poverty*

Poverty Designation	Frequency	Percent
Living in Poverty	376	37.4
Not living in poverty	630	62.6

As indicated in Table 5, 37.4% of the students included in the analysis lived in poverty as defined by the Ohio Department of Education by receiving free or reduced lunch.

Tables 6-9 are summaries of how many minutes per week students, grades K-3, had for physical education. It is important to note that the total for schools and total students included in each table did not equal one another because not all schools that responded have grades K-3. One common theme throughout all four grade levels was that 40 minutes of physical education per week was the most frequently time allotted.

Table 6 provides the data regarding minutes allocated for physical education, specifically, for Kindergarten-level students.

Table 6. *Minutes Per Week of Physical Education in Kindergarten*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
10	1	4.3	53	6.1
30	4	17.4	153	17.6
40	6	26.1	297	34.1
45	4	17.4	141	16.2
50	2	8.7	58	6.7
55	1	4.3	47	5.4

60	2	8.7	69	7.9
80	1	4.3	19	2.2
90	1	4.3	22	2.5
100	1	4.3	12	1.4

Table 7 provides the reported minutes allocated for physical education classes for first-grade level students.

Table 7. *Minutes Per Week of Physical Education in First Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
10	1	4.3	53	6.1
30	4	17.4	153	17.6
40	5	21.7	239	27.4
45	4	17.4	141	16.2
50	3	13.0	116	13.3
55	1	4.3	47	5.4
60	2	8.7	69	7.9
80	1	4.3	19	2.2
90	1	4.3	22	2.5
100	1	4.3	12	1.4

Table 8 provides the reported minutes allocated for physical education classes for second-grade level students.

Table 8. *Minutes Per Week of Physical Education in Second Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
10	1	4.2	53	5.7
30	4	16.7	153	22.1
40	5	20.8	239	25.6
45	4	16.7	141	15.1
50	3	12.5	116	12.4
55	1	4.2	47	5.0
60	2	8.3	69	7.4
70	1	4.2	61	6.5
80	1	4.2	19	2.0
90	1	4.2	22	2.4
100	1	4.2	12	1.3

Table 9 provides the reported minutes allocated for physical education classes for third-grade level students.

Table 9. *Minutes Per Week of Physical Education in Third Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
10	1	4.0	53	5.3
30	4	16.0	153	15.2
40	5	20.0	239	23.8
45	4	16.0	141	14.0
50	3	12.0	116	11.5
55	1	4.0	47	4.7
60	2	8.0	69	6.9
70	1	4.0	61	6.1
80	2	8.0	93	9.2
90	1	4.0	22	2.2
100	1	4.0	12	1.2

Tables 10-13 are summaries of how many minutes per day students, grades K-3, received for recess. One common theme throughout all four grade levels was that 30 minutes of recess was the most frequent time allotted. Table 10 provides the reported minutes allocated for recess for kindergarten-grade level students.

Table 10. *Minutes Per Day of Recess in Kindergarten*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
15	1	4.3	21	2.4
20	5	21.7	147	16.9
25	1	4.3	87	10.0
30	11	47.8	385	44.2
45	4	17.4	194	22.3
50	1	4.3	37	4.2

Table 11 provides the reported minutes allocated for recess for first-grade level students.

Table 11. *Minutes Per Day of Recess in First Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
15	1	4.3	21	2.4
20	6	26.1	170	19.5
25	1	4.3	87	10.0
30	12	52.2	470	54.0
45	2	8.7	86	9.9
50	1	4.3	37	4.2

Table 12 provides the reported minutes allocated for recess for second-grade level students.

Table 12. *Minutes Per Day of Recess in Second Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
15	1	4.2	21	2.3
20	6	25.0	170	18.2
25	1	4.2	87	9.3
30	12	50.0	470	50.4
45	2	8.3	86	9.2
50	2	8.3	98	10.5

Table 13 provides the reported minutes allocated for recess for third-grade level students.

Table 13. *Minutes Per Day of Recess in The Third Grade*

	School		Student	
Minutes	Frequency	Percent	Frequency	Percent
15	1	4.0	21	2.1
20	6	24.0	170	16.9
25	1	4.0	87	8.6
30	14	56.0	595	59.1
45	1	4.0	35	3.5
50	2	8.0	98	9.7

Preliminary Analyses

Table 14 presents the descriptive analysis of BMI and Adjusted BMI. These results included the mean, standard deviation, skewness , kurtosis, and the results of a One-Sample Kolmogorov-Smirnov (One Sample K-S) across all BMIs adjusted. The One Sample K-S test evaluates the assumption that the distribution of the data is normally distributed. Both Raw BMI and BMI Adjusted are represented in the table, however, only the adjusted score was used in further analyses.

Table 14. *Test for Normality*

	Average Raw BMI	Adjusted BMI
N	994	994
Mean	18.590	64.518
Std. Deviation	1.270	7.21
Skewness	0.227	-0.41
Kurtosis	-0.588	-0.744
1 Sample K-S	.107*	.140*

Note: * indicates $p<.001$

Results indicated that the skewness and kurtosis for BMI and Adjusted BMI are within acceptable levels as they were both less than |2.0| and |5.0| respectively (Field, 2009). Both the raw and adjusted BMIs for the students were significant on the One Sample K-S. This is usually an indicator that the BMI scores are not normally distributed. However, with a sample size this large, a significant finding on the Kolmogorov-Smirnov test can occur quite easily with small deviations from normality (Field, 2009; Tabachnick & Fidell, 2013). Therefore, based on the guidelines of Field (2009), the assumption of normality was deemed tenable.

Table 15 is a zero-order correlation analysis between BMI and mediating factors (Community Type, Poverty, and School Performance) and independent variables (Physical Education and Recess for grades K-3). As expected, the amount of physical education across all grade levels was highly correlated with one another because many schools allotted the same time to physical education across all four grade levels. This pattern of results was similar for time allocated for recess as well.

Table 15A. *Zero-Order Correlations for Independent, Mediating, and Dependent Variables*

	T	P	OV	PE	PE	PE	PE
Community Type	.000						
School performance	.009	.00					
Poverty	.025	.296**	.000				
Kindergarten PE	.035	.441**	138**	.000			
First grade PE	.050	.417**	111**	988**	.000		
Second grade PE	109**	.330**	073*	988**	.000**	.000	
Third Grade PE	.036	.218**	059*	988**	.000**	.000**	.000
Kindergarten Recess	.163**	220**	.076*	.200**	.206**	.206**	.206**
First grade recess	.169**	268**	.126**	.269**	.266**	.266**	.266**
Second grade recess	085**	299**	.141**	.269**	.266**	.002	.002
Third grade recess	133**	268**	112**	.0206**	.197**	084**	.073*
Kindergarten Combine	.176**	.068**	.029	.146**	.135**	.135**	.135**

First grade combined	.194**	.103**	.083**	.130**	.138**	.138**	.138**
Second grade combined	.117**	.168**	.107**	.130**	.340**	.138**	.340**
Third grade combined	.048	.192**	.049	.984**	.995**	.996**	.996**
BMI	.057*	-.045	062*	011	009	025	.004

**Correlation is significant .01 level(1tailed)
*Correlation is significant at .05 level(1tailed)

Table 15B. *Zero-Order Correlations for Independent, Mediating, and Dependent Variables*

	rec	rec	rec	rec	PAK	PA1	PA2	PA3
Kindergarten Recess	.000							
First grade recess	842**	.000						
Second grade recess	842**	.000**	.000					
Third grade recess	782**	902**	931**	.000				
Kindergarten Combine	.940**	.756**	.756**	.718**	.000			
First grade combined	.780**	.918**	.918**	.846**	.833**	.000		
Second grade combined	.780**	.918**	.940**	.905**	.833**	1.00**	.000	
Third grade combined	.139**	.189**	.092**	.161**	.201**	.215**	.427**	.000
BMI	.003	.027	.045	.064*	.007	.031	.051	.002

Based on the zero-order correlations, little to no variance in BMI could be explained by physical activity with the exception of the amount of daily recess for the third grade. In examining the correlations between the dependent variable and the mediating variables, Community Type and Poverty were the only mediating variables significantly correlated to BMI. Although significant, all three of these variables presented weak correlations with BMI.

In light of the results of the zero-order correlation analyses, test of statistical assumptions for regression analyses were conducted. It was established (above) that the dependent variable, adjusted BMI, was normally distributed. Curve estimation analyses indicated that linearity is tenable. Variance inflation analysis revealed that there are no issues with multicollinearity, [.969, 1.02]. Mahalonobis Distance analysis indicated that there are no influential outliers [.767, 11.494]. Test of homogeneity of variance indicated that no heterogeneity is present. The full output for the regression analysis is provided in Appendix B.

Regression Analysis: Student Level Analysis

Regression analyses were considered the most appropriate strategy for answering the proposed research question. A sequential multiple linear regression analysis was conducted to evaluate the prediction of BMI, adjusted for age and sex, from the correlations that showed a significant relationship to BMI: Recess in grade 3, and, Community Type, and Poverty. The dependent variable, BMI, adjusted for age and sex, was a continuous variable; the independent variables were quantitative, with third grade

Recess and Poverty being a discrete variable, and Community Type being a nominal variable.

The regression was conducted in two models. The initial model included the independent variable and all three predictor variables. The second model was conducted without the Community Type because the coefficient was no longer significant in the first regression model. However, it did not add to the model by taking it out, and the first model accounted for more of the explanation for BMI.

BMI = 53.88 + 3.99(poverty) + 1.34 (Community Type) + .219 (Third grade recess)

The details of the two models are indicated on Table 16.

Table 16. Model One and Model Two Results at Student Level

	B	SE B	β
Model One			
Constant	53.88	3.88	
Poverty	3.99	1.86	.068
Community Type	1.34	.908	.047
Third grade recess	.219	.108	.065
Model Two			
Constant	55.96	3.468	
Poverty	4.09	1.85	.070
Third grade recess	.241	.11	.071

Note. R^2 for Model One = .011; R^2 for Model Two =.009.

As indicated above, Model One, with the all three independent variables, resulted in an $R^2 = 0.011$, $F(3, 1001) = 3.726$, $p = 0.011$. Model Two, with the subtraction of the Community Type variable revealed a lesser powerful $R^2 = 0.009$, $F(2,1003) = 4.481$, $p = .012$. This pattern of results suggested both models account for approximately 1% of the

variation in BMI, with Model Two accounting for two-tenths of 1% less than the first model.

Regression Analysis: Building Level Analysis

A sequential multiple linear regression analysis utilized the same independent variables to evaluate the prediction of average BMI adjusted for age and sex at the school building level. The dependent variable, school average BMI adjusted for age and sex, was a continuous variable; the independent variables were quantitative, with Third grade recess being a discrete variable, Poverty rates for the school being continuous, and Community Type being a nominal variable.

Like the Student Level analysis, the building level regression was conducted in two models. The initial model included the independent variable, and all three predictor variables. Model Two was conducted without the Community Type for consistency with the Student Level models. Like the Student Level models, removing the community type variable in the second model did not add to the power or significance.

The details of the two models are indicated in Table 17.

Table 17. Model One and Model Two Results for Building level.

	B	SE B	β
Model One			
Constant	45.44	6.69	
Poverty	9.86	.065	.298
Community type	2.10	1.18	.327
Third grade recess	.339	.161	.413
Model Two			
Constant	49.53	6.59	
Poverty	.10	.07	.313
Third grade recess	.368	.17	.448

Note. R^2 for Model One = .0.304; R^2 for Model Two =.198.

As indicated above, Model One, with the all three independent variables, resulted in an $R^2 = 0.304$, $F(3, 21) = 3.058$, $p = 0.051$. Model Two, with the subtraction of the Community Type variable revealed a lesser powerful $R^2 = 0.198$, $F(2,22) = 2.715$, $p = .088$. Neither of these models was statistically significant, therefore we cannot suggest either model accounts for any variance in average adjusted BMI at the Building Level.

Summary

Chapter 4 examines the ability for physical activity variables (Physical education and recess for grades K-3) and mediating variables (Community Type, Poverty, and School Performance designations) to impact BMI as measured by BMI adjusted for Age and Sex. There were 1,006 students from 25 different schools in the data set. The data collected included a preexisting data set of BMI measurements of third graders from the 2009-2010 school-year. It also included data on school building level ratings and percentage of students in Poverty from the Ohio Department of Education. The data collected resulted from a phone survey of a random sample of the schools from the BMI

dataset. The phone survey asked questions concerning organized physical education and recess time for students at the school in grades K-3.

Distribution of the outcome variable revealed a negative skewness, as one third of the sample was either overweight or obese, as indicated by being at or above the 85th percentile for BMI adjusted by age and sex.

Zero-order correlations were run between BMI and all the potential predictor variables (both independent and mediating). The significant correlations between the dependent variable and the other variables were used to determine which variables should be part of the regression model. Three variables (Third grade recess, Community Type and Poverty) were significantly correlated to the BMI variable.

Regression models were conducted to determine the predictability of BMI. Two models were conducted at the Student Level and the school building level each. Both included one model with all three significantly correlated variables, and the second one omitted the Community Type variable. Both Student Level models were significant, however they only counted for about 1% of the predictability of BMI percentiles. Neither school building level regressions were significant.

Chapter 5

Methods and Procedures

The BMI data on over 360 elementary schools and 17,000 third graders in Ohio during the 2009-2010 school year was requested from the Ohio Department of Health. A stratified random sample was taken to include students from 60 schools. The stratification was based on what community type the school was located. Schools were categorized by metropolitan, suburban, Appalachian and rural. Each category had fifteen schools selected. All sixty schools were contacted to ask information concerning the physical education curriculum, the health education and recess given in minutes per day for grades K-3 for the 2009-2010 school year. Data was analyzed on the twenty five schools that responded to a phone survey that asked questions about physical education curriculum and recess offered to students in grades K-3 in 2009-2010. This accounted for 1,006 students to be included in the sample. Other data in the data set included the percentage of students receiving free or reduced lunch for the 2009-2010 school year and the school building academic performance designations for the 2009-2010 year. These data on these two variables were acquired from the Ohio Department of Education.

Descriptive statistics were conducted on the dependent variable, which was the BMI adjusted for age and sex. They were also conducted on potential dependent and mediating variables, which include minutes per week of physical education for grades K-3, minutes per day of recess grades K-3, the type of community the school resides, being eligible for free or reduced lunch and the academic performance designation of the school.

A Kolmogorov-Smirnov test for normality on the dependent variable, BMI adjusted for age and sex, was computed. The results for the normality revealed that further analysis was tenable. Next, a zero order correlation was conducted between the dependent variable and all the potential independent and mediating variables to determine which variables should be included in further analysis. Those that were significantly correlated to BMI percentile adjusted for age and sex were selected to be included in a sequential multiple linear regression test. Those variables were minutes of daily recess in the third grade, children receiving free or reduced lunch and the type of community. There were two sets of regression analyses. The first set was run at the student level. There were two models run at the student level. The first model included the dependent variable and all three potential predicting variables. The second model included removing the community type variable. The second set was run at the building level. To maintain consistency, the two models run were identical to the two student level models.

Major Findings

The first major finding is that in this sample of Ohio school children is that just over 1/3 (33.4%) of the children were either overweight or obese. The percentage of the sample of children that were obese was 17.7%. This is in line with rest of the country as the obesity rate for children the two to 19 years old was approximately 18% (Ogden, Carroll, Kit, & Flegal, 2012).

The amount of time for either daily recess or weekly physical education allotted was homogenous. At least 50 percent of students in all grades K-3 had between 30 and 50 minutes of weekly physical education and close to 50 percent of all students had

recess for 30 minutes per day. In examining this data against the Healthy People 2020 objectives, the schools in this sample offered far below the goal of daily physical education, which corresponds to Healthy People 2020 goal PA-4.1 of increasing the percentage of elementary schools offering daily physical education to 4.2% (CDC, 2009). All schools in the sample offered 1 or 2 physical education classes per week. However, the schools in sample, compared to the Healthy People 2020 goal PA-7, fared much better. The Healthy People 2020 goal PA-7 looks to increase the percentage of elementary schools to 67.7% offering an appropriate time for recess daily. The Healthy People 2020 document indicates that 20 minutes or more of daily recess is appropriate. In this sample, 96.0% of schools offered 20 minutes or more daily recess.

Only three of the independent and mediating variables, minutes per day of recess in the third grade, community type and being eligible for free or reduced lunch, were found to be significantly correlated to the dependent variable, BMI adjusted for age and sex. These variables were found to be significant when conducting a regression analysis. However, these three variables can only account for 1% of the variance in BMI percentile adjusted for age and sex.

Discussion

The current research examined two objectives with four total hypotheses tested. The first objective was to examine if the amount of physical education or recess a school provides has an impact on a child's BMI. The hypothesis specific to this objective was that there would be an inverse relationship between the amount of physical education offered in school and the child's resulting BMI. In examining this relationship in this

particular study, the only statistically significantly correlated variable among the physical activity variables was the amount of recess offered in the third grade. When placed into the regression model, along with two mediating variables accounted for roughly 1% of the variance. This was contrary to the much of the literature related to this subject. Several studies have indicated that increasing time allotted for physical education can significantly impact childhood obesity (Brescoll et al, 2008; Brownson et al, 2010; Cawley et al, 2012).

The second objective was to examine if other variables modified the effects of the association between BMI and the amount of physical education. There were three hypotheses to address this objective. The first of these, not in any specific order by power is that rural, Appalachian or metropolitan school districts will impact the relationship between physical education and students' BMI by contributing to higher BMI rates than suburban districts. The community type variable which directly correlates to this hypothesis was found to be statistically significant when correlated with BMI adjusted for age and sex. This variable was included in the regression analysis and was found to be significant in the regression calculated at the student level. However, as previously indicated the regression could only predict 1% of the variance. While not strong, the type of community the school district is located yielding significance concurs with the literature on the environment being a part of the BMI percentile equation (Singh et al, 2010; Moore et al, 2012)

The second hypothesis under this objective was that a school district's academic performance will negatively impact the relationship between physical education and

students' BMI. The findings in the current research do not support this hypothesis. There was no significant correlation between the school district performance designation and the independent variable of adjusted BMI. This is counter to much of the literature that suggests that there is a relationship between academic achievement and BMI, especially at the elementary school level (Castelli et al., 2007; Davis et al., 2011; Donnelly & Lambourne, 2011; Kantomaa et al, 2012).

Socioeconomic status and its relationship to childhood obesity are pervasive throughout the literature. Its inclusion as a moderator in the current research here was a given. Several meta-analyses and single case studies have supported the concept that there is an inverse relationship between income and percentage of children with high BMI percentiles (Gundersen et al, 2011; Fernandes and Sturm, 2010; Eagle et al, 2012). The current research demonstrated that the third hypotheses from this objective concurred that socioeconomic status and the students' BMI adjusted for sex and age are significantly related. Even though poverty was a weak but significant correlation to BMI, was the most powerful predictor, B=3.99, which was more than double the next closest predictor. However, socioeconomic status as indicated by free or reduced lunch, along with community type and third grade recess time only accounted for 1% of the variance in BMI adjusted for age and sex.

Recommendations

The current research presented some course of action for future study.

1. Because of the lack of variance among schools in terms of their time allotted for physical education and recess for the schools in the sample,

conducting a larger scale analysis, either comparing Ohio to another state, or including Ohio data in a regional or national sample where you might increase the variability of physical education and/or recess time.

2. Doing intervention based research by measuring differences in BMI in children comparing before and after increased physical education and/or recess times in the daily curricula.
3. Because of the inequities and the sequelae that exist as a result of where a child lives, we need to continue the measure the how this manifests itself in both educational outcomes and its relationship to health outcomes, including obesity.
4. As an extension of the previous recommendation, conducting a study similar to the current investigation, perhaps utilizing individual academic performance indicators rather than the school performance designation might yield more usefulness of this concept as a mediating variable.
5. Although diet and nutrition was not included as a independent or mediating variable, in this analysis, more studies should look at the strength of dietary choices. Perhaps the addition of a qualitative piece examining schools that make transitions to better dietary offerings and how they make the transition.
6. With the increased demands for accountability in the performance of students and teachers, it would be interesting to conduct a qualitative study examining teachers' perceptions about time and other barriers preventing teachers from incorporating more physical education or activity.

The current research also presented some recommendations for policy change. The policy changes outlined below can be organized into addressing childhood obesity from an ecological perspective. That is to say policy changes that are recommended here occur at the intrapersonal, interpersonal and community/population levels.

1. From the intrapersonal level, schools need to offer more opportunities for physical activities for students throughout the school day. The time allotted for daily recess is adequate as most schools met or exceeded the Healthy People 2020 recommendation for daily recess. However, the time allotted for physical education was below the Healthy People 2020 standard of offering daily physical education. No school in the sample offered daily physical education. Schools in this sample offered either one or two days of physical education.
2. The school year analyzed was 2009-2010. At the completion of this research, the data were six years old. This school year was chosen because this was the last year the Ohio Department of Health had such a robust data set. Since then Ohio has systematically through legislation made it easier for schools to opt out of doing BMI measurements on children and not reporting them to the Ohio Department of Health. This does not serve our children well nor help the cause of reducing childhood obesity in Ohio. In examining this issue from the population or community based level, this legislation needs make it more difficult for

schools to opt out of reporting. The researcher is sympathetic to the increased accountability placed on schools in terms of academic achievement. However, schools have a captive audience and conducting BMI calculations on students and having that data on a large scale is crucial in planning population-based interventions with the intent of reducing childhood obesity.

3. As an extension of the previous recommendation, and impacting the interpersonal level, BMI testing should be reported to the parents. While there is controversy surrounding this, this can serve as a trigger to cue some parents into action. It is not the exclusive responsibility of the school to prevent or reduce childhood obesity as parents too need to have some accountability for their child's health and well being.

Limitations of the Study

While every attempt was made to conduct conventional and accepted research and data analysis, below is acknowledgement of limitations to this research.

The data set collected was based upon the 2009-2010 school year. Had the data been more recent, the results may be different. This was done out of necessity as there has not been a data set of BMIs collected on this grand scale in Ohio since then.

Using school level academic indicators and not having individual academic performance indicators for each student may have contributed to a less powerful relationship of this concept to the dependent variable than is actually the case.

The relatively small variation in the amount of physical education per week and daily recess, coupled with a large data set, decreased the ability to assess variations. The large sample size potentially helped with regression equation being statistically significant, while the lack of variation in time allotted potentially resulted in a weak predictability of the regression equation.

Conclusions

The elementary schools that were included from the sampling population were schools that did BMI measurements on their third grade students and reported them to the Ohio Department of Health. Schools had the ability to opt out of reporting to the Ohio Department of Health and it did not include students attending private schools. Although the students and schools were randomly selected from a larger list of schools, they were not randomly selected from the entire list of elementary schools and students in Ohio.

The purpose of the current research was to determine if physical activity specifically defined as the amount of time allotted for physical education in minutes per week and minutes per day allotted for recess, impacted a student's BMI. In the current research, the objective related to the relationship of physical activity and BMI yielded that third grade recess was related to BMI in the sample. Third grade recess was statistically significant as part of the regression model, but a weak predictor of BMI. As

previously indicated, the amount of time devoted to physical education and recess across schools was homogenous. This lack of diversity in time allotted for physical education and recess coupled with the large sample size could reasonably explain the lack of power in the variability of this relationship.

The current research also sought to determine if various factors found throughout the literature acted as mediators in this relationship. Those factors included the type of community the school resided in, the overall performance rating of the school the child attended and socioeconomic status as explained by the percentage of students on free or reduced lunch. While it can be argued all three of these mediating variables may have some overlap, it was important to treat them as separate variables. This is evidenced by the fact that two, and not all three, of the variables, community type and children receiving free or reduced lunch, were significantly related to the dependent variable. These two variables were included in further analysis and found to be a significant mediating variable to third grade recess, but again only accounting for 1% of the variability. School performance designation was not significantly related to the BMI adjusted for age and sex and excluded from further analysis.

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APPENDIX A

Phone Survey

My name is Nicholas Cascarelli and I am a doctoral student at Youngstown State University. I am doing my dissertation research on the relationship between a school's physical education curriculum and a child's propensity for being overweight or obese. The proposed research will also examine if and how the rate of students who receive free or reduced school lunch, type of community the school district exists, the time in the curriculum dedicated to health education, and the school district performance mediate the relationship between the time dedicated to the physical education in grades K-3 and a child's BMI in the third grade. Your school was randomly selected from a list of schools that reported BMIs to the Ohio Department of Health during the 2009-2010 school-year. I have three brief questions for you.

1. How many minutes per week were dedicated to physical education in grades K-3?
2. How many minutes of recess per day did children receive in grades K-3?
3. How many minutes per week were dedicated to health education grades K-3?

Thank you very much for your responses.

APPENDIX B

Descriptive Statistics for Students

		Raw BMI	BMI adjusted for age and sex
N	Valid	1006	1006
	Missing	45	45
Mean		18.5483	64.7125
Std. Deviation		3.98752	28.33264
Skewness		1.840	-.519
Std. Error of Skewness		.077	.077
Kurtosis		5.656	-.900
Std. Error of Kurtosis		.154	.154

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	522	49.7	49.7	49.7
	male	529	50.3	50.3	100.0
	Total	1051	100.0	100 0	

One-Sample Kolmogorov-Smirnov Test

		Raw BMI	BMI adjusted for age and sex
N		1006	1006
Normal Parameters[a,b]	Mean	18.5483	64.7125
	Std. Deviation	3.98752	28.33264
Most Extreme Differences	Absolute	.145	.107
	Positive	.145	.107
	Negative	-.106	-.104
Test Statistic		.145	.107
Asymp. Sig. (2-tailed)		.000[c]	.000[c]

a. Test distribution is Normal.

b. Calculated from data.

d.Lilliefors Significance Correction.

School Descriptives

		Community type	School performance designation	Minutes per week of PE Kindergarten	Minutes per week of PE first grade
N	Valid	25	25	23	23
	Missing	994	994	996	996
Mean		2.44	2.80	47.61	48.04
Std. Deviation		1.121	1.291	20.219	20.155
Skewness		.163	1.036	1.087	1 029
Std. Error of Skewness		.464	.464	.481	.481
Kurtosis		-1.309	1.416	1.662	1.616
Std. Error of Kurtosis		.902	.902	.935	935

		Minutes per week second grade PE	Minutes of third grade PE	Minutes per day of recess for Kindergarten	Minutes per day of recess first grade	Minutes per day of recess for second grade	Minutes per day recess for third grade
N	Valid	24	25	23	23	24	25

N issing	995	994	996	995	994	994
Mean	48.96	50.20	30.43	28.70	29.58	29.00
Std. Deviation	20.215	20.740	9.643	8.689	9.546	8.780
Skewness	.884	.738	.574	.896	.865	1.034
Std. Error of Skewness	.472	.464	.481	.481	.472	.464
Kurtosis	1.175	.561	-.393	.914	.351	1.382
Std. Error of Kurtosis	.918	.902	.935	.935	.918	.902

Community type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Metro	6	.6	24.0	24.0
	Suburban	8	.8	32.0	56.0
	Appalachian	5	.5	20.0	76.0
	Rural	6	.6	24.0	100.0
	Total	25	2.5	100.0	

	M issing	System	994	97.5		
	Total		1019	100.0		

School performance designation

			Frequency	Percent	Valid Percent	Cumulative Percent
	V alid	Excellent with Dis inction	3	.3	12.0	12.0
		Excellent	8	.8	32.0	44.0
		Effective	9	.9	36.0	80.0
		Con inuous Improvement	3	.3	12.0	92.0
		Academic Emergency	2	.2	8.0	100.0
		Total	25	2.5	100.0	
	M issing	System	994	97.5		
	Total		1019	100.0		

Student Level Regression Model 1

odel	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
	.105[a]	.011	008	28.23186	011	3.726	3

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8909.893	3	2969.964	3.726	.011[b]
	Residual	797834.882	1001	797.038		
	Total	806744.775	1004			

Student Level Regression Model 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
	.094[a]	.009	007	28.23500	009	4.481	2

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	7145.053	2	3572.527	4.481	012[b]
	Residual	799606.871	1003	797.215		
	Total	806751.924	1005			

School Level Regression Model 1

odel	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
	.551	.304	205	6.4270	304	3.058	3

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	378.922	3	126.307	3.058	.051
	Residual	867.423	21	41.036		
	Total	1246.345	24			

School Level Regression Model 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
	..445	.198	.125	6.7406	.198	2.715	2

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	246.747	2	123.373	2.715	.088
Residual	999.599	22	45.436		
Total	1246.345	24			

APPENDIX C

Youngstown STATE UNIVERSITY

College of Graduate Studies

Revised 1.11.16

Originality of Thesis/Dissertation Verification Form

All theses and dissertations are required to be assessed for originality and proper citation of resources utilized. Effective April 1, 2016, this form must accompany the signature pages submitted to the College of Graduate Studies

Student's First Name Nicholas M.I. V Student's Last Name Cascarelli

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Degree EdD Program Educational Leadership

Graduation Date 5/7/16

Thesis/Dissertation Title

By signing below, the student and adviser certify that the thesis or dissertation specified is the original work of the student and that other resources utilized in the thesis or dissertation are indicated by proper citations. The authenticity of the specified thesis or dissertation has been verified by the student and advisor. iThenticate was utilized as part of that verification process.

Note: The student and advisor will address any potential issues identified prior to signing the **Originality of Thesis/Dissertation Verification Form** and submitting the thesis or dissertation to the College of Graduate Studies.

Name of Thesis Advisor Karen Lawrence Signature [redacted]

Student Signature [redacted]

Date 4/27/16

APPENDIX D

Youngstown
STATE UNIVERSITY

One University Plaza, Youngstown, Ohio 44555
Office of Grants and Sponsored Programs
330.941.2377
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April 18, 2016

Dr. Karen Larwin, Principal Investigator
Mr. Nicholas Cascarelli, Co-investigator
Department of Educational Foundations, Research, Technology & Leadership
UNIVERSITY

RE: HSRC Protocol Number: 166-2016
Title: The Impact of Physical Education on Childhood Obesity in Ohio School Children

Dear Dr. Larwin and Mr. Cascarelli:

The Institutional Review Board has reviewed the abovementioned protocol and determined that it is exempt from full committee review based on a DHHS Category 3 exemption.

Any changes in your research activity should be promptly reported to the Institutional Review Board and may not be initiated without IRB approval except where necessary to eliminate hazard to human subjects. Any unanticipated problems involving risks to subjects should also be promptly reported to the IRB.

The IRB would like to extend its best wishes to you in the conduct of this study.

Sincerely,

[redacted]

Mr. Michael A. Hripko
Associate Vice President for Research
Authorized Institutional Official

MAH:cc